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Case Study

Mozambique and Nigeria: Using Results from Supply Chain Costing

Knowing the true costs of getting commodities to health facilities is an important element for program planning.

Costing studies provided two countries with data to advocate for resources and to make informed supply chain investments.

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By ensuring the availability of essential medicines at health facilities, well-performing supply chains contribute to healthcare delivery and to positive health outcomes. Detailed information about supply chain operating costs and cost drivers can help supply chain managers, stakeholders, and development partners make sound decisions that will improve supply chain performance. This information can also be used to support advocacy for funding the supply chain and realigning pricing policies. However, during planning, the actual cost of getting these commodities to health facilities is often unknown or overlooked.

This case study examines how two countries—Mozambique and Nigeria—carried out supply chain costing studies; it offers insight into how the results were a crucial tool for countries and were used to inform policy, design, budgeting, and planning decisions.

In Mozambique, research found that a dedicated logistics system (DLS) for vaccines was more cost efficient and cost effective than the traditional system. Partners used the study findings to advocate for broader adoption of the DLS. As a result, the minister of health authorized all provinces to explore implementing the dedicated system; so far, three additional provinces are doing this.

In Nigeria, states facing changes in contraceptive cost recovery used the results of a costing study to identify and prioritize opportunities for improving the supply chain and making distribution design and budget decisions.

Mozambique: Using Cost Evidence for System Change

Background and Rationale for Costing

In March 2002, the Mozambique Ministry of Health (MISAU) started a five-year pilot project in Cabo Delgado province in

northern Mozambique. The goal was to strengthen the quality of the health services by improving immunization services, vaccine supply, and community and health worker support. In the pilot study, supported by VillageReach and the Foundation for Community Development, the DLS replaced an ad hoc system where frontline health workers collected vaccines and related supplies from their district office. The DLS employs a small number of specialized workers who visit the health centers every month to deliver vaccines and supplies, repair equipment, collect data using a management information system, and offer supportive supervision.

The DLS showed impressive results in coverage and vaccine availability. An impact evaluation conducted four years into the program showed a 27 percent increase in the diphtheria, pertussis, tetanus (DPT-hepatitis B3 vaccine coverage rate and a decrease in the percentage of health centers reporting a stockout—from 80 percent to 1 percent. Despite these impressive results, questions remained about the cost required to sustain these achievements, prompting VillageReach to conduct a costing study that compared the DLS in Cabo Delgado to the traditional vaccine logistics system in Niassa province.

Costing Approach

To address the challenges related to the haphazard vaccine supply chain in Niassa, researchers used a micro-costing approach, gathering costs for each activity and step of each segment in the supply chain and calculating the portion attributable to the vaccine program.

The study included surveys to collect distribution, transport, and cold chain costs at the provincial level, district level, and service delivery points (SDPs).[1] In Niassa, VillageReach collected a random sample of data at 10 health centers in eight districts, which were chosen using probability proportional to size. District and provincial supply chain entities associated with these 10 SDPs were also surveyed. In Cabo Delgado, the study used records of actual costs incurred from all facilities at both the provincial and SDP levels.

Staff entered datasets from both provinces into an Excel-based cost model to calculate the following estimates for each province, including the total cost—

- to operate a vaccine supply chain for one year
- per child, receiving DPT-hepatitis B3 (as a proxy for a fully immunized child)
- per child, under age five
- per vaccine dose delivered.

Results

Absolute costs do not tell the whole story: despite its higher price tag, the dedicated logistics system was more cost effective and cost efficient.

Although the absolute cost to operate a vaccine supply chain for one year was higher with the DLS in Cabo Delgado than with the traditional system in Niassa, the new system was more cost effective and cost efficient. Table 1 summarizes the two provinces' basic vaccine-related characteristics and supply chain costs by highlighting four comparisons: absolute costs, costs controlling for population differences, relative cost effectiveness, and relative cost efficiency.[2]

[1] Although the model accommodates cold chain depreciation costs, the analysis excluded these costs because the cold chain infrastructure in the two provinces was substantially different.

[2] In the study, cost effectiveness was defined as the increase in health outcome (measured by childhood vaccination coverage) relative to the expenditure. Cost efficiency was defined as effort (measured by doses delivered) relative to the expenditure.

Table 1. Summary of Niassa and Cabo Delgado Province Characteristics and Vaccine Logistics System Costs: Allocation of Costs for One Year

Characteristic/Comparison	Niassa (traditional)	Cabo Delgado (dedicated system)	Difference
Population	1,178,117	1,632,809	
Population of children under age 5	179,892	303,007	
Absolute Costs			
Distribution	$142,757.04	$117,802.30	$24,954.74
Transport	$35,968.39	$ 55,234.48	($19,266.09)
Personnel	$75,482.23	$ 35,376.00	$40,106.23
Cold chain	$31,306.42	$27,191.82	$4,114.60
Vaccines and supplies	$123,806.00	$187,616.51	($63,810.51)
Total vaccine logistics costs	$266,563.04	$305,418.80	($38,855.76)
Costs Controlling for Population Differences			
Total cost per child under age 5	$1.48	$1.08	$0.40
Relative Cost Effectiveness			
DPT3 2008 coverage rate for children age 24–35 months[a]	70%	95.4%	(25.4%)
Total cost per child receiving DPT-hepatitis B3	$6.07	$5.03	$1.04
Relative Cost-efficiency			
Number of vaccine doses delivered	498,624	889,152	(390,528)
Total cost per dose of vaccine delivered[b]	$1.50	$1.18	$0.32

Notes:

[a] For details of the coverage rates, see Kane 2008.

[b] The total cost per dose of vaccine delivered was calculated by adding the transport, personnel, and cold chain costs; and dividing that sum by the total doses delivered. Then, because the vaccines and syringes have a cost per dose, those costs were added to the result.

The total logistics costs to operate the vaccine supply chain for one year was U.S.$38,856 greater in Cabo Delgado than in Niassa. Of the total supply chain costs, both provinces invested the largest percentage of resources in vaccines and supplies, with 61 percent of the costs in Cabo Delgado and 46 percent in Niassa going to those commodities. Niassa spent a larger percentage on personnel (28 percent) and cold chain (12 percent) costs, compared to Cabo Delgado (12 percent and 9 percent, respectively). Conversely, Cabo Delgado spent a larger percentage on transport (18 percent), compared to Niassa (14 percent).

When controlling for population size, the DLS cost $0.40 less per child than the traditional system, indicating that the traditional system requires a higher level of effort to manage than the new DLS.[3]

[3] However, vaccine supply chain costs have fixed and variable costs, and Niassa's lower population and larger geographic size means that even with maximum efficiency, Niassa's costs per child under age 5 will always be higher than in Cabo Delgado. For more details and analysis on this issue, see the full cost study report.

Furthermore, the DLS also cost $0.32 less per dose delivered. While the total cost of the DLS is higher than the traditional system, the demonstrated cost effectiveness and efficiency results in savings for the government.

Use of Results

Costing study results were successfully used to advocate for broader implementation of the dedicated logistics system for vaccines.

Partners used the costing study results to advocate for broader implementation of the DLS. VillageReach disseminated the results widely to the Ministry of Health (MOH) in Mozambique and its partners, including nongovernmental organizations (NGOs), and bilateral and multilateral donors. Understanding the cost was particularly interesting to MISAU, because it would ultimately need to pay for incorporating the DLS into its existing operations.

During the dissemination process, VillageReach encountered several challenges. For example, when using the costing findings to advocate for system change, they met some resistance because of the study limitations in comparing the two provinces. Also, the costing expertise of the stakeholders varied widely. To manage these challenges, VillageReach enlisted an independent economist to review the study and to validate and present the results. The opinion of a neutral expert also helped ensure that the stakeholders perceived the findings as fair and unbiased.

Another challenge was resource allocation. While the traditional system relied on resources from the health-center level, the DLS depended on resources from the provincial level. As a result, broader implementation of the new system would require a shift in resources from the district budget to the province, a change that could be seen as contradicting the government-wide policy of decentralization.

While these challenges took time and resources to address, they were important steps in building confidence in the study and ownership of the process. As a result, the minister of health authorized each of Mozambique's provinces to explore implementing the dedicated logistics system. Today, four of Mozambique's 10 provinces are implementing the new system, which now extends to more than 445 health centers.

Nigeria: Using Cost Data to Budget and Advocate

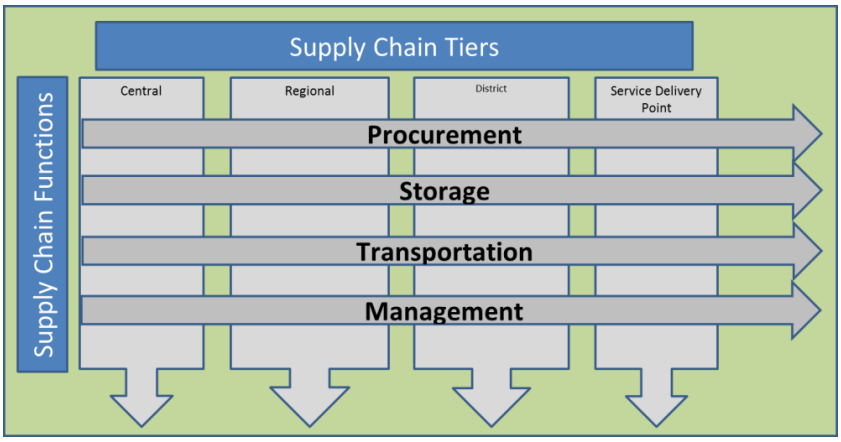
Background and Rationale for Costing

In 2010, to help evaluate possible structural changes in the supply chain, the Federal Ministry of Health (FMOH) in Nigeria carried out a study so they could better understand the costs of its contraceptive logistics management system (CLMS). Furthermore, in April 2011, the Government of Nigeria announced that it intended to eliminate the user fee charged to contraceptive clients. Eliminating the long-standing cost recovery model required each of Nigeria's 36 states to decide how to organize and finance contraceptive distribution under the new system. The costing study results were also used to inform these decisions.

Costing Approach

The study used the Supply Chain Costing Tool (SCCT)—an activity-based approach developed by the USAID | DELIVER PROJECT—to standardize measurement and analyze the costs.

Figure 1. The SCCT captures costs by tier and by function.



The costing study included a sample of 44 facilities that offer family planning commodities; it represented all tiers in the CLMS, including the Central Contraceptive Warehouse in Lagos; state central medical stores; local government area (LGA) medical stores; and SDPs, including hospitals and health centers. The facilities were selected from six states—one from each geopolitical region. Also included in the study were supply chain functions carried out by the FMOH and its national partners: United Nations Population Fund (UNFPA), U.S. Agency for International Development (USAID), and the Department for International Development (DFID). Based on results from the sample, analysts extrapolated an estimate of supply chain costs at the national level.

The SCCT approach captures and organizes supply chain costs into four functions (procurement, storage, transportation, and management), by organization; and by each level or tier (central, regional, facility level, etc.) of the supply chain. Primary and secondary data is collected across functions and levels for a comprehensive view of the time, effort, and resources required to distribute commodities at each stage in the supply chain. Where available, accounting information can supplement primary data. The outputs from the tool are used to estimate the cost of delivering individual commodities from the port of entry down to the SDP.

Standard indicators include—

- supply chain costs as a percentage of the total value of commodities
- supply chain cost per $U.S. value, volume, or weight of commodities
- cost by tiers and functions.

Results

Initial findings from the costing study indicated that there were high fixed costs and low volume throughput at all levels, which reflects a system operating at suboptimal levels when examined on a cost-per-unit basis. Given the levels of system throughput, system resources—particularly labor and warehouse space—were often arbitrarily allocated and underutilized.

Table 2. Total Estimated Supply Chain Costs, by Tier, for Nigerian Contraceptive Logistics Management System ($U.S.)

Function	Tier 1 (central)	Tier 2 (state)	Tier 3 (local government area)	Tier 4 (service delivery point)	Total
Procurement	67,952	940	23,578	102,241	194,710
Storage	47,999	60,972	118,188	863,490	1,090,649
Transportation	-	46,314	494,865	311,464	852,643
Management	2,057	81,317	343,562	350,315	777,251
Total system costs	**118,008**	**189,543**	**980,192**	**1,627,511**	**2,915,254**
Total throughput (commodity value)					970,742
Average cost per $U.S. throughput by tier	**0.12**	**0.2**	**1.01**	**1.68**	**3**

Storage and transportation represented the main costs. Total storage costs increased with each successive move down the supply chain; primarily because of the number of facilities—lower levels have more facilities. Transport is the only variable cost in the supply chain; therefore, it is the only cost that can be addressed in the short term. The study showed that transportation in the lower tiers was not being optimally used—for example, trucks were exclusively delivering or collecting contraceptives and were not fully using cargo space. Overall, the study concluded that the cost recovery margins were insufficient to cover the cost of distributing contraceptives: the estimated annual deficit was $0.5 million. In addition, cost recovery margins were unbalanced by tier. Tiers 1 and 2 broke even when the margins were compared to transportation costs, but tiers 3 and 4 had large deficits.

Use of Results

Costing data helped to inform the selection of new distribution models for contraceptives, as well as to highlight where resource constraints put states at risk for disruption of distribution.

Anticipating the elimination of the long-standing cost recovery model, each of Nigeria's 36 states had to decide how to organize and finance contraceptive distribution under the new system. The FMOH, with support from the USAID | DELIVER PROJECT and UNFPA, organized two workshops for family planning coordinators and the directors of primary health care from all 36 states and the Federal Capitol Territory. After attending the workshops, the stakeholders from each of the states had the tools they needed to plan and advocate for the resources required to effectively distribute their family planning commodities. In order to do this, each state needed to determine an appropriate distribution model and associated transportation costs, and contraceptive commodity needs (reflecting anticipated increase in demand resulting from fee removal).

Using data from the costing study, the project prepared templates and a budgeting tool to help participants determine the volume of commodities they would need to distribute, based on their forecast; identify the costs associated with various distribution systems; calculate estimated distribution costs relative to the value of commodities distributed; and compare distribution systems. Based on the revised forecasts and new distribution models, the projected cost of the supply chain per unit of commodity throughput value was lower than the level found in the original study.

Participants used this information to draft an operational plan for each state; which served as their main advocacy tool. These plans included forecast volumes; the proposed distribution model; key assumptions; and annual supply chain cost estimates, with clear next steps and follow-up actions to ensure funding for the proposed supply costs.

Costing data also helped to highlight which states were more at risk for disruption of distribution because of lack of funding, and where to focus to ensure continuous supply. Participants compared the account balances from cost recovery accounts (provided by the participants) to the estimated annual costs of distribution. Doing so enabled the states to estimate the number of months they would be able to fund commodity distribution before additional funds were required.

Lessons Learned and Conclusions

Knowing the true costs of getting commodities to health facilities is an important element for program planning. Collecting the cost components is an important step, but researchers and managers must appropriately interpret the results and translate them into programmatic changes. The experiences in Mozambique and Nigeria highlight helpful lessons in using costing results.

- Neutral experts can help increase understanding and credibility of costing results among stakeholders.
- Costing data can help practitioners and managers estimate budget needs in the face of changing policies.
- Costing data provides insight into performance and the cost effectiveness of various distribution models.
- Specific cost data provides the evidence stakeholders and supply chain managers need to advocate for funding more effectively with local and state governments, as well as national partners and potential donors.

In both countries, at the state and provincial levels, costing was critical for decisionmaking about supply chain system design. By helping to promote adequate funding and improvements, costing led to more rational use of resources.

Additional Resources

To learn more about supply chain costing, the following resources are available on the USAID | DELIVER PROJECT website deliver.jsi.com

- Supply Chain Costing Tool
- Tien, Marie, Elaine Baruwa, and Darwin Young. Forthcoming. *Supply Chain Costing Tool User's Manual. Beta Version.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4.
- McCord, Joseph, Marie Tien, and David Sarley. Forthcoming. *Guide to Public Health Supply Chain Costing: A Basic Methodology.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4.
- USAID | DELIVER PROJECT, Task Orders 4 and 7. Forthcoming, *Improving the Financial Sustainability of Rwanda's Public Health Supply Chain Through Cost Analysis.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 4.

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