USAID | DELIVER PROJECT
FROM THE AMERICAN PEOPLE

Supply Chain Management Newsletter

Quarter 1, 2008

DELIVER Project, 2006

A logistics worker restocks supplies in Uganda.

Read this newsletter for the latest information on supply chain and USAID | DELIVER PROJECT innovations.

This issue includes:

- The Bullwhip Effect: The Importance of Consumer Demand Data Throughout the Supply Chain
- Handheld Technologies at the Supply Chain Last Mile
- Optimizing the Supply Chain Network
- Optimizing Warehouse Layout
- Spotlight on Mozambique: Evaporative Cool Boxes for Storage in Remote Clinics

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Welcome to the Quarter 1, 2008 installment of the quarterly USAID | DELIVER PROJECT Supply Chain Management E-Newsletter. The Supply Chain Management (SCM) team will send you information on relevant supply chain management topics and share project information. The e-newsletter will include articles on supply chain best practices, public and private sector supply chain technology, project topics, and descriptions and evaluations of pilot programs. The e-newsletter is also available on the USAID | DELIVER PROJECT website at www.deliver.jsi.com under Publications>Logistics Briefs.

The team welcomes your input! To submit an idea for a future newsletter, or to share information with our readers, please contact Ryan McWhorter, Technical Advisor, at rmcwhorter@jsi.com, or Suzy Sacher, Program Officer, at ssacher@jsi.com.

The Bullwhip Effect: The Importance of Consumer Demand Data Throughout the Supply Chain

What do patio furniture, fireworks, and snow shovels have in common? The three products are seasonal. If you graph the demand throughout the year, demand for each product would spike at a specific time of the year.

What do toothpaste, telephones, and diapers (or bullwhips!) have in common? Their retail sales remain fairly steady throughout the year. Despite uniform consumer demand though, retailers' orders to distributors change more than the actual demand. Also, the orders from distributors to factories change even more; orders from factories to suppliers continue this trend. Although customer demand for a product may remain more or less constant, inventory and back order levels vary significantly throughout the supply chain. As information about the demand for a product moves up in the manufacturing process, it becomes distorted, like the wave movement in a cracked whip, or the bullwhip effect.

For most supply chains, retailers, wholesalers, manufacturers, and suppliers make forecasts separately; rarely is the actual sales data shared beyond the retail level. If retailers notice a slight increase in sales, they may see it as the beginning of a trend and increase their orders, just in case. When the wholesaler receives an increased order, they adjust their forecasts to reflect a presumed increase in demand. Finally, based on the wholesaler's order, the manufacturer may further inflate the order. Even though consumer demand has not increased, the supply chain has ramped up as if it has. Likewise, a decrease in sales can lead to the bullwhip effect. A slight drop in sales whips through the supply chain, resulting in lower inventory, orders, and forecasts.

Because changes in the retailers' orders vary much more than customer demand, the wholesaler can expect to have more safety stock or capacity than the retailer. This is also true for the distributor and the factory, leading to higher costs for them, and ultimately, higher costs for the consumer. As an example, consider a store with an irregular ordering pattern, ordering 1,000 units of a product for several weeks, then not placing an order for months. In this case, the production, shipping, and storage capacity at the higher levels of the supply chain must be greater than if the store routinely ordered 500 units of the product each week.

What can be done to lessen the bullwhip effect? Studies of various supply chains have shown that some high-level strategies can help.

1. **Provide complete information on customer demand to each level of the supply chain.** This reduces the uncertainty throughout the supply chain. Using the same forecasting and buying practices throughout the supply chain can also help.

2. **Reduce lead times.** Long lead times produce significant gaps in information, intensifying the bullwhip effect. Slow procurement, reporting, and transportation add to lead time. To reduce lead times, use long-term strategic partnerships and even minor tactical changes such as communicating data more efficiently.

3. **Develop strategic supplier relationships where appropriate.** Vendor-managed inventory is one model. In this system, the manufacturer controls the inventory at the retail level; they determine how much inventory to ship to the retailer or to keep on hand. By not relying on the retailers' orders, the manufacturer avoids the bullwhip effect. By keeping the manufacturer close to the customer, the manufacturer, distributors, and retailers can reduce overall inventory and meet demand.

4. **Lower the variability of customer demand.** To do this, the private sector encourages retailers and manufacturers to minimize occasional bargain prices and use an "everyday low pricing" strategy instead. This keeps prices consistent and avoids sporadic price promotions. Customers are less likely to stock up and more likely to order regularly; even if the bullwhip effect occurs, the varying demand is less.

You might ask, "How does this relate to my work; what should I do?" Consider systems that have many inventory levels and long reporting flows from the service delivery point to the central level. These systems are prone to poor visibility to inventory and demand data, the exact cause of the bullwhip effect. Remembering the four strategies above, one practical strategy to reduce the bullwhip effect is to reduce lead times. This strategy can lead to many ideas and activities. In fact, the USAID | DELIVER PROJECT is currently developing new ways to quickly share consumption data using handheld devices (cell phones or personal data assistants [PDAs]) (see accompanying article). You may have other ideas.

To share your thoughts with us, please contact Suzy Sacher at ssacher@jsi.com.

Handheld Technologies at the Supply Chain Last Mile

Limited access to timely, accurate, and complete data can produce dramatic and unnecessary

fluctuations in ordering and distribution, often the result of the aptly named bullwhip effect. A long reporting flow—both in time and number of levels—results in a less efficient product distribution. To improve overall supply chain performance and lessen reporting lead times, the USAID | DELIVER PROJECT is investigating the use of handheld technology at the supply chain's "last mile." This is possible because of major improvements to the communications technology in developing countries.

The difference between a long and short reporting flow varies between industries. Retail stores—Wal-Mart, in particular, and high-tech manufacturers—tend to have the shortest; their daily point-of-sale data go directly to strategic suppliers. Our project's reporting and inventory visibility ranges from biweekly, web-enabled reporting, to quarterly, form-based reporting. In extreme cases, distribution decisions are based on six-month-old data. As described by the bullwhip effect in the preceding article, delays in information can impact the supply chain; resulting in increasing variability in orders, inventory, and back-order levels as the distance increases from the original data source.

As with the private sector, the public sector is increasingly using widespread technology. The project's Supply Chain Management (SCM) team studied technology applications at the last mile in three countries to determine if they are applicable and valuable to our unique environments. For each country, we found a different solution.

In Zimbabwe, JSI proposed a Delivery Team Topping-Up (DTTU) delivery process to help address economic and personnel constraints that were resulting in service delivery points (SDPs)-level stockouts despite having over a one-year supply of commodities at the central level. Delivery teams, comprised of a driver and an area coordinator, visit each facility once every three months. The area coordinator conducts resupply calculations for each of the commodities being delivered and resupplies the facility with commodities on the spot. The area coordinator enters resupply information into an automated logistics management information system (LMIS) that is maintained at the central level. Despite worsening economic conditions, the system functions very well, with over 94 percent coverage of facilities reported in the third quarter of 2007, and a stockout rate of less than 5 percent for all commodities, except female condoms. However, as other delivery mechanisms have broken down across the country, other public health programs are seeking to integrate into the DTTU system, most notably HIV/AIDS test kits and nevirapine from the SCMS project. With the increased workload, the program moved toward automating the data collection and on-site delivery calculations to reduce mathematical errors and reduce the time the delivery team spends at each site. The program has contracted with a software developer to design the needed tool; the developer will use small, rugged laptops for the on-site data entry. After the electronic information from the automated deliveries is downloaded into the existing DTTU software, it is expected that data encoding errors will be eliminated and data encoding time reduced at the central level.

In Tanzania, 32 percent of the 55 SDPs analyzed in 2007 had a stockout of at least one contraceptive during a recent six-month period. Fifteen percent of the 55 SDPs had a stockout during the same period. Late or missing inventory reports were a primary contributor to the stockouts. Using this information, we focused on stock monitoring, which would engage the district coordinator and improve inventory visibility. Because web-enabled solutions are not available in many Tanzanian districts, we proposed using short message service (SMS) text messaging technology that will enable SDPs to send their inventory report to the district coordinator twice a month. This easy-to-use, simple, low-cost reporting method improves supervision, enables transfers, and reduces overstocking and understocking.

In Bangladesh, the LMIS performs well; close to 100 percent of facilities report each month. Any improvement to the system would not impact reporting rates, but could impact timeliness. Typically, central-level distributions are made based on inventory data that are 1.5-months-old. Fortunately, history has shown that this has little

impact on stockouts; in fact, stockouts in the system are unusual. However, if there is limited commodities countrywide, products can be moved between regions to reduce the effects of the constrained supply. Or, if insufficient product is coming into the country, a central and regional manager can better distribution the product to the lower levels. Improved reporting timeliness would allow managers to better plan the distribution of product. Unique to Bangladesh, many reports are completed monthly at the last mile (more than 25,000), which makes handheld devices too costly. Therefore, we focused on a higher level in the system where a desktop or laptop computer could be used to capture reports, while also acting as a gateway for the large number of inventory reports. By removing the time delays when paper forms are moved and transcribed, reports could be automatically validated and transmitted electronically, decreasing the time spent completing the long journey to the central level.

Every country is unique; no single technology solution applies in all environments. Determining what solution to apply depends on the number of units needed, type and amount of information to be recorded, available transmission technology (cellular, Internet, satellite), capacity of the end users, and the country's desire to implement a new technology.

Before we piloted the technology solutions in Tanzania, and Bangladesh our team investigated how other companies are using handheld technologies:

- Voxiva—cell phone technology to collect and transmit HIV/AIDS patient information in Rwanda
- SATELLIFE—personal data assistants (PDAs) to collect data and provide reports in Uganda
- NOVACOM—satellite transmission to monitor global locust migration
- SCMS—electronic forms on PDAs to record health service data in Cote D'Ivoire
- Save the Children USA—PDAs to record and transmit pediatric health data in Bangladesh.

Visit the Web and read the compelling stories from each organization.

If you are interested in learning about how technology can be applied at the last mile to improve supply chain performance, or if you would like to learn more about this activity, please contact Ryan McWhorter at rmcwhorter@jsi.com.

Optimizing the Supply Chain Network

Where should I place distribution centers and warehouses? What happens to inventory, cost, and service level if I double my transportation capacity? Faced with these supply chain questions, the USAID | DELIVER PROJECT is using commercial software tools to show countries how their supply chain structure impacts cost and service level.

Suppose a country's Ministry of Health seeks a recommendation on the number of inventory levels that should be implemented in their country. Another country may plan to change their distribution network from a political hierarchy of regions and districts to one based on population distribution. Or, consider a more common question: How much inventory for a given product should I store at different levels of my supply chain? These are common network design questions.

To analyze a supply chain network, you must evaluate a combination of variables, including location, inventory, and transportation. To better understand how complex network analysis can be, consider an example of a standard set of playing cards. Did you know that the number of distinct orderings of a deck of 52 playing cards is a number so large that it has 67 zeros in it? A standard distribution network has hundreds of products across hundreds of locations, and each product can have a range of transportation options and inventory policies. With so many options, mathematical tools can help you analyze and identify solutions.

Both the public and private sectors must solve supply chain network problems. Companies like Dell and Wal-Mart, and government agencies, including the U.S. Department of Defense and Health and Human Services, have used network optimization tools to improve their supply chains. In the late

1990s, these tools and the companies that made them flourished. You can use these tools today to model a supply chain and its options, producing a set of optimal, though constrained, network strategies. Typically, they will include a set of input or import screens and a range of analysis tools, including exportable reports, graphs, and maps.

Because this technology is mature and robust, the project's supply chain management team has reviewed commercial network optimization software that could be used to answer network, inventory, or transportation questions in host countries. The project considered not only feature functionality but also financial stability and the vendor's enthusiasm to address and solve public health distribution problems. In February 2008, the project initiated a partnership with Llamasoft, Inc. Llamasoft is an industry leader in supply chain optimization and simulation tools, and we look forward to working with them to deliver valuable supply chain network recommendations.

Parallel to software selection, the project is collaborating with USAID, the World Health Organization, and the World Bank to pilot the entire network analysis process, including logistics system analysis, development, and application of a cost input sheet, and tactical and strategic supply chain recommendations.

A network optimization analysis produces options to strengthen the public sector health care supply chain; these options can be used for strategic discussions and planning by decision makers, such as the Ministry of Health, Central Medical Stores, and the Ministry of Finance.

After the analysis, you will be able to answer the following questions:

- How many distribution centers and warehouses should I include in the supply chain?
- Where should I place distribution centers and warehouses?
- What are the ideal minimum and maximum inventory positions in my distribution centers and warehouses?
- What would happen to my inventory, cost, and service level if I increased transportation capacity?
- What is the total cost of the supply chain?
- What impact does the current design have on the system's ability to meet its customer service demands?
- What are the costs and requirements for different supply chain design scenarios?

The tool can help countries understand what impact the supply chains will have on cost and service levels given the current design and the customer service goals. Knowing this, countries can consider strategic supply chain changes based on the current analysis by highlighting the relationships and trade-offs between warehousing, inventory, and transport capacity.

The project is currently seeking countries that are interested in distribution network analysis. If you would like to learn more about this activity, please contact Ryan McWhorter at rmcwhorter@jsi.com.

Optimizing Warehouse Layout

How important is a warehouse layout to the supply chain? Can simple changes to the location of stock and areas where stock is received, packed, and issued increase efficiency and reduce cost? The USAID | DELIVER PROJECT has an easy-to-learn method that warehouse managers can use to change the layout of their warehouse, ultimately improving their throughput and reducing overall costs.

Warehousing is an integral part of all logistics systems. Improving warehouse efficiency can dramatically improve customer satisfaction. Sometimes, during the planning process, the internal layout of the warehouse is overlooked. Without a planned efficient layout, a manager may misallocate staff, use inappropriate operating procedures, and overlook unnecessary storage/material handling equipment. Layout should never be an afterthought—it should be the first thought!

The project looked to the Logistics Institute of Georgia Tech for a method that would enhance warehouse and distribution center layout.

Experienced logistics managers use systematic layout planning, with appropriate tools, to improve equipment selection and human resource allocation.

By using the methodology, a manager can—

- improve the performance of warehouse/distribution centers
- reduce handling costs in storage and order picking
- group materials for efficient handling and storage
- offer practical approaches to storage, order picking, packing material movement, and physical control
- streamline material flow in warehouse/distribution centers
- plan for expansions and new facilities.

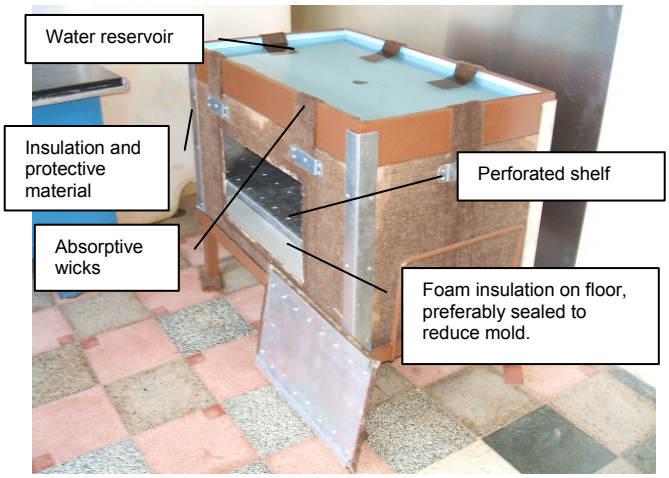
The strength of the methodology is its flexibility. With few changes, it can be used almost anywhere to improve warehouse efficiency and reduce recurrent costs. Warehouse managers benefit from a new layout design with limited outside technical assistance.

Warehousing layout is one of the supply chain management team's core competencies. If you plan to install new warehouse space, reorganize your existing warehouse to improve efficiency and cost, or would like to learn more about warehouse layout planning, please contact Jim Eberle at jeberle@jsi.com.

Spotlight on Mozambique: Evaporative Cool Boxes for Storage in Remote Clinics

If you work in a remote health facility in a developing country and your products must be stored at 20ºC cooler than the surrounding temperature, what options do you have? Mozambique is facing that question today.

To encourage the rational use of malaria drugs, Mozambique's Ministry of Health and National Malaria Control Program are expanding the use of rapid diagnostics tests for malaria to all levels of the health system. Maintaining the tests at the correct temperature is a challenge—RDTs must be kept at 25°C (77°F) or below, while temperatures in the hottest areas in Mozambique can reach 45°C (113°F). The project needed to ensure that the products remained at a cool temperature despite the hot, humid weather and lack of electricity common in remote areas.



Mozambique is testing cool boxes to determine if they can provide cooler storage for health commodities.

The project proposed an evaporative cool box. Made in Mozambique of aluminum, steel, and burlap, the box stores laboratory tests toward the bottom. (It could also be used to store medicines.) In a compartment above, absorptive wicks hang out of a pool of water. The evaporation from the wicks cools the contents of the box. Cambodia has used a similar design with promising results.

Three cool box prototypes were made in Mozambique and are being tested at the provincial warehouses in Maputo, Zambézia, and Tête provinces; each province has a different weather pattern. The National Malaria Control Program, laboratory section of the Ministry of Health, and *CMAM*, the central medical stores, are collaborating with the project on the testing, which is taking place during the four hottest months of the year. Provincial warehouse personnel use an electronic thermometer to monitor the temperature and humidity inside and outside the cool box. An evaluation of the testing data will determine if the cool boxes are effective and appropriate for use nationwide.

Cool Box Design and Rollout: Points to Consider

Type of Metal

- Rate of heat conductivity (if the water is not refilled promptly, the metal could become very hot, heating instead of cooling the products).
- Risk of rusting.

Training

- Clinic employees must learn how to maintain the water reservoir to prevent the cool box from overheating.
- Procedures must be put in place to ensure the water is consistently refilled to the correct level without overfilling, causing it to leak. (Mozambique is filling the reservoir to three-fourths of its capacity.)

Dew Point

- Evaporation is faster in a drier climate.

General Construction Criteria

- Outer construction must be all metal, including legs and shelving.
- Galvanized metal sheet is preferred but aluminum sheet is acceptable.
- Cover should be local insulation material; wicks of a similar material, but a finer weave to increase capillary action is preferable.

Dimensions:

- Approx. 1 × 0.6 × 0.5 meters

The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

USAID | DELIVER PROJECT
John Snow, Inc.
1616 Fort Myer Drive, 11th Floor
Arlington, VA 22209 USA
Tel: 703-528-7474
Fax: 703-528-7480
www.deliver.jsi.com
AskDeliver@jsi.com