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USAID GLOBAL HEALTH SUPPLY CHAIN PROGRAM
Procurement and Supply Management

TO3 LAST MILE DYNAMIC ROUTING

Adoption Roadmap

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The USAID Global Health Supply Chain Program-Procurement and Supply Management (GHSC-PSM) project is funded under USAID Contract No. AID-OAA-I-15-0004. GHSC-PSM connects technical solutions and proven commercial processes to promote efficient and cost-effective health supply chains worldwide. Our goal is to ensure uninterrupted supplies of health commodities to save lives and create a healthier future for all. The project purchases and delivers health commodities, offers comprehensive technical assistance to strengthen national supply chain systems, and provides global supply chain leadership.

GHSC-PSM is implemented by Chemonics International, in collaboration with Arbola Inc., Axios International Inc., IDA Foundation, IBM, IntraHealth International, Kuehne + Nagel Inc., McKinsey & Company, Panagora Group, Population Services International, SGS Nederland B.V., and University Research Co., LLC. To learn more, visit ghsupplychain.org

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Acronyms

3PL	third-party logistics
LM-DOS	Last Mile-Dispatch Optimization System
WMS	Warehouse Management Systems

Introduction

This report outlines the implementation roadmap for more efficient last-mile distribution operations using the Last Mile – Dispatch Optimization System (LM-DOS) tool. The GHSC-PSM team developed a Proof of Concept of the LM-DOS to best address the unique challenges of last-mile dispatch in developing countries. These challenges were identified in an in-country assessment conducted by the team to develop an understanding of the current state of countries' distribution systems.

The team envisions the roadmap building over the course of three phases, each adding a degree of data-driven strategic planning, summarized here:

- **Phase 1.A: Short-Term Dispatch Optimization**
  Countries can plan optimized dispatches on a short-term basis once orders are ready for dispatch.

- **Phase 1.B: Proactive Dispatch Planning**
  Countries have the data and understanding to strategically plan dispatches over a longer period.

- **Phase 2: Integrated Dispatch Planning and Optimization**
  Countries can prioritize the picking of approved orders by aligning the tool with existing systems and processes.

- **Phase 3: Optimized Distribution Strategy**
  Countries can plan the timing and frequency of order collection to further refine the overall distribution strategy.

The proposed roadmap presents an opportunity for countries to work with the GHSC-PSM team to develop a link between the distribution process and the supporting tool. While the Proof of Concept tool fills the requirements of Phase 1.A and 1.B, later phases will require countries to work together with the team to incorporate existing systems and processes. In the background, we outline the need for more efficient last-mile distributions and highlight the key criteria necessary for the supporting tool.

Background

Last-mile distribution is a critical step in the supply chain for ensuring patients have access to life-saving medicines and supplies when and where they need them. Currently, out of the nine countries surveyed in the in-country assessment, seven use a fixed set of distribution routes. This approach limits the options and ability of transportation teams to respond to missing, late, or emergency orders, and can result in low utilization of transportation resources, stockouts at sites, lack of trust in on-time delivery, and increased transportation costs.

The team recommends the adoption of a decision support tool to simplify the complex and time-consuming planning tasks for the distribution manager, while trying to reduce transportation costs and improve last-mile distribution performance. The tool should be developed to complement and integrate with in-country systems, such as existing technology and distribution procedures, to help countries better understand and improve their processes. The proposed tool will be able to handle unique challenges identified in the in-country assessment, including:

- **The requirement to handle multi-day deliveries.** The assessment identified six countries that use a mix of single- and multi-day delivery, three countries that use only multi-day delivery, and no countries that use only single-day delivery.

- **The need to account for a mix of third-party logistics (3PL) contracted and government-owned vehicles, and a mix of vehicle sizes.** The assessment identified five countries that use a mix of 3PL contracted and government-owned vehicles, three that use only government-owned vehicles, and one that uses only 3PL contracted vehicles. The assessment also found that, generally, there is a mix of vehicle sizes ranging from medium size, to vans and lorries.

- **Including volumetric data to inform decisions of routing.** Currently, volumetric data is not being used to inform dispatch planning, presenting an opportunity to incorporate such data into a decision support tool. Considering volume in dispatch planning will help to improve vehicle utilization, ensure facilities are not stocked above maximum capacity, and drive insights into the products and orders having the most influence on the last-mile delivery system.

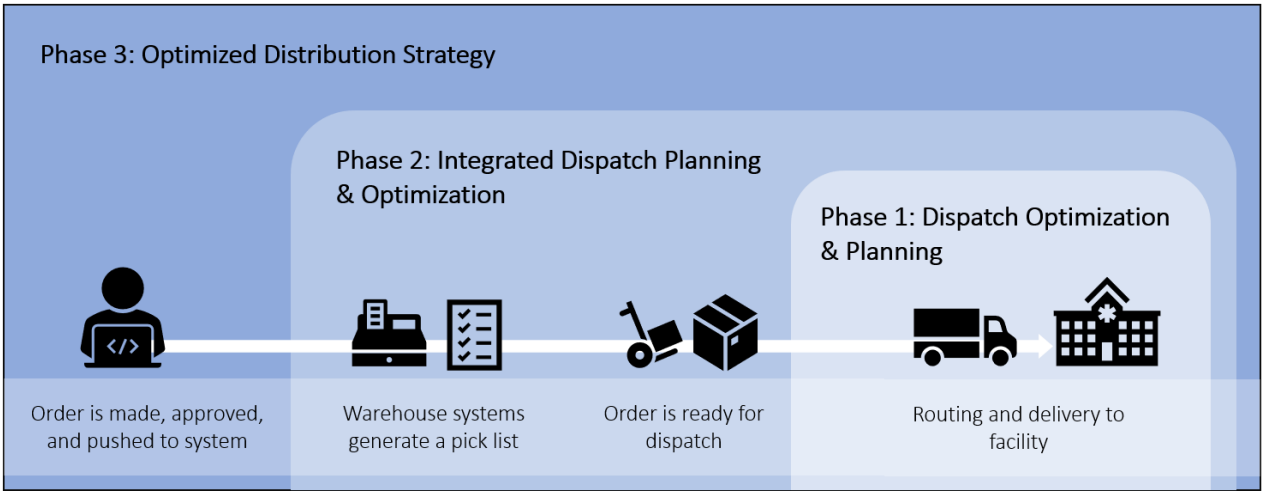
- **The requirement of having a simple-to-use interface that directly integrates with Excel.** The assessment found that staff generally do not have strong technical skills, making tools that integrate easily with Excel desirable.

The GHSC-PSM team developed a Market Research report assessing existing tools that might fulfill the requirements of dynamic routing for developing countries. Two tools, VillageReach and Project Last Mile were identified as the best potential fits. VillageReach stood out for its user-friendly Excel-based interface but was limited by not factoring in costs or facility storage capacity. Project Last Mile is a substantial tool, having adapted best practices to develop routing optimization and logistics management capability, but requires significant startup data and technical resources, which many countries may see as a barrier to entry. While viable options, these identified tools do not completely fulfil the requirements of last-mile delivery for developing countries, so the GHSC-PSM team developed a proof of concept for the LM-DOS tool.

The GHSC-PSM team proposes the first phase of the adoption roadmap for the LM-DOS to enable countries to plan and evaluate dynamic routing for last-mile delivery. The proof of concept fulfils the requirements of this first phase (1.A and 1.B), but additional development and integration are necessary to transition into the later phases. GHSC-PSM envisions countries working together with the team to create a tool linked closely with the processes and existing systems used in-country. Next, we discuss each of the phases of the roadmap in detail, and the actions countries will need to take to enter each point in the roadmap.

Roadmap Phases

Figure 1: Adoption Roadmap



Phase 1.A: Short-Term Dispatch Optimization

Countries can plan optimized dispatches on a short-term basis once orders are ready for dispatch

In the first phase, the team envisions countries using the LM-DOS to plan routes once an order is ready for dispatch, as shown in Figure 1. Countries will continue using existing systems and processes to handle order collection, picking, and dispatch preparation, but they will have an additional distribution management tool to aid in dispatch planning. The tool will determine an optimal routing solution with goals of improving on-time performance and reducing transportation costs.

The LM-DOS is easily customizable to adapt to in-country systems, so a country can quickly begin using the tool and seeing the benefits of dynamic routing. With the various complexities of route-planning to consider – from managing networks of facilities, vehicles, and orders to tracking gas and per diem costs, 3PL rental fees, road closures or vehicle breakdowns – manually planning last-mile delivery becomes difficult and time-consuming. By adopting the tool in this first phase, management will no longer have to manually factor all these complexities into planning vehicle assignments and routes.

In this phase, the tool incorporates data from existing systems to plan dispatches based on product, order, facility, and fleet data, and has the flexibility to adapt to a country's current processes. Exhibit 1 details the data countries will need to gather to begin utilizing the tool for dynamic routing. The interface is user-friendly and built in Excel, and allows planned dispatches to be exported to Excel, PDF, or visualized in a Leaflet map. Dispatch results have multiple output formats to read and view the solution, including a driver view, a key performance indicators view, and various management views.

Exhibit 1. Data Required in Phase 1

	Data Required in Phase 1
Order Data	– Order ID

	– Product ID – Quantity – Destination – Dispatch Date – Requested Delivery Date – Order Date (optional) – Picking Date (optional)
Product Data	– Product ID – Item Description – Unit of Measure – Unit Volume (the GHSC-PSM team has resources to fill in this data when necessary) – Temperature Requirements (optional)
Facility Data	– Facility ID – Facility Name – Facility Location (such as an address or latitude and longitude) – Facility-to-Facility Distance Matrix (the GHSC-PSM team can utilize open-source tools to create this matrix when necessary)
Fleet Data	– Vehicle ID – Vehicle Capacity – Average Gas Mileage – Availability Date (when the vehicle will be ready for a dispatch)

Initially, the tool is envisioned to be run "last-minute", such as on a weekly basis, to best account for unexpected field circumstances. These short-term results allow management to begin thinking about routing parameters and start to understand constraints and bottlenecks to the distribution cycle, before moving into Phase 1.B: Proactive Dispatch Planning.

Phase 1.B: Proactive Dispatch Planning

Countries have the data and understanding to strategically plan dispatches over a longer period.

After a country has adopted Phase 1.A and gained experience using the LM-DOS for dispatch planning, management will have an improved understanding of efficient routing and constraints on their delivery system and will be able to strategically plan and evaluate future routes. Once a country has gained this experience with dynamic routing, the opportunity arises to begin planning delivery schedules and routes for longer-term distribution periods.

Management will be able to strategically create regular routing plans and schedules for longer periods (e.g., six months at a time), with the experience of using the tool to help plan efficient routes and identify sources of bottlenecks. The tool has built-in functionality allowing the user to manually adjust dispatch planning based on prior experience, including grouping facilities or orders together, to allow for this level of strategic planning.

Additionally, the team envisions that in this phase, countries will begin creating benchmarks for delivery based on prior performance. Countries can use the statistics provided by the LM-DOS on benchmarks such as travelled distance, resource allocation, and on-time delivery fulfillment to better understand each component of the distribution system. These benchmarks then aid countries in comparing metrics across different warehouses and facilities, identifying areas for improvement, and taking proactive action to improve the areas causing bottlenecks and issues.

Phase 2: Integrated Dispatch Planning and Optimization

Countries can prioritize the picking of approved orders by aligning the tool with existing systems and processes

In Phase 2, the team envisions the LM-DOS tool expanding to help prioritize the order of facility pick lists within the warehouse for dispatch. This phase builds on the dispatch optimization enabled in Phase 1 to incorporate another step in the distribution cycle, as shown in Figure 1. Countries will continue to follow their current order processes but have the additional technology to support generating prioritized pick lists in addition to routing and dispatch planning.

The team envisions the LM-DOS outputting a diagram that orders facility pick lists in the most effective way based on planned dispatches. The diagram will inform warehouse management on the order in which pick lists should be fulfilled. This will ensure if a group of facilities is on a route planned to depart on a certain day, orders for those facilities will be picked ahead of time and ready to leave the warehouse on the day the dispatch is planned. The tool will also provide flexibility in planning facility picking based on transportation resources. A user can indicate fleet resources and vehicle availability dates, and the most efficient dispatch planning and pick list order will be generated by the tool. This will aid in reducing the impact of delays on future dispatches.

To enable accurate planning, the LM-DOS tool must be linked to the distribution process. Countries will need to work with the GHSC-PSM team to inform and develop the integration of existing in-country processes and systems with the LM-DOS. While the tool can be run independently of warehouse management systems (WMS), there must a process flow in place to ensure order information is loaded into the LM-DOS concurrently with WMS systems. Exhibit 2 describes the additional data sources a country should have available to transition to this phase.

Exhibit 2. Additional Data Required in Phase 2

	Additional Data Required in Phase 2
Order Data	– Access to WMS systems – Pick Grouping

Once a country reaches this phase, it will have the technology to enable further improvements to on-time delivery fulfillment and resource utilization. Management will not have to manually plan picking priority, order dispatch dates, vehicle assignments, or routes, and instead the most efficient picking order and dispatch plan will be automatically generated. The ability to orchestrate warehouse processes with dispatch planning will allow countries to align and coordinate these steps of the distribution cycle. This means when an unexpected issue arises which may disrupt the normal distribution flow, such as a vehicle delay or an unusually large order, countries have the flexibility to quickly adapt and smoothly deliver. Taking the step towards proactive planning, as opposed to reactive, allows countries to plan distribution resources more effectively based on needs and have greater flexibility with managing those resources.

Phase 3: Optimized Distribution Strategy

Countries can plan the timing and frequency of order collection to further refine the overall distribution strategy.

In the final phase of the roadmap, countries will have the ability to strategically plan order collection based on distribution data. Countries will use the LM-DOS to determine the timing and frequency of order collection in addition to planning picking and dispatches.

Before entering this phase, countries will have established a process for dispatch planning and developed a regular delivery schedule with the technical aid of the LM-DOS. With the knowledge of planned dispatches and routes, countries can begin strategically planning order collection to align with the delivery schedule. For example, given a facility on a bimonthly distribution schedule, countries can plan to collect orders on a bimonthly basis, and time the order collection to optimally align with dispatch. By pulling order collection planning into the distribution process, countries will effectively link all stages of the last-mile distribution cycle, and curate a smoother, more consistent flow of deliveries. Exhibit 3 details the additional data a country will need to successfully enter this phase.

Exhibit 3. Additional Data Required in Phases 3

	Additional Data Required in Phase 3
Order Data	– Order Completion Date – Order Frequency

Entering this phase helps countries further refine their distribution cycle by encouraging proactivity in order collection. Countries will be able to align order collection with transportation and warehouse resources to ensure more consistent and reliable supply to all facilities. This will especially aid in improving the consistency of delivery to the more remote, farther distance facilities by ensuring transportation resources are available based on delivery schedules.

Management will also have a complete view into statistics on utilization, bottlenecks, predicted order completion times, and facility data. This means a distribution manager can see when a facility last received a delivery, plan when a facility should receive its next delivery, and then plan when an order should be placed to successfully achieve that planned delivery date. Reaching this final phase of the roadmap will allow countries full insight, planning capability, and decision support at each stage of the distribution cycle, from order placement, to pick prioritization, to routing and delivery.

Conclusion

This roadmap provides a direction for countries to improve their last-mile distribution strategy. Countries can easily begin following this roadmap by adopting Phase 1.A and quickly seeing the benefits of dispatch optimization. After a period of using the LM-DOS, management will have increased insight into the most efficient routing decisions for their country and will be able to start proactively influencing groupings and routing parameters in Phase 1.B.

To move into the later phases, countries will work closely with the GHSC-PSM team to link existing management systems with the tool to build on the routing functionality. Countries will be able to further progress their distribution strategy beyond dispatch planning by generating prioritized pick lists in Phase 2 and then by influencing order collection times in Phase 3. The tool will be fully linked to the distribution process, and management will have full insight and planning over order fulfillment, bottlenecks and constraints, and overall health of the last-mile distribution cycle.

By following this roadmap, the LM-DOS tool will provide decision support by quickly determining an efficient solution at every stage of the distribution cycle, thus freeing up distribution managers' time in making those decisions. By working with GHSC-PSM to develop a link between distribution processes and technology, countries will see the benefits of dynamic planning, including improved on-time delivery fulfillment, better utilization of transportation resources, and minimized costs. More critically, taking these steps to improve the last-mile distribution strategy will ensure more patients have consistent access to life-saving medications and supplies when and where they need them.