Using an open-source dynamic routing tool for sustainable, flexible, and cost-effective last mile distribution in Zambia

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Background: Why is a Dynamic Routing Tool Needed?

As the number of destination facilities grows, the number of possible facility sequences grows exponentially.

If 4 health facilities are scheduled for deliveries, they can be sequenced 24 different ways for a delivery route. But if 22 facilities are scheduled for deliveries, the number of possible sequences grows to 1,124,000,727,777,607,680,000 — that’s over 1.1 sextillion!

A dynamic routing tool, such as the Dispatch Optimizer Tool, can quickly conduct these complex mathematical calculations that are beyond human capability. This can allow transportation planners the flexibility to reconstruct routes weekly as volumes and conditions change.
What Problems Does the Dispatch Optimizer Solve?

Reduce cost and time of deliveries while maintaining service standards by dynamically optimizing delivery routes.
Why **Dynamic Route Optimization**?

Static Route Planning vs. Dynamic Route Optimization:

**Static Route Planning**
- Using set routes planned with or without the use of route optimization software
- Even if routes are mathematically optimized, they are done so for one static scenario and reused under changing circumstances
- This makes it difficult to manage changing volumes, late orders, changing circumstances

**Dynamic Route Optimization**
- Software like the Dispatch Optimizer can allow rapid dynamic adjustments based on changing circumstances and uncertainty
- Can adjust to variability in orders (e.g., different commodity types, quantities, seasonal patterns)
- Can adjust to changes in vehicle and driver availability
- Can optimize late orders separately to find the most efficient dispatch plans while not delaying the on-time orders
- Can adjust as a rainy season impacts accessibility (e.g., split truck routes onto smaller 4x4 SUVs, remove inaccessible facilities)

This is what most countries do today, but there is now the ability to do better.

Open-source software and improving data and IT landscapes have opened options that used to be accessible primarily to corporations able to purchase costly software licenses.
Experience Using DOT in Zambia and Beyond
A Successful Roll-out in Zambia

- **Engagement with local stakeholders**
  ZAMMSA collaborated with USAID’s GHSC-PSM project and their 3PLs in Lusaka to coordinate efforts for the application and business processes

- **User-focused design tailored to public health supply chains**
  App developers spent time embedded in ZAMMSA central medical warehouse and 2 hubs, observing operations and collecting requirements for an operational route optimization application

- **Ongoing and expanding operational use**
  ZAMMSA staff use the tool weekly, with all regional hubs and about 1,955 last-mile health facilities in Zambia currently receiving deliveries planned using this tool; working on expansion to every hub in-country
Transforming Transportation and Warehouse Planning

BEFORE

• Transportation planning was done manually, using guess work based on prior experience
• Sometimes delivered to the same facility on multiple routes for different commodities
• Warehouse sometimes staged orders and the truck was too small or unnecessarily large
• Consistently increasing commodity categories and volumes in Zambia was making reliance on prior experience risky

AFTER

• Data-driven decision making that is flexible to changing circumstances
• Reduced instances of multiple dispatches to the same facility
• Volumetrics and optimized vehicles ensure the best vehicles are planned for each load
• Transportation planners are well prepared to respond to changing or increasing order volumes, even during health crises

Other benefits: Reduced costs and carbon emissions; increased customer satisfaction and employee/3PL coordination
The footprint and features continue to grow, as other countries actively seek to learn from Zambia’s example and adopt the tool.

**Early 2020**
A proof of concept was developed by USAID GHSC-PSM in Excel and tested in Haiti.

**October 2021**
The Dispatch Optimizer was launched in Zambia’s central medical warehouse in Lusaka.

**June 2022**
Based on the initial success, the tool was adapted and rolled out in Luanshya and Mansa, Zambia.

**July 2022**
The app was tested in Kenya, including developing new features to address country-specific needs.

**2023 and Beyond**
Zambia is expanding to 2 new hubs this year and 3 by end of 2024. New features are improving use.

Mali is also testing use of the app.
Technical Solution Details
How to Use the Dispatch Optimizer Tool

The process to generate optimized routes with the Dispatch Optimization Tool

1. User uploads order template; facility details are pre-loaded in the application.
2. User reviews the customers for the order on a map and excludes any as needed.
3. User reviews the available fleet and customer vehicle restrictions and modifies, as needed.
4. User selects parameters for the model and clicks a button to run the optimization.
5. Optimization outputs the ideal routes and vehicle assignments and displays them on the website as maps and KPIs.
6. User downloads an Excel file, which includes stop-by-stop route plans for drivers and loading plans for warehouse managers.

OUR VALUES
- Integrity
- Respect
- Accountability
- Efficiency
- Reliability
- Teamwork
- Innovation
- Client Centeredness
- Environmentally Friendly
The Dispatch Optimizer Application

Route maps, details and KPIs can be viewed on the interactive website.

Or downloaded in Excel for manual modifications, additional analysis, or sharing plans with warehouse staff and suppliers.
Collaborating with and Contributing to Open-Source Technology

- Tool built on top of open-source tools, as shown in the graphic – including OpenRouteService from co-panelist organization HeiGIT
- Deployed on Azure cloud and users access it like any website
- Source code is available for download on GitHub (link below)
- Tool can be adapted for other types of health commodity distribution or service delivery, such as for community health workers conducting home visits

Want to Learn More?

Visit the QR Code on the Screen to...

- READ more about the Dispatch Optimizer Tool
- WATCH a video about the Dispatch Optimizer Tool
- EXPLORE the Dispatch Optimizer Tool's source code
- EMAIL for more details
Thank You!