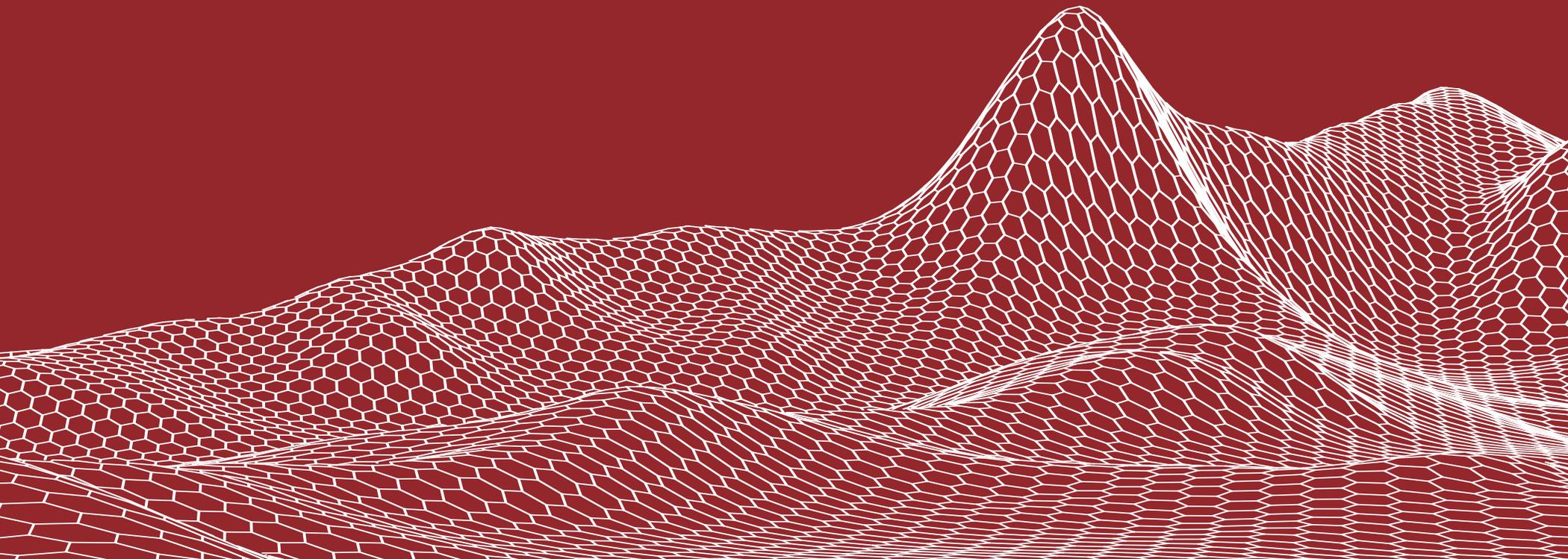

Reaching the Last Mile: Tanzania's Medical Supply Chain

REACH PROJECT



This research is funded by the Mastercard Center for Inclusive Growth; the Canada Research Chairs program; and the Ralph and Roz Halbert Professorship of Innovation at the Munk School of Global Affairs & Public Policy. Research was conducted from September 2018 through June 2019, including primary fieldwork in Tanzania in April 2019. Interviews and site visits were conducted in Toronto, Dar es Salaam, and Mwanza.

The authors of this report express our gratitude and appreciation to those we met and interviewed in Tanzania, including program administrators, government officials, front-line social service professionals, civil society activists, and scholars. Your work and dedication are inspiring.

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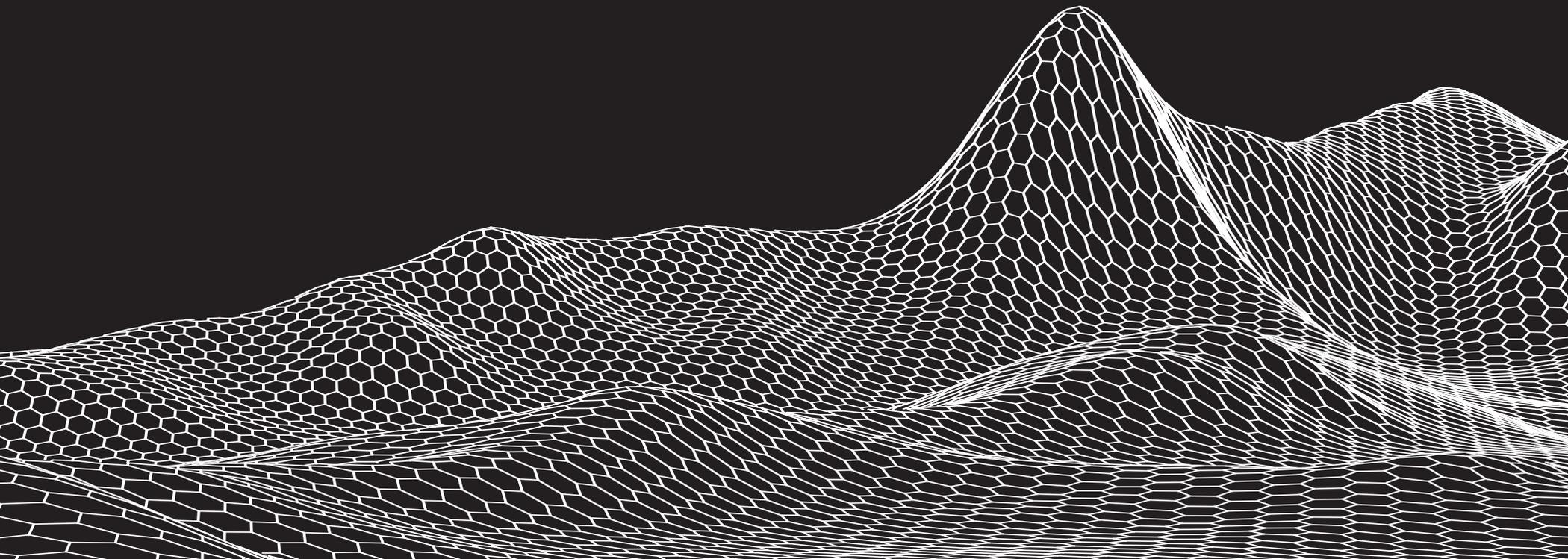
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Gradual Reform in Tanzania's Medical Logistics



William Easterly began his 2006 book *The White Man's Burden* recounting how development aid has failed to reach the world's poorest people.¹ It is as much a critical observation of inefficient logistics and supply chain management as it is an indictment of our priorities as a global society. The year before Easterly's book came out, the fifth Harry Potter book sold millions of copies and shipped around the globe within days of its publication. Why is it that a popular novel can make its way into the hands of millions with such incredible efficiency, but we cannot seem to get essential, potentially life-saving medicines and medical supplies to the people who need them most?

The government of Tanzania and its partners have made great strides in addressing this paradox. Before the 1990s, medicines and medical supplies were distributed to drop-off points throughout the country. Where the medicines went from there was unclear—so was how they got from the hundred or so drop-off points to clinics and, ultimately, to patients.

Over the last three decades, the country's government has gradually and purposefully improved its medical supply chain management and logistics system. Today, the central Medical Stores Department (MSD) is responsible for delivering all medical commodities, including medicines given by donors, directly to over 7,500 public and faith-based health facilities across the

country. This is a remarkable feat: the majority of the population lives in the countryside, far from cities and suburban centers. Getting medicines to distant rural clinics and dispensaries is not easy.

Improving Tanzania's medical supply chain system has been gradual, involving the slow integration of new processes, technologies, and infrastructure over more than two decades. Building and sustaining human capacity have been integral to this process. The use of global positioning system (GPS) technologies and geo-mapping software to optimize delivery routes has made logistics more precise, and in turn, more efficient. Transforming information-management platforms—from medical supplies inventory management to online ordering—has been critical to more efficient processes. Innovations in warehouse construction have allowed storage units to be located closer to health facilities.

In this report we recount the gradual process of reform and improvement in Tanzania, highlighting the extraordinary efforts of local policymakers and program implementers, as well as their collaborations with international organizations and private-sector partners.

¹William Easterly, *The White Man's Burden: Why the West's Efforts to Aid the Rest Have Done So Much Ill and So Little Good* (New York: Penguin, 2006).

IF A COMPANY CAN DELIVER SODA ANYWHERE IN AFRICA, WHY CAN'T ORGANIZATIONS DELIVERING MEDICINES DO THE SAME?

In Tanzania, companies like Coca-Cola worked with local organizations to figure out how to deliver medicine. However, delivering bottles of soda is not the same as delivering medicines and medical supplies. Effective inventory management can mean the difference between timely access to essential medicines and medical supplies, on the one hand, and perpetual stock-outs (i.e., not enough medicines) or oversupply in health facilities, on the other.

Medicines are valuable commodities. Security and governance mechanisms are required to keep products safe and ensure they are delivered before the expiration dates—in time and in good condition to where they are supposed to go. Sophisticated information management systems—such as those needed to effectively manage inventory, storage, ordering, and distribution—require technical infrastructure and skilled workers, both of which are scarce in poor, remote, and rural settings. Delivery trucks need roads, and as we learned in the field, access to good roads in rural and remote Tanzania is not always available. When our truck drove off the ferry in Mwanza, for example, it was only five minutes into our journey that the paved road disappeared and became a dirt track.

We identify the challenges and bottlenecks that need to be addressed if the country's medical supply chain system is to reach everyone. The case illuminates what can be done and what needs to be done in resource-poor settings to ensure that life-saving medicines get to everyone, everywhere.

MEDICAL SUPPLY CHAINS

Tanzania's medical supply chain system began to modernize in the 1990s and early 2000s, driven in part by government efforts to strengthen the national health system, especially in primary healthcare provision. Public health facilities were modernization's main targets because the majority of citizens, especially poor households, used the public system for primary care. Rural health facilities had to be integrated into the national medical care system and the country's medical supply chain.

The Medical Stores Department

At the center of Tanzania's medical supply chain system is the Medical Stores Department (MSD)—a semi-autonomous body that manages the purchase, storage, and distribution of medicines and medical supplies (referred to as “medical commodities”) throughout the country. The MSD was established in 1993 as a financially self-sustaining and nonprofit government department under the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC).

The MSD serves all tiers of public health facilities including hospitals, health centers, clinics, and dispensaries.² It also serves some faith-based organizations that provide health care for large segments of the population. The MSD procures, stores, and distributes two categories of medical commodities: “normal” or sellable commodities, and “vertical” commodities. Normal commodities are procured, stored, and sold directly to health facilities. They are considered essential medicines

and supplies and are sold at a published standardized price. Vertical commodities, on the other hand—such as antiretroviral drugs, immunizations, TB medications, and controlled substances such as opioids—are secured through donor funding or supplied by donors.

The MSD is a national operation, though it runs zonal MSD offices. Each zonal MSD operation is responsible for supplying medical commodities to facilities within its zone boundaries and for ensuring that facilities receive medicines and supplies when and where they are needed.

The MSD began operating in 1994 in eight zones—Dar es Salaam, Mwanza, Iringa, Moshi, Mbeya, Tabora, Dodoma, and Mtwara—in addition to operating two sales points in Tanga and Muleba that support additional sales and distribution for the Moshi and Mwanza zones respectively. Another sales point is planned for Mwanza, the country's second-largest zone, which serves 11 million Tanzanians through 1,300 public health facilities. The complexity of medical distribution is magnified by the largely decentralized nature of Tanzania's government and health system.

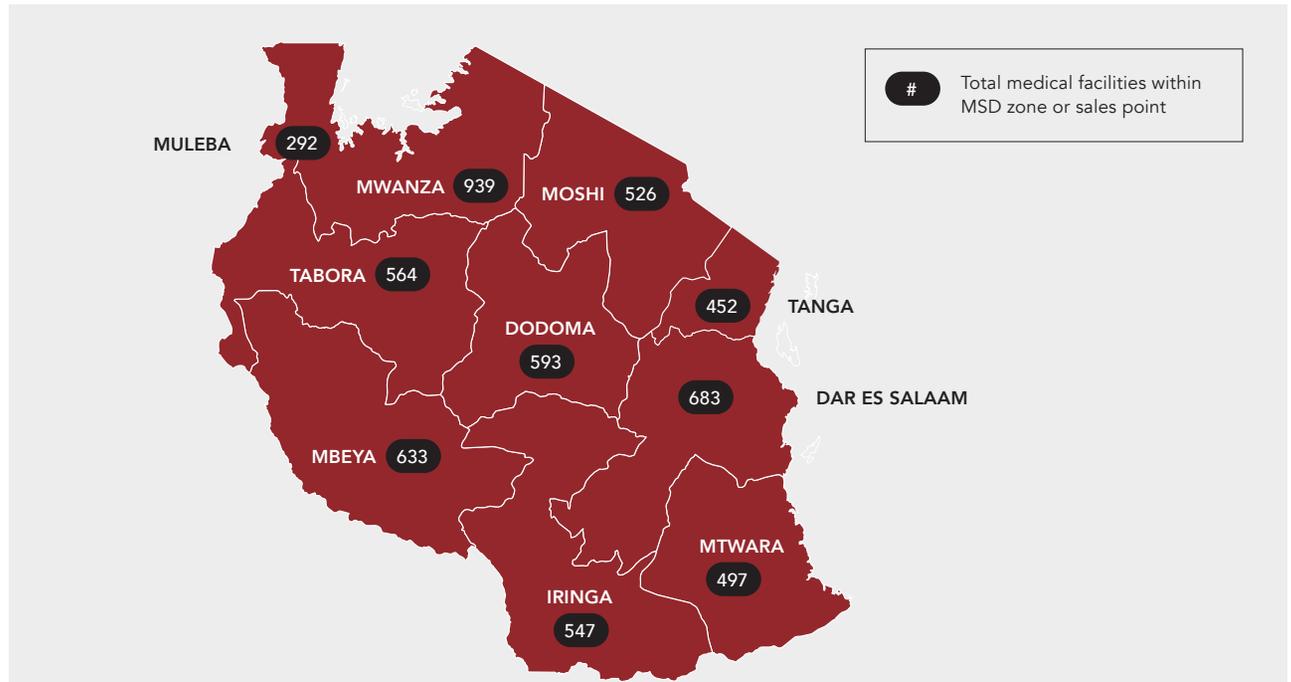
In the 1990s, the MSD was responsible for delivering medical supplies to a hundred or so district drop-off points throughout the country. Today it directly delivers medical commodities to over 7,500 facilities and operates seven additional community outlets located in national and regional hospitals. Operating seven days a week, the outlets provide medicines directly to patients at reduced prices.

² Dispensaries are typically small facilities with between two and five medical staff on site (e.g., a nurse and a medical assistant) who can diagnose and treat patients, do deliveries, and sell a set list of essential medicines, including selected prescription drugs.

Although presently the MSD is heralded as one of Africa's leading examples of effective medical supply chain management, this has not always been the case. Until the 2000s when the medical supply chain and logistics system began to reform, Tanzania's medical supply chain failed to deliver medical commodities to many areas of the country. Deliveries were often late and health facilities' orders were often only partially filled and sometimes not filled at all. This made it especially difficult for hard-to-reach clinics and hospitals to treat their patients.

When it was first created in the 1990s the MSD was unable to consistently and reliably meet the needs of facilities across the country. First, the government bodies responsible for managing medical supply chain operations lacked the capacity—the skilled personnel and expertise—to efficiently deliver medical commodities across the entire country. Managing cold chain storage and reducing damage and expiration require sophisticated technical skills and management experience. With limited human resources, little money, and insufficient experience in medical supply chain management, the MSD was ill equipped to tackle the challenges hindering the effectiveness of the country's medical supply chain.

Second, the MSD lacked access to modern supply-chain-management processes, which inhibited its ability to improve delivery. At the time, procurement and inventory management relied on paper-based information systems instead of modern reporting tools. Health facilities were inexperienced when it came to inventory management and record keeping. This affected the flow of reliable and timely information from the clinics to the central MSD and contributed to the perpetual undersupply of medicines and frequent stock-outs.



	MSD Zone								Sales Point	
	Dar es Salaam	Mwanza	Iringa	Moshi	Mbeya	Tabora	Dodoma	Mtwara	Tanga	Muleba
National Hospitals	1	0	0	0	0	0	0	0	0	0
Special Hospitals	4	0	0	1	0	0	1	0	1	0
Referral Hospitals	3	1	0	1	1	2	1	3	0	0
Regional Hospitals	1	5	3	3	2	2	2	2	1	1
Municipal Hospitals	4	1	1	0	2	1	2	0	0	0
District Hospitals	7	10	4	5	15	5	6	9	4	2
Health Centers	54	98	40	76	38	48	41	38	39	24
Dispensaries	574	797	485	415	560	500	515	420	370	244
Military Hospitals	1	1	0	1	1	1	0	1	4	0
District Designated Hospitals	3	4	4	10	4	2	5	1	4	6
Faith-based Organization	31	9	10	14	10	3	20	23	8	14
Private/NGO/Government Institutions	0	13	0	0	0	0	0	0	21	1
Total	683	939	547	526	633	564	593	497	452	292

FIGURE 1. Strategic locations of MSD zones and sales points. Tanzania map by Vemaps.com.

Third, the MSD did not provide local distribution. Until the mid-2000s, the MSD did not deliver directly to health facilities. Instead, it distributed medical commodities to 130 district-level drop-off points. The MSD's lack of oversight over local distribution meant that district authorities, rather than the central MSD administration, were responsible for delivering medical commodities to health facilities. As a result, medical commodities often failed to reach health facilities, especially those in remote and rural areas.

MODERNIZING THE SUPPLY CHAIN IN THE 2000S

Starting in 2009, the government introduced several policies aimed at improving health service delivery and increasing access across the public health system. Specifically, the MSD initiated several changes to the medical supply chain system to improve efficiency and access for patients. Funding from the government to support these reforms grew throughout the 2010s. Government funding to the MSD, for instance, increased eightfold, from 29.25 billion Tanzanian Shillings (TZS) in 2015–16 (approximately USD 12.5 million) to TZS 260 billion (approximately USD 110 million) two years later.

As part of these reforms, the government led a reorganization of the country's supply chain system. Now over 7,500 health facilities receive deliveries rather than the previous 130 district-level drop-off points. The MSD was able to improve the system when it assumed greater control over the entire supply chain—from procurement of medical commodities to direct delivery to health facilities.

International nongovernmental organizations played an important role. The most significant impetus for changes to the medical supply

chain came from the United States Agency for International Development (USAID) Deliver Project. In tandem with USAID's Supply Chain Management System (SCMS), the Deliver Project worked with the central government—specifically the MoHCDGEC and the MSD—to improve the medical supply chain's performance. USAID addressed skills deficits in procurement, organizational capacity, and the availability of real-time and accurate data across the system. The Deliver Project concluded in 2016, though a follow-up initiative called the Global Health Supply Chain Program Technical Assistance was created to continue its work and the work of the SCMS.

Another program called Project Last Mile (PLM) also contributed to supply chain improvement. Launched in 2010, the collaboration between Coca-Cola and the MSD leveraged Coca-Cola's private-sector expertise in corporate management and logistics to improve the distribution of medical supplies and medicines in Tanzania. The PLM partnership focused on three key areas: delivery logistics, planning and procurement, and human resource management. Coca-Cola and the MSD collaborated with Accenture Development Partners to synthesize and translate private-sector knowledge into a set of best practices adapted to the public sector.

The USAID Deliver/SCMS and PLM initiatives affected Tanzania's medical supply chain in four ways:

1. **Organizational strengthening.** In partnership with the USAID Deliver/SCMS Project, seventy-three people were hired into a newly formed division called the Logistics Management Unit within the MoHCDGEC. USAID Deliver/SCMS provided capacity-building programs to train staff in procurement and inventory-management skills.

2. **Integration of fragmented supply chains.** Before the USAID Deliver/SCMS partnership began, the country's medical supply chain was fragmented. Different products were shipped separately with little coordination. With USAID Deliver/SCMS support, the MSD introduced a fully integrated supply chain, referred to as the Integrated Logistics System. The MSD also implemented an electronic logistics management information system (eLMIS) to eventually replace the paper-based system. The eLMIS would eventually become the sole platform for collecting, organizing, and managing logistics data for the entire medical supply chain.
3. **Warehousing and storage improvements.** To address the MSD's limited storage capacity, USAID Deliver/SCMS, with support from the Global Fund to Fight AIDS, Tuberculosis and Malaria, implemented the "warehouse in a box" (WiB) storage solution. The WiB added storage space by using pre-engineered modular components, a turnkey solution for fast warehouse renovation. This strategy achieved a 165 percent increase in the MSD's warehouse capacity with only a 60 percent increase in its land footprint. The improved warehousing solution contributed to significant cost savings.
4. **Route optimization.** Major improvements in supply chain distribution came from USAID Deliver/SCMS, John Snow Incorporated (a private consulting firm specializing in implementation), and PLM's efforts to optimize delivery routes. Using sophisticated geo-mapping software, experts from these organizations worked with MSD to optimize delivery routes across each of the MSD's zones. Route optimization reduced the amount of fuel and time required for delivery to facilities, resulting in a more efficient use of

Modernizing Tanzania's Supply Chain: Key Players and Timeline

The Coca-Cola Company and the Coca-Cola Africa Foundation provided funding and logistical expertise to Project Last Mile. Institutions under the Coca-Cola umbrella engage in corporate capacity sharing by providing its experiences in delivery, distribution, and marketing.

The United States Agency for International Development (USAID) is an independent agency of the US federal government that is

primarily responsible for administering civilian foreign aid and development assistance. USAID is the primary driver and a funder of the USAID Deliver/SCMS Project. Under the ten-year Deliver Project, USAID improved health across the globe by strengthening supply chains.

John Snow Incorporated (JSI) is a public health research and consulting firm. It was a major implementing partner on the Deliver

Project and an implementing partner of a portion of Project Last Mile. JSI's technical expertise in supply chain management equips MSD to address infrastructural and technical challenges in the supply chain.

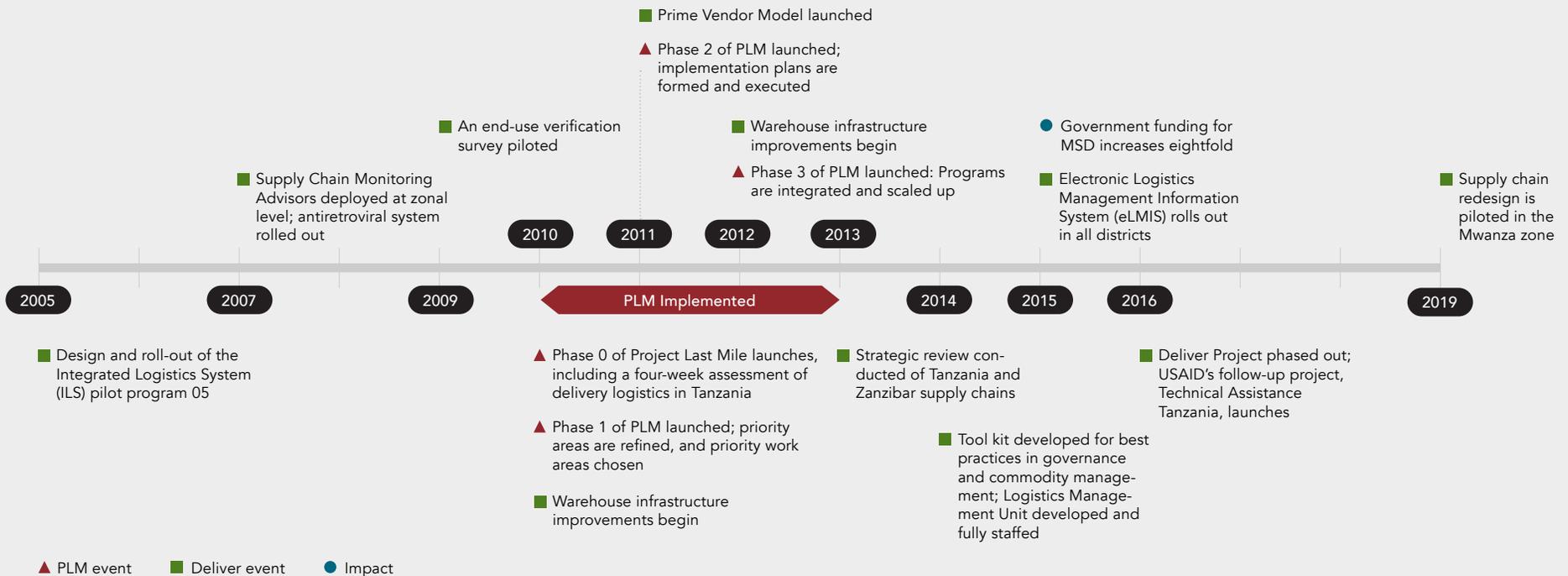


FIGURE 2. Modernizing Tanzania's supply chain: Key players and timeline

resources and enabling more frequent and on-time deliveries.

Route optimization initially posed a major challenge for supply chain managers in the MSD because they lacked reliable mapping data and on-the-ground routing information. To improve distribution, the MSD first initiated an ambitious data-collection project, collecting GPS information from delivery vehicles as they drove their regular routes. The data identified the specific locations of (previously unmapped) health facilities. The project improved mapping coverage of the country which was vital for determining travel speeds and delivery times to and from health facilities. We learned, for instance, about travel times and distances between distribution points but also the specific amount of time drivers spent at each health facility during drop-off. Drivers spent between less than thirty minutes in some facilities to up to two hours in others.

All of this previously unknown information was necessary to model optimal routes. The MSD utilized the Llamasoft Supply Chain Guru software to streamline delivery routes. Computer-simulated modeling was expected to save time, fuel, and ultimately, money.

The MSD developed two optimized delivery models. The regular model identifies the most efficient delivery route to each facility. In some regions, optimized models meant fewer routes needed to be driven and contributed to more efficient reloading schedules at the zonal warehouse. The other, more innovative

option is the mobile warehousing model which uses multiple vehicles and a chain-like transfer of medical commodities. Toyota Land Cruiser trucks deliver directly to facilities, while larger refrigerated ten- or fifteen-ton trucks function as "mobile warehouses," traveling along routes where the four-wheel-drive Land Cruisers can restock without returning to the zonal warehouse.

According to JSI's report on route optimization, which was published in September 2015, delivery routes in Tanzania were optimized to improve the medical supply chain's efficiency. Mobile warehousing reduced the number of routes driven.³ For example, in Sikonge, route optimization and route sequencing effectively reduced the time, travel distance, and cost of delivery.

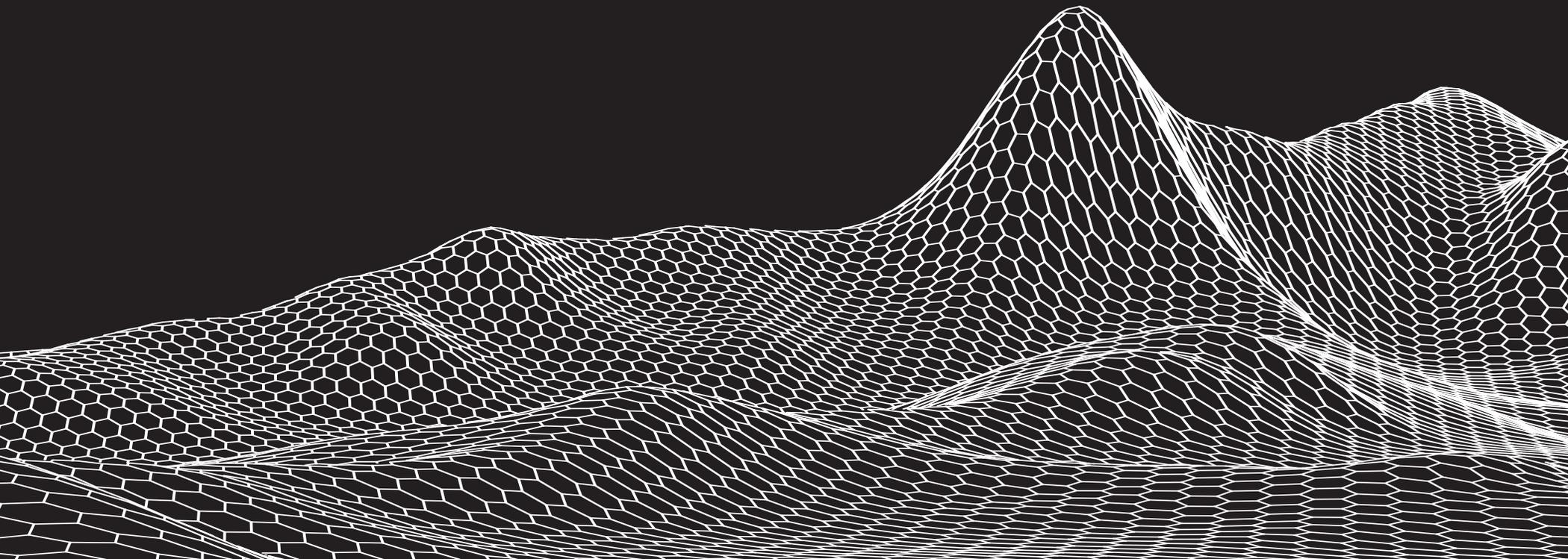
Despite the promise of route optimization and potentially greater efficiencies in Tanzania's medical supply chain system, the MSD experienced many challenges in implementation. For example, maintaining optimized models requires regular data updates such as up-to-date information about delivery locations and the volume of commodities to be delivered to each facility. Another challenge stems from changing weather (and thus road) conditions. During the rainy season, for instance, roads can be washed out and become inaccessible to vehicles. And finally, human- and technical-capacity issues remain a perpetual problem in the MSD. Frequent staff turnover, the lack of geospatial modeling skills, and the cost of modeling software licenses have made it difficult to sustain earlier efforts at route optimization.

SUMMARY

Starting in the 1990s, the government introduced policies to improve health service delivery and increase access across Tanzania's public health system. This led to the creation and subsequent reorganization of the country's medical supply chain, which moved from a district-delivery model to a direct-delivery model. These system improvements—including organizational strengthening, supply chain integration, storage improvements, and route optimization—were supported by several programs including Project Last Mile, a collaboration between Coca-Cola and the Medical Stores Department, and the USAID Deliver/SCMS Project.

³ Karlan Jankowski, "Delivering to the Last Mile in Tanzania: Route Optimization with Medical Stores Department" (Arlington, VA: USAID Deliver Project, Task Order 4).

How the Medical Supply Chain Works Today



Tanzania's medical supply chain system has become more efficient and effective at ensuring essential medicines and medical supplies reach everyone in the country. However, challenges remain, especially in terms of reaching the hardest to reach in the countryside and more remote regions. Internally driven improvements within the Medical Stores Department (MSD) and contributions from external partners such as USAID, Project Last Mile (PLM), John Snow Incorporated (JSI), and the Global Fund have gradually improved the reach of the country's medical supply chain system. As before, the MSD continues to manage every part of the medical supply chain: procurement, storage, and distribution. It also drives process improvements.

PROCUREMENT

The MSD is the country's single largest buyer of medical commodities. As a result of the country's weak domestic manufacturing capacity in the health sector, most medical commodities are purchased from foreign sources. Eighty percent of medicines, 90 percent of medical supplies, and 100 percent of laboratory supplies are imported. The MSD's procurement directorate purchases medical commodities directly from 130 manufacturers in twenty-six countries through open tenders. The directorate also manages contracts and ensures compliance. To ensure compliance, the MSD adheres to and implements international standards including Public Procurement Regulatory Authority (PPRA), International Organization for Standardization (ISO), and World Health Organization (WHO) guidelines, with procurements approved by the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) and registered with the Tanzania Medical Devices Authority (TMDA).

Since medical commodities are expensive and often have a predetermined shelf life (i.e., they expire), procurement processes must ensure an adequate supply of commodities to prevent shortages while avoiding oversupply or wastage at the clinic level. Procurement processes need to minimize wastage as well. In other words, managing procurement and optimizing stock levels affect the availability of essential medicines and supplies, as well as the supply chain and distribution system's financial viability.

STORAGE

The internal medical commodities supply chain starts at the MSD central warehouse in Dar es Salaam. All medical supplies and medicines that are eventually delivered to health facilities are initially stored in the MSD central warehouse. Items are catalogued in the electronic inventory management system as soon as they are delivered to the warehouse.

In addition to the 5,000-square-meter storage facility in Dar es Salaam, each zonal MSD operates its own warehouse. Zonal warehouses are smaller, ranging from 700 to 1,500 square feet each. They receive medical commodities from the central MSD warehouse and prepare supplies for direct delivery to health facilities. MSD warehouses, including both the central and zonal facilities, are equipped with standard and cold chain storage capabilities.

Many of the zonal warehouses are quick-build, modular structures known as warehouses in a box or WiBs. Constructed to meet international standards and simulate permanent warehouse structures, WiBs have essential supply chain storage infrastructure including racks, cold chain facilities, and logistics procedures for picking and

MSD as a Centre of Excellence

The MSD's procurement practices have caught the attention of other African nations. In 2018, it became the largest supplier of medicines and laboratory and medical equipment for the sixteen member states of the Southern African Development Community (SADC). As the SADC's procurement hub, the MSD receives and fulfills orders for the region. Through consolidation the MSD enjoys significantly more purchasing power so it can negotiate better prices for the region.

Random Access Storage: Inventory Management Sophistication

The MSD uses random access storage in its warehouses. Employees scan incoming products and place them on empty shelves, regardless of what other products are stored nearby. Each product and shelf has a unique barcode that allows staff to record where every product is stored and every time it is moved.

MSD staff report that using this system has reduced theft, maximized space (because every empty space is used), and kept the inventory database current because barcode scanning is an integral part of warehouse operations. This warehousing approach has also improved both the speed and accuracy with which MSD fills orders.

packing. Unlike permanent facilities, however, WiBs require less time to construct and occupy a smaller land footprint.

The MSD uses the Enterprise Resource Management (ERP) in its warehousing operations. The Epicor 9 system was used for inventory management. All zonal warehouses and a central MSD storage facility are connected to a central information system—the electronic Logistics Management System (eLMIS). The integrated digital platform instantly updates inventory information in the various warehouses. MSD managers are thus able to track precisely how many commodities are in each warehouse at any given time. Real-time information sharing makes it easier to coordinate interzonal shipments and increase stocks where they're needed while reducing waste and spoilage caused by overstocking.

DISTRIBUTION

Once medical commodities are received and sorted and the zonal warehouses record stock levels, orders are filled (“picked and packed”) and then delivered by trucks to local health facilities. Refrigerated ten- to fifteen-ton trucks (i.e., “mobile warehouses”), lighter five- and ten-ton trucks, and nimbler but smaller four-wheel-drive Land Cruisers transport and deliver medical supplies to health facilities. Land Cruisers are used in the most remote areas, given their ability to navigate rough, often unpaved, terrain.

The MSD continuously improves fleet utilization, delivery times, and fuel efficiency by tracking its trucks using GPS technology. In addition to heavy trucks and Land Cruisers, the MSD also deploys boats and canoes to reach the most remote areas. The MSD is currently piloting the use of drones in Mwanza as an alternate mode of delivery to reach



FIGURE 3. *The Mwanza District WiB.* This prefabricated modular structure has a smaller footprint than a permanent warehouse and comes outfitted with supply chain infrastructure.

very remote clinics. The potential effectiveness of drone delivery has yet to be fully realized—current innovations can carry only light loads and travel relatively short distances.

ORDERING AND RECEIVING

Health facilities—from small-scale dispensaries to national hospitals—manage their own medical commodities inventory. Strategically managing inventories is crucial. Reducing expirations and wastage, for example, is essential for effective supply chain management. Health facilities need to ensure they have enough supply to adequately treat their patients while avoiding surpluses that

can lead to unnecessary expirations and waste. Despite plans to migrate to a fully electronic platform, health facilities continue to order their medical commodities through a paper-based report-and-requisition (R&R) system. Health centers, clinics, and dispensaries place their orders once every three months, while larger hospitals order supplies every month. The R&R system requires health facility managers to fill out paper forms that capture information about the facilities' current inventory, stock-outs, and orders and requisitions. These forms are then sent to the district-level health authority, which can make final adjustments to the order. The paper forms



FIGURE 4. An MSD Land Cruiser

are then converted into electronic documents and sent to the zonal MSD warehouse.

Despite plans to migrate to a fully electronic platform, health facilities continue to order their medical commodities through a paper-based R&R. However, for the 30 percent of health facilities in Tanzania with a computer and stable Internet connection, they can access the eLMIS directly. At the facility level, the government of Tanzania operates two different types of information systems. GoTHOMIS is the system for district hospitals, health centers, and dispensaries. Afya Care is the system designed for regional

hospitals. Both systems have a pharmacy module component for managing medicines and supplies. Health centers, clinics, and dispensaries place their orders once every three months, while larger hospitals order supplies every month. A redesigned system is being piloted to allow monthly orders from health facilities, which are then resupplied every other month. To date, this redesign has been implemented in the Mwanza zone. The R&R requires health facility managers to fill out paper forms that capture information about the facilities' current inventory, stock-outs, and orders and requisitions. These forms are then sent to the district-level health authority, which can

make final adjustments to the order. The paper forms are then entered with the eLMIS, which sends the orders to MSD's ERP for fulfillment.

The zonal MSD warehouse reviews and cross-checks orders against its inventory. The warehouse staff then pick and pack the medical commodities and load the order into trucks to dispatch to health facilities. Because the MSD directly delivers to health facilities, medical supplies and medicines might be transferred mid-route from larger trucks to Land Cruisers, especially to get to hard-to-reach rural clinics and health centers efficiently. To ensure medical commodities are delivered to the intended facility, local health committees made up of local leaders receive, check, and sign off on the delivery. According to external assessments and clinic-level accounts of this routinized practice, this simple yet effective governance mechanism has dramatically improved the medical supply chain's efficiency and mitigated corruption and theft.

FACILITY BUDGETS

Every facility manages an account administered by the MSD. The government deposits facility funds into each facility's MSD account quarterly. The budgeted amount is determined by the size of the facility's population catchment area or on a per capita basis.

The costs of normal medical commodities (i.e., sellable medical commodities) are debited from the facility's account. Vertical items (i.e., those provided by donors) are charged to the MoHCDGEC, though we were told that the MSD charges a nominal fee to cover the cost of procurement (when necessary), storage, and delivery. Specifically, donors are charged a storage and distribution fee, while facilities pay a delivery fee to MSD.

Managing Medical Commodity Inventory

Health facilities must manage their own medical commodity inventories. On the one hand, they want to ensure they have adequate supplies to meet their patients' needs. On the other hand, facilities want to avoid overstocking medicines to prevent expiration and wastage. And of course, they must manage these considerations in the context of hard budget constraints.

Health facilities' budgets in Tanzania are determined on a per capita basis, based on their specific catchment area. However, we learned from facility managers that because patients can and will seek care outside of their specific catchment area, health centers will experience higher demand for medicines. Seasonal wage earners, for example, may seek care in clinics other than their own. This results in potential shortages. It also makes it difficult for managers to plan.

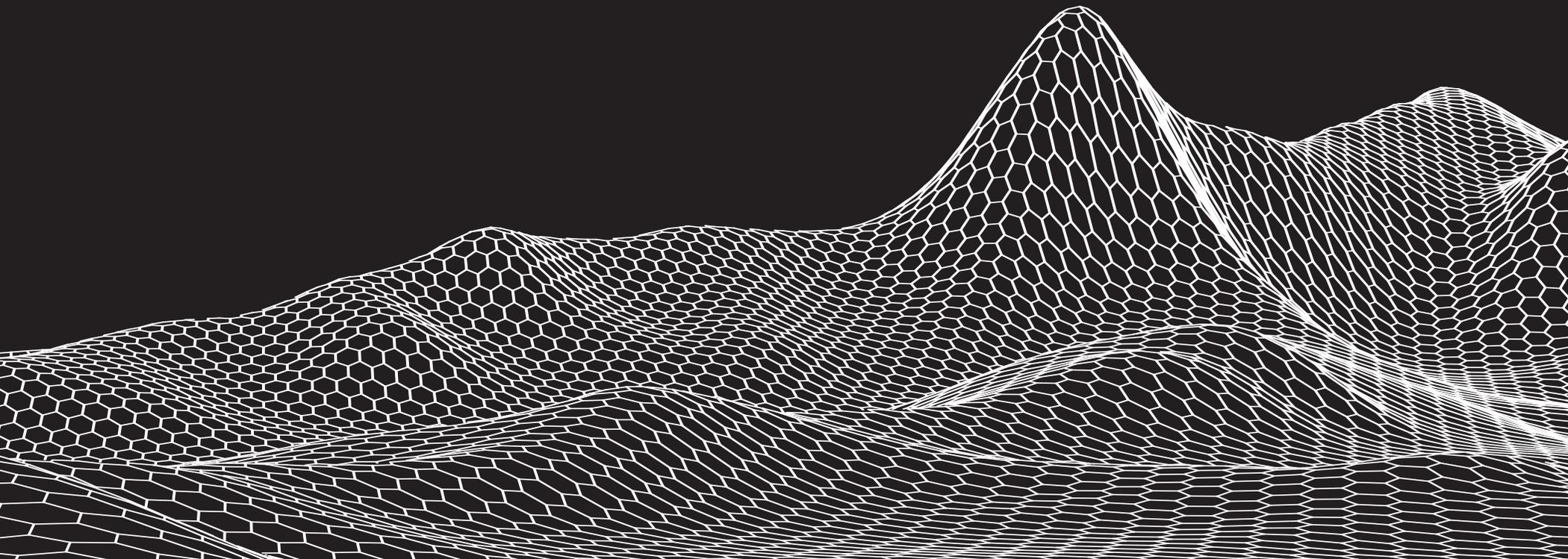
Health facilities, especially smaller clinics and health centers, must manage their inventories and place their quarterly orders strategically. They operate with hard budget constraints they have to balance with patient needs.

Visiting several rural clinics in Mwanza, we learned that clinics occasionally have access to discretionary funds in addition to "receipt in kind" funding in the MSD account of each health facility. Some clinics collect community council funds or user fees to provide some discretionary relief when supplies are low or when hard budget constraints kick in. We also learned that several clinics within a particular region or area cope with supply shortages by sharing medical supplies. In some cases, clinics also turn to private suppliers to make up for medical supply shortfalls. For example, under the Prime Vendor System established by PO-RALG, facilities can use their discretionary funding to procure medical supplies through external suppliers when the MSD is out of stock. Such purchases are sourced from designated regional "prime vendors" appointed by the government based on their good procurement practices.

SUMMARY

The MSD is responsible for the procurement, storage, and distribution of medical commodities for the national medical supply chain. Public health facilities (and approved faith-based organizations) place orders and have accounts with the MSD. To fulfill these orders the MSD buys medical commodities, the majority of which are imported. Once these commodities have been purchased MSD stores them at its central warehouse in Dar es Salaam and then distributes them to zonal warehouses across Tanzania, which in turn ensure they are distributed directly to health facilities.

Supply Chain Redesign



Despite significant improvements made by the Medical Stores Department (MSD) over the past two decades, government officials, international organizations, as well as external consulting firms highlight several bottlenecks and inefficiencies that persist in Tanzania's public medical supply chain system. Critical assessments focus on specific challenges in operational inefficiency and poor data quality. Despite the introduction of new and integrated information-management platforms and systems, information gaps between stakeholders persist.

In response, the government redesigned the system. This lengthy and thoughtful process began in 2015, with pilot programs rolling out in 2019. The redesign aimed to continue improving the medical supply chain system's performance, ensuring medical commodities reach every health facility and patient, regardless of where they are located.

The redesign had four main objectives:

- **Adjust inventory "maximum-minimum parameters" to fit storage capacity.** Local health facilities continue to grapple with physical limitations caused by the lack of storage space. This is most apparent in rural facilities where medical supplies stockrooms are small. Cold storage can also be a problem in facilities that do not have reliable access to electricity, which is the case in many rural clinics. The lack of adequate storage space results in perpetual stock-outs and medicine expirations.
- **Increase delivery frequency.** From an inventory-management perspective, especially in settings where storage facilities are inadequate, maintaining smaller inventories makes sense. However, this also means that medical commodities must be delivered more

frequently. Currently, facilities order (and receive) medical commodities once every three months. The plan is to increase this to once every two months.

- **Increase data visibility.** Strategically managing inventory and ordering requires accurate and timely data on facility inventories. By increasing the frequency of delivery, health facilities and warehouses must also increase the frequency and reliability of inventory reporting. Having more and better data contributes to improved management.
- **Implement an electronic reporting system.** To date, many health facilities continue to use a paper-based report-and-requisition (R&R) system. According to MSD officials, this has led to missing and inaccurate information shared between health facilities and the MSD. To fix this, the redesign aims to electronically integrate the entire supply chain. In other words, the proposed redesign requires the comprehensive use of MSD's online reporting system for inventory management and orders. As before, facilities can achieve this by directly submitting information via the electronic system, or by entering paper R&Rs at the district level. However, under this renewed process, facility-level management information systems can automatically generate an R&R into eLMIS. This order is then converted from eLMIS into MSD's ERP.

IMPLEMENTING THE REDESIGN

The redesigned system is being phased in gradually. An initial pilot rolled out in March 2019. In the new system, ordering and delivering medical commodities will occur bimonthly instead of quarterly. This will ensure that health facilities maintain stock levels that adequately service their patient populations and reduce the risk of

overstocking medicines. Like before, district health authorities report on inventory and then check and process orders.

As part of the budgeting process, health facilities must forecast their annual inventory requirements. They will also provide monthly electronic reports of their existing inventory to the MSD, including accurate and up-to-date information about stock on hand, the risk of stock-outs, the number of stock-out days, and other inventory-related data. Clinics, dispensaries, and health centers make bimonthly orders based on their inventories.

The redesign is expected to have a significant impact on how medical commodities are managed, ordered, and delivered, and the supply chain's overall performance. The MSD has outlined four key performance indicators that are central to its ongoing evaluation of the redesign implementation:

- Fill rates (the fulfillment of facility orders on time) must be over 90 percent.
- Deliveries to the health facilities must be on time, within twenty days from the order date to the time they are received and accounted for by the facility.
- The rate of medicine expirations should be reduced to below 1 percent.
- Inventory deliveries must be accurate.

THE MWANZA ROLL-OUT

Our research team visited Mwanza in April, soon after the pilot was rolled out in March. The MSD office there had started to optimize its electronic reporting and ordering platforms, integrating all commodities into a single supply chain logistics system. Specifically, the Mwanza MSD is consolidating all data regarding normal

and vertical medical commodities into a single information-management platform. The Mwanza MSD is redesigning the integrated logistics system (ILS) to handle orders and deliveries on a more frequent basis. Information from the previously separate HIV/AIDS medicines delivery system as well as the Tanzanian Food and Nutrition Centre (TFNC) is being integrated into the Mwanza Integrated Logistics System. Finally, the transition from paper-based ordering to paperless ordering will significantly improve data sharing and visibility between the health facilities and the MSD.

According to Mwanza zonal MSD officials, health facilities are required to electronically submit their monthly inventory report to the district medical office on the fifth day of each month. Facilities order medical commodities every two months, and they have to place their orders before the tenth day of the month. By the tenth day, the district medical office must receive, process, and approve the order. By the thirtieth day of that month—just twenty days later—the zonal MSD warehouse must deliver the medical supplies and medicines directly to the facility.

The turnaround time is remarkably quick. The MSD is committed to delivering within three weeks of an order being placed by any health facility, regardless of where the clinic or center is or how distant and remote the facility is from the zonal warehouse.

The full implementation of electronic reporting and ordering platforms is expected to increase overall efficiency in the system. With support from the Global Fund, the integration of mobile phones and other mobile platforms should facilitate timely monitoring and evaluation of the supply chain system. Health facilities and other medical supply stakeholders can provide direct feedback on the redesigned system to the MSD and government ministries.

Timeline	Responsibility	Organization in charge
5th of each month	Submission of monthly R&R order forms	Health facility
10th of ordering month	Order to be received, processed, and approved by district hospital supervisor	District Medical Office (DMO) or hospital supervisor
30th of ordering month	Delivery of commodities to health facilities	MSD

FIGURE 5. Mwanza district's new pilot online ordering system

The supply chain system redesign pilot is expected to affect not only the Mwanza medical commodities delivery system but also the district's health system more generally. By implementing fully integrated electronic reporting and ordering platforms, the MSD expects to have more accurate information about the district's specific health needs. Medical commodities that prevent and treat diseases specific to the Mwanza region—such as higher incidences of tuberculosis, leprosy, and malaria compared to the rest of the country—can also be more effectively and efficiently delivered through an integrated delivery system.

SUMMARY

Following critical feedback on operational inefficiencies, information gaps, and poor data quality within the Tanzanian healthcare system, the government implemented the first pilot of its redesigned system in 2019. The redesign aimed to increase the frequency of deliveries, improve storage capacities, augment data visibility, and

introduce electronic reporting. By ensuring that fill rates in facilities are over 90 percent, faster and accurate delivery of commodities with a turnaround of twenty days, and a medicine expiration rate of below 1 percent, the redesign will significantly transform the medical supply chain's overall performance.

The redesigned system has been piloted by the Mwanza district MSD and has three features:

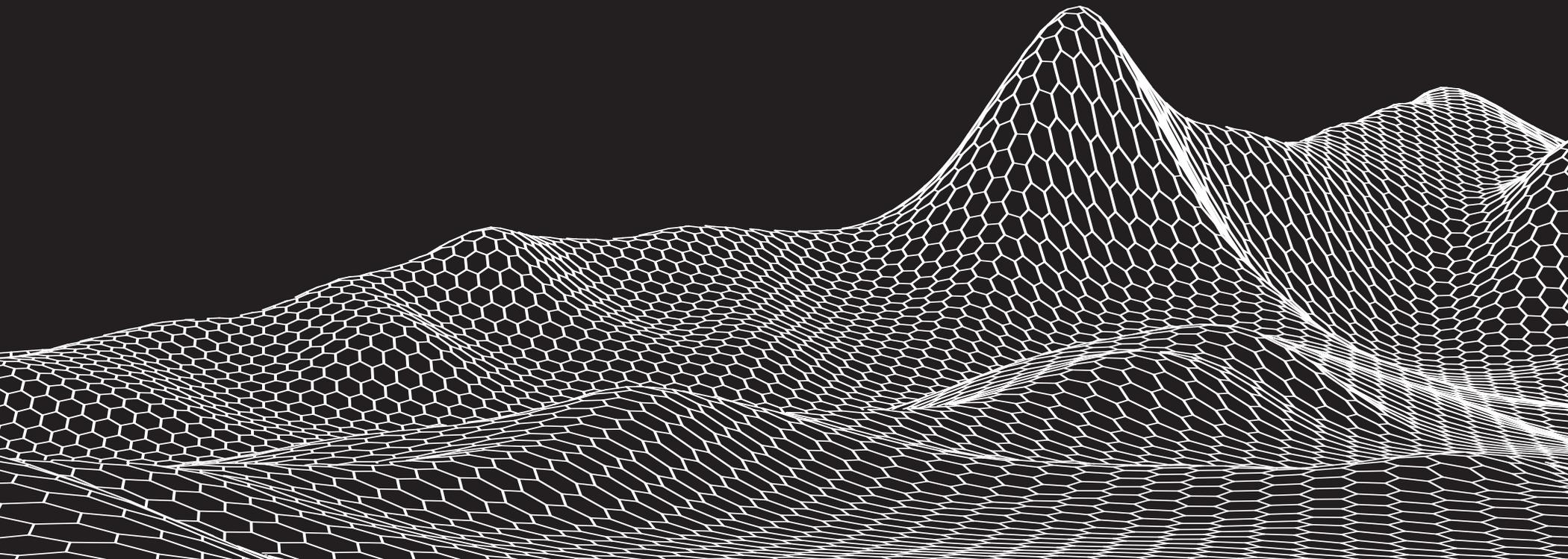
- *bimonthly (instead of quarterly) orders*, to accelerate turnaround times for orders and deliveries of healthcare commodities;
- *paper-based rather than online ordering*, to improve data sharing, accuracy, and visibility; and
- *consolidation of all medical commodities data* into a single information-management platform.

The integrated platform is expected to help health facilities and other medical supply stakeholders to provide direct feedback to the MSD and affiliated government ministries.

Challenges



Despite improvements in Tanzania's medical commodities supply chain system over the past several decades, major challenges remain.



DATA QUALITY

Data quality has been a persistent problem in the healthcare system. Poor-quality and inconsistent data affect the ability of the government, and the Medical Stores Department (MSD) specifically, to plan effectively, set priorities, and formulate national budgets.

The availability of high-quality data is critical for the MSD. When it comes to route optimization, for example, truck delivery routes need to be planned meticulously with accurate data, modeled with computer software right down to road conditions, seasonal weather's effects, and the time it takes to process and drop off medical supplies at each clinic. Drop-off schedules at the facilities are timed to the minute if they are to be optimally efficient; unanticipated hold-ups at clinics can delay the entire delivery chain. This can be even more of a problem when light delivery trucks need to coordinate with mobile warehouses (i.e., heavier trucks) to schedule restocking mid-route.

We learned that despite efforts to streamline and improve the electronic reporting and ordering systems, many facilities, especially rural and remote ones, struggle to use the electronic Logistics Management System (eLMIS) effectively.

Poor data impede the ability of Tanzania's over 7,500 health facilities to forecast their supply and demand for medical commodities. At the national level, this hinders the budget-allocation process. Poor data can also negatively affect how human resources are allocated, resulting in persistent staffing gaps in health facilities. This is a particularly acute problem among rural and remote facilities and dispensaries.

The MSD has worked closely with international partners such as USAID and John Snow Incorporated (JSI) to enhance data quality, quantification, and performance measurement. For instance, JSI trained central and zonal MSD staff on data analysis and management. The Global Health Supply Chain Technical Assistance Program in Tanzania has also developed a key performance indicators framework to help supply chain managers assess performance. Despite these efforts, implementing partners and government stakeholders alike share the view that poor data quality remains a key bottleneck in the country's medical supply chain management system.

PHYSICAL INFRASTRUCTURE

Poor physical infrastructure poses another supply-side challenge for the medical supply chain. Hard infrastructure—such as railways, road, water, electricity—is critical to logistics and supply chain management. In many areas, especially rural and remote districts, there is a shortage of such infrastructure.

As part of our fieldwork, we visited several clinics in rural Mwanza that lacked stable sources of electricity (they faced constant power outages), making it difficult—and in some cases impossible—for certain health facilities to use the electronic inventory management and ordering systems. Internet connectivity in some clinics does not exist, whereas for many others service is spotty, so the online systems are inaccessible or difficult to use in many facilities. We also learned that infrastructure challenges can be exacerbated by severe weather events. For example, rainy seasons make it even more difficult for medical supplies to reach those who live in hard-to-reach regions.

HUMAN RESOURCES

Human resources (HR) capacity, or “soft infrastructural capacity,” is limited across the medical supply chain system. Many people we spoke to identify the lack of HR capacity as the most critical challenge in the country's health system. Specifically, they point to the dearth of skilled expertise and a shortage of personnel in health facilities. HR challenges are especially acute in rural health facilities where remoteness and geographic isolation make it difficult to recruit and retain workers. The challenges of training health workers, maintaining HR standards, and preventing the departure of health workers to better-paid private-sector positions are some of the many HR issues that remain.

In Mwanza, we learned from officials in the zonal MSD that HR constraints directly affect their ability to deliver medical commodities to every health facility. For example, officials explained that even though they have been able to increase the size of the Mwanza MSD truck fleet to twenty new vehicles with support from the Global Fund, they have been unable to recruit new drivers. The zonal MSD warehouse can employ only thirteen drivers so seven trucks that could be deployed remain idle for lack of enough drivers. The lack of skilled human resources—from IT experts to health practitioners—remains a challenge throughout the health system.

The HR shortage stems in part from a 2015 government program that scrutinized health worker qualifications. There were concerns that health workers were fraudulently claiming to have appropriate qualifications. Following investigations, the government dismissed over

Skills Shortage in Remote Areas

Health facilities located in remote areas sometimes face particular challenges that disconnect them from the MSD's central administration. Visiting one facility in Mwanza, we learned from a worker that the greatest need there was staff with basic computer skills. Without these skills, staff are unable to comply with the modernized electronic stock management system, which inevitably leads to delays in deliveries to the clinic.

5,000 hospital and health facility staff. This disproportionately affected facilities in rural and remote regions. Currently, health sector staffing levels have recovered to pre-2015 levels, although the quality of workers continues to vary widely.

International development organizations, both private and public, have prioritized human capacity building as critical for medical supply chain improvement. For example, as part of Project Last Mile (PLM), Coca-Cola provided advice to the MSD about reforming its HR performance-evaluation system. More recently, the company introduced an online training module, the Supply Chain Academy, to improve staffing performance. In 2014, the USAID Deliver program conducted an HR assessment of Tanzania's medical supply chain personnel. The program subsequently partnered with the government to provide training for staff workers and managers.

Capacity-building efforts have a mixed record. During interviews with key people in international organizations and consultancies, we learned that among MSD staff, there are varying and inconsistent levels of expertise and interest in global positioning system (GPS) mapping and computer-modeling software. Training is costly for both skilled workers in MSD offices and at the local clinical level. Health facility managers explained to us that pulling health workers away from their already HR-strained facilities for training affects the quality and availability of health services. To solve this dilemma, some nongovernmental organizations have adopted models of in-facility mentorship and on-the-job training.

POLICY INTENT AND IMPLEMENTATION

Despite the country's efforts to improve its medical commodities supply chain, results have been mixed at best, highlighting the gap between policy intentions and implementation. It is difficult for the government to effectively implement national plans because of inconsistent and low levels of human capacity, budgetary constraints, and poor data quality across different regions and districts.

The Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC) sets country-wide policy guidelines and priorities for the health system. However, the government's decentralized structure contributes to inconsistent implementation at lower levels of government. District and regional medical offices often have different requirements for inventory reporting and management. Varying levels of expertise among skilled workers in district offices similarly affect how policies and programs are implemented at the local level, a problem not uncommon in many countries.

SUMMARY

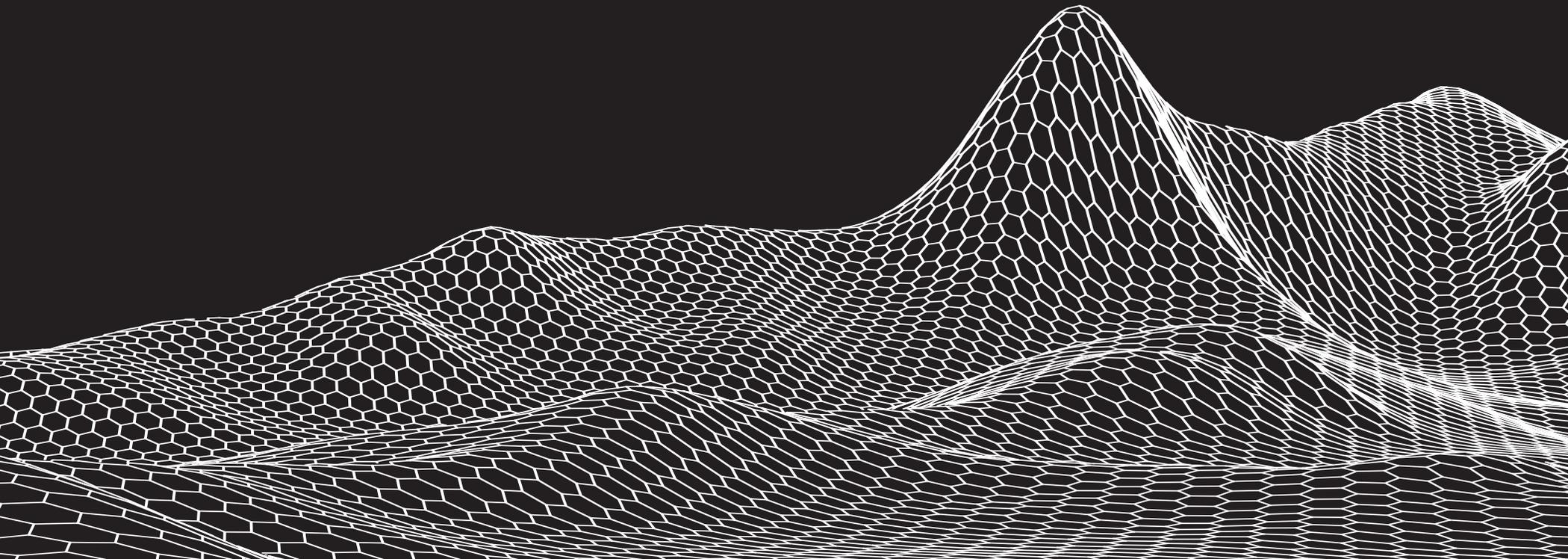
After a decade of improvement, several challenges remain when it comes to Tanzania's health logistics supply chain. Inconsistent data quality, lack of physical infrastructure, a shortage of human resources, and uneven policy implementation are the most significant barriers.

The Last Mile



The health logistics supply chain does not end once medicines reach the facilities.
The end of the supply chain is the patient.

— Sisawo Konteh, chief operating officer, Aga Khan Health Service, Tanzania



The health logistics supply chain does not end at the medical facility. The so-called last mile, referring to the hardest-to-reach end users and patients, poses particularly difficult challenges in Tanzania where poor and marginalized people often live and work in areas that are especially remote and distant. Getting medicines and medical supplies to clinics is one thing; getting them to people is another. Several programs, initiatives, and structures have been implemented in efforts to reach this last mile.

OUTREACH

Health facilities' outreach services play a crucial part in reaching hard-to-reach households. For many people living in remote communities, clinics and health centers are inaccessible. For example, in the Kagunga district—located about 700 kilometers (435 miles) from Tanzania's capital, Dodoma—outreach services are an integral part of the health center's strategy to reach the hardest-to-reach families. The Kagunga facility's annual plan is executed in tandem and through consultation with community leaders.

Still, the provision of outreach services is inconsistent in catchment areas where health facilities lack adequate human resources. We learned, for example, that the dearth of basic hard and soft infrastructure in hard-to-reach areas poses a disincentive for medical staff to stay and provide long-term support for the district. Inadequate numbers of trained personnel lead to facilities choosing to prioritize in-clinic patient care over outreach. Facilities are stretched too thin to engage in effective outreach programming.

COMMUNITY HEALTH WORKERS

The services provided through clinical outreach are different than the work done by community health workers (CHWs), although both are intended to reach the hardest to reach. Clinical outreach services and CHWs both offer critical health interventions, including child immunization, family planning, pediatrics, HIV/AIDS testing, and eye and dental checks. However, while outreach services are supposed to be a part of the health facility's operations, CHWs are often trained volunteers from the immediate locale. They are usually unpaid or minimally remunerated.

CHWs face many challenges when it comes to effective reach, including inconsistent levels of training, weak linkages to health facilities, and lack of monitoring by health clinics.



FIGURE 6. An accredited drug-dispensing outlet or ADDO

ADDOS

Accredited drug-dispensing outlets, or ADDOs, provide a critical link in the medical supply chain that helps make medical commodities more accessible to those living in remote or hard-to-access regions. Known as *duka la dawa muhimu* in Swahili, these essential private drug shops operate in rural or peri-urban areas. They are run by the district pharmacy council and staffed by personnel with basic medical training.

In 2002, in response to a national shortage of registered pharmacists, ADDOs were launched by the Ministry of Health, the Tanzania Medical Devices Authority (TMDA), and the Strategies for Enhancing Access to Medicines Program. Since the inception of the private pharmacy system—which includes staff training, accreditation, and regulatory oversight—ADDOs have expanded access to medicines and provided information about prevalent illnesses such as malaria and HIV.

DIRECT DELIVERY

The MSD's direct delivery system has achieved substantial success in closing the gap in the last mile. In the past, when the central MSD delivered medical commodities to district drop-off points, little was known about how the commodities made it to health facilities—especially remote ones. The country's rural demographic composition and diverse geography make the work of delivering to the last mile especially difficult.

Over the past fifteen years or so, the MSD's direct delivery system has expanded its reach to more than 7,500 facilities across the country. In addition to fleets of trucks, the MSD employs other means of transportation to deliver medical supplies, including boats and ferries, canoes, motorcycles,

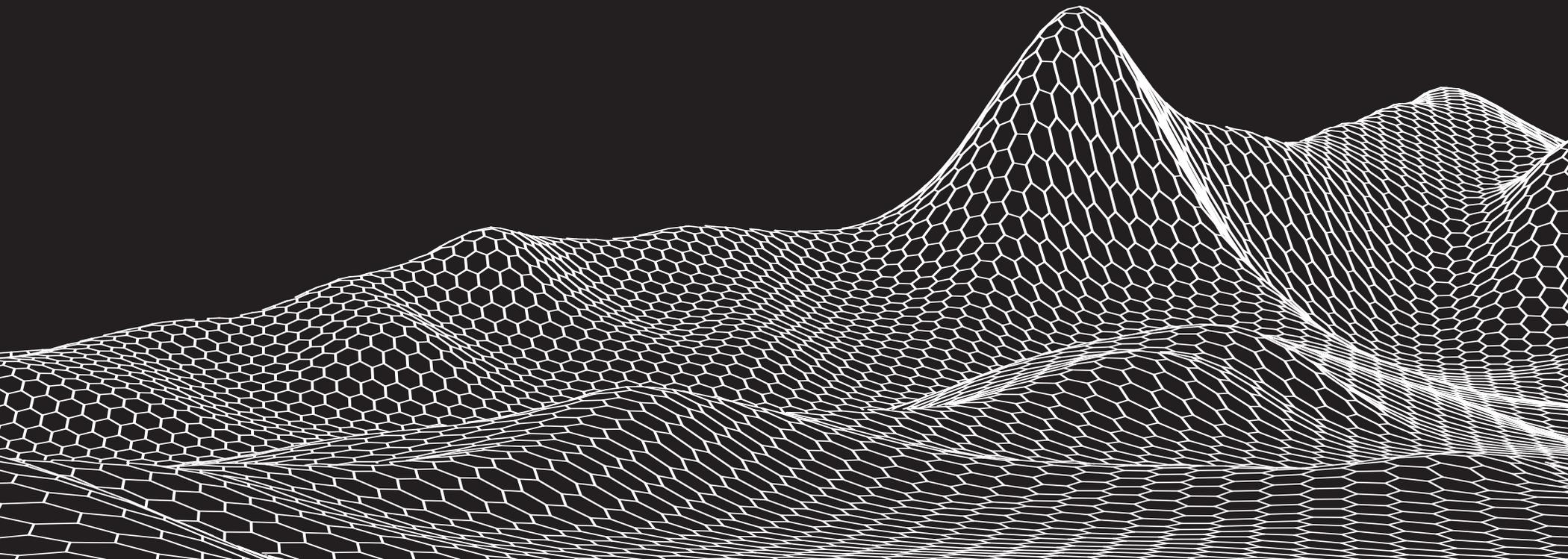
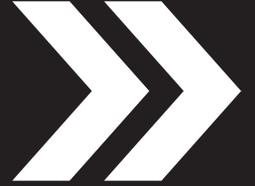
and even bicycles to ensure reach across a variety of terrains. Improved access and availability of medical commodities has reduced the number of people who need to travel long distances for medicine and treatment.

While direct delivery remains challenging in areas with underdeveloped local transport and insufficient human and financial capital, the government and the MSD are developing the capacity to deliver to all facilities nationally. As we learned in Mwanza, some districts are piloting the use of drones to deliver medicines and essential supplies to hard-to-reach areas.

SUMMARY

Despite persistent shortfalls in Tanzania's health logistics supply chain, the country has made extraordinary strides to reach the very "last mile" by engaging in clinical outreach, employing community health workers, establishing ADDOs, and committing to direct delivery through the MSD.

Lessons Learned



The modernization and continual improvement of Tanzania's medical supply chain system has been an evolutionary process over the past thirty years. What we see today does not resemble how medicines were distributed (or not distributed) during the 1990s. In the past, medical commodities were shipped to 130 district-level drop-off points. Today, medical commodities are supposed to be directly delivered to every public health facility (and some private facilities) in the country, regardless of where the facilities are, how poor the district is, or how distant the facility may be from a central warehouse. The Medical Stores Department (MSD) has improved overall system performance so much that it is now a center of excellence and the regional procurement hub for the Southern Africa Development Community. Many lessons can be learned from this extraordinary case.

POLITICAL COMMITMENT

Modernizing the country's medical supply chain system did not happen overnight—it demanded patience, resources, and a long-term commitment from a variety of stakeholders. New programs, initiatives, technologies, and processes were gradually introduced over a long period of time, requiring extraordinary political will on the government's part. The government contributed fiscally as well, notably through an eight-fold budget increase over the past three years, reflecting its deep commitment to the system's redesign in late 2017.

PRIVATE-SECTOR INSIGHTS

From the start of the supply-chain-modernization process, the government embraced participation and advice from private-sector actors. The MSD—the main agency in charge of the procurement, storage, and distribution of medical supplies—

is a parastatal, and not purely governmental, organization. The USAID Deliver/SCMS and Project Last Mile partnerships drew heavily on private-sector expertise and skills to deliver capacity-building initiatives to the MSD, including enlisting corporations such as Coca-Cola and private-sector firms like John Snow Incorporated into their projects. Deloitte also contributed substantively to MSD's supply chain review and redesign. Many of the process improvements we have described here—from information management, route optimization, and computer modeling to human resource management and performance assessment—came from private-sector insights.

LOCAL ADAPTABILITY

Despite the tendency to seek a one-size-fits-all solution to complex supply chain challenges, the MSD and its local partners have had to adapt to local conditions, maintaining a strong commitment to standardized supply chain processes while accommodating local adaptations so that the system can work throughout Tanzania.

In our research, for instance, we saw how zonal MSD offices and warehouses worked closely with local health facilities to ensure medicines were delivered on time. They relied on a variety of delivery methods, ranging from large trucks to agile Land Cruisers and motorcycles—and even canoes for really out-of-the-way facilities. We also learned from facility managers that they often devise adaptive coping strategies to ensure they can provide medicines and supplies to their patients. For example, facility managers of rural clinics explain how they often share supplies with nearby clinics when there are shortages, or how groups of clinics will pool their resources or share access to Internet connectivity. The overall system

works because local stakeholders adapt to their specific local conditions.

INVESTING IN INFRASTRUCTURE

Above all else, an efficient supply chain system requires good infrastructure to get products to their customers as efficiently as possible. Roads are critical, especially paved roads that are not washed out during the rainy season. Trucks and reliable alternative means of transportation are necessary as well. Sophisticated and effective information systems—from inventory management and data sharing to timely ordering—are critical to maintaining effective supply chains. And of course, well-run supply chains require skilled and trained workers.

The Tanzanian case demonstrates the importance of good infrastructure in part because of the investments the government and the private sector have made and in part because of gaps in infrastructure, both hard and soft, in the medical supply chain system. In other words, where the system has developed strong infrastructure, we have seen improvement. Where infrastructure is lacking, the system has underperformed.

The government's ongoing investments in the medical supply chain, especially in organizational and human capacity building, bode well for Tanzania's goal of ensuring medicines and medical supplies reach everyone, everywhere.

RESEARCH TEAM



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ANUSHREE WARRIAR holds a master's in economics from the University of Mumbai, India, and a Master of Global Affairs from the Munk School of Global Affairs & Public Policy, University of Toronto. Her passion for inclusive innovation, public-private partnerships, and economic development have led her to work with international organizations such as the UN International Organization for Migration in Geneva, federal and provincial governments, private-sector consultancies, and research labs. She is currently the research and programs officer for the Reach Project.

REACH PROJECT



Development is about delivery—the will and ability to deliver interventions to very poor and vulnerable people to help improve their lives. The development “space” is filled with great ideas and innovative solutions, from technological interventions to new policy initiatives. But the effects of these potentially game-changing ideas are severely mitigated if they do not actually get to the people they are intended to benefit. We think of this challenge in terms of “reach.” Solutions can solve problems only if they reach those who need them most.

The Reach Project focuses on the delivery of services and interventions to those who are hardest to reach. We are a research initiative supported by a partnership between the Munk School of Global Affairs & Public Policy at the University of Toronto and the Mastercard Center for Inclusive Growth. The Reach Project is led by Professor Joseph Wong. The commitment of student researchers and faculty mentors from across the University of Toronto drives our work. Together, we examine the delivery of services and interventions to those who are hardest to reach in countries around the world.



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