MAXIMIZING FOOD AID SUPPLY CHAIN COST EFFECTIVENESS

A Report from the Food Aid Quality Review Workshop at the 2017 Health and Humanitarian Logistics Conference

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FROM THE AMERICAN PEOPLE

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INTRODUCTION:

In a time of unprecedented humanitarian need and limited resources, a key goal for the humanitarian and development community is to enhance cost effectiveness, particularly of the on-going and emergency food aid supply chains. Food aid supply chains are deemed to be cost effective if they "deliver the right product to the right people at the right time for the right price/cost" to reach the desired impact for a beneficiary population, this will include considerations of product design, procurement, transportation, and retail channels or the 'last mile[1]' for humanitarian aid.

As humanitarian and development projects struggle to reach all populations in need of food aid assistance, maximizing supply chain cost effectiveness has become an increasingly salient issue. Optimizing economic decision-making around food aid policy and programming requires crucial evidence in food aid commodities' cost-effectiveness coupled with nutritional impact. This goes beyond price per ton of food provided to understanding the total cost of an effective intervention in relation to defined outcomes among food aid beneficiaries. Innovative tools are critical in this effort to improve predictive modeling and programmatic decision making.

The USAID Food Aid Quality Review (FAQR) project[2] is developing tools to maximize cost-effectiveness in the food aid value chain while also promoting efficiency gains across the US government and global food aid actors. Driven by the priorities, mission, and mandate of the United States Agency for International Development (USAID)/Office of Food for Peace (FFP) to increase efficiency, maximizing USAID/FFP's ability to provide assistance and making the most of the tax dollars. In order to promote conversation around the FAQR developed tools and other important, relevant tools, the FAQR team organized a session at the 2017 Health and Humanitarian Logistics (HHL) Conference in Copenhagen, Denmark on June 7th, 2017.

Four food aid supply chain cost effectiveness tools currently being developed and used by development and humanitarian organization decision makers at different levels were presented as case studies during the conference session. This report summarizes the cases and offers insight into the future strategies for maximizing food aid supply chain cost effectiveness.

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[1] The 'last mile' concept is relevant to activities involved in delivering food aid products and/or commodities to defined beneficiaries. Thus, in a food aid distribution program, the last mile refers to the final leg of delivery. The items delivered will typically have come from a storage facility, such as a central or satellite warehouse, to a distribution point. It is at the distribution point that beneficiaries take ownership of the food.

[2] A team led by Tufts University Friedman School of Nutrition Science and Policy faculty has been carrying out a Food Aid Quality Review (FAQR) for the United States Agency for International Development (USAID)/Office of Food for Peace (FFP). FAQR seeks to provide USAID and its partners with actionable recommendations on ways to improve nutrition among vulnerable people for whom the direct distribution of food aid can make a significant impact. The project is doing so by integrating the latest science on nutritional needs of beneficiary populations across the developing world and a growing understanding of the role of specially-formulated commodities in meeting defined nutritional needs. For more information: https://foodaidquality.org/

CASE STUDIES:

Food Aid Supply Chain Cost Effectiveness Tools

The four tools detailed in the report are: (1) FAQR Decision Support Tool for cost-effectiveness calculation and (2) FAQR Commodity Supply Chain Optimization Tool, (3) World Food Programme's Optimus System, and (4) World Vision Last Mile Mobile Solutions.

1. Decision Support Tool for Specialized Nutritious Food Aid Products cost-effectiveness calculation

The Food Aid Quality Review (FAQR) project has developed an interactive decision support tool that informs the selection of more cost-effective specialized nutritious food aid products that range from Fortified Blended Foods (FBFs) and micronutrient powders (MNPs) to Ready-to-Use Foods (RUFs) and High-Energy Biscuits (HEBs). The tool is targeted to food aid program officers tasked with the selection of specialized nutritious food aid products for nutrition programming purposes. The tool's development is motivated by a need to compare cost effectiveness of alternative products for addressing specific food aid issues. In the tool, comparison of products is based on expected costs (including shipping, in-land transportation, and last-mile costs) and expected impacts (including a range of measures of 'success'). Please see Figures 1-4 for a schematic description of the tool's framework.

The web-based tool uses recent historical data on program costs and program impact assessments from the literature to compare the cost and cost-effectiveness of alternative specialized nutritious food aid products that are designed to meet the nutritional needs of specific target beneficiary groups. The tool has three types of input: (1) demand for a specialized nutritious food aid product, (2) related cost parameters including procurement and logistics costs, and (3) nutritional effectiveness parameters. The output is a side by side comparison of products among all cost and nutritional effectiveness dimensions considered.

The availability of data has been the biggest challenge in the tool's development as well as the usability of the tool, which will require sustained data updates. The FAQR team has drawn data and evidence from USAID, World Food Programme (WFP), United Nations Children's Fund (UNICEF) and scientific and programmatic literature. Continued availability of data will be a key factor in the tools future growth, especially data related to nutritious impacts as the questions of how to measure effectiveness and how to convert effectiveness into field outcomes remain salient.

Figure 1: Nutrition Programming Purpose-based Algorithms to Calculate Required Amount of Selected Specialized Nutritious Food Aid Product

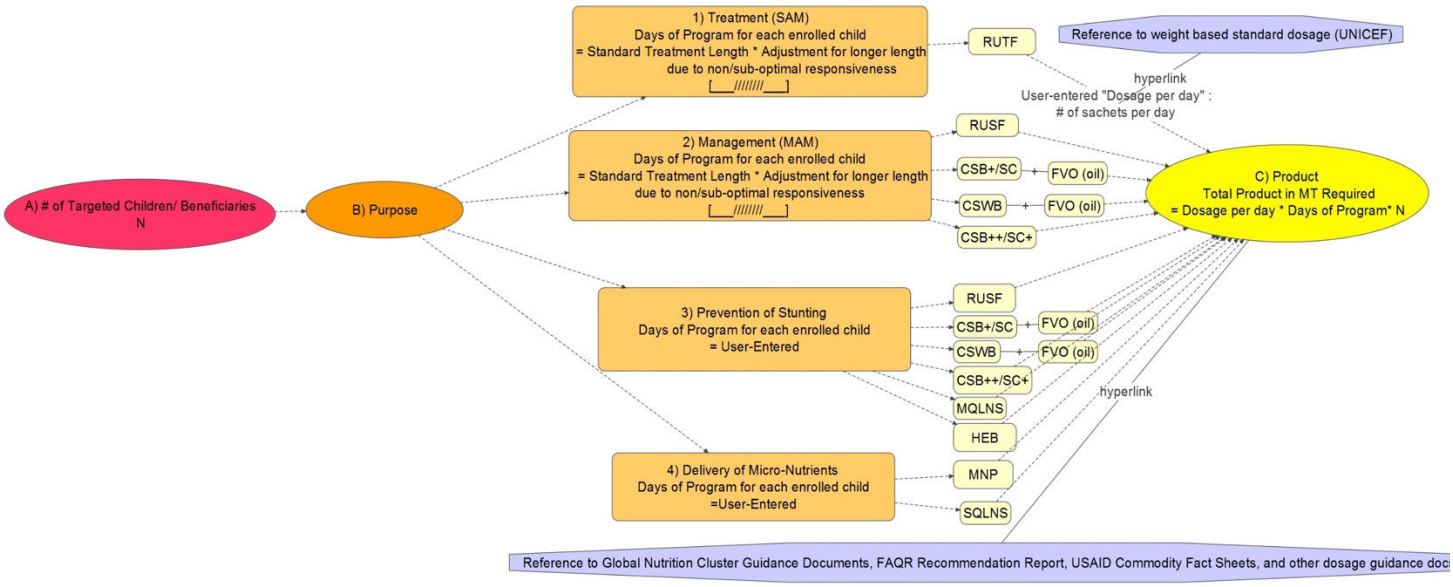


Figure 2: Sliders on Ranges of Historical Product and Supply Chain Cost Data

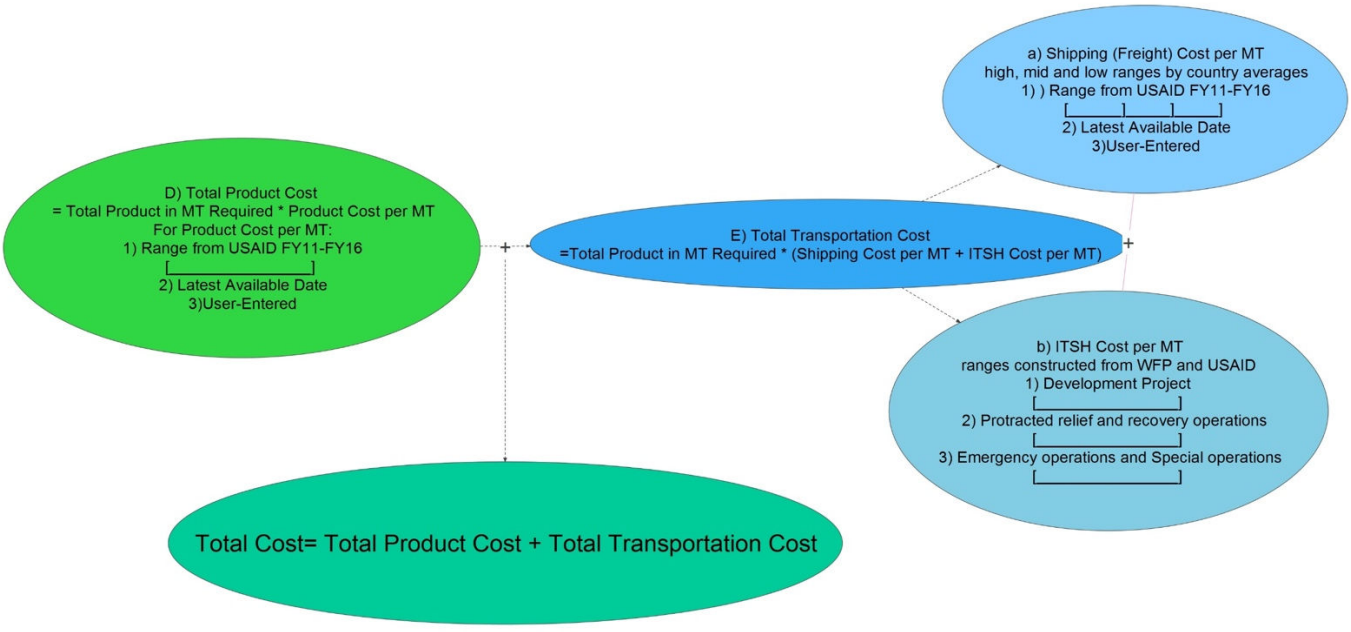


Figure 3: Sliders on Data-Guided Ranges of Coverage/Reach, Effectiveness Coverage, and Purpose-specific Program Impact

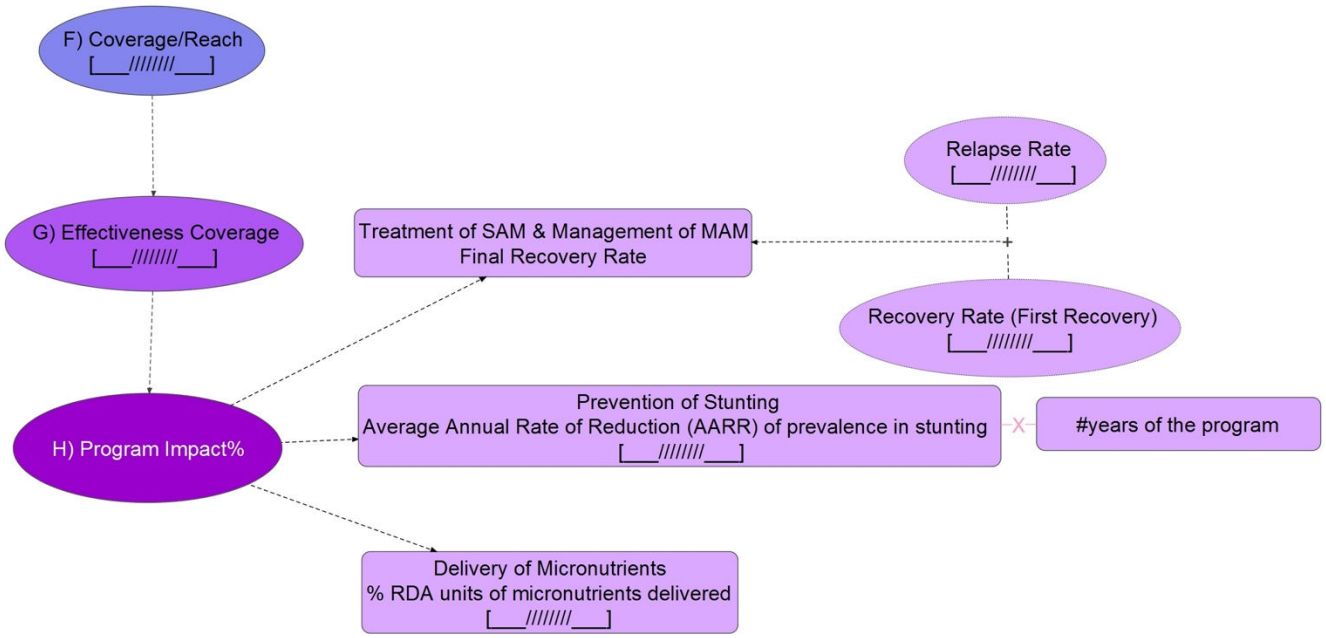
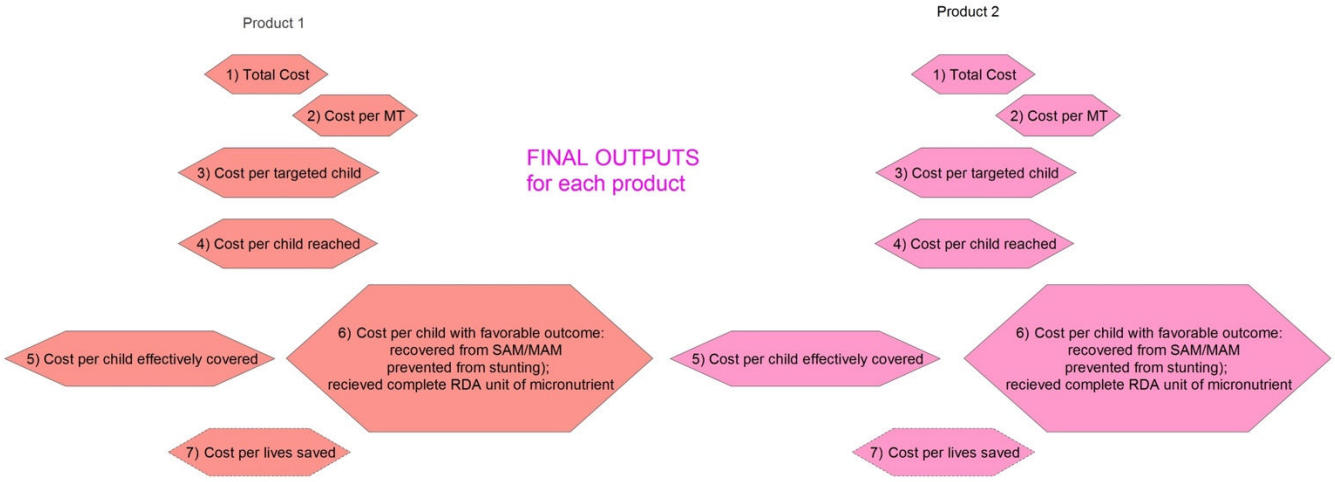


Figure 4: Final Outputs for each product

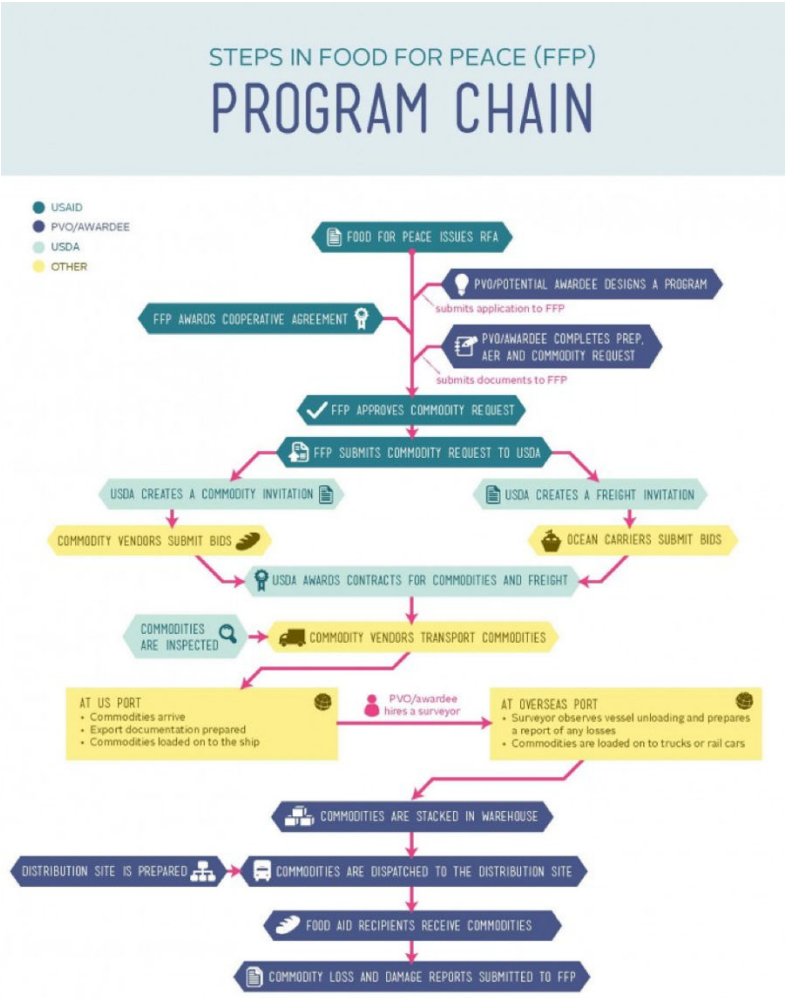


2. *Commodity Supply Chain Optimization Model and Tool*

FAQR is developing a supply chain optimization tool based on the current operations of the USAID/FFP supply chain (Figure 5). The current USAID/FFP supply chain starts with the receipt of a request for a FFP related need. USAID prepares and runs a competitive bidding process to procure the requested commodities and the necessary ocean transport. Once the bids are awarded commodities are procured and first transported to U.S. loading ports or U.S. prepositioning warehouses via ground transportation and then shipped to their overseas destinations. When the commodities arrive at their destination ports they are once again sent via inland transportation to either partner warehouses or to USAID international prepositioning warehouses. USAID partners are responsible for the remaining

distribution. The aim of the tool is to aid stakeholders to make decisions that deliver the right commodity with the right volume to the right place at the right time in a cost-effective way by identifying the right procurement and transportation strategies, transfer modality ratios and prepositioning options for all operations. Please see Figure 6 for a schematic description of the tool's framework.

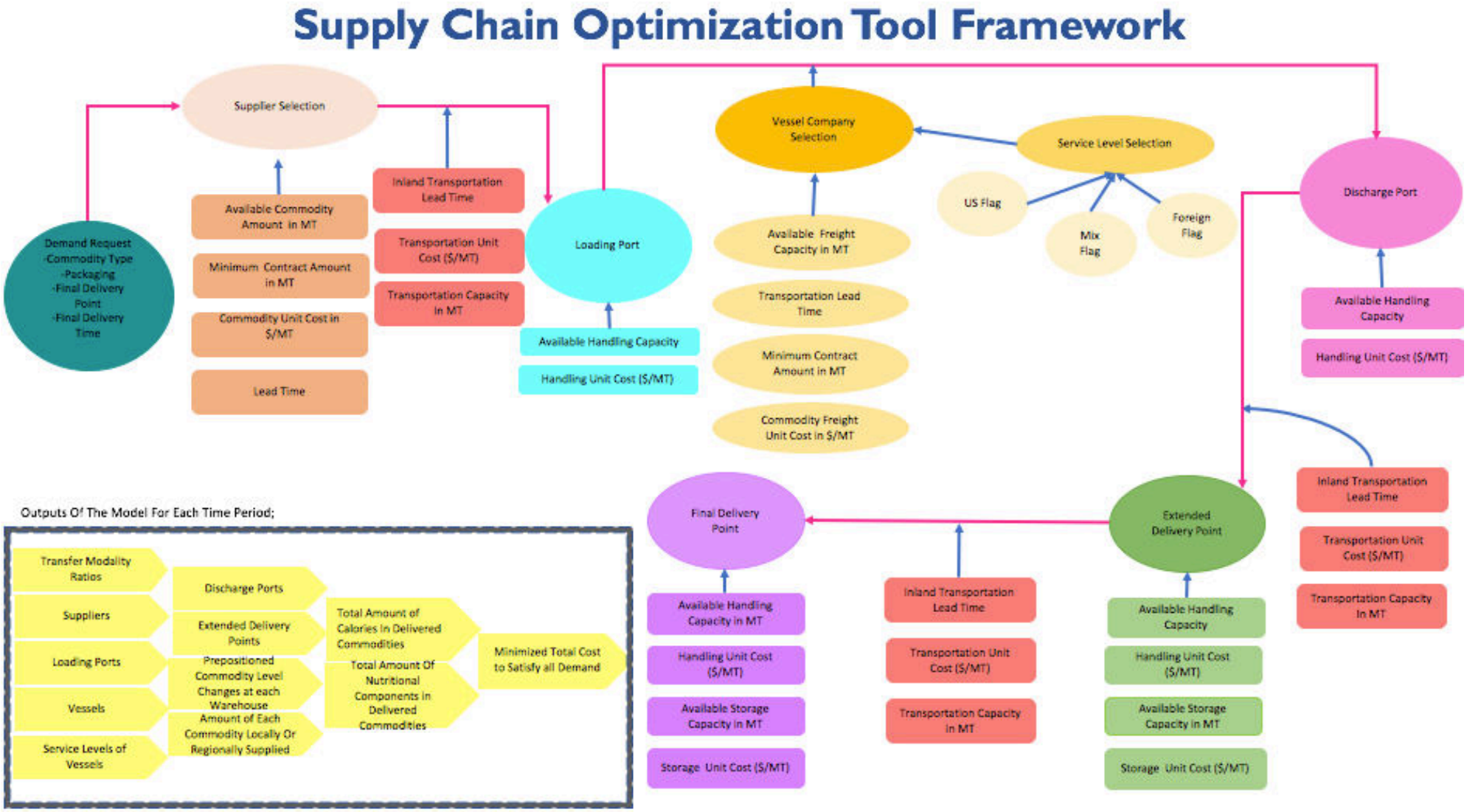
Figure 5: USAID/FFP Program Chain



The Commodity Supply Chain Optimization Model identifies the optimal choices in transfer modality, prepositioning levels, procurement, ocean transportation and inland transportation, for satisfying pre-determined demand using data provided by USAID, USDA and USAID partner's including WFP. The ability of the model to consider the extent of the supply chain operations from procurement to final delivery points depends on the availability of cost, capacity and lead time data throughout the supply chain.

Based on historical data analysis efficiency gains from the tool's recommendations are expected to be driven by better utilization of advanced purchasing to decrease procurement costs due to seasonal fluctuations of commodity prices, increasing the effectiveness of prepositioned commodity usage and improving decisions on vessel service level assignments.

Figure 6: Commodity supply chain optimization tool framework

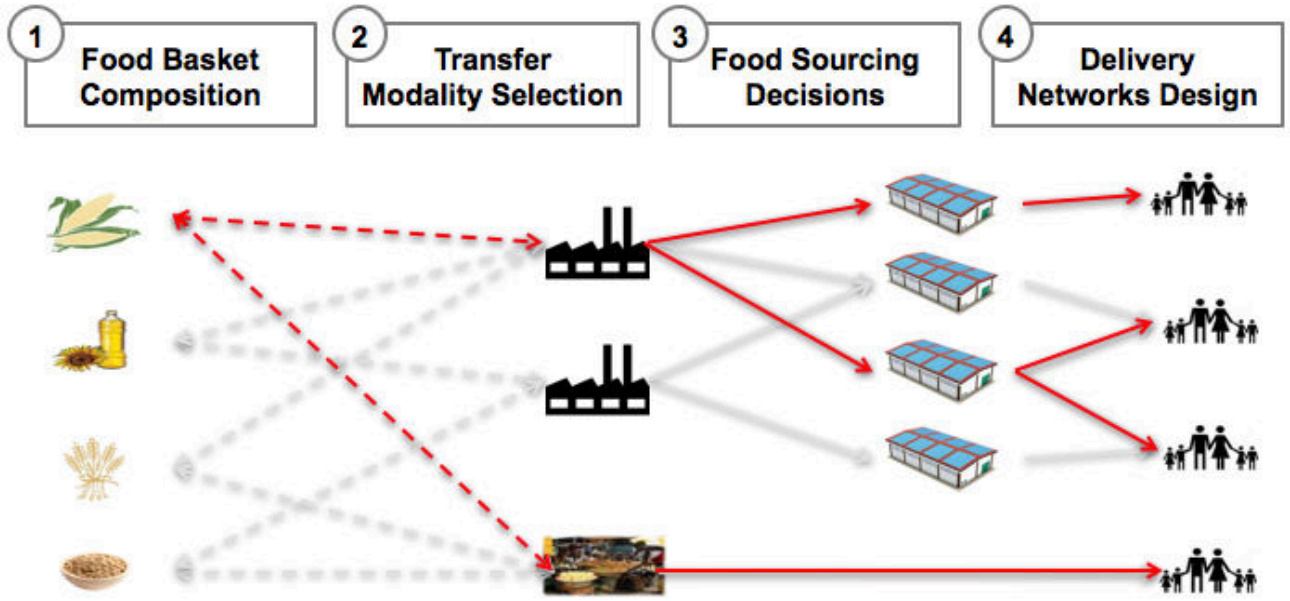


3. World Food Programme (WFP) Optimus System

The World Food Programme (WFP) is currently assisting 80 million people in around 80 countries each year. This means that on any given day, WFP has 5,000 trucks, 40 oceanic shipments and 70 planes on the move. Every year WFP distributes approximately 12.6 billion rations at an estimated average cost per ration of US$ 0.31. Because of the complex and ever-changing nature of their operations, advanced analytics and mathematical modeling are needed to help WFP manage the complexity of their system and design optimal programmatic and operational interventions that make the most of available resources.

The Optimus tool designed by WFP is a cross-functional system that supports evidence-based program and operations design by using algorithms to rapidly assess and compare the cost-effectiveness of a wide range of scenarios. Please see Figure 7 for a schematic description of the tool's framework.

Figure 7: Optimus system framework



To use the tool functional experts jointly define input parameters, objectives and constraints while the optimizer runs the analytics and provides a range of solutions. The system takes as input the available commodities across the supply chain (e.g. from smallholders, retailers, international markets, etc.) that could address the targeted nutritional gaps, and then identifies the optimal design of the operation (e.g. which food basket to provide, which transfer modality to use, etc.). By optimizing the key decisions defining an operation simultaneously, significant efficiency and effectiveness gains are achieved.

For example, when WFP considered redesigning the food basket for Syria, Optimus was used to evaluate the cost-effectiveness of different food basket compositions, comparing their nutritional outputs and end-to-end costs. This helped the country office to find a food basket composition that provided the same level of kilocalories at a lower cost. Implementing the tool's proposed changes to the food basket led to considerable efficiency gains, with more than 20M USD confirmed savings to

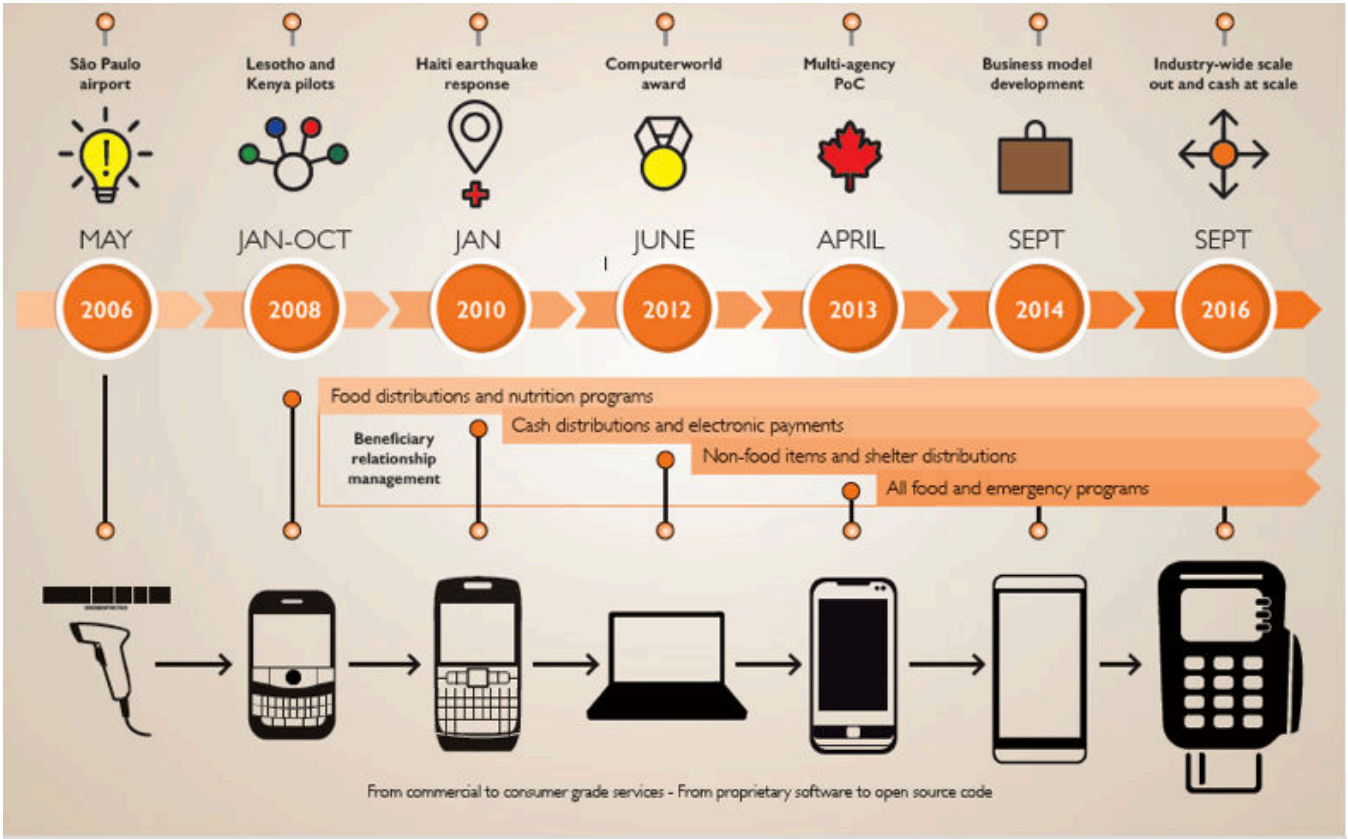
date. As is, Optimus is being used to optimize level 3 and complex emergencies on a continuous basis. In parallel, WFP has been creating a web application to provide all country offices access to the Optimus tool, which will be rolled out globally in 2018.

WFP stated that their main challenge is that data availability and quality across countries is quite variable, and that it's often hard to integrate information from different sources. Because of this, they are investing heavily in initiatives that strengthen their data foundation.

4. *World Vision Last Mile Mobile Solutions*

Since 2008 World Vision has been implementing the Last Mile Mobile Solutions (LMMS) in 27 countries, reaching 9 million beneficiaries. The tool is focused on the last mile, defined as the transition areas between the agency and beneficiaries. It seeks to address some key last mile problems such as, (a) the ability to measure reach, impact, and accountability, (b) the question of did the right aid get to the right person and the right time, and (c) if aid provided made a difference. Please see Figure 8 for the development timeline of LMMS.

Figure 8: Timeline of the LMMS evolution



With LMMS beneficiaries are registered into the system with associated vulnerability criteria and the system determines what ration is needed. LMMS scans a beneficiary bar code to register receipt of assistance and can be integrated with other parts of the supply chain, for example warehouse systems.

The integration of LMMS with other supply chain systems is key to align efforts and combine information across supply chain, with the consideration that these different tools and systems must be able to communicate with each other.

To date, the efficiency gains obtained by LMMS in time and cost savings have been quantifiable in the generation of reports and feedback. The tool has improved transparency, reduced fraud, and resulted in increased dignity for beneficiaries. Furthermore, the platform over time has been able to be scaled up, as it started with a focus on food aid products but can now capture any commodity that is being distributed. There has been a notable convergence between private and NGO sectors to drive this innovation forward.

CHALLENGES FOR OPERATIONALIZING SUPPLY CHAIN TOOLS

Despite the utility of these tools there have been challenges faced in implementing them by decision makers at different levels.

For any decision support tool to be accepted and implemented, programmatic and operational objectives must be coded into the system. In the food aid supply chain context this requires the identification of agreed-upon meaningful objectives that represent cost effectiveness. This task is very challenging given the variety of perspectives in an end-to-end supply chain and various organizations involved. Furthermore, there are not currently agreed-upon universal standards on product-specific dosages, durations of interventions, and ranges of expected impacts for each product.

Data plays a key role in the success of any analytical system. Data availability particularly for downstream supply chain components is not always guaranteed in food aid supply chains. Furthermore, although data might be available, its quality and accessibility by the tool developers and users might not be at a level needed for effective implementation. Moreover, master data management which includes matching taxonomy, coding, frequency of synchronization and data updates across systems, and beneficiary data security are significant challenges that need to be resolved.

While technological issues make automation and standardization of analytical tools difficult, another challenge lies in managing the complexity of the information/data needed to support the models and tools. Often, tools designed to consider multiple scenarios across the supply chain require a large and complex set of input parameters to be entered and updated by users. Organizations do not always have the capacity to support the users of these technologies. Both tool development and long term user support require financial investments where the benefits of these investments only materialize over time and sometimes can't be fully quantified.

Finally, managing the change process in humanitarian organizations with many stakeholders and some with decentralized structures is an essential but difficult task. First, the mindset of "we've always done it this way" needs to be overcome by continuous stakeholder engagement and effective demonstration of the decision aid tools impact on programmatic goals and operational efficiency. Second, the users and stakeholders must be given opportunities for feedback as the tools evolve over time.

Some of the next steps to deal with the challenges identified above include increased collaboration and communication between organizations for shared services and data to reduce duplication of efforts. Along the same lines, it is important to be aware of existing technologies and tools and repurpose those that already exist and are working.

CONCLUSIONS

This workshop provided over 25 participants for a diverse range of background and expertise with the unique opportunity to consider four food aid supply chain cost effectiveness frameworks and discuss how to address current information gaps and overcome barriers to implementing these tools and frameworks. By the end of the session, attendees had obtained a better understanding of (1) which sources of information could generate more timely and complete insights on costs along the entire value chain; (2) how decision-makers choose between alternatives relating to food aid supply chain management; and (3) what is needed to make use of supply chain cost effectiveness frameworks, tools, and models more pervasive in the sector.

These tools represent the forefront of the food aid supply chain field. Barriers to implementing these tools and frameworks still exist. Further efforts are needed to provide more timely and complete information on costs, capacities and lead times along the entire value chain, allowing for decision making based on analytical supply chain cost effectiveness frameworks, tools, and models. As humanitarian and development programmers and policy makers continue to implement these tools and frameworks pathways for improvement will become more defined.

Annex 1: Workshop #2: Food aid supply chain cost effectiveness; a discussion of learning, adaptation and capacity building

A second workshop followed the workshop on tools to maximize food aid supply chain cost effectiveness, with a discussion of food aid supply chain cost effectiveness issues were discussed from a perspective of field adaptation and capacity building. Three case studies were presented to stimulate discussion around learning, adaptation, and capacity building. WFP Ethiopia shared experiences from years of collaboration with the Government of Ethiopia on the Food Management Improvement Project (FMIP) and plans for the new Supply Chain Capacity Building Project aimed to reduce port congestion, centralize procurement, integrate railway transport, develop systems for road transport efficiency and safety, and improve coordination and emergency preparedness. Massachusetts Institute of Technology's (MIT) Humanitarian Response Lab shared experiences in learning and adapting based on two research projects involving food packaging: with smallholder farmers in Uganda and in international supply chains from the United States to ports in Africa. Finally, World Vision International shared experiences learning and adapting in deployment of information systems. Below are brief descriptions of each presentation.

WFP Ethiopia Supply Chain Capacity Building Project

Ethiopia is a populous country that experiences frequent droughts, climate shocks and emergencies. The Logistics Cluster, with WFP as the lead agency, was activated in May of 2016 on the request of the Ethiopian government to respond to the El Niño drought in Ethiopia. The Logistics Cluster, while supporting the government in implementing the response, performed a gap analysis on country entry points, storage and transportation capacities, logistics coordination, pipeline visibility and distribution lead times. Furthermore, strategies for addressing these gaps were implemented including increased storage capacity, surge staff availability and seconding of logistics advisors, improvements in reporting, information management and coordination, the Ethiopian operations shifted from moving 100,000 tons per year to 100,000 tons per month.

A key insight from this experience is that organizations and governments cannot wait for emergencies to implement supply and logistics strengthening systems. The recurrence of climate shocks necessitates a long-term strategy and current strengthened systems will not be sufficient moving forward. Building the capacity of governments and other partners should be a key aspect of a long-term strategy. Other process improvements in food aid supply chains include implementation of commodity tracking and allocation tools, development of commodity management procedure manual, and management of warehouses.

Massachusetts Institute of Technology's (MIT) Humanitarian Response Lab: Purchase for progress—Uganda

MIT's study focused on reducing post-harvest losses by considering different handling and storage options. Four types of hermetic storage options were offered at reduced price to farmers. Cost analysis of these four options were conducted to determine which option is the most sustainable on the market without subsidization. The study also considered willingness to pay, adoption by farmers

and supply chain impacts. The study concluded that allowing markets to be sustained by the private sector actually increases adoption and facilitating markets helps to sustain growth.

World Vision, Information Technology

The presentation discussed change management processes for IT systems, ensuring there is a robust process for making functional requests to IT tools, and inter-agency collaboration for repurposing rather than recreating data.

Annex 2: Description of Workshop

As humanitarian and development projects struggle to reach all populations in need of food aid assistance, maximizing food aid supply chain cost effectiveness has become an ever more salient issue. Economic decision-making around food aid policy and programming requires crucial evidence in food aid commodities' cost and cost-effectiveness. This goes beyond price per ton of food provided to understanding the total cost of an effective intervention in relation to defined outcomes among food aid beneficiaries. Two important issues need to be addressed: i) how to fill significant evidence and data gaps; and ii) what tools and frameworks could be used to improve predictive modeling.

The proposed workshop seeks to address these issues by offering an introduction to four food aid supply chain cost effectiveness frameworks currently used by development and humanitarian organization decision makers at different levels. It will also feature an interactive discussion with session participants on how to address current information gaps and overcome barriers to implementing these tools and frameworks. By the end of the session, attendees will have a better understanding of (1) which sources of information could generate more timely and complete information on costs along the entire value chain; (2) how decision-makers make choices relating to food aid supply chain management; (3) what is needed to make supply chain cost effectiveness frameworks, tools, and models more predictive; and (4) the steps that humanitarian and development programmers and policy makers can take to implement and improve these frameworks and tools in their own work.

Structure

0:00 – 0:05	Introductions
0:05 – 0:45	Representatives from four organizations each have approximately 10 minutes to present the tools or frameworks they use to promote supply chain cost effectiveness, as well as barriers and information gaps they face in using these models. 1. FAQR supply chain optimization model, USAID/FFP 2. WFP cost effectiveness tool 3. UNICEF supply chain division 4. World Vision LMMS tool
0:45 – 0:55	Interactive discussion between panel and audience on the following questions: • What are your organizations' objectives in using supply chain cost effectiveness frameworks, and how do decision-makers make choices relating to food aid supply chain management? • What data and information is currently used to inform supply chain cost effectiveness, and what sources could generate more timely and complete information on costs along the entire value chain? • What is needed to make supply chain cost effectiveness frameworks, tools, and models more predictive?
0:55 – 0:60	Panel of the agency representatives respond to the points raised in the discussion and answer any lingering questions.

Annex 3: Presenter Biographies

Ozlem Ergun, Supply Chain Specialist Food Aid Quality Review (FAQR), Northeastern University

Professor Ergun has worked with food aid, supply chain design and optimization and emergency response projects with a variety of organizations including UN WFP, UNHCR, and FEMA. As the Supply Chain Specialist, she focuses on mathematical modeling and analytics to aid decision making on what, where, how, and to whom to deliver food aid. Professor Ergun received a Ph.D. in Operations Research from MIT.

Keziban Tasci, Steve Vosti, Ye Shen, Maria Wrabel and Lindsey Ellis Green contributed to Professor Ergun's presentation.

Koen Peters, Supply Chain Consultant, World Food Programme

Koen Peters is an optimisation expert working for the Supply Chain Innovation & Incubation unit of the World Food Programme. For the past three years, he has been developing and institutionalising a range of analytical tools that support evidence-based decision making. In particular, he is the project lead for Optimus, an optimisation tool that supports field staff in designing their operations end-to-end. This online tool integrates key decisions, such as the food basket design, transfer modality selection, and sourcing & delivery strategy. In parallel to his work at WFP, Koen is pursuing a PhD at Tilburg University (NL) as part of its Data Science for Humanitarian Innovation research program.

Keith Chibafa, **Head of Business Development (LMMS)**, **World Vision International**

Keith Chibafa joined World Vision International in 2010 after a career in the private sector. He is responsible for overseeing World Vision International's efforts to collaborate with key local and international entities interested in the implementation and execution of WVI's Last Mile Mobile Solutions (LMMS) technology. In addition, he provides advisory and technical support to innovative approaches to Cash Transfer Programming and digital payments.

Annex 4: Summary of 2017 Health and Humanitarian Logistics Conference (available at: https://chhs.gatech.edu/conference/2017/)

2017 Health & Humanitarian Logistics Conference at UN City in Copenhagen draws participants from around the world to share solutions and save lives

The challenges of meeting fundamental human needs and responding to emergencies have been continuing and growing at a fast pace. Healthcare is in the forefront for many countries, with a wide range of focus areas including childhood survival, communicable and non-communicable diseases, and nutrition. Critical health emergencies, such as the Ebola outbreak and the ongoing Zika challenge, as well as natural and man-made disasters have ravaged numerous communities around the world. The negative effect of emergencies is disproportionally high on low income or vulnerable populations, complicating ongoing development needs in health, nutrition, education, and other key areas. Whether we face an emergency or a long term development challenge, there are often many actors who play a role, limited resources available, as well as variability, uncertainly, and potential disruptions in the demand and supply chains. All of these factors highlight the importance of logistics and supply chain management in these contexts.

In light of these grand challenges, the **Conference on Health & Humanitarian Logistics** provides an open forum to discuss new solutions in health systems, disaster preparedness and response, and long-term development. Co-organized by the Center for Health and Humanitarian Systems (CHHS) at Georgia Institute of Technology, INSEAD, MIT Humanitarian Response Lab, and Northeastern University, the conference offers a unique platform for participants to discuss challenges, share best practices, and explore potential collaborations, with the goal of enhancing efficiency and effectiveness in health and humanitarian systems, and ultimately improving and saving lives around the world.
2017 marked the **9th year** of the conference, which took place during June 7-9, in Copenhagen, Denmark at the UN City, hosted and co-organized by the UNICEF Supply Division. The event drew over 200 attendees from 39 countries and 127 organizations, including non-governmental organizations and UN agencies as well as government, industry, foundations, and academia.
The agenda featured 3 plenary panel sessions and 53 break-out presentation and workshop sessions led by practitioners and thought leaders on current challenges and solutions in health and humanitarian logistics. 31 posters were presented, providing a platform for networking and discussions around new tools and implementations.

Dr. Richard Brennan, Director of Emergency Operations for the World Health Organization (WHO) Emergencies Programme division, delivered the opening keynote, and addressed the role of logistics in health and humanitarian response and the importance of global, national and local capacity building, cross-sector collaboration and partnerships, and performance measurement. Brennan led the Ebola Response as the Director at the WHO headquarters from October 2014 to January 2016 and now oversees the organization's response to global health emergencies as part of the new Emergencies Programme, from preparedness and prevention to response, and from humanitarian emergencies to disease outbreaks. Plenary panel sessions included presentations focused on: 1) Global Health Emergencies; 2) Innovation and Influencing Markets; and 3) Ensuring Sustainability of Supply Chain Systems Strengthening Interventions. (Keynote and plenary presentations are available on the conference website: chhs.gatech.edu/conference/2017/panels)

Participants were active on **Twitter** (#2017HHLConf) throughout the event, sharing points and reflections, reacting to the presentations and workshops. Participants also commented that the conference was "very educational and allowed for great networking among participants" and "the workshops were well-organized, insightful, and very informative."
The conference could not have been possible without the generous sponsorship from key partners such as the UPS Foundation, the premiere sponsor for the 9th year, Imperial Health Sciences, Johnson & Johnson, the William David Institute at the University of Michigan, and the Partnership for Supply Chain Management.