

When Supply Chains Save Lives

By Jan Komrska, Laura Rock Kopczak, and Jayashankar M. Swaminathan

Jan Komrska (jkomrska@unicef.org) is a pharmacist working at UNICEF Supply Division.

Laura Rock Kopczak (kopczak@alummi.stanford.edu) is a professor specializing in humanitarian logistics in the MIT-Zaragoza Masters in International Logistics Program.

Jayashankar M. Swaminathan is GlaxoSmithKline Distinguished Professor at Kenan-Flagler Business School, University of North Carolina. He can be reached at msj@unc.edu.

More than 20 million children worldwide suffer from severe acute malnutrition. The situation is especially critical in the Horn of Africa—the countries of Ethiopia, Somalia, and Kenya. UNICEF is effectively responding to that humanitarian challenge by providing specially formulated “therapeutic” foods to those in need. A more diversified supply base and more efficient supply chain are important parts of the story.

Abdi Tadole was one of the lucky children. Prolonged drought had laid siege to crops and livestock and all those who depended on them in Abdi’s village in Northern Kenya. Abdi’s grandmother, desperately worried about the starving two-year-old, carried him 10 kilometers to a dispensary. And there he was diagnosed and nursed back to health with vitamins, antibiotics, and high-protein therapeutic food.¹

Amid continuing headlines about world hunger and food insecurity, there are, happily, more and more stories like Abdi’s. A large part of the reason for that is the recent development of ready-to-use therapeutic food (RUTF)—a rich paste made of peanuts mixed with milk powder, oil, sugar, and fortified with vitamins and minerals. The sticky paste, distributed in little foil packets, is specially formulated to revive children with severe acute malnutrition (SAM). It has brought back many from the brink, restoring them to relative health in just a few weeks. Indeed, many observers have credited the food with lowering mortality rates during times of famine.

Individual packaging of the therapeutic food allows easy handling and prevents contamination of the product between feedings. Mothers can take RUTF home and give it to the child there, rather than having the child spend time in a feeding



center. In 2007, the use of this innovative “hit” product to address a major cause of elevated child mortality was endorsed by the United Nations, and demand took off.²

But the other part of the story is the responsiveness and effectiveness of the nutrition supply chain—specifically, the ability of the United Nations Children’s Fund (UNICEF) to quickly bring and distribute RUTF to where it is most needed. Given the lumpy, “spiky” growing demand for the product, it requires an extraordinarily responsive supply base and supply chain to effectively meet that need. The task is especially tough because UNICEF has set a goal to include sourcing from countries

where the product is used—countries in which local manufacturers face unique challenges.

The first long-term supply arrangement (LTA) for RUTF was established in 2001 with a sole qualified supplier, Nutriset, which manufactured the product at its site in France. By 2004, demand began to rise as more countries started piloting the use of RUTF, and it became increasingly urgent for UNICEF to identify new sources. During 2006 and 2007, the organization’s Supply Division began to work with in-country manufacturers that could produce the product for local use, approving local suppliers in Niger and Ethiopia. However, it was quickly revealed that the capacity and performance of

these suppliers was very low and both countries would have to continue to rely mostly on imported product.

The situation at the global level became critical in mid-2008, when a hunger emergency affecting 8.4 million people was declared in the Horn of Africa, which includes Ethiopia, Kenya, and Somalia. Even after approval of a second global supplier (Vitaset, located in Dominican Republic), the 11,000 metric tons³—a total of 72,000 cartons—ordered by UNICEF, still largely from Nutriset, did not meet the peak demand. As a result, deliveries to country programs outside the Horn had to be postponed by three months, on average. Meanwhile, only 27 percent of orders for the Horn of Africa arrived on time, while the remaining 73 percent arrived with an average delay of 37 days. Furthermore, during the summer of 2008, UNICEF had to ship two-thirds of ordered product to the Horn of Africa by air, spending \$8.2 million to do so. (Air shipment cost \$36.92 per carton vs. \$4.58 per carton for sea shipment.)

The lumpy, “spiky” growing demand for the product requires an extraordinarily responsive supply base and supply chain to effectively meet that need.

As a result of this experience, the Supply Division made three key decisions:

1. Carry out a study on RUTF supply chain performance in order to identify weaknesses and propose solutions.
2. Open the market for new RUTF suppliers by conducting an open bidding exercise.
3. Begin conducting annual forecasting for RUTF with individual country programs.

In 2011, an even more severe drought hit the Horn of Africa. This time, UNICEF was met with even higher expectations—the more so because RUTF was now familiar and so the feeling was that supply chains for the product would now be running smoothly. Those sentiments were on target: With the supply chain improvements that UNICEF had made, the organization was able to meet demand in that corner of Africa while maintaining uninterrupted supply to other parts of the world.

This article tells the story of how UNICEF Supply Division worked from 2008 to 2011 to ensure a diverse, sustainable, and responsive supply base, growing from a

single European supplier to a network (in 2011) of 19 suppliers located around the world. The agency accomplished this in the midst of continued rapid demand growth and while improving supply chain responsiveness and effectiveness. The article also previews the next set of challenges faced by UNICEF.

If there is one thing that can be predicted, it is that natural disasters will strike again and again. UNICEF’s experience provides valuable insights into how to create responsive supply chains for innovative hit products that leverage local supply in places such as Ethiopia, Niger, and Haiti.⁴

The Supply Chain for RUTF

UNICEF Supply Division, the agency’s centralized procurement unit, delivers commodities to more than 130 countries worldwide. The three largest commodity groups include vaccines (2011 procurement spend of \$1.03 billion), pharmaceuticals (\$192 million), and nutrition products including ready-to-use therapeutic food (\$166 million).

UNICEF is the world’s major purchaser of RUTF.⁵ Although RUTF is delivered to 57 countries worldwide, demand is concentrated in just a few countries: Ethiopia, Somalia, Kenya, Niger, and Pakistan, followed by Nigeria, the Democratic Republic of Congo, Yemen, Sudan, and Chad. A country’s annual purchase volume varies dramatically as emergencies come and go. The level of total worldwide funding available varies with the economic climate and donor priorities.

The RUTF supply chain, like the supply chains for many products used by relief agencies, is not a typical product supply chain driven by customer desire to own and ability to pay for the product. On the contrary, the need for product in developing countries is generally identified by non-governmental organizations (NGOs) or by UN agencies such as UNICEF.

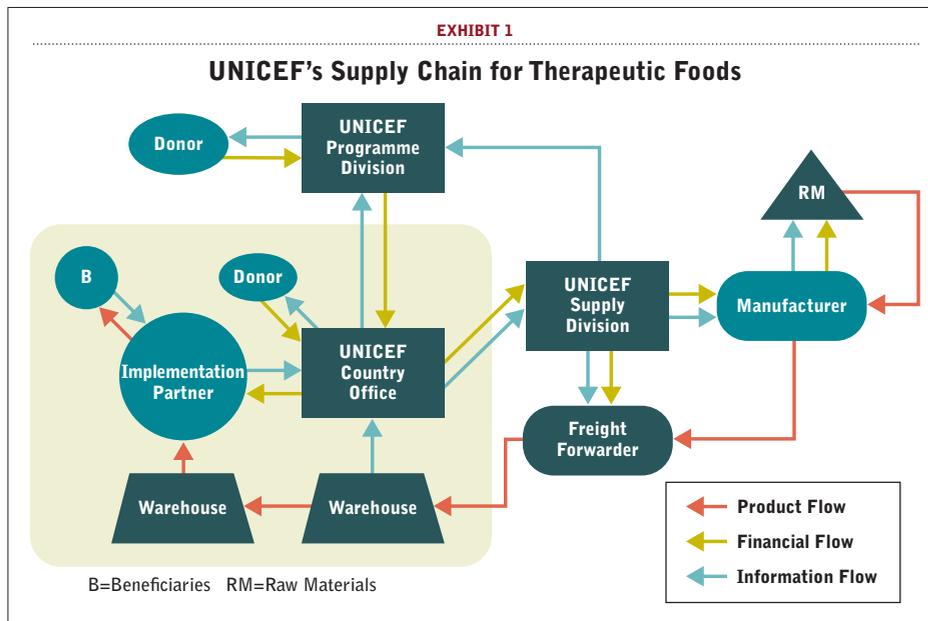
The “customers” in this case are children aged six months to 59 months. The children’s caretakers are usually unaware of the product’s existence and they lack financial resources to purchase it. These beneficiaries receive product for free through the existing health care system (health posts) or a parallel system (feeding centers) set up by NGOs in areas where the national health care system is non-existent or non-functional. The caretakers can then take the product with them and feed the children at home.

The RUTF supply chain is similar to the supply chain for essential medicines that are typically purchased and distributed to beneficiaries by national governments for free or for a small fee under pre-defined

agreed conditions. But as RUTF is a relatively new product, it is not yet integrated into existing national health care systems and its specific features (weight, volume, resale value) suggest that existing national distribution systems are not yet ready to embrace it. High product cost is also an obstacle for its inclusion in the national health budget. Therefore, UNICEF

North Carolina (UNC) and Duke University to conduct a study to identify RUTF supply chain weaknesses and propose solutions.

The study identified the following major sources of uncertainty that made it extremely difficult to match demand and supply for beneficiaries in the Horn of Africa.⁶



- Lack of information-sharing among the various supply chain entities—donors, Supply Division, UNICEF country office, Ministry of Health, and implementing partners.

- Lack of data about forecasts and consumption that could inform proper production capacity and logistics planning.

- Very long order-to-delivery lead times caused by a combination of long lead times for purchase order authorization and placement, production, and shipping.

- Uncertainty about the

remains the major provider of RUTF and must mobilize financial resources from various donors prior to product procurement and shipment. Virtually all food of this type is procured using donor-specific funding for which project proposals must be submitted by UNICEF country offices. Delays in availability of funds are a frequent contributor to delivery delays and product stock-outs.

The flow of information, funds, and RUTF product is relatively straightforward. (See Exhibit 1.) Supply Division places firm orders with suppliers, based on requisitions from UNICEF country offices. Suppliers manufacture the product and deliver it to an agreed seaport or airport. After the product has been cleared, it is delivered to the implementing partners (government or NGOs) who make sure it reaches beneficiaries.

Challenges in the Horn of Africa

Recently, the Horn of Africa has been the dominant destination for RUTE, accounting for almost half of UNICEF's shipments in 2008 and in 2011. In 2008, as noted earlier, poor performance of the UNICEF-managed RUTF supply chain in the region led Supply Division to commission a team from the University of

availability of funding and timeliness of funding releases.

The final report made five recommendations:

1. **Implement key performance indicators to monitor and manage the supply chain.**

2. **Pre-position buffer stock to cut lead times and improve delivery of RUTF.** Positioning stock in-country or in/near-region would reduce lead times. However, issues such as the product's limited shelf life, lack of working capital, and in some locations physical security concerns limited the amount of stock that could be held. For the Horn, adding buffer stock in either Dubai or Mombasa was considered.

3. **Diversify the RUTF supplier base to better serve global needs.** Diversifying the supply base would increase competition and enhance responsiveness. Fostering supply from suppliers located in countries of use would stimulate growth in local agriculture and food production and avoid cumbersome customs clearance processes. Local manufacturers, however, faced multiple challenges, including poor infrastructure, cost and timeliness of imported inputs, maintaining product quality, availability of working capital and foreign exchange, and timeliness of product delivery.

4. **Improve inter-agency and donor collaboration**

to improve response to nutrition emergencies. For example, uncertainty could be reduced by collaborating with donors to improve matching timing of funding releases with procurement needs.

5. Improve information flow and forecasting.

Providing suppliers with better demand forecast information would allow them to plan for raw material purchases and better manage their production capacity.

How UNICEF Addressed the Challenges

In response, the UN agency made the following moves to improve the supply chain between 2008 and 2011:

Global Demand Forecasting

To address growing demand for the ready-to-use therapeutic food, UNICEF developed an Excel-based forecasting tool to calculate the quantities and value of products needed to treat the estimated number of children with severe malnutrition for each country of use, based on the UNICEF country offices' estimates of monthly admissions of children into feeding programs.⁷ UNICEF first undertook global demand forecasting for RUTF in January 2009. The aggregate forecast of global product needs informed the bidding process and allowed Supply Division to tell individual suppliers how much product would be purchased by those countries whose demand had been allocated to them.

Accuracy of the aggregate forecast improved significantly: from 53 percent in 2009, to 81 percent in 2010, and 99 percent in 2011. However, forecast accuracy for individual countries varied significantly. Therefore, a mid-year forecast review was introduced. All countries ordering less than 50 percent of forecasted quantities by mid-year are contacted with a request for explanation and possible adjustment of their forecast.

Expanding the Supply Base

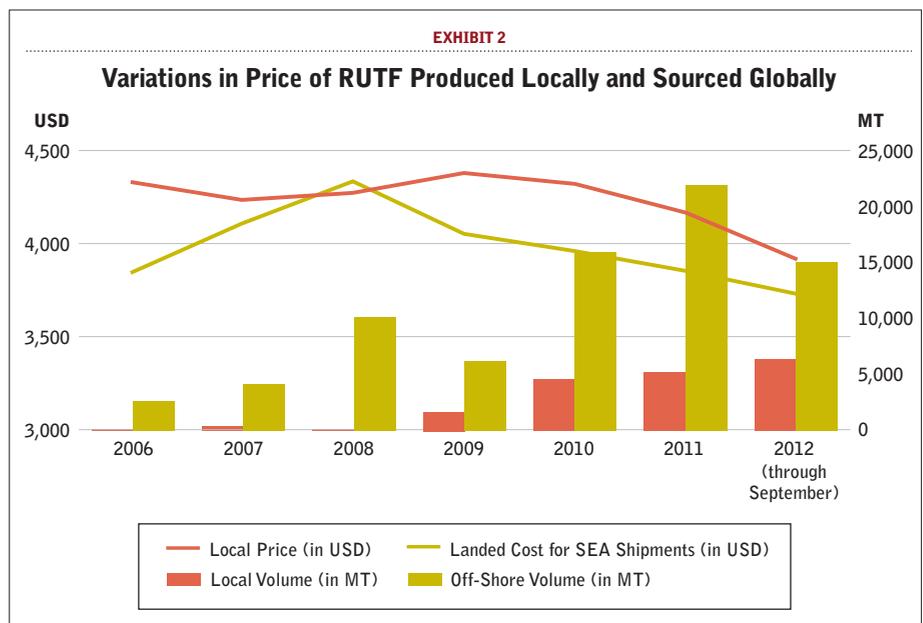
UNICEF used a competitive bidding process to increase the number and diversity of suppliers. The aim was to increase competition and responsiveness and achieve the right balance of “global” and “local” suppliers. UNICEF conducts limited

competitive bids, soliciting offers only from qualified suppliers. The first competitive bidding process was preceded by an advocacy campaign among food manufacturers. The campaign was geared to starting RUTF production and included an invitation to suppliers to express their interest in producing the therapeutic food for the UN agency.

For many products, UNICEF establishes a two-to-three year long-term agreement (LTA) with the supplier that makes the lowest acceptable offer. The agency eventually develops a back-up LTA with the supplier that makes the second lowest acceptable offer. However, this approach would not have encouraged further RUTF market development and would have left UNICEF with one or two suppliers. Therefore, UNICEF established LTAs with all companies that met its technical requirements and allowed for additional suppliers later as they demonstrated that they could meet the requirements.

Today there are 11 qualified suppliers located in countries where the product is used (Democratic Republic of the Congo, Ethiopia, Haiti, Kenya, Madagascar, Malawi, Mozambique, Niger, Sudan, Tanzania, and Zimbabwe). While much of the demand is concentrated in Africa, nutritional emergencies may occur anywhere. For example, recent large-scale emergencies that required RUTF included the floods in Pakistan and the earthquake in Haiti.

The agency follows a variation of the “dual supply” sourcing strategy. UNICEF uses local suppliers to meet a portion of demand in their own countries, producing at a steady rate. It also uses global suppliers, which



are more responsive, to flexibly meet the remainder of any demand needed in those countries, to respond to demand in other UNICEF program countries, and to handle sudden spikes in demand caused by immediate responses to emergencies. Global suppliers have better access to working capital, and have demonstrated that they can very quickly adjust quantities of inputs and levels of production. (There are 10 suppliers outside the countries of use located in Dominican Republic, France, Norway, India and South Africa.)

Depending on the country and on the supplier, using a local supplier can be very challenging. With local suppliers, UNICEF typically sets an order level and orders regularly, so the supplier can run at a steady rate and fill its capacity. Even with the steady purchase volume, a given local supplier may not deliver reliably, as lead times for getting cash, foreign exchange and importing raw materials such as powdered milk and the vitamin and mineral mix may be too long. On the other hand, the local sources of ingredients like peanuts, sugar and oil are often of poor quality and unreliable. Overall, across all local suppliers, cost has been higher than that for global suppliers, in part because of import duties on raw materials of as much as 30 percent to 40 percent and in part because these manufacturers are in a start-up mode, with relatively low volumes.

In addition, delivery timeliness has not been as good. In 2011, among the 11 global suppliers, it ranged from 20.0 percent to 92.9 percent of orders delivered on time. Two suppliers located in Kenya and Madagascar have transitioned from being local suppliers to becoming global suppliers; they will now need to work to improve their delivery performance.

In addition to responsiveness, global suppliers are kept in the line-up for economic reasons. There are significant variations between the weighted average landed price of RUTF per MT shipped by sea from global suppliers to beneficiary countries and the weighted average price of locally purchased RUTF. (See Exhibit 2.) While in 2008, locally purchased RUTF was cheaper compared to imported product due to exceptionally high fuel prices and a strong euro-dollar exchange rate, the locally purchased RUTF has generally been more expensive.⁸ However with increasing purchase volumes the local price is decreasing slowly.

Donor Collaboration and Pre-Positioning of Buffer Stocks

UNICEF initiated work in two other areas: donor

collaboration and pre-positioning of buffer stock. The funding schedule for the country offices showed marked variability due to coordination issues between donor agencies and UNICEF. While donor agencies had their own reasons to hold back funding for RUTF, such delays made it extremely difficult to manage the on-the-ground flow of product, resulting in poor product availability. UNICEF has worked with the University of North Carolina research team to develop optimal operating policies under funding uncertainty and to quantify the impact of funding schedules on performance. Such analysis provides important insights as UNICEF evaluates the potential costs and benefits of innovative solutions such as bridge funding mechanisms that enable better collaboration between funding agencies and country offices.

Pre-positioning of buffer stocks for the Horn of

With its supply chain improvements, UNICEF was able to meet demand in that corner of Africa while maintaining uninterrupted supply to other parts of the world.

Africa has not yet been implemented because the agency has been unwilling to allocate substantial chunks of money as upfront investments for inventory buffers. However, UNICEF Supply Division has been able to collaborate with the UNICEF regional office to solicit funds from the European Commission Humanitarian Aid Department (ECHO) for the investment required to implement a buffer stock strategy in West Africa—specifically, in facilities in Ghana for Burkina Faso and in Cameroon for Chad, Central African Republic, and Cameroon.

Positive Results to Date

Droughts have occurred regularly in the Horn of Africa over the last several decades, resulting in substantial loss of crops and livestock. Exacerbated by rising prices of basic foodstuffs and restrictions on trade movement caused by conflict, droughts have directly contributed to many more children suffering from acute malnutrition. In 2008 and again in 2011, the situation deteriorated so dramatically that humanitarian crises were declared. UNICEF country offices in Somalia, Ethiopia, and Kenya responded to the crises with a range of interventions that

focused on the most vulnerable. Delivering RUTF to malnourished children was a cornerstone of these interventions.

From 2008 to 2011, Supply Division identified and implemented several measures focusing on sourcing strategy as well as supply chain and supplier performance that contributed to the success. Dramatic improvements have been made. (See Exhibit 3.) Demand in the Horn grew rapidly from 2008 to 2011 as RUTF delivery volume more than doubled. Use of local supply increased significantly. Better planning and funding availability allowed for longer allocated

times for deliveries. At the same time, the use of air for delivery from Nutriset decreased dramatically—from 71 percent in 2008 to 13 percent in 2011. The decrease in air shipments resulted from better forecasts of country programming needs, faster funds mobilization by the donors, and increased production capacity of the local supplier. However, delivery timeliness was far from perfect: 29 percent of orders in 2011 still arrived late, with an average delay of 28 days.

Even though 11 global RUTF suppliers had been approved by 2011, Nutriset remained the region's major supplier because of various restrictions in the Horn, supplying 78 percent of delivered volume (for example, rebels threatened to ban UNICEF from Somalia should products manufactured in Kenya or the United States be distributed). While in 2008 Nutriset had to cover nearly all of worldwide UNICEF demand for RUTF, in 2011 nearly half was covered by other suppliers. This enabled Nutriset to focus on expediting deliveries to the Horn. Hilina in Ethiopia remained the only qualified local source of RUTF while

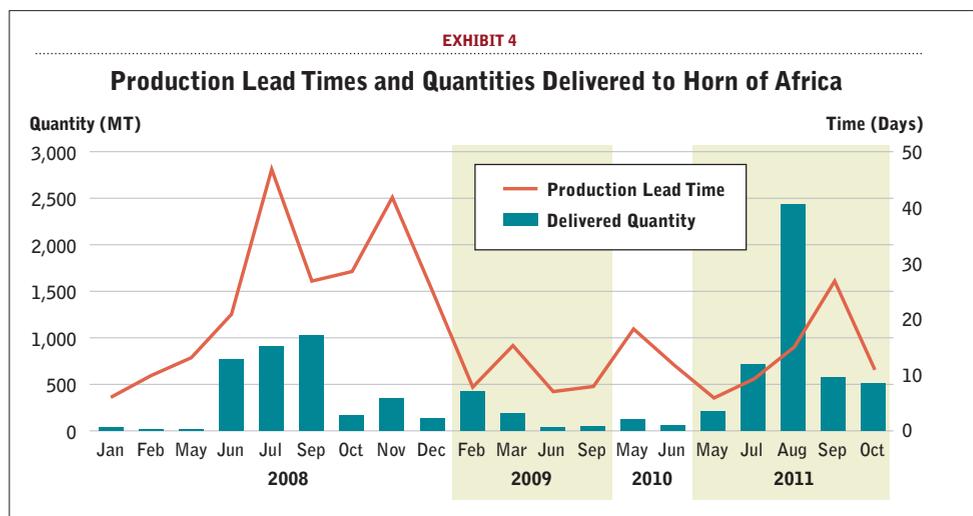
other local sources were qualified in countries outside the Horn of Africa.

When demand for RUTF peaked in June and July 2008, the average production lead time at Nutriset increased to 45 days and remained high for six months. (See Exhibit 4.) (Production lead time is the time between the date the order is placed with the manufacturer and the date the goods are ready for pick up by the freight forwarder for onward shipping by air or sea.) In contrast, when nearly 2,500 MT of product was ordered in August 2011, Nutriset delivered this quantity within 15 days. While production lead time increased to 25 days in September, it returned to normal levels the following month.

EXHIBIT 3

Performance Improvements Between 2008 and 2011

		2008	2011	Improvement
Quantity	Ordered Quantity	4,500 MT	9,500 MT	+ 5,000 MT
Sourcing	Share Sourced from Local Suppliers	4%	21%	+ 17%
	Share Sourced from Nutriset	96%	78%	-18%
Lead Times	Country Office Requested Lead Time	46 days	62 days	+16 days
	Supplier Lead Time (Nutriset)	33 days	20 days	-13 days
	Shipping Time Le Havre-Mombasa	37 days	36 days	-1 day
	Shipping Time Le Havre-Addis Ababa	42 days	42 days	0 days
Delivery Performance	On-Time Delivery to Port of Entry	27%	61%	+34%
	Average Delay	37 days	28 days	-9 days
	On-Time Delivery by Supplier (Nutriset)	N/A	78%	
	Average Delay by Supplier (Nutriset)	N/A	16 days	
Cost	Percent of Product Shipped by Air	71%	13%	-58%
	Product Cost per MT	\$3,828.26	\$3,677.54	-\$150.72
	Freight Cost per MT	\$1,924.23	\$545.04	-\$1,379.19
	Landed Cost per MT	\$5,752.49	\$4,222.57	-\$1,529.92



The Challenges Ahead

UNICEF Supply Division has successfully boosted the availability of ready-to-use therapeutic food and assured a responsive, sustainable and diverse supply base. At the same time, the agency has crafted a strong methodology for RUTF supply chain improvement and performance measurement. As a consequence, UNICEF has been able to cut landed cost of the therapeutic food by 27 percent, saving \$14.2 million during the 2011 response to the famine crisis in the Horn of Africa. UNICEF's experience provides valuable insights into how to create responsive supply chains for innovative hit products that face lumpy, spiky demand and leverage local supply in places such as Ethiopia, Niger and Haiti.

Looking ahead, Supply Division will continue to work with UNICEF Programme Division and external partners to address evolving issues that could affect RUTF availability and accessibility for beneficiaries. Five areas appear to be most salient:

1. *Resolve concerns about the flow of funds by creating working capital and/or buffer stocks.* Uncertainty related to the amount and timing of funding schedules could be mitigated by adding appropriate buffers of cash or stock of RUTF.

2. *Anticipate future production capacity needs as the market evolves further.* Given expected demand growth and uncertainty about where demand will arise, demand forecasting and supply planning will be critical for establishing appropriate local and global production capacity.

3. *Grow and manage the supply base as a network to balance availability, cost and development objectives.* Continue to work to define how each global and local supplier contributes to timeliness, cost effectiveness, and flexibility of local and worldwide supply, as well as to support of local development objectives.

4. *Extend measurement of global and local supplier performance.* UNICEF Supply Division is working to further refine its criteria for measuring supplier performance, for what constitutes good supplier performance, and for bet-

ter assessing local suppliers' delivery performance.

5. *Establish efficient local supply chains.* Building sustainable in-country RUTF supply chains managed by national authorities will allow integration of the product into national health care systems. 

UNICEF Supply Division has successfully boosted the availability of ready-to-use therapeutic food and assured a responsive, sustainable, and diverse supply base.

End Notes:

- 1 "Child Alert, Horn of Africa: A report on the impact of drought on children," UNICEF 2006 and <http://www.nytimes.com/2010/09/05/magazine/05Plumpy-t.html?pagewanted=all>
- 2 UN Joint Statement issued jointly by WHO, WFP, UNSCN and UNICEF.
- 3 1 MT contains 72 cartons of RUTF and can save the lives of 72 children.
- 4 For a general discussion of supply chains for innovative products, see "What is the Right Supply Chain for your Product?" by Marshall Fisher, *Harvard Business Review* (March-April, 1997).
- 5 Other major purchasers include MSF, the Clinton Foundation, UNHCR and various other NGOs
- 6 For more detail, see W. Gilland, C. Mourchero-Vickery, A. So and J. M. Swaminathan "A Supply Chain Analysis of Ready-to-Use Therapeutic Foods for the Horn of Africa: The Nutrition Articulation Project" (November 2009).
- 7 In addition to RUTF, UNICEF Supply Division also ensures that all other products (anthropometric equipment, therapeutic milk and various pharmaceuticals) are available at each feeding center.
- 8 The UNICEF contract for supply of RUTF with Nutriset is in euros.

Copyright of Supply Chain Management Review is the property of Peerless Media and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.