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Zimbabwe: Supply Chain Costing of Health Commodities

JULY 2010

This publication was produced for review by the U.S. Agency for International Development. It was prepared by the USAID | DELIVER PROJECT, Task Order 1.

Zimbabwe: Supply Chain Costing of Health Commodities

USAID | DELIVER PROJECT, Task Order 1
The USAID | DELIVER PROJECT, Task Order 1, is funded by the U.S. Agency for International Development under contract no. GPO-I-01-06-00007-00, beginning September 29, 2006. Task Order 1 is implemented by John Snow, Inc., in collaboration with PATH; Crown Agents Consultancy, Inc.; Abt Associates, Inc.; Fuel Logistics Group (Pty) Ltd.; UPS Supply Chain Solutions; The Manoff Group, Inc.; and 3i Infotech. The project improves essential health commodity supply chains by strengthening logistics management information systems, streamlining distribution systems, identifying financial resources for procurement and supply chain operations, and enhancing forecasting and procurement planning. The project also encourages policymakers and donors to support logistics as a critical factor in the overall success of their health care mandates.

Recommended Citation
Sarley, David., Elaine Baruwa, and Marie Tien. 2010. *Zimbabwe: Supply Chain Costing of Health Commodities.* Arlington, Va.: USAID | DELIVER PROJECT, Task Order 1.

Abstract
A costing analysis was conducted for the USAID | DELIVER PROJECT field office in Harare to compare six different scenarios, based on the Delivery Team Topping Up (DTTU) system and the essential drug system. This report presents the findings of the average supply chain costs of delivering U.S.$1.00 of health commodities by looking at the relationship between average costs and the value of products managed by the supply chain.

Cover photo: A logistics worker in Zimbabwe enters data using Auto DRV software on a rugged laptop.

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Acronyms

AC	average cost
CAZ	Crown Agents, Inc., Zimbabwe
DFID	Department for International Development
DPS	Department of Pharmaceutical Services
DRV	delivery receipt voucher
DTTU	Delivery Team Topping Up
ED	essential drug
EDL	essential drug list
EDS	essential drug system
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GOZ	Government of Zimbabwe
HIV	human immunodeficiency virus
JSI	John Snow, Inc.
LMIS	logistics management information systems
LSU	logistics sub-unit
M&E	monitoring and evaluation
MOH	Ministry of Health
MOHCW	Ministry of Health and Child Welfare
NatPharm	National Pharmaceutical Company
NGO	nongovernmental organization
NVP	nevirapine
PHC	primary health care
PMD	Provincial Medical Director
PMTCT	prevention of mother-to-child transmission
QA	quality assurance
RTK	rapid test kit
SCCT	supply chain costing tool
SCMS	Supply Chain Management System project
SDP	service delivery point

UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
ZIP	Zimbabwe Informed Push
ZNFPC	Zimbabwe National Family Planning Council

Acknowledgments

The authors would like to thank and express their sincere appreciation to the Zimbabwe USAID | DELIVER PROJECT staff for the time, expertise, and support they provided for this activity. Special thanks go to Carol Mashingaidze and Louis Kajawu; they accompanied the team in the field, traveling with them throughout the data collection process. We are also grateful to the health facility staff who took time from their busy schedules to provide us with valuable information. This activity would not have been possible without the support of the Ministry of Health and Child Welfare and USAID.

Executive Summary

The USAID | DELIVER PROJECT field office in Harare is unique among project offices in that it manages, rather than just provides, technical support to in-country public health supply chains, The Government of Zimbabwe and donor and implementation partners have acknowledged that the Zimbabwe National Family Planning Council (ZNFPC)/Delivery Team Topping Up (DTTU) system achieves high product availability for the 11 contraceptives and health products it carries. Based on the vendor-managed inventory system used in the commercial soft drinks industry, this system puts the burden of stocktaking and calculating top-up amounts on delivery teams that serve as a mobile warehouse, instead of on the already busy medical staff in each facility. The question often asked is—at what cost? Also, how would those costs change if different products were added to the delivery routes? How do they compare to a more traditional pull essential drug system (EDS)?

The current study applies a function-based supply chain costing tool (SCCT) to answer these questions and to guide counterparts with supply change management decision making. Commercial supply chain costs are often difficult to estimate; this is particularly true of public health supply chains. Costs occur across multiple functions (procurement, storage, transportation, management), across different organizations, and at different levels or tiers (central, regional, facility-level, etc.). The function-based SCCT uses an analytical approach to identify, organize, collect, and estimate costs, and then analyzes them. After costs are analyzed, they can guide supply chain system design, help ensure supply chains are properly funded, and improve efficiency so that more funding is available for necessary products. However, supply chain costing is not a simple accounting exercise. The tool uses accounting information, where available, but this is supplemented with primary data collection, including an analysis of the time, effort, and resources needed to complete different supply chain functions—in Zimbabwe, a combination of key informant interviews and direct observations also provided rich data.

Cost comparisons were made in a series of different scenarios, which are described in this paper. Because these scenarios involved different product bundles and volumes, we calculated the average supply chain cost of delivering U.S.$1.00 of health commodity in each scenario. This enabled us to look at the relationship between average costs and the value of products managed by the supply chain to address some of the key management questions summarized in table 1.

Table 1. Summary of Costing Scenarios

Scenario	Commodity Bundles Delivered	Delivery Approach	Cost Comparisons Made	Results Used to Answer the Following:
Scenario 1	11 Family planning	Delivery Team Topping Up (DTTU)	—	What is the cost of delivering 11 family planning commodities using the bimonthly DTTU system?
Scenario 2	11 Family planning	DTTU	Scenario 2 vs. scenario 1	What is the cost impact of moving from a bimonthly to a quarterly delivery schedule?
Scenario 3	11 Family planning + 44 primary health care (PHC)	Integrated DTTU	Scenario 3 vs. scenario 2	What is the cost impact of adding the 44 PHC commodities to the quarterly DTTU schedule, when staff are on project salaries?
Scenario 4	11 Family planning + 44 PHC	Integrated DTTU	Scenario 4 vs. scenario 3	What is the cost impact of adding the 44 PHC commodities to the DTTU if staffed by personnel on public service salaries only versus the development partner/project salaries assumed in scenario 3?
Scenario 5	44 PHC	EDS pull	—	What is the cost of delivering the 44 PHC commodities using the pull EDS on a quarterly schedule?
Scenario 6	44 PHC + 11 family planning	EDS pull	Scenario 4 vs. scenario 6	What is the cost of an integrated DTTU system compared to a pull EDS handling the same products on a quarterly schedule?

In estimating the supply chain costs, we adopted two interlinked approaches. First, we used the function-based costing tool to collect all the transport, management, and storage costs incurred at the central and branch level for the 11 DTTU commodities. Working with the USAID | DELIVER PROJECT, Crown Agents, and the ZNFPC offices, we collected information on all the costs incurred to operate the DTTU. We called these tier 1 costs. The tool was also used to collect facility-level (tier 2) costs for a cross-section of 29 facilities. This included their management and storage functions because those facilities did not incur transport costs. Facilities visited covered the main types of primary and secondary health facilities in urban and, where appropriate, rural settings.

These 2009 costs, estimated under scenario 1, captured how the DTTU operated with a bimonthly delivery schedule. These cost estimates were then used to calculate three other scenarios—2, 3, and 4—each with different adjustments. In scenario 2, we estimated the costs if the 11 DTTU commodities were moved to a quarterly delivery schedule. Then, in scenario 3, we added 44 primary health care commodities to the 11 carried by the DTTU. In scenario 4, we recalculated scenario 3 costs using the government of Zimbabwe per diems and salaries for the truck delivery teams and other partner-supported salaries from scenario 3.

For the EDS scenarios 5 and 6, we used a budget-style approach to estimate the costs. The lack of actual EDS information by function meant that the function-based approach used in the earlier scenarios would require numerous assumptions. Data from scenarios 3 and 4 helped to project out what costs would be if the EDS was fully functioning. Discussions with stakeholders in three workshop/meetings resulted in an agreement on the structure of the EDS scenarios and the assumptions being made for unit costs and number of staff, and other resources required, similar to a budget-based approach.

While the cost analysis captures all the in-country supply chain functions, we have not included the procurement fees in the cost comparisons. As most of the procurement is done offshore, the procurement fees are included as part of the landed cost of the commodities. This should not be confused with the logistics sub-unit's (LSU's) handling charges to clear products from customs when costs are incurred in-country and are categorized under the procurement function. National procurement costs could be estimated for the EDS scenarios, while donor procurement costs vary considerably from donor to donor.

Before reviewing cost estimates from the different scenarios, it is necessary to understand the different factors that drive costs for the DTTU and EDS. A key cost driver for the DTTU scenarios is the amount of time the delivery team needs to spend in the field on their delivery routes. As the number of products increase, more time is required in the field to count inventory at facilities and then to pick the products to leave behind. At some point, if the number of products becomes too large, then the cost of the team time and the cost of their per diem will become too costly. Because the DTTU operates like a mobile warehouse, there is a limit to the number of products that can be managed in one drop. For larger numbers of products, it may be less costly to do the picking and packing in the central or branch warehouse, rather than on a mobile warehouse. DTTU program management is another important cost driver, but this is likely to decrease as more products are added. Transport costs may increase.

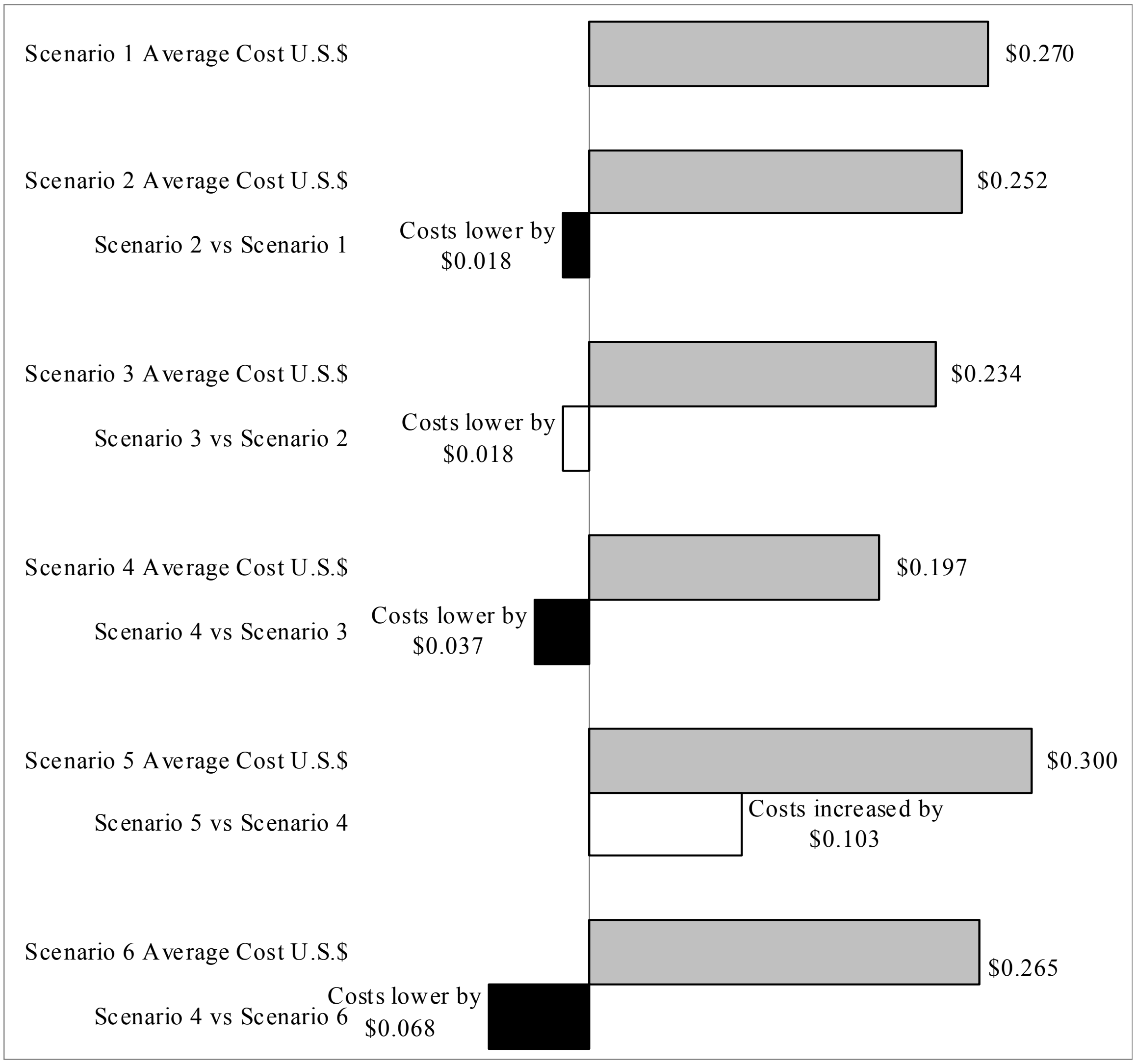
By comparison, the key cost drivers with the pull EDS are the number of staff to be trained, staff turnover that requires frequent training, supervision costs, and the time spent by staff managing their own stock. With 1,404 facilities to be managed, these average costs are substantial for smaller volumes of products, but the costs decrease as the value and volume of product handled increases.

The cost drivers, described earlier, suggest that for smaller numbers of products, the DTTU approach will probably have lower average costs than the EDS approach. As the number of products increase, the average cost of the EDS will decrease and, at some point, will probably be lower than the costs for the DTTU.

The cost of a DTTU delivery for 11 products on a bimonthly schedule is, on average, U.S.$0.27 to deliver each $1.00 of commodity carried (see figure 1). This average cost is reduced to $0.252 with a quarterly schedule because of savings in transport cost. Therefore, a quarterly schedule is a more efficient approach to product delivery. Adding the 44 PHC commodities to the DTTU increases the total operating costs by $1.5 million, but this is matched by an increase in the value of the commodities handled. The average cost for delivering the 55 products decreases to $0.234 on a quarterly delivery schedule. However, average costs are reduced to $0.197 per $1.00 of delivered commodity if the Ministry of Health (MOH) salaries and per diems are used instead of project salaries and per diems.

By comparison, the average cost of delivering product under the two EDS scenarios is higher.

Figure 1. Comparison of Costing Results (Average Costs)



The smaller total volume of products associated with the 44 products results in the highest average cost of all the scenarios—$0.300. The EDS is designed to handle a larger volume of products. This is evident in scenario 6 where the average cost for the EDS for the 55 commodities is $0.265. It should be noted, while only 11 commodities are added, the additional volume and value of products more than doubles that associated with the 44 PHC commodities.

When the results were discussed with the Ministry of Health and Child Welfare (MOHCW) and National Pharmaceutical Company (NatPharm) counterparts, and donor partners, a number of key conclusions were drawn:

- A DTTU informed push approach appears to be less costly than a pull system for a smaller number of commodities that are intended for primary health care facilities.
- The DTTU delivery system can add PHC commodities for a similar average cost of delivery with additional funding for capital and operating costs.

- The costs of staff time, training, and supervision at the facility level represent most of the pull EDS costs; these costs need to be funded to ensure that the approach works. Note that medical staff must take time away from other duties (including seeing patients, in some cases) to perform the supply chain activities.
- For larger numbers of commodities in a fully functioning, traditional, pull EDS supply chain costs would probably be less costly than trying to manage these products in a DTTU system. The pull EDS training and supervision costs would be spread over a larger value of commodities being handled.
- Future applications to the Global Fund need to ensure that these facility costs, particularly staff time, are funded or they will risk system performance problems.

The average delivery cost is a key indicator that should be considered in further supply chain system design. The present analysis is a benchmark that can improve the efficiency of supply chain operations: it can make more funding available to ensure that health products are purchased and reach their intended clients.

Introduction

This report presents the results of a supply chain costing exercise conducted in Zimbabwe in November 2009 and January 2010. The U.S. Agency for International Development (USAID) funded this work through the USAID | DELIVER PROJECT; it included staff from the USAID | DELIVER PROJECT and Abt Associates, Inc. The work involved the second field test of the function-based supply chain costing tool, which the project developed; it followed earlier work by the same team in Zambia. The work in Zimbabwe differed in a number of important ways from the analysis in Zambia. Discussions with the project field office identified three key objectives for the cost work:

- Provide project stakeholders with an understanding of the Zimbabwe National Family Planning Council (ZNFPC)/Delivery Team Topping Up (DTTU) costs.
- Undertake some cost comparisons for different supply chain scenarios involving different bundles of products of primary health commodities and different ways of delivering them.
- Develop a tool to guide management decision making that local staff and counterparts could apply in looking at further system design options.

The DTTU system was implemented in Zimbabwe to ensure the availability of condoms and contraceptives in public and nongovernmental organization (NGO) facilities. It adapts a supplier-managed inventory approach—often used in the commercial soft drinks sector—to the public health system in Zimbabwe. The DTTU systems require that special investments are made to ensure that reliable vehicles, drivers, technical staff members, or a combination of these, will directly provide or *top up* facilities with the health products they need. Under a DTTU system, delivery trucks are filled with a predetermined quantity of a product—usually based on past consumption patterns—and the product is driven to health facilities. The drivers or other staff members who are part of the delivery team calculate current consumption and resupply quantities, and they reconcile inventories at each facility they visit. Thus, they top up the inventory of each facility with quantities needed to meet the next period's requirements.

As the USAID | DELIVER PROJECT's success story, Delivery Team Topping Up: Bringing About Reliable Distribution in Difficult Environments, stated, the DTTU has been very successful in improving product availability.

"An evaluation in 2007 showed remarkable results. Focusing on condoms for HIV and AIDS prevention and contraceptives, the evaluation found that throughout the nation, the DTTU system has achieved 99 percent of coverage of all service delivery points—more than 1,200 clinics. On the same national scale, it has achieved more than 95 percent availability of contraceptives and HIV and AIDS condoms."

To ensure product availability during Zimbabwe's economic difficulties, donors have invested in establishing and operating the DTTU. A key question now for donors and the Government of Zimbabwe (GOZ) is whether the DTTU is still justified as the economy recovers. Is the DTTU approach more expensive than more traditional approaches, such as the pull essential drug system (EDS)? What adjustments can be made to the DTTU to reduce cost? How would costs be affected if the number of products carried was expanded? Should the National Pharmaceutical Company (NatPharm) and the Ministry of Health consider a version of the DTTU approach as more products are funded by donors, including the Global Fund?

To answer these questions requires an understanding of the actual cost of delivering products included in the DTTU and the alternative approaches. A previous analysis (Bunde et al. 2007) looked at the DTTU accounting data to derive an estimated delivery cost of 12 percent of the commodity value. This analysis did not include the Ministry of Health and Child Welfare (MOHCW) costs; it was based only on the DTTU accounting information; it did not include an estimation of the actual costs of the different functions associated with the DTTU.

To address the questions listed above requires a fuller understanding of all the costs involved in ensuring that products are delivered. Costs need to be estimated across several implementing partners, including donor and the GOZ-funded entities. It also requires an understanding of costs incurred at different tiers or levels in the supply chain in Zimbabwe.

As funding for health commodities in Zimbabwe increases, the Ministry of Health and NatPharm are seeking increased funding for their supply chain. Estimating the cost of a fully functional EDS in Zimbabwe will help ensure that sufficient resources are identified for both NatPharm and the MOHCW to fund the supply chain. Estimating EDS costs will help in the system design and will allow comparisons with the cost of alternate models of delivery, such as the DTTU and Zimbabwe Informed Push (ZIP) models.

The DTTU contrasts with the traditional pull EDS where the staff at the facilities are responsible for these calculations and for ordering resupplies. The DTTU more closely resembles an *informed* push system where pre-determined quantities are delivered, but the quantity size can vary and they are determined or informed by current consumption data collected by the delivery team.

The USAID | DELIVER PROJECT developed and applied a supply chain costing tool (SCCT) in Zambia (Baruwa, Tien, and Sarley 2009). Zimbabwe was selected as the second field test for the tool. The SCCT was used directly to cost the DTTU. Discussions with the project office in Harare revealed that the range of different questions to be addressed also required the application of the costing tool using a budget-based approach, which would be applied to estimate costs of the EDS in two different scenarios.

The function-based costing tool provides the actual cost of delivering product using the current variations of the DTTU supply chain (scenarios 1–4). A different budget-based version of the costing tool was developed to cost the hypothetical pull EDS (scenarios 5–6).

This report includes a synopsis of the DTTU and the EDS, summarizes the costing methodology, then presents six different cost scenarios. See the appendix in this report for more detail on the assumptions behind each scenario.

DTTU and EDS Overview

The DTTU has three main characteristics: (1) specially trained ZNFPC team leaders, drivers (or other accompanying technical staff members), (2) reliable transport, and (3) adequate operating funds. In situations where options for transport within the public and private sectors are not available or reliable, this approach means, in practice, that the DTTU will need to acquire and maintain its own fleet of trucks. This creates a major start-up cost, but, in some fragile state situations, donors recognize the need and are prepared to cover this expense. The recurrent costs of fuel, maintenance, and staff travel expenses must also be covered.

The DTTU system is a partnership of the USAID | DELIVER PROJECT and Supply Chain Management System (SCMS) projects, funded by USAID, Crown Agents, Inc. Zimbabwe (CAZ) funded by DFID, the Zimbabwe National Family Planning Council (ZNFPC) and the logistics sub-unit (LSU) of the MOHCW AIDS & TB Unit and National Pharmaceutical Company (NatPharm). Since its implementation in 2004 with condoms and family planning products, several additional HIV-related products have been added to the system; it has developed a reputation for reliability despite the challenging social and economic environment.

The project in Zimbabwe supports the DTTU through two of its USAID-funded projects: the USAID | DELIVER PROJECT (project) and the Supply Chain Management Systems (SCMS) project. The project in Zimbabwe provides technical support to the DTTU. The project also employs logistics support, drivers, administrators, and supervision staff; they are seconded to the MOHCW. They may also be funded by other partners, such as Crown Agents, Inc. (CAZ) or GOZ, through ZNFPC. Vehicles, maintenance, and fuel are also paid for and managed by the project in Zimbabwe. The USAID | DELIVER PROJECT procures commodities through the project (male and female condoms and contraceptives); SCMS procures HIV/AIDS commodities. SCMS funds the staffing of the LSU, which also funds and manages the procurement of HIV-related products. The funding source, USAID, is used from this point forward and refers to both the USAID | DELIVER PROJECT and the SCMS project.

The Department for International Development (DFID) (United Kingdom) supports the DTTU through its contract with CAZ. This funds the salaries and per diems for drivers and other supervisory staff of the DTTU. In addition, CAZ quantifies, procures, and funds the pills for family planning. The ZNFPC is the agency of the GOZ that provides storage facilities for the family planning commodities and pays the salaries of the team leaders who accompany the delivery vehicles as part of the DTTU delivery teams (per diems are paid for by CAZ).

The LSU resides physically at the NatPharm site but it is funded by SCMS. The LSU quantifies and procures HIV-related products and also provides some supervision for the DTTU. The preventing mother-to-child transmission (PMTCT) and rapid test kit (RTK) commodities are stored at NatPharm.

Although UNICEF is not a DTTU partner in the current system, UNICEF currently procures the primary health care (PHC) drugs for the EDS. Their role is modeled in several of the cost scenarios involving primary health care commodities.

The DTTU system is a two-tiered system. Goods are procured, stored, and transported by facilities in the first tier (tier 1), which is made up of the DTTU partners discussed earlier in this report. After procurement and in-country delivery, the commodities are stored either at NatPharm or the ZNFPC; the DTTU delivery trucks and teams pick them up and then distribute them directly to the second tier facilities (tier 2) facilities, which include—

- central/university/provincials/municipal/district/rural hospitals
- maternity clinics/polyclinics
- rural health centers and clinics.

All the tier 1 facilities, as well as a sample of each type of the tier 2 facilities, were included in the DTTU supply chain costing study. A full list of these facilities is provided in appendix C, including a list of functions performed by each partner and facility, the region where the facility is located, as well as the population density (high/low) of the facility and whether or not it is a rural/urban facility. See appendix D for a list of the 11 products carried by the DTTU and the 44 products carried by the EDS.

NatPharm has historically operated a pull order system for essential drugs. Health facilities issue requisition orders for the products needed; they are then sent by post or in person to their district pharmacy manager, which is located at the district hospital. The orders are then processed, checked, and consolidated at the district before transmission to the local NatPharm branch store for fulfillment. The four branch stores then obtain their products from one of the two regional stores. The EDS has suffered in the economic crisis from underfunding and this has contributed to reduced product availability. The UNICEF PHC kits are providing a much-needed supply of products to the system, but a lack of budget for staff training and supervision has slowed the process.

Supply Chain Costing Tool

The supply chain costing tool is used to estimate the cost of getting individual commodities from the port of entry delivered through the supply chain, down to the service delivery point (SDP). It looks at actual processes, and the time and effort required to complete delivery of the product at each stage in the supply chain.

The approach used in the supply chain costing tool is to model the supply chain in terms of its structure and management, and functions; and the quantity of product or commodity that flows through it. Each of these supply chain characteristics must be described in detail in order for the tool to determine supply chain costs. These three characteristics determine both the sample of facilities that must be included in the data collection process and the manner in which the metrics calculated by the tool may be used to determine the previously described categories of costs.

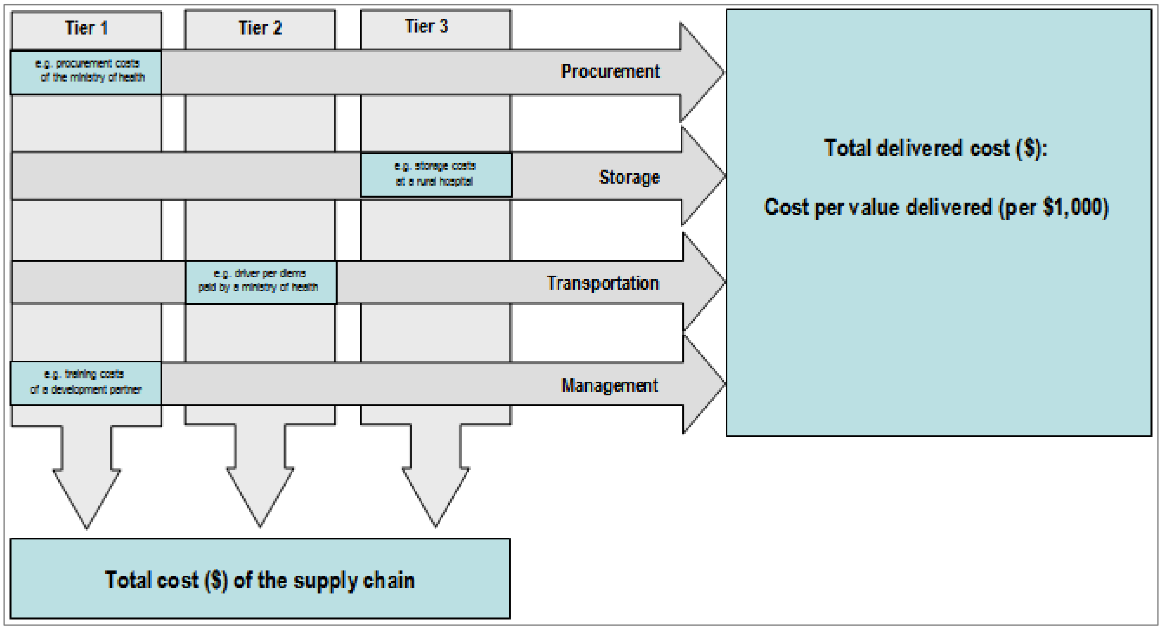
The core functions of a supply chain costed by the tool include—

- procurement
- storage
- transportation
- management (quantification, quality assurance/supervision, logistics management information systems [LMIS], training and operating costs).

Each function is divided into a labor component, an equipment cost component, and a third *other* section to capture costs peculiar to the particular function. Figure 2 is adapted from the work of Raja, Grace, and Chesley (2000) on costing Ghana's supply chain and it shows how the costs of a supply chain can be described in terms of both tiers and function.

The total delivered cost in figure 2 is defined as the total cost of delivering a unit of a commodity to the end user. The unit can be defined in value terms by $1,000 worth of commodities, or volumetrically as per meter squared (m^2), or by weight per kilo (kg) of commodity. The total delivered cost includes the cost of procuring that unit at each tier of the supply chain, the cost of storing that unit at every point where the commodities are stored, and the cost of transporting each commodity unit between each storage point in the supply chain.

Figure 2. Supply Chain Functions and Tiers (illustrative)



The total delivered cost is typically analyzed in terms of the percentage of the value of the good required to deliver the good; e.g., if it costs $200 to deliver $1,000 worth of family planning and HIV commodities, then the delivered cost is 20 percent of the value of the delivered goods. This indicator can help supply chain managers budget sufficient funds for product delivery. This is particularly important when policymakers, planners, and development partners are planning commodity donations and procurement actions because this helps budget the cost of ensuring that essential commodities are delivered to the end user in-country.

The total costs by tier in figure 2 refers to the total costs of every function performed by each facility, in each tier; which can be aggregated to estimate the total cost of each tier. This information is typically presented in terms of who is covering these costs so that it can be determined what role different partners are playing.

The types and quantities of commodities distributed by the supply chain provide the denominator to determine the various unit or average cost metrics. To use the tool, every commodity in the supply chain must be described, including the price of the commodity at procurement and the volume of each unit of the commodity during each stage of its supply chain journey.

Usually, supply chains straddle several administrative and institutional layers and involve multiple players, so that it is common to find that no single organization knows the exact total costs of the supply chain system. Furthermore, because the costs are not recorded by activity, but rather by accounting or budget line; staff salaries and benefits, fuel, office costs, and a walk-through approach interviewing key players is necessary to determine the costs involved in delivering commodities.

EDS Cost Using a Budget-Based Approach

As described above, the costing tool can help determine the cost of the actual inputs for supply chain systems that are working. In situations where supply chain budgets have been underfunded, a different approach is required. Where there have been budget constraints, the necessary products may not be available. Staff may not be funded to undertake all the functions required to ensure product availability. Other resources for training, supervision, and ordering may also be missing. This summarizes the constraints the pull EDS has been operating under.

Calculating EDS costs requires a theoretical estimation of the resources needed to operate it. This will require a top down, or macro, approach to approximate the likely costs that would be incurred if the EDS was fully functional. Constructing a meaningful model of a functioning EDS will involve multiple levels of assumptions, all agreed to with the stakeholders.

In this type of modeling exercise, the scope for an assumption error is very large. It is better to focus on building a simple model with consensus on the general assumptions made rather than attempting to go into intricate detail on how the EDS might work. As Professor Terry Pohlen stated at the Council for Supply Chain Management Professionals (CSCMP) 2009 Chicago conference when he commented on supply chain costing, "It is better to be approximately correct than precisely wrong."

A proposed EDS costing approach is similar to a budgeting exercise undertaken for a workplan before the work is undertaken. Typically, the budget will involve estimating the main tasks to get the work done, making assumptions about the level of effort and other inputs, and assigning average costs to those inputs. This represents our expectation on what the costs of the activity might be. Validation by stakeholders of the assumptions will ensure that the budget is approved. As the results will probably be sensitive to the assumptions made, upper and lower estimates will be made based on different assumptions for key cost factors.

Costing Scenarios and Assumptions

Several key cost questions need to be addressed.

- What is the cost of using the DTTU to deliver commodities?
- Can changes in delivery schedules help reduce this cost?
- How would delivery costs change if more products were added to the DTTU system?
- How does the cost of the DTTU system compare to that of the EDS, if it was fully operational?
- How do these costs compare to the costs of other supply chain systems?

To answer these questions, we developed a series of supply chain cost scenarios. Each scenario involves different assumptions about the value and volume of products distributed and the way they are distributed. We estimated the costs for the delivery of different commodity bundles with different assumptions for delivery intervals, delivery approach, and the average costs being used. Table 2 summarizes the six scenarios developed and the key assumptions underlying each scenario.

Table 2. Summary of Differences between Cost Scenarios

Scenario	Commodity Bundles Delivered	Delivery Interval	Delivery Approach	Average Cost Assumptions
Scenario 1	11 Delivery Team Topping Up (DTTU) commodities	Bimonthly	DTTU	Average costs from DTTU, Crown Agents, and other partners
Scenario 2	11 DTTU commodities	Quarterly	DTTU	Average costs from DTTU, Crown Agents, and other partners
Scenario 3	44 primary health care (PHC) commodities plus the 11 DTTU commodities	Quarterly	Integrated DTTU	Average costs from DTTU, Crown Agents, and other partners
Scenario 4	44 PHC commodities plus the 11 DTTU commodities	Quarterly	Integrated DTTU	MOH salary and per diem costs
Scenario 5	44 PHC commodities	Quarterly	EDS pull system	MOH and NatPharm average costs
Scenario 6	44 PHC commodities plus the 11 DTTU commodities	Quarterly	EDS pull system	MOH and NatPharm average costs

For ease of comparison, we focus on the cost of delivery as a percentage of the commodity cost. Comparisons can also be made in terms of the cost per kg or m^2 delivered. A comparison of scenarios 1 and 2 will demonstrate whether a bimonthly or quarterly schedule is more cost efficient for the DTTU delivery of its existing 11 products. A comparison between scenarios 2 and 3 can show whether expanding the range of products carried by the DTTU to integrate PHC commodities increases or decreases average costs. While we would expect scenario 4 to cost less than scenario 3, are the cost differences significant? Similarly, comparing scenario 5 and scenario 6 will determine whether expanding the number and volume of commodities covered increases or decreases the estimated EDS costs. Finally, comparing scenario 3 and 4 and scenario 5 and 6 will help gauge whether the integrated DTTU or the pull EDS is the more cost efficient approach to delivering commodities. Scenarios 1 through 4 were all developed using the costing tool. Scenario 5 and 6 used the budget-based approach. It should be noted that we do not attempt to undertake any program effectiveness analysis. This could be considered with the proposed ZIP rollout, as product availability could be considered with cost data.

Approach

The DTTU system was reviewed as a necessary step before trying to determine the inputs and costs of running the system. Several project reports were reviewed describing the system in detail. The DTTU standard operating procedures manual was also reviewed.

Scenario 1 describes the cost of the existing DTTU system based on a bimonthly delivery schedule. Both qualitative and quantitative data was collected to determine the DTTU supply chain costs. Data was collected through interviews with key informants and the review of reports and financial data. The project field office conducted much of the work in advance by working with the MOH, ZNFPC, and NatPharm. Supply chain cost data were collected from a wide range of sources, including logistics reports, transport schedules, expenditure reports, and on-site interviews at each of the facilities sampled.

A range of respondents were interviewed to collect information. For facilities in tier 1, at least one person was interviewed in each of the different teams responsible for administrative, financial, logistics/storage, and service delivery functions. For example, the costing team spoke to the logistics advisors that manage transportation and the LMIS to identify the roles played by each partner in the transportation function of the DTTU; and also to obtain all the relevant delivery records required to determine the volume of commodities that flow through the DTTU in a single year. Using the facility's annual report and payroll documents, the finance and administrative officer for each tier 1 partner was interviewed to determine labor and operating costs.

The tool classifies each partner as a *facility* and then asks the respondent/respondents at each facility which of the three primary functions—procurement, storage, or transportation—does the facility carry out. For example, ZNFPC does not conduct any procurement activities; therefore, the questions focused on ZNFPC's storage activities.

In many tier 2 facilities, very few people actually handled the commodities. Where possible, the data collection team obtaining data from tier 2 facilities followed the schedule of a DTTU delivery route. This enabled direct observation of the delivery team as they worked. To estimate SDP staff time spent on managing DTTU commodities, the SDP staff were asked to estimate the time spent each week or month on supply chain–related tasks. Salary data were then collected or obtained by matching each staff member's civil service grade to the public service management salary guide, or by asking staff directly. All the SDP facilities' interviews were completed in less than two hours.

A variety of quantitative resources were used; for example, cost data were obtained primarily by reviewing financial expenditure reports, usually with the facility's financial or senior administrator. The JSI/Zimbabwe office and Crown Agents provided information on the quantities of commodities procured for the entire country and the quantity of commodities delivered to each of the sampled SDPs. The supply chain costing tool provides pre-programmed surveys to guide interviews with respondents as they discussed procurement, storage, transportation, operating costs, and staff time.

After the DTTU cost under scenario 1 was estimated, the next step was to determine all the assumptions required to estimate the cost of a quarterly DTTU delivery schedule captured in cost scenario 2. Discussions with DTTU fleet management staff confirmed that a quarterly delivery schedule would not require any increase in the size of the transport fleet. The key differences were related to fleet operating costs associated with the new delivery schedules, including the potential difference in labor and fuel costs that might occur if the schedule was changed.

Comparing scenarios 2, and 3 and 4, was a more complex analysis. Scenarios 3 and 4 involved the addition of the 44 PHC products. The increased volume would require significant adjustments to the DTTU system. Delivery schedules had to be adjusted to account for the need to replenish delivery trucks with commodities during a distribution run. The number of vehicles had to be increased which, in turn, increased fuel, insurance, and maintenance cost. Finally, all these changes also affected the number of delivery days for drivers and team leaders. Additional staff also had to be added to accommodate the inclusion of the 44 PHC commodities under supervision, quantification, and the LMIS. The staff time at the health facility was also doubled to account for their increased time to manage the PHC commodities.

A sample of facilities was selected to ensure geographical representation and to ensure that each type of facility was included. The sample of facilities covered the two largest cities in Zimbabwe—Harare and Bulawayo. The two sampled provinces included Manicaland, which is the most eastern province, with the densest population of health facilities; and Matabeleland South, a sparsely populated southwestern province. Out of approximately 1,404 facilities, the data collection team visited 29.

For scenarios 5 and 6, as a macro budgeting exercise, the EDS costing model estimated the total costs to run the EDS system nationwide. It considered costs incurred both by NatPharm and the MOH. The model used a series of linked spreadsheets to describe the costs of different supply chain components. For each component, key assumptions defined the level of effort and other inputs with the average cost for each input. These costs were apportioned between the MOH and NatPharm; and then compared to the estimate commodity value, volume, and, weight handled by the system. EDS costs were estimated at each level in the system; they require assumptions both on the total inputs required to operate the EDS and the average costs of those inputs. Costs incurred by both NatPharm and the MOH were considered. At the central level, this required estimating the total number of staff involved in the management functions at NatPharm headquarters, the Harare store, and the MOH. Costs included management time, central storage costs, transportation to regional stores; and other operational costs, including training, the LMIS, and office costs.

Data were collected from project sources and during meetings with individual stakeholder, who validated key assumptions to guide the model construction. These assumptions were then discussed and adjusted during a stakeholder workshop with counterparts from NatPharm and the MOHCW. An agreement was reached on the number of facilities, staff required, time needed for different functions, and commodities that could be handled. Agreement was also reached on supervision and training needed to keep the EDS functional.

At the Bulawayo and branch level, the inputs and costs of running each store are estimated. This includes branch storage, picking and packing, and transport costs to the SDPs. Similarly, for SDPs the average cost incurred at each type of SDP, including staffing and storage, are estimated. To provide the total cost, these are multiplied by the total number of SDPs of each type. Assumptions are made on the number of trips, average number of kilometers per trip, and the average cost per kilometer. With NatPharm and the project office, the estimate of the quantity, value, volume, and weight of the 44 drugs on the essential drug list (EDL), plus the 11 DTTU commodities, have been determined.

Assumptions

Scenario 1—Bimonthly Delivery

Because it was not possible to visit every facility and province in Zimbabwe, the costing team had to make several assumptions to simplify the analysis. The sample of facilities covered the two largest cities in Zimbabwe; the two sampled provinces included Manicaland and Matabeleland South. The team assumed that the Matabeleland South was representative of the other less-densely populated provinces, which we were unable to visit. Although the team visited at least one of each of the more numerous types of facility commonly found in Zimbabwe, private-for-profit facilities were not included as part of the sample.

As noted, five of the scenarios being costed were hypothetical and many cost assumptions and simplifying were required in order to model their costs. These are listed below.

Scenario 2—Quarterly Delivery

Scenario 2 estimates the cost of changing the delivery schedule from a bimonthly to a quarterly schedule; key assumptions include those listed below:

- When the quarterly schedule is introduced, it was assumed that no additional vehicles are required to deliver the adequate quantity of commodities to each and all facilities. In practice, this may not be true of Manicaland, which is a densely populated province that may require one additional short journey to restock the delivery truck.

It is assumed that the additional commodities will not change the amount of time required to make each delivery, at each site, in any significant manner. In practice, because the number of commodities being counted will not change, and it may only take a few minutes longer to count the extra units of each commodity.

- No change was made to the useful life of each vehicle, although the overall mileage covered on a quarterly schedule will decrease with the likely wear and tear of each vehicle. Although, on a quarterly schedule the vehicles may be in a better condition at the end of five years, several of them have already been used on a bimonthly schedule. Also, in accounting terms, the book life of a vehicle follows standard accounting practice, typically a straight line depreciation over three or four years, irrespective of the actual physical condition of the vehicle.

- As the maintenance schedule and costs are determined by the mileage covered by a vehicle (every 10,000 kilometers for the large delivery trucks), overall maintenance costs were reduced by one third, which relates to the reduction in annual mileage that results from the change in schedule.

Scenario 3 and 4—Adding PHC Products to the DTTU, Quarterly Delivery

Scenario 3 estimates the cost associated with an increase in the number of commodities being delivered by the DTTU system when 44 PHC commodities are added to the 11 already carried. This scenario continues to use project salaries for project staff. Assumptions for scenario 3 include—

- Four deliveries per annum are added to all the facilities served by the expanded DTTU system.
- Additional replenishment miles each quarter to replenish stock in each district are required to accommodate the addition of the 44 commodities into the expanded DTTU system. This required—
  - three additional delivery trucks and three drivers
  - two additional monitoring and evaluation (M&E) vehicles for the two additional DPS staff
  - increase in costs for the maintenance, insurance, and tires for additional delivery and M&E vehicles
  - per diem for the additional drivers and team leaders.
- The total distance to deliver to each facility, not including the replenishment mileage, from scenarios 1 and 2 remained the same.
- The cost of storing six months of stock of PHC commodities at $6.00 per square meter per month at NatPharm was assumed.
- The time spent by staff to perform supply chain tasks at SDPs is doubled to reflect the addition of the PHC commodities.
- The logistics manager's time for the LMIS function is increased from 30 percent from scenario 1 and 2 to full time.
- Two additional data entry clerks are added, for a total of three clerks, to accommodate the additional 44 commodities handled by the LMIS.
- Assume that the PMTCT and RTK team would also quantify the PHC products, increasing their time from 1.5 days per quarter to 5 days per quarter.
- The area coordinators and deputy logistics advisor's time remained the same.
- Two additional Department of Pharmaceutical Services (DPS) logistics officers are added to make supervision visits for five days every month. The current supervision schedule by four logistics officers remained the same.
- The estimated operating costs at the health facilities is increased from 0.5 percent to 1 percent to account for the additional space the PHC commodities will occupy in each of the health facilities.
- An assumption of 100 percent of the storage space will be used for the 55 commodities at rural heath centers, rural hospitals, and clinics; while 25 percent of the storage space will be used for the 55 commodities at district, provincial, and central hospitals.

- Additional fuel costs and per diem were costed for the DPS logistics officers. Additional costs include the training of 40 additional team leaders, plus the purchase of eight rugged laptops, and the cost of updating the Auto Delivery Receipt Voucher (DRV) software.

Scenario 4 is the same as scenario 3, but it replaced the DTTU staff costs with salary and per diem levels used by the MOH and NatPharm, specifically—

- All project supported salaries were substituted with the MOH civil service salary scale. These apply to the positions funded by USAID and Crown Agents.
- The rate of $30/day, instead of $50/day, was substituted for the per diem funded by USAID and Crown Agents.

Scenarios 5 and 6

Scenarios 5 and 6 attempt to capture how a pull EDS would work if it was fully funded. As the system has not been funded, or entirely functional, actual data does not exist. Trying to estimate the actual costs of tracking commodities being delivered requires a large number of assumptions. Rather than use the detailed function-based costing tool, a top-down budget style model was developed. This also required assumptions at multiple levels for each of the main supply chain functions. These are described in detail in the appendix and include—

- volume and value of essential drugs and DTTU commodities ordered—these were taken from the PHC kit list and from DTTU commodity value and volumes
- level of staffing required to operate the EDS at each level of the system for the major functions involved, as defined in agreement with stakeholders
- annual MOH staff training needs and the proportion of those costs attributed to the commodities being handled
- cost per kilometer of truck haulage, including driver, fuel, depreciation, and maintenance costs for each delivery run
- depreciation costs for trucks and other equipment
- average number of kilometer traveled for each delivery run
- storage costs per square meter at central regional and SDP stores
- computer hardware and software costs at different levels.

The costs in the model do not include support from SCMS, Crown Agents, or other similar organizations. The assumption is that UNICEF will continue to donate the essential drugs (ED) kits, so no procurement costs are assumed for NatPharm.

Results for Scenario 1 and 2

The overall supply chain cost of tier 1 of the DTTU is \$1.46 million under scenario 1; this is reduced to \$1.32 million under scenario 2, with the assumption of a quarterly delivery schedule (table 3). The reduction in cost between the two scenarios of \$142,107 is due to the lower transport costs incurred from the change in schedule. It is also due to slightly lower storage costs.

Table 3. Summary Costs of the DTTU Tier 1 Partners—Scenario 1 and Scenario 2

	Scenario 1	Scenario 2
Total value of commodities passing through (\$)	\$7,726,115	\$7,726,115
Total volume of commodities passing through (m^3)	2,485	2,485
Total weight of commodities passing through (kg)	235,604	235,604
Procurement costs	\$54,760	\$54,760
Storage costs	\$96,882	95,080
Transport costs	\$789,477	649,623
Management costs	\$523,491	523,041
Total costs	**\$1,464,611**	**\$1,322,503**

The supply chain costs are estimated in terms of each of the following functions: procurement, storage, transport, and management. For costing the DTTU system, these are aggregated in two ways: for tier 1 of the system, for tier 2 of the system, and then overall. Both procurement and transport occur only at tier 1 facilities; that is, by the DTTU partners. Tier 2 facilities in this system only have storage costs (space and labor) and management costs, where the management costs are almost entirely the operating costs associated with the storage space.

Transportation accounts for the largest proportion of the DTTU costs at the tier 1 level, followed by management (figure 3). Management comprises several important activities; these are discussed in more detail in the management costs results section.

The DTTU's tier 1 is made up of four partners; the total tier 1 costs can be broken down and are shown by partner in tables 4 and 5.

Figure 3. Breakdown of Costs by Supply Chain Function for Scenario 1 and 2

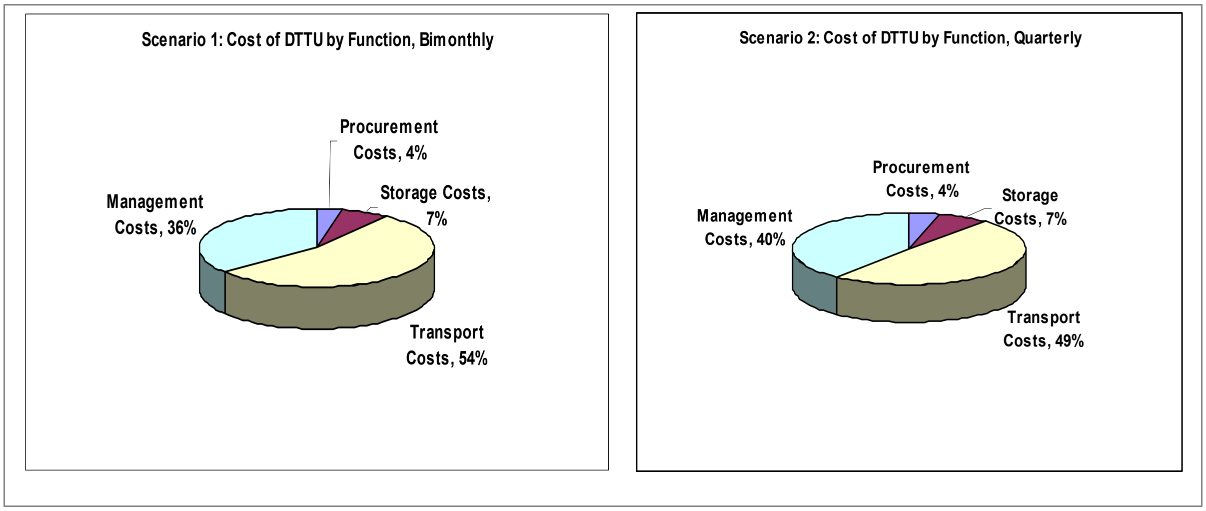


Table 4. Summary Costs for the DTTU Supply Chain—Tier 1 Partners for Scenario 1

	Crown Agents	LSU	USAID	ZNFPC
		Scenario 1		
Total value of commodities passing through ($)	$2,524,838	$1,316,232	$7,726,115	$6,409,883
Total volume of commodities passing through (m^3)	221	38	2,485	2,447
Total weight of commodities passing through (kg)	55,008	6,032	235,604	229,572
Procurement costs	—	$54,760	—	—
Storage costs	—	—	—	$96,882
Transport costs	$289,283	—	$493,921	$6,270
Management costs	$278,314	$29,544	$209,817	$6,183
Total costs	**$567,597**	**$84,304**	**$703,738**	**$109,335**

Table 5. Summary Costs for the DTTU Supply Chain—Tier 1 Partners for Scenario 2

	Crown Agents	LSU	USAID	ZNFPC
		Scenario 2		
Total value of commodities passing through ($)	$2,524,838	$1,316,232	$7,726,115	$6,409,883
Total volume of commodities passing through (m^3)	221	38	2,485	2,447
Total weight of commodities passing through (kg)	55,008	6,032	235,604	229,572
Procurement costs	—	$54,760	—	—
Storage costs	—	—	—	$95,082
Transport costs	$213,683	—	$429,667	$6,270
Management costs	$278,314	$29,544	$209,817	$5,732
Total costs	**$491,997**	**$84,304**	**$639,484**	**$107,085**

Tables 4 and 5 display a comparison of the costs between delivery schedules for each partner. It should be noted that the commodity values and volumes are not additive across partners because several partners handle the same commodities. Crown Agent's costs for transportation are reduced by approximately $75,000 after moving to a quarterly schedule; while USAID's contribution toward transport costs is lowered by approximately $64,000. These two reductions are discussed below; they constitute the major part of the overall reduction in costs of the DTTU system when it moves to a quarterly schedule; that is, the difference in costs between scenario 1 and scenario 2.

Transportation costs constitute the largest proportion of the total costs for the DTTU; the partners in tier 1 are responsible for them. The tier 2 facilities do not have any transportation costs because the DTTU partners deliver all the products; therefore, health facilities do not need to pick up any commodities. Even satellite SDPs that receive irregular supplies of other commodities from their *base* facility receive their DTTU commodities directly and on schedule.

Table 6 shows the impact of a schedule change on transportation costs. With the change to a quarterly schedule, the reduction in fuel costs and per diems constitute the main drivers for the cost savings.

Table 6. Comparison of Transportation Costs for Scenario 1 Versus Scenario 2

	Bimonthly (U.S.$)	Quarterly (U.S.$)	Savings (U.S.$)
Salaries	112,775	112,775	0
Depreciation	161,467	161,467	0
Per diem	226,800	151,200	75,600
Fuel	150,633	100,422	50,211
Maintenance/insurance	137,803	123,760	14,043
Total	**789,478**	**649,624**	**139,854**

With the switch to quarterly deliveries, reduced per diems are the largest single reason for reduced transport costs. The relevant staff categories—drivers, team leaders, and area coordinators—each make up a similar proportion of the overall per diem costs. Only the drivers and team leaders are directly affected by a change in schedule, as they travel less under the quarterly schedule. The area coordinators role of supervision is likely to remain the same under both schedules and their costs remain the same. Per diem alone makes up a remarkably high proportion of the cost of the DTTU: approximately 10 percent.

The costs of transporting units of DTTU commodities are shown in table 7. This shows that average costs are lower using a quarterly schedule instead of the bimonthly schedule.

Table 7. Comparison of Transportation Cost Metrics for Scenario 1 vs. Scenario 2

	Bimonthly (U.S.$)	Quarterly (U.S.$)
Cost per U.S.$ of commodity delivered	0.19	0.17
Cost per m^3 delivered	589.40	532.22
Cost per kg delivered	6.22	5.61

As previously stated, the tier 1 costs collected represent all the costs incurred by the four DTTU partners. The tier 2 costs were collected from a sample of facilities. No procurement or transportation costs were incurred by the tier 2 facilities in the DTTU. The costs incurred by these SDPs tends to differ between facility types; therefore, a range of facility types were included in the costing sample. However, it should be noted that although all facility staff are government workers, the salaries for staff in Bulawayo and Harare cities are paid much higher salaries than the rural staff. Therefore, clinics and health centers (which account for most of the facilities in the country) are further disaggregated into urban and rural categories. The average costs for storage and operating costs were obtained for each sampled facility type; these costs were then extrapolated to all tier 2 SDPs that the DTTU reaches. Because the differences between scenarios 1 and 2 relate to tier 1 costs only (transportation and management), the tier 2 costs are the same for both scenarios (table 8).

Table 8. Total Tier 2 Costs for Scenarios 1 and 2

Facility Type	Number Sampled in Costing Study	Number in DTTU Supply Chain	Total Storage Costs (U.S.$)	Total Management Costs (U.S.$)	Total (U.S.$)
Central hospitals	2	6	5,235	11,761	16,995
Maternity clinics	6	40	54,001	34,414	88,415
Provincial hospitals	4	7	2,926	4,195	7,120
District hospitals	2	48	69,162	10,734	79,896
Rural hospitals	2	110	28,284	15,393	43,677

Facility Type	Number Sampled in Costing Study	Number in DTTU Supply Chain	Total Storage Costs (U.S.$)	Total Management Costs (U.S.$)	Total (U.S.$)
Urban clinics	3	47	29,637	59,399	89,036
Urban health centers	2	5	3,571	5,695	9,265
Rural clinics	5	654	127,007	142,920	269,927
Rural health centers	3	487	67,714	6,667	74,381
Totals	**29**	**1404**	**387,536**	**291,177**	**678,714**

Transportation costs have been included in tier 1 to ensure that the health facility location has no impact on the supply chain costs incurred at the SDP. The total DTTU system costs are as follows:

- Scenario 1: total DTTU cost of $2,143,324 (where $1,464,611 is the tier 1 cost and $678,714 is the tier 2 cost)
- Scenario 2: total DTTU cost of $2,001,217 (where $1,322,503 is the tier 1 cost and $678,714 is the tier 2 cost).

Moving from a bimonthly schedule to a quarterly schedule reduces the cost of running the DTTU by approximately $142,107. Most of this reduction comes from reduced delivery team costs, both labor and per diem, as well as from lower fuel costs. Maintenance costs are also slightly lower. There does not appear to be a need for increased storage space at the facility level with a delivery schedule change even though more products will be delivered at each delivery. There is little change to management costs at either tier of the system and procurement remains the same under each scenario.

On an individual level, per diems constitute a high proportion of the money received by any one person working on the DTTU. The cost saving achieved in moving to a quarterly delivery schedule is largely driven by the reduction in per diems, rather than the reduction in fuel costs.

Results for Scenario 3 and 4

In scenarios 3 and 4, 44 PHC products are added to the 11 DTTU products to create an expanded DTTU system delivering 55 commodities to health facilities, every quarter. The PHC commodities are those defined in the current package and it is assumed that UNICEF will continue to support procurement and delivery to NatPharm. It is also assumed that each health facility will receive one set of commodities, irrespective of the facility's size; and including the DTTU products, after each quarter, for a total of four deliveries per year. Scenarios 3 and 4 are theoretical systems developed to allow cost comparisons between the other scenarios discussed in this report.

Scenario 2 and 3 Cost Comparison

Scenario 3 adds 44 products to the DTTU products and estimates the additional procurement, transportation, and storage inputs required to deliver all 55. Both scenarios 2 and 3 are on a quarterly distribution schedule, using project-supported funding.

Adding the 44 products increases the tier 1 supply chain costs from $1.3 million from scenario 2 to $1.8 million for scenario 3, an increase of $507,530 million (table 9).

Table 9. Tier 1 Supply Chain Costs between Scenarios 2 and 3

	Scenario 2	Scenario 3	Difference
Total value of commodities passing through	$7,726,115	$14,720,506	—
Total volume of commodities passing through (m^3)	2,485	7,624	—
Total weight of commodities passing through (kg)	235,604	1,426,196	—
Procurement costs	$54,760	$54,760	$0
Storage costs	$95,080	$243,671	$148,591
Transport costs	$649,623	$816,596	$166,973
Management costs	$523,041	$715,006	$191,965
Total cost	**$1,322,503**	**$1,830,033**	**$507,530**

When the 44 PHC products were added, the rental space at NatPharm's facilities to hold the PHC products, in addition to the storage costs for the DTTU products, increased the cost of storage from $95,080 to $243,671.

A number of additional costs were needed to transport the 55 products. As noted earlier, in the previous assumptions section, additional mileage, vehicles, and the associated maintenance, fuel, and insurance costs, drivers, and per diem were added to scenario 3;this increased the costs from $650,000 in scenario 2 to $817,000 for scenario 3.

The labor required for the quantification, supervision, and LMIS to accommodate the addition of the PHC products required more time by the LSU staff; two additional DPS logistics officers, plus their time and per diem for supervision visits; and two more data entry clerks. Training costs for 40 more team leaders, modification of the DRV software, and purchase of eight more rugged laptops were also assumed to be additional costs for the expanded DTTU system. These management costs increased from $523,000 for scenario 2 to $715,000 for scenario 3; they contribute to the difference in cost between the two scenarios.

Scenario 3 and 4 Comparison

The main differences between the scenarios 3 and 4 are the salary inputs. The salaries in scenario 4 were replaced with the equivalent MOHCW civil salary scale. These include the positions funded by SCMS and the USAID | DELIVER PROJECT and other Crown Agents. The ZNFPC staff, team leaders, and warehouse staff already use the MOHCW civil salary scale for their employees.

The tier 1 costs for scenario 3 and 4 are $1.8 million and $1.2 million, respectively (see table 10). The lower cost for scenario 4 is mainly due to the MOH salaries in this scenario. ZNFPC currently uses the MOH civil salary scale; therefore, their proportion of costs did not decrease from scenario 3 to scenario 4. The figure overleaf shows the summary statistics for each partner that supports the expanded DTTU system for scenarios 3 and 4.

The main differences in costs between the two scenarios are the transport and management functions. The average supply chain cost for tier 1 facilities per dollar is marginally higher for scenario 3, at $0.12 per dollar and $0.09 for scenario 4.

Table 10. Summary Costs for Tier 1 for Scenarios 3 and 4

	DTTU Scenario 3	DTTU Scenario 4
Total value of commodities passing through	$14,720,506	$14,720,506
Total volume of commodities passing through (m^3)	7,624	7,624
Total weight of commodities passing through	1,426,196	1,426,196
Procurement costs	$54,760	$54,760
Storage costs	$243,671	$243,671
Transport costs	$816,596	$649,355
Management costs	$715,006	$330,157
Total cost	**$1,830,033**	**$1,277,943**
Cost per $ of annual pass through	$0.12	$0.09

For scenarios 3 and 4, the USAID projects continue to fund a majority of the transportation and all of the LSU staff, training, and equipment costs (see figure 4). They retain the largest share of costs in both scenarios, with 47 percent and 51 percent, respectively (see figure 4). If the LSU proportion is added to USAID, their share would increase to 56 percent (scenario 3) and 56 percent (scenario 4). It is assumed that Crown Agents will continue to fund a majority of the per diems in the expanded DTTU system (scenario 4) for the team leaders, drivers, and area coordinators. Their other costs include driver's salaries, management staff time, operating costs, and Crown Agent's support costs. Crown Agents make up 31 percent and 25 percent of the total expanded DTTU tier 1 costs in each of scenarios 3 and 4. ZNFPC costs are composed of warehouse costs to store the contraceptives, as well as team leader salaries and operating costs. Figure 5 shows that transportation and management comprise the majority of costs for supply chain functions carried out in the integrated DTTU system. In scenario 3, management costs account for 39 percent, mostly for the labor needed to staff the LSU, as well as the training, M&E per diems, and equipment required. When the MOHCW salaries and per diems are used in scenario 4, the management proportion decreases and transportation costs, subsequently, increase.

Figure 4. Scenario 3 and 4—Comparison of Tier I Costs by Partner

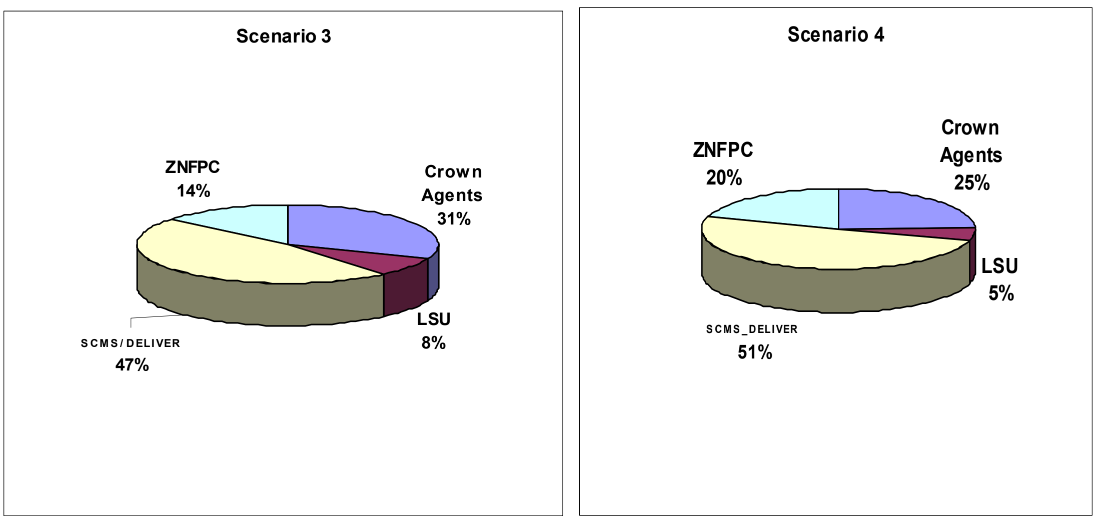
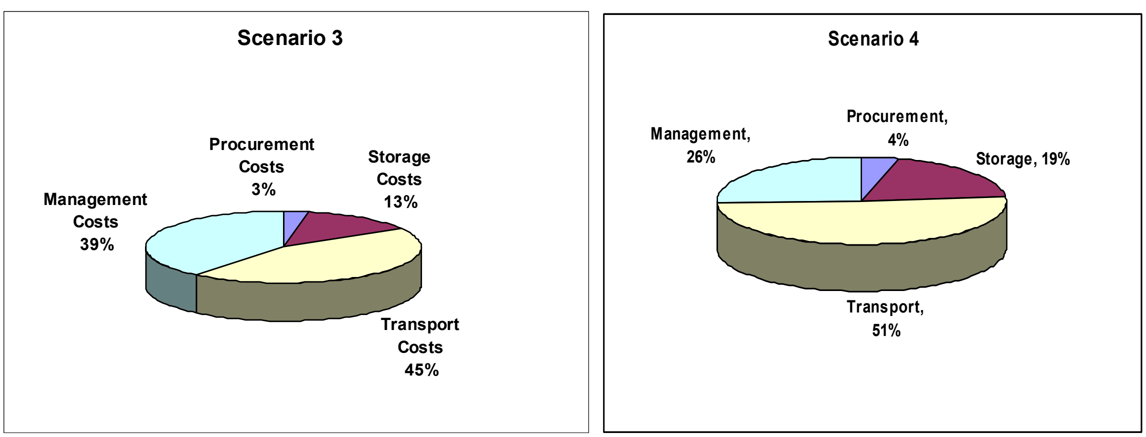


Figure 5. Scenario 3 and 4—Comparison of Tier I Costs by Function



Transportation costs associated with delivering a much higher volume of commodities were expected to increase; and a number of assumptions were developed to determine the additional kilometers, per diem, labor, and vehicles needed to integrate the delivery of the PHC commodities with the existing DTTU products. The replenishment distance included is the additional distance that the teams will need to cover in order to replenish stock, due to the addition of the PHC commodities for scenarios 3 and 4. This mileage is in addition to the current distance covered in scenarios 1 and 2.

Furthermore, with the addition of the PHC commodities, three additional vehicles and drivers were required, for an increase from 10 to 13 delivery vehicles and drivers. This is based on the assumption that five provinces will be covered at a given time and a maximum of 11 trucks will be required. Two trucks will be needed to provide coverage when trucks are pulled out for service.

To support the addition of two DPS logistics officers to monitor the PHC products for a total of seven M&E vehicles and drivers, it is also assumed that two more monitoring and evaluation vehicles will be needed for scenarios 3 and 4. Subsequently, the addition of the trucks also increased the cost to maintain and insure the vehicles between scenarios 2 and 3, and 4 (see table 11).

Table 11. Comparison of Transportation Costs between Scenarios 2, 3, and 4

	Scenario 2 Quarterly –DTTU (U.S.$)	Scenario 3 Project Supported (U.S.$)	Variance between Scenario 2 and 3 (U.S.$)	Scenario 4 MOH Supported (U.S.$)	Variance between Scenario 3 and 4 (U.S.$)	Variance between Scenario 2 and 4 (U.S.$)
Salaries	112,775	125,272	12,497	37,230	(88,041)	(75,545)
Depreciation	161,467	218,386	56,919	218,386	—	56,919
Per diem	151,200	198,000	46,800	118,800	(79,200)	(32,400)
Fuel	100,422	115,805	15,383	115,805	—	15,383
Maintenance/ insurance	123,760	159,134	35,374	159,134	—	35,374
Total	649,623	816,596	166,973	649,355	(167,241)	(268)

Table 11 shows the difference in costs between scenarios 2, 3, and 4, which are all on a quarterly schedule. Between the scenarios, the largest differences in costs are per diem and fuel. By adding the PHC products onto scenarios 3 and 4, all of the transport components increase in cost from scenario 2 and 3, for an increase of $166,973. The changes in the number of delivery days from scenario 2 to deliver and replenish the commodities in scenarios 3 ($198,000) and 4 ($118,800) changes the per diem costs each quarter. The use of $30/day for per diem is the reason for the reduction in scenario 4. The use of the MOH civil salary scale substantially reduced the labor costs in scenario 4 to $37,320 from $125,272, which was one of the major costs differences between the two scenarios. As a result, the transportation costs for scenario 4 ($649,355) is nearly the same cost as scenario 2 ($649,623), even though 44 more commodities are being delivered in scenario 4.

Table 12. Scenarios 2, 3 and 4—Comparison of Transportation Metrics for Tier 1

	Scenario 2—DTTU – Quarterly (U.S.$)	Scenario 3—Integrated DTTU, Project Supported (U.S.$)	Scenario 4—Integrated DTTU, MOH Supported (U.S.$)
Cost per U.S.$ of commodity delivered	0.17	0.12	0.09
Cost per m3 delivered	532.22	240.05	167.63
Cost per kg delivered	5.61	1.28	0.90

The use of MOHCW-level inputs reduces the delivery costs. The cost to deliver U.S.$1.00 worth of commodity changes from $0.17 in scenario 2 to $0.12 in scenario 3 and $0.09 in scenario 4 (see table 12). The average cost to deliver an m^3 and kilogram also decreases, indicating that cost efficiency is greater in transporting the additional PHC products in scenario 3.

One reason for the management cost increase between scenarios 2 and 3 is the cost of the additional time required for the quantification team to quantify the PHC products (table 13). The team comprises seven LSU personnel—a LSU manager, an upstream logistics coordinator, four logistics officers, and a data analyst. An assumption was made that the PMTCT and RTK team would also quantify the PHC products, increasing their time from 1.5 days per quarter to 5 days per quarter. Additionally, the logistics advisors time was increased from 30 percent to full-time in scenarios 3 and 4. Under the LMIS component, two more data entry clerks were also added to scenarios 3 and 4 to accommodate the PHC products to the LMIS. The current supervision schedule by four logistics officers, making visits six times a year for five days each, from scenario 1 and 2, was maintained. Two additional DPS logistics officers were added to make supervision visits every month for five days each, to scenarios 3 and 4. The training of 40 additional team leaders for the addition of the PHC products, updating of the Auto DRV software, and purchase of eight rugged laptops increased the miscellaneous costs between scenarios 1 and 2, and scenarios 3 and 4.

Table 13. Scenarios 3 and 4—Management Costs for Tier 1

Management Cost Components	Scenario 2 (U.S.$)	Scenario 3 (U.S.$)	Scenario 4 (U.S.$)
LMIS labor	84,450	128,197	13,900
QA labor	184,476	216,776	26,341
Quantification labor	10,371	29,997	1,826
Operating costs	68,574	68,574	68,574
Miscellaneous	114,644	210,937	210,937
Other labor	60,526	60,526	8,580
Total	**523,041**	**715,006**	**330,157**
Total DTTU cost	**1,322,503**	**1,830,033**	**1,277,943**
% of total DTTU cost	**40%**	**39%**	**26%**

The substitution of the MOHCW-level salaries in scenario 4 reduces the management costs substantially in each of the management labor components. The per diem rate of $30/day rather than $50/day reduced the per diem costs for the M&E staff under miscellaneous costs in scenario 4. The management costs make up 39 percent and 26 percent of DTTU tier 1 costs in scenarios 3 and 4, respectively.

Table 14. Total Tier 2 Costs for Scenarios 3 and 4

Facility Type	Number Sampled in Costing Study	Number in DTTU Supply Chain	Total Storage Costs (U.S.$)	Total Management Costs (U.S.$)	Total Supply Chain Costs (U.S.$)
Central hospitals	2	6	12,125	23,521	35,646
Maternity clinics	6	40	102,800	67,327	170,127
Provincial hospitals	4	7	7,531	8,389	15,920
District hospitals	4	48	65,364	21,469	86,833
Rural hospitals	2	110	69,768	30,787	100,554
Urban clinics	3	47	50,502	118,798	169,300
Urban health centers	6	4	6,808	10,960	17,768
Rural clinics	3	654	518,197	250,337	768,534
Rural health centers	2	487	296,461	13,334	309,795
Total	**32**	**1,404**	**1,129,556**	**544,923**	**1,674,479**

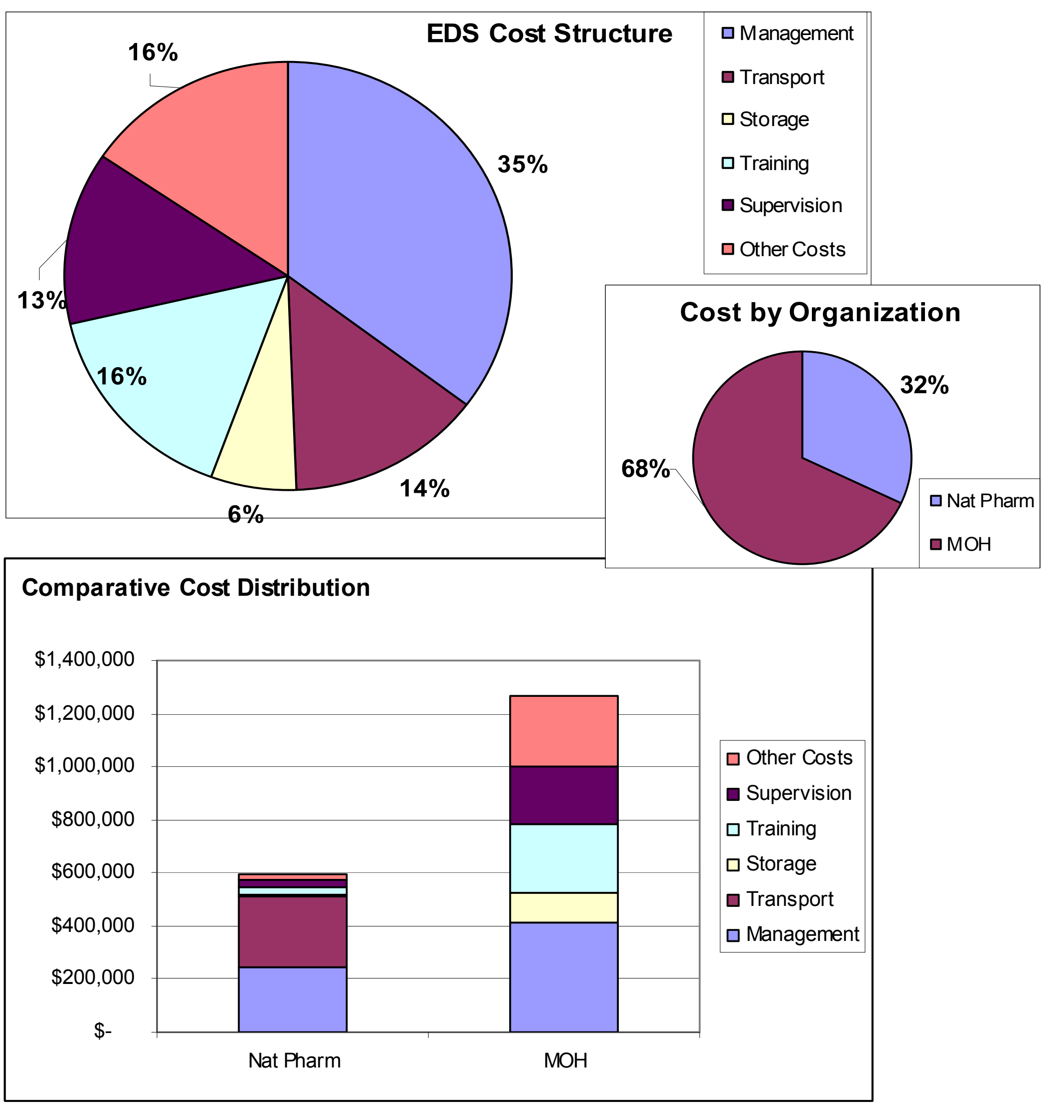
Tier 2 costs show the majority of costs are in storage, which is made up of health facility labor time spent managing the commodities and space costs (table 14). Rural health clinics, which have the largest number of facilities in the country, also proportionally make up the largest amount of supply chain costs at the SDP level. The tier 2 costs make up 48 percent and 57 percent of total supply chain costs in scenario 3 and 4.

Results for Scenario 5 and 6

The EDS cost estimates suggest that a pull-based supply system for the 44 PHC products distributed quarterly would cost the GOZ $0.30 for every $1.00 of commodities distributed. The total cost of the EDS system would be approximately $1.9 million per year for an estimated $6.2 million in PHC commodities distributed. These results are based on a large number of assumptions and should be interpreted as indicative of the supply chain costs that would be required. This $0.30 in-country costs per $1.00 of commodity distributed is relatively high, reflecting the intensive effort required for the system to function.

Results are summarized in tables 15 and 16 and figure 6 for scenario 5. Management (35 percent), training (16 percent), transport (14 percent), and supervision (13 percent) are key cost components.

Figure 6. EDS Cost Results for Scenario 5



When considering the total share of costs, the local facility costs incurred by the MOHCW (68 percent) is twice as large as NatPharm's share (32 percent). To operate the EDS pull system requires a lot of time and effort by MOHCW staff. For the whole system to function, PHC staff need to manage their own supplies. Initial training would be needed to target two cadres per facility, including further training to compensate for staff attrition. District pharmacists, who visit once a month, would also need to supervise facility staff. The time taken by MOH staff is time taken away from serving their respective clients at PHC and district health facilities.

MOHCW district supervision, facility management, and training together represent nearly $1.3 million in estimated costs. While part of this cost is staff salaries, the majority is actually out-of-pocket expenses for per diems and transport costs that are not always fully funded. It is the lack of funding for training and supervision that can frequently derail even the best managed system.

Table 15. EDS Annual Cost Results for Scenario 5

Cost	NatPharm (U.S.$)	MOH (U.S.$)	Total EDS Costs (U.S.$)
Management	243,310	416,193	659,503
Transport			264,518
Fuel	115,934		115,934
Salaries	15,921		15,921
Per diem	40,080		40,080
Other	92,583		92,583
Storage	8,255	106,400	114,655
Training			293,138
RHC staff		188,250	188,250
District supervisors		58,771	58,771
Provincial & central		16,139	16,139
Branch training	29,977		29,977
Supervision			244,263
NatPharm	26,673		26,673
Provincial and central			—
District supervisors		217,590	217,590
Other costs	25,000	264,949	$289,949
Total costs	597,733	1,268,292	1,866,025

Table 16. Supply Chain Cost per U.S.$1.00 of Commodities Delivered for Scenario 5

Scenario 5	Tier 1 (U.S.$)	Tier 2 (U.S.$)	Total (U.S.$)
Management	0.04	0.07	0.11
Transport	0.04	—	0.04
Storage	0.00	0.02	0.02
Training	0.00	0.04	0.05
Supervision	0.00	0.03	0.04
Other costs	0.00	0.4	0.05
	0.10	0.20	0.30

One important conclusion that can be made from the model is that if the system is to ensure product availability, then both the MOHCW and NatPharm need to be funded to fulfill their respective roles. Global Fund applications have focused on the importance of funding NatPharm, but without adequate funding for management, supervision, and training of MOHCW staff, it is unlikely that the EDS pull system will work.

The results for scenario 6 are consistent with those for scenario 5, but they reflect the impact of economies of scale, resulting in lower average supply chain costs (table 17). In scenario 6, we model a commodity through-put of $14 million compared to $6.2 million in scenario 5. Compared to the total supply chain costs in scenario 6, there is an increase to $3.7 million from $1.9 million in scenario 5. So the increase in the value of commodities handled is much larger than the associated costs. The average supply chain cost for each $1.00 of commodity delivered is $0.26 with management, storage, and training comprising the three largest cost components (table 18 and figure 7).

Table 17. EDS Annual Cost Results for Scenario 6

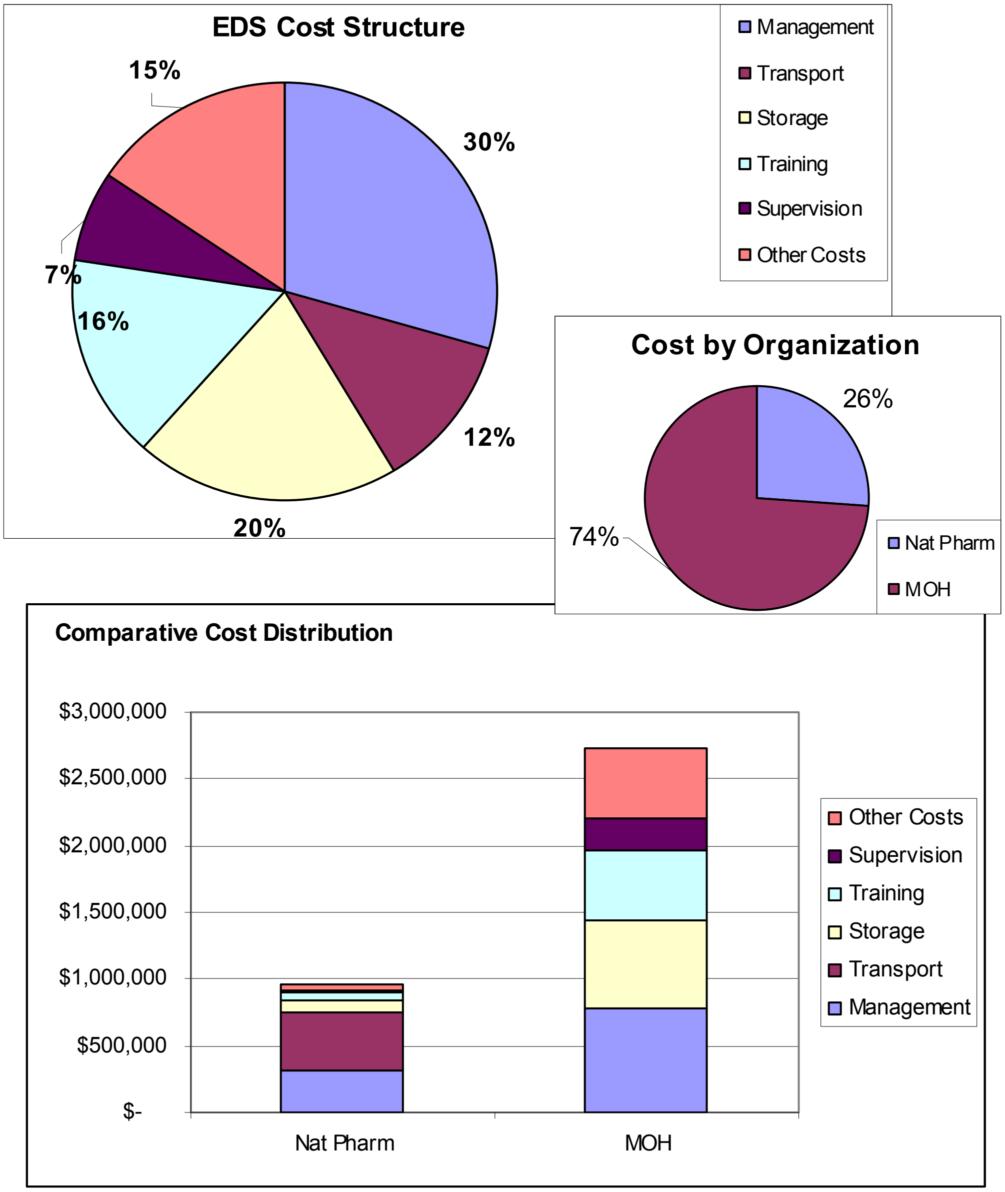
Cost	NatPharm (U.S.$)	MOH (U.S.$)	Total EDS Costs (U.S.$)
Management	312,827	776,340	1,089,167
Transport			439,099
Fuel	192,451		192,451
Salaries	26,428		26,428
Per diem	66,533		66,533
Other	153,687		153,687
Storage	82,290	668,480	750,770
Training			586,276
RHC staff		376,500	376,500
District supervisors		117,543	117,543
Provincial and central		32,278	32,278
Branch training	59,955		59,955
Supervision			257,814
NatPharm	27,624		27,624
Provincial & central			—

Cost	NatPharm (U.S.$)	MOH (U.S.$)	Total EDS Costs (U.S.$)
District supervisors		230,190	230,190
Other costs	41,500	529,898	571,398
Total Cost	963,295	2,731,229	3,694,524

Table 18. Supply Chain Cost per U.S.$1.00 of Commodities Delivered for Scenario 6

Scenario 6	NatPharm (U.S.$)	MOH (U.S.$)	Total (U.S.$)
Management	0.02	0.06	0.08
Transport	0.03	—	0.03
Storage	0.01	0.05	0.05
Training	0.00	0.04	0.04
Supervision	0.00	0.02	0.02
Other costs	0.00	0.04	0.04
	0.07	0.20	0.26

Figure 7. EDS Cost Results for Scenario 6



Comparing Results across Scenarios

In the preceding sections, we estimated and presented the costs of the delivery of different commodity bundles with different assumptions for delivery intervals, delivery approach, and input cost assumptions. In making these comparisons, a number of points should be remembered (summarized in table 19).

Scenarios 1 and 2 compare how the costs of the DTTU bimonthly delivery schedule would be reduced if it was adjusted to a quarterly schedule. The cost analysis shows that there would be an efficiency gain in moving to a quarterly schedule because of the savings in transport costs and per diems, which result in lower average costs for delivered commodities.

Scenario 3 then increases the products being transported by the DTTU, on a quarterly schedule, to include 44 PHC commodities. While this results in an increase in total costs, the increase in the total value of commodities carried is greater; therefore, reducing the average cost of delivery. To compare scenario 2 and scenario 3 results, we need to compare the average cost of moving $1.00 of commodity because the two scenarios are comparing different commodity bundles. Scenario 4 applied the MOH salary and per diem rates to this expanded product list. The total and average costs of the DTTU operation were thus reduced even further.

Scenario 5 looks at the cost of the pull EDS; this is needed to estimate the combined pull EDS and DTTU product list in scenario 6. Scenario 5 is necessary to build scenario 6. Scenario 6 should be compared with scenario 3 and 4, as it compares the cost of delivering the same product bundle by the DTTU informed push approach or the pull EDS approach. Comparisons of both total and average cost are appropriate here because the value of the commodities is essentially the same. There is a small difference in the total value of commodities transported because the DTTU scenarios include delivery to the nongovernmental organizations (NGOs) clinics not covered by the pull EDS system. Both scenario 5 and 6 assumed a quarterly delivery schedule.

For an easier comparison, we focus on the cost of delivery as a percentage of the commodity cost. Comparisons can also be made in terms of the cost per kg or m^3 delivered. In the comparisons below, we have excluded the procurement costs from all the scenarios, focusing instead on the in-country costs. It is not clear who would procure the commodities for an expanded DTTU or EDS system; and UNICEF's administrative charges may not be an appropriate benchmark to use. In presenting the results, we first looked at how the total costs of the scenarios compare. We then looked at the average cost comparison, as this provides an easier comparison. We then looked at the main cost drivers and then developed some conclusions on how costs compare between an informed DTTU push and the pull EDS.

Table 19. Scenario Costing Comparisons

Scenario	Commodity Bundles Delivered	Delivery Approach	Cost Comparisons Made	Results Used to Answer the Following:
Scenario 1	11 family planning	DTTU	—	What is the cost of delivering 11 family planning commodities using the bimonthly DTTU system?
Scenario 2	11 family planning	DTTU	Scenario 2 vs. scenario 1	What is the cost impact of moving from a bimonthly to a quarterly delivery schedule?
Scenario 3	11 family planning + 44 primary health care	Integrated DTTU	Scenario 3 vs. scenario 2	What is the cost impact of adding the 44 PHC commodities to the currently structured DTTU?
Scenario 4	11 family planning + 44 primary health care	Integrated DTTU	Scenario 4 vs. scenario 3	What is the cost impact of adding the 44 PHC commodities to the quarterly DTTU if staffed by personnel on public service salaries[1] only, as opposed to the development partner/project[2] salaries assumed in scenario 3?
Scenario 5	44 primary health care	EDS pull	—	What is the cost of delivering the 44 PHC commodities using the EDS system?
Scenario 6	44 primary health care + 11 family planning	EDS pull	Scenario 6 vs. scenario 3	What is the cost impact of adding the 11 family planning commodities to the EDS system costed in scenario 5?

Notes:

1. Public service salaries assumed in scenarios 4, 5, and 6.

2. Development partner/project salaries (e.g., USAID | DELIVER PROJECT) assumed in scenarios 1, 2, and 3.

Total Costs by Distribution Tier

Figure 8 and tables 20 and 21 summarize the total supply chain costs estimated for each scenario, classified by tier. Tier 1 facilities are defined as the central-level partners. In the DTTU scenarios, this includes JSI/Zimbabwe, Crown Agents, NatPharm-LSU, and ZNFPC. In the pull EDS scenarios, tier 1 partners refer to NatPharm and DPS local costs. Tier 2 costs relate to all the MOHCW facility management costs incurred at the different facilities receiving product in the EDS scenarios; including the cost of training and supervision, as well as in facility management and storage. Thus, tier 1 relates to central storage and distribution costs; tier 2 relates to the in facility management, training, and supervision costs.

Figure 8. Total Supply Chain Cost by Distribution Tier Excluding Procurement Costs

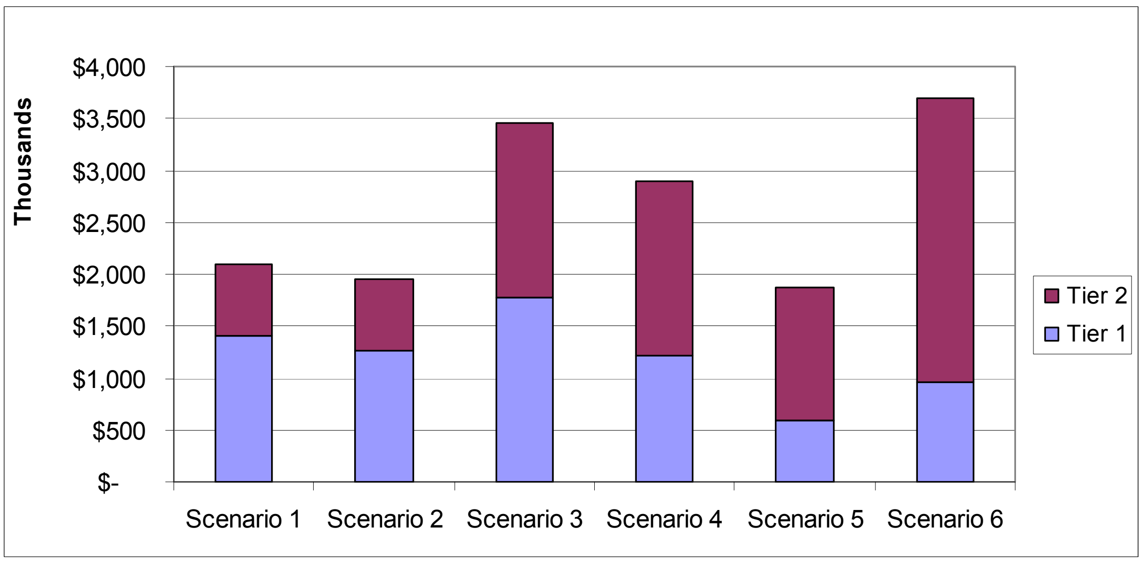


Table 20. Comparing Total Tier 1 and Tier 2 Costs by Scenario

Supply Chain Costs	Tier 1 (U.S.$)	Tier 2 (U.S.$)	Total (U.S.$)
Scenario 1	1,409,851	678,714	2,088,564
Scenario 2	1,267,743	678,714	1,946,457
Scenario 3	1,775,273	1,674,479	3,449,751
Scenario 4	1,223,183	1,674,479	2,897,662
Scenario 5	597,733	1,268,292	1,866,025
Scenario 6	963,295	2,731,229	3,694,524

The total tier 1 costs of DTTU operations are larger than the tier 2 costs for scenarios 1, 2, and 3. Total tier 1 costs are the greatest in scenario 3, but as the number of products carried by the DTTU increases in scenario 3 and 4, the tier 2 costs also increase. Tier 1 costs are between 68 percent and 66 percent in scenarios 1 and 2. This share then falls to 51 percent in scenario 3 and 42 percent in scenario 4. By comparison, the pull EDS scenarios usually have higher tier 2 costs; in percentage terms; these account for 68 percent, with 32 percent for tier 1 costs. The highest total costs for both tiers are under scenario 6. This is largely caused by the higher tier 2 costs associated with a fully functioning pull EDS system. The total costs of scenario 6 are greater than scenario 3 and scenario 4, which have the same bundle of commodities and quarterly delivery schedule. (See table 21 for a summary of costs.)

Table 21. Summary of the Costing Comparison Results (total costs)

Comparison	Results Shown as Total Costs and Difference in Total Costs
What is the cost of delivering 11 family planning commodities using the bimonthly DTTU system?	Scenario 1 Total Cost: $2,088,564
What is the cost impact of moving from a bimonthly to a quarterly delivery schedule?	Scenario 2 Total Cost: $1,946,457 Scenario 2 vs Scenario 1: Costs lower by $142,107
What is the cost impact of adding the 44 PHC commodities to the currently structured DTTU?	Scenario 3 Total Cost: $3,449,751 Scenario 3 vs Scenario 2: Costs increased by $1,503,294
What is the cost impact of adding the 44 PHC commodities to the DTTU if staffed by personnel on public service salaries only as opposed to the development partner/project salaries assumed in scenario 3?	Scenario 4 Total Cost: $2,897,662 Scenario 4 vs Scenario 3: Costs lower by $552,089
What is the cost of delivering the 44 PHC commodities using the EDS system?	Scenario 5 Total Cost: $1,866,025
What is the cost impact of adding the 11 family planning commodities to the EDS system costed in scenario 5?	Scenario 6 Total: $3,694,525 Scenario 4 vs Scenario 6: Costs lower by $244,774

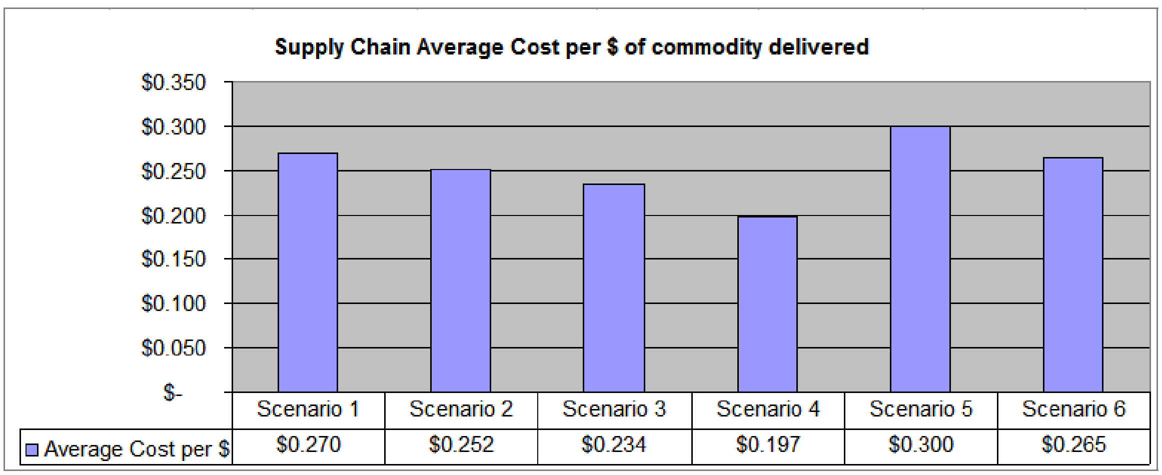
Experience has shown that when tier 2 costs are underfunded, this can have a very negative effect on system performance. Local staff are untrained and unsupervised, resulting in a negative impact on staff and system performance. For the pull EDS system, orders are often miscalculated and not transmitted, which leads to increased stockouts.

If emphasis is placed on ensuring funding for tier 1 costs, then central storage and distribution may be funded, but the last mile product management is neglected.

Average Cost Comparisons

For easier comparison across the scenarios, it is more useful to consider average or unit costs instead of total costs. This enables us to consider the different value of products being managed under each scenario. Figure 9 shows average supply chain cost comparisons for each scenario, expressed as the cost in U.S.$ of delivery of $1.00 in health commodity to the SDPs. We have excluded procurement costs from each scenario; these costs represent the cost of management, transport, and storage. For the DTTU and the integrated DTTU costs, we captured all the costs of the different partners and the associated time spent by counterpart staff at facilities. Scenarios 5 and 6 do not include any support from any donor partners.

Figure 9. Comparative Average Costs for Different Supply Chain Scenarios (excluding procurement)



The average cost of the bimonthly DTTU is estimated to be $0.270 per U.S.$ of commodity delivered. Moving to a quarterly delivery schedule in scenario 2 is more cost efficient than the bimonthly schedule because the DTTU average costs are reduced to $0.252 for each dollar of commodity delivered. In other words, a quarterly schedule saves $0.018 for every $1.00 delivered, which is 7 percent of the average cost (see table 22).

Increasing the number of commodities carried in the integrated DTTU in scenario 3 results in a lower average cost of delivery—to $0.234 for each dollar of commodity delivered. This reflects economies of scale as the increase in the value of the commodities carried is greater than the associated increase in supply chain costs. If the MOH salaries and per diem rates for drivers are applied in scenario 4, the average cost is further reduced by $0.037 to $0.197 per dollar of commodity delivered.

A combination of relatively high total costs and relatively smaller volume of products being handled by the pull EDS under scenario 5 means that scenario 5 has the highest average supply chain costs. At $0.300, the average supply chain cost of the pull EDS system with the 44 PHC commodities is $0.101 greater than scenario 4. Combining the 11 DTTU products and 44 PHC products in scenario 6 achieves economies of scale compared to scenario 5. But the resulting average cost of $0.265 is still 3 to 7 cents higher per dollar of each commodity delivered than an integrated DTTU system, depending on whether or not the local salary scales are adopted by the integrated DTTU.

In cost efficiency terms, an integrated DTTU and PHC system using the DTTU model of driver-managed inventory is more cost efficient than an integrated pull EDS system.

As we add commodities to either the DTTU or the pull EDS system, the supply chain cost also increases. In total cost terms, the pull EDS system uses fewer resources, but an analysis of total costs alone is misleading. Total costs need to be considered in relation to the value of the commodities being moved through the system.

While adding the 44 PHC commodities to the 11 DTTU commodities marginally increased the average cost of delivering those commodities, the integrated DTTU system costs less than the pull EDS for the same bundle of commodities.

Table 22. Summary of the Costing Comparison Results (average costs)

Comparison	Results Shown as Average Costs and Differences in Average Costs per U.S.$ of Commodity Delivered
What is the cost of delivering 11 family planning commodities using the DTTU system?	Scenario 1 Average Cost US$ $0.270
What is the cost impact of moving from a bimonthly to a quarterly delivery schedule?	Scenario 2 Average Cost US$ $0.252 Scenario 2 vs Scenario 1 Costs lower by $0.018
What is the cost impact of adding the 44 PHC commodities to the currently structured DTTU?	Scenario 3 Average Cost US$ $0.234 Scenario 3 vs Scenario 2 Costs lower by $0.018
What is the cost impact of adding the 44 PHC commodities to the DTTU if staffed by personnel on public service salaries only as opposed to the development partner/project salaries assumed in scenario 3?	Scenario 4 Average Cost US$ $0.197 Scenario 4 vs Scenario 3 Costs lower by $0.037
What is the cost of delivering the 44 PHC commodities using the EDS system?	Scenario 5 Average Cost US$ $0.300 Scenario 5 vs Scenario 4 Costs increased by $0.103
What is the cost impact of adding the 11 family planning commodities to the EDS system?	Scenario 6 Average Cost US$ $0.265 Scenario 4 vs Scenario 6 Costs lower by $0.068

Cost Drivers

To identify the cost drivers for each system, it is important to understand the differences between the informed push and pull ordering systems (see summary in table 23). In the DTTU informed push, higher costs are incurred at the tier 1 level as drivers and their assistants spend more time delivering products. They require more time at each facility to do the physical count; this also requires higher per diem costs. The number of staff on the truck, the size of the truck, and how full it is on each delivery will also be factors.

By comparison, the EDS pull system involves far more costs at the tier 2 level. The number of staff being trained, the time local staff spend managing their stock, supervision, and the costs of placing orders are all key cost drivers.

Table 23. DTTU and EDS Cost Drivers

DTTU—Informed Push	EDS—Pull
For facilities on their route, driver teams pick and pack vehicle in the warehouse based on previous consumption levels. They then count the product at the facility, calculate consumption, and top up the local stock to the system maximum. Local staff have less responsibility for product management.	Local facility staff are responsible for managing their inventory and calculating their reorder requirements based on consumption data and minimum and maximum levels. Orders are then sent to the local district hospital where they are processed and consolidated before transmission to NatPharm branch stores. Product orders are regularly fulfilled.
Cost Drivers • fleet management cost • truck capacity—size of the trucks being used • drivers per diem • number of staff in the truck • time counting and pick products at the facility.	**Cost Drivers** • number of staff to be trained system wide • staff turnover • supervision costs • ensuring orders are placed • time managing own stock.

In figure 10 and table 24, the average costs are divided into their main elements: management, transport, and storage. While we present all of the scenarios, the main focus should be on comparing scenario 3 and 4 with scenario 6.

Most of the cost difference between scenario 6 and scenarios 3 and 4 is driven entirely by the cost of the MOH facility management, supervision, and training needed to run the pull EDS system (table 24). For scenario 3, management costs are $0.16 for every $1.00 of commodity delivered; this represents 68 percent of the total average cost of $0.234. This share is the same in scenario 4, although with the application of local salaries for drivers and assistants, the total cost is slightly lower at $0.14. Management costs represent a similar proportion for scenario 6 at 68 percent; $0.18 out of the total average cost of $0.265.

Figure 10. Average Cost Breakdown by Component for Each Scenario

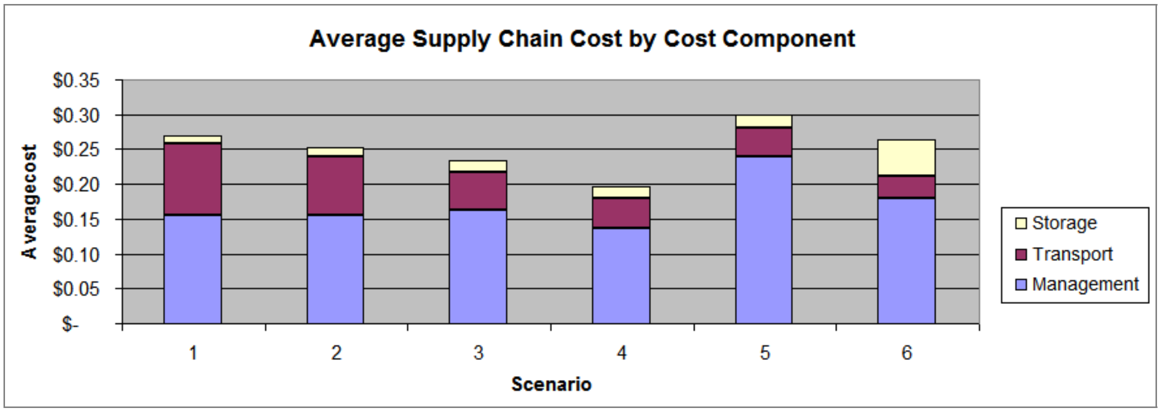


Table 24. Average Supply Chain Costs Divided into Components

Commodity Value	$7,726,115	$7,726,115	$14,720,506	$14,720,506	$6,227,186	$13,953,301
Cost Component	**Scenario 1 (U.S.$)**	**Scenario 2 (U.S.$)**	**Scenario 3 (U.S.$)**	**Scenario 4 (U.S.$)**	**Scenario 5 (U.S.$)**	**Scenario 6 (U.S.$)**
Management	0.16	0.16	0.16	0.14	0.24	0.18
Transport	0.10	0.08	0.06	0.04	0.04	0.03
Storage	0.01	0.01	0.02	0.02	0.02	0.05
Total	**0.270**	**0.252**	**0.234**	**0.197**	**0.300**	**0.265**

Economies of scale means the cost of integrating the DTTU and EDS products into the pull EDS reduces average costs to $0.265 for every $1.00 of commodity delivered. That still costs between $0.03 and $0.07 more than the integrated DTTU approach.

The integrated DTTU approach to health commodity delivery is more intensive in its use of transport than the traditional pull EDS. Its reliance on a smaller cadre of specialized drivers and drivers' assistants means that its facility management costs are substantially less than under the EDS, even though those drivers receive higher wages and per diem. The far greater number of MOH staff required to make the EDS work, particularly the cost of supervision and training, contributes to the EDS being more than twice as expensive as the DTTU system. The smaller dedicated DTTU staff, their higher salaries, and their per diem result in less staff turnover and fewer training needs. This is the main cost advantage that the DTTU approach has over the pull EDS approach.

For scenario 6, we can break down this large average management costs down further in table 25:

Table 25. Supply Chain Cost per U.S.$1.00 of Commodities Delivered for Scenario 6

	Tier 1/ NatPharm (U.S.$)	Tier 2/ MOH (U.S.$)	Total Average Cost (U.S.$)
Management	0.02	0.06	0.08
Transport	0.03	—	0.03
Storage	0.01	0.05	0.05
Training	0.00	0.04	0.04
Supervision	0.00	0.02	0.02
Other costs	0.00	0.04	0.04
Total average cost	0.07	0.20	0.26

Tier 2 management costs, including supervision and training, represents $0.12 out of the total $0.20 tier 2 MOH costs, with $0.06 for facility management; while the cost of supervision and training is $0.06. This is greater than all the NatPharm transport, storage, and management costs combined. As mentioned in the presentation of the scenario 5 results, any Global Fund proposals that do not include a budget for the $0.20 per dollar of commodity delivered for the MOH costs, risks undermining the supply chain's ability to actually deliver product. When these costs are typically underfunded, they undermine the operational effectiveness of the whole system.

Conclusion—Can the DTTU Be Expanded Further?

Supply chain costing is a tool that helps managers better understand the cost of delivering commodities to clients. In public health logistics, the tool can help identify the cost of different supply chain systems and identify design changes that can help improve cost efficiency.

Moving the DTTU system from a bimonthly to a quarterly delivery schedule helped reduce average costs by saving on transport costs. Adding the 44 PHC commodities to the DTTU system further reduces the average costs of delivery, although the total costs of operation would need to increase to accommodate the increase in products managed.

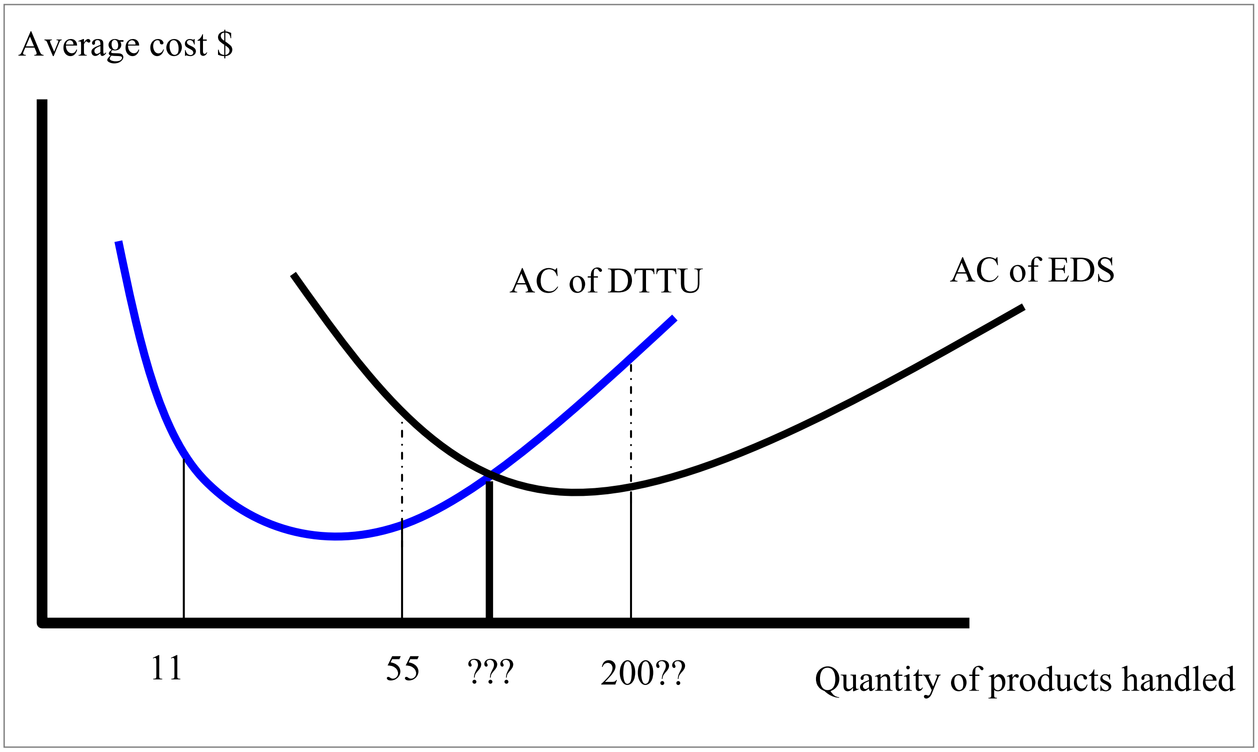
By comparison, the pull EDS is estimated to be substantially more expensive in terms of the average cost of delivering the 55 products to the SDPs. The MOH costs for staff supervision and training are substantial and, with the cost of staff managing supplies in facilities, accounts for two-thirds of the total cost. Stated another way, an integrated DTTU system offers a more cost-efficient route to delivering the 55 products being distributed in Zimbabwe.

A key question raised at the stakeholder workshop in Harare was—

> *While the average costs for the 55 products being studied appears to be lower for the integrated DTTU than the pull EDS, can the same be said for a larger number of products?*

The simple answer is that the analysis comparing the 55 products does not directly provide an answer. There is no guarantee that the average cost of an integrated DTTU will remain lower than the average cost of a pull EDS as more products are added based on the analysis being conducted. When the 44 products were added to the 11 DTTU, the products average costs actually increased marginally. Would they increase further if more products were added? At some point, as more products are added to the integrated DTTU system, the time needed to do product counts at facilities, and then to sort through and unload the needed commodities, will increase. This will also increase per diem costs and, at some point, the DTTU average costs may exceed the costs of a pull EDS. This phenomenon is illustrated in figure 11.

Figure 11. Comparing the Actual Costs of DTTU and EDS



The integrated DTTU is more cost efficient than the pull EDS for smaller volumes of products. Would this still be true for 200 products? Would it make more sense to focus the integrated DTTU on essential primary health products for primary health facilities? Could that system run in parallel with a pull EDS for secondary facilities, such as district hospitals? Such segmentation of supply chains, even within an integrated health care delivery system, reflects industry best practice. First, identify different client and product characteristics; then determine the most efficient and responsive way of meeting those client and product delivery needs.

Key conclusions from the workshop included—

- The DTTU can add PHC commodities for a similar average cost—this will require additional funding for operating and capital costs.
- A DTTU approach is less costly than a pull system for a smaller number of commodities.
- For larger numbers of commodities, a pull system may be less costly.
- The MOH costs represent the majority of the pull EDS costs; we must ensure these are actually funded.
- An informed push system makes sense for PHC commodities; it will allow MOH staff to spend more time with their clients.
- But, the pull system can work for district hospitals that handle large number of health commodities.

Next steps identified by workshop participants included the following:

- The informed push system may continue as an approach in the short- to medium-term at the primary level where the objective is to ensure full supply for a limited numbers of products.
- The pull ordering systems will continue for other levels.
- Consideration should be given to piloting the delivery of an integration DTTU, PHCP, and ZIP products in the Midlands after the ZIP pilot is completed.
- There does not appear to be a need to extend the DTTU approach to other products.
- Further cost analysis may be necessary to validate whether other cost scenarios for an integrated ZIP result in lower costs.

Additional discussions identified the importance of balancing the challenges of further product integration while safeguarding the performance of the existing product distribution.

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Appendix A

Note: In many cases, appendices A–D refer back to the text in the main body of this report. Do not separate the appendices from the report.

International Comparisons

To estimate the supply chain costs to meet the Millennium Development Goals, a survey of the international health supply chain costs was undertaken at the same time costing work was being done for the World Health Organization (WHO). According to the survey results, few public health supply chain cost studies have been done. It is very important to understand what has been included in the cost analysis when making comparisons between the studies that have been undertaken.

Table 26. Summary of Cost Estimates for Select Countries by Product Group

Country	Product	Selected Logistics Cost (%)*	Procurement	Storage	Distribution	Management	LMIS	Note
Bangladesh	Contraceptives	1						Bangladesh contracts out 50% of its distribution to private transport providers (from USAID | DELIVER PROJECT data)
Malawi	ACTs	18						Includes program management but not MOH staff costs, (from USAID | DELIVER PROJECT data)
Uganda	Contraceptives	3						Transport study (Abdallah, Healey, and O'Hearn 2002)
Nigeria	ARVs	4.8						Transport from CMS to tertiary and secondary sites by NGO contractor (from USAID | DELIVER PROJECT data)
Liberia	Bed nets	44						Household delivery of bed nets, of which 8% for procurement and QA testing; 36% in-country distribution (from USAID | DELIVER PROJECT data)
Zimbabwe	Condoms	12						DTTU excludes MOH staff costs (Bunde et al. 2007)

Country	Product	Selected Logistics Cost (%)*	Procurement	Storage	Distribution	Management	LMIS	Note
Ghana	Essential health commodities	13						Health Supply Chain Costing Study (Huff-Rouselle and Raja 2002)
Egypt		6						Excludes MOH staffing costs (Abdallah and Wilson 2002)
Zambia	ARV rural SDPs ARV urban SDPs	16.1 9.0 to 10.4						*Health Supply Chain Costing Study* (Baruwa, Tien, and Sarley 2009)
Honduras	Essential drugs	6.5						NGO distribution costs (Gribble et al. 2006)

Note: The costs shown for each country relate to the components shaded in grey.

Source: (Sarley, Allain, and Akkihal 2009)

The DTTU costs under scenario 4 and 5, when expressed as a percentage at 18 percent and 15 percent; are comparable to the costs shown in table 26. The scenario 5 costs are higher than all the cost examples except for the delivery of bed nets to individual households in Liberia, which is a country with poor infrastructure. A more useful comparison is to examine the costs for supply chain functions, such as storage and distribution across countries. A project survey of the CMS charges in different countries was also undertaken as part of the costing work for WHO; it is summarized in table 27.

Table 27. Survey: Central Medical Stores Charge for Logistics Services

Country	Procurement and Clearance	Storage and Distribution	Distribution to…	Total Cost (%)
Lesotho	No	Clearance, storage, and delivery	SDPs	16 (4 for ARV)
Nepal	No	Medical Stores charges 4%, but it should be higher—at 10%, includes clearance	SDPs, but more expensive for internal air transport	10
Malawi	No	12.5%, includes clearance	Clearance, storage, and distribution to districts	12.5
Mozambique	2%	8%, includes M&E and pharmacovigilence	Distribution from central to provincial	10
Rwanda	No	9%, includes clearance	From airport to regional warehouses	9
Tanzania	4% includes clearance	15%	Distribution to district level	19
Uganda	2.2% just clearance	10%,	Distribution to district level plus 3% for SDP delivery	15.2
Zimbabwe scenario 1, 2, and 3	Included as part of commodity cost	Between 8% and 11%	SDPs	Between 23 and 27
Zimbabwe scenario 4		6%	SDPs	20
Zimbabwe scenario 5		6%	SDPs	30
Zimbabwe scenario 6		8%	SDPs	27

Note: The USAID DELIVER | PROJECT field offices provided the data for table 27.

Source: (Sarley et al. 2009)

Appendix B

Summary of the DTTU Partners (Tier 1) and Facilities (Tier 2) and Their Functions Included in the Supply Chain Costing Study

Facility Name	Tier Classification	Facility Type	Urban/ Rural	Populations Density	Region	Procurement	Storage	Transportation
SCMS_DELIVER	Tier 1. Central Level	DTTU Partner	-	-	National	X		X
ZNFPC	Tier 1. Central Level	DTTU Partner	-	-	National		X	
LSU	Tier 1. Central Level	DTTU Partner	-	-	National	X		
Crown Agents	Tier 1. Central Level	DTTU Partner	-	-	National	X		X
Edith Operman MC	Tier 2. SDP Level	Maternity Clinic	Urban	High	Harare City		X	X
Highfield Maternity Clinic	Tier 2. SDP Level	Maternity Clinic	Urban	High	Harare City		X	X
Chitungwiza CH	Tier 2. SDP Level	Central Hospital	Urban	High	Harare City		X	X
Kunaka RHC	Tier 2. SDP Level	Rural Health Center	Rural	Low	Harare City		X	X
Jonas Clinic	Tier 2. SDP Level	Clinic	Rural	Low	Harare City		X	X
Budidiro Maternity and Clinic	Tier 2. SDP Level	Maternity Clinic	Urban	High	Harare City		X	X

Facility Name	Tier Classification	Facility Type	Urban/ Rural	Populations Density	Region	Procurement	Storage	Transportation
Glen View Maternity and Clinic	Tier 2. SDP Level	Maternity Clinic	Urban	High	Harare City		X	X
Wilkins Hospital	Tier 2. SDP Level	Provincial Hospital	Urban	High	Harare City		X	X
Esigodini DH	Tier 2. SDP Level	District Hospital	Rural	Low	Matebeleleland South			X
Habani Clinic	Tier 2. SDP Level	Clinic	Rural	Low	Matebeleleland South			X
ZNFPC Clinic	Tier 2. SDP Level	Clinic	Rural	Low	Matebeleleland South			X
Gwanda PH	Tier 2. SDP Level	Provincial Hospital	Rural	Low	Matebeleleland South	X		X
Ekukanyeni Clinic	Tier 2. SDP Level	Clinic	Rural	Low	Matebeleleland South	X		X
Mhlanlandela Clinic	Tier 2. SDP Level	Clinic	Rural	Low	Matabeleleland North	X	X	X
Gulati RHC	Tier 2. SDP Level	Rural Health Center	Rural	Low	Matebeleleland South	X		X
Matobo Mission Hospital	Tier 2. SDP Level	Rural Health Center	Rural	Low	Matebeleleland South	X		X
Shangani RH	Tier 2. SDP Level	Rural Health Center	Rural	Low	Matebeleleland South			X
Rusape DH	Tier 2. SDP Level	District Hospital	Rural	Low	Matebeleleland South	X		X
Mahvudzi Clinic	Tier 2. SDP Level	Clinic	Rural	Low	Manicaland	X	X	X
Gurobi RHC	Tier 2. SDP Level	Rural Health Center	Rural	Low	Manicaland	X	X	X
Mutare PH	Tier 2. SDP Level	Provincial Hospital	Urban	High	Manicaland		X	X
Sakubva Hospital	Tier 2. SDP Level	Clinic	Rural	High	Manicaland	X	X	X

Facility Name	Tier Classification	Facility Type	Urban/ Rural	Populations Density	Region	Procurement	Storage	Transportation
Odzi RHC	Tier 2. SDP Level	Rural Health Center	Rural	Low	Manicaland		X	X
Marange RH	Tier 2. SDP Level	Rural Hospital	Rural	Low	Manicaland		X	X
Thorngrove PH	Tier 2. SDP Level	District Hospital	Urban	High	Bulawayo City		X	X
Northern Clinic	Tier 2. SDP Level	Clinic	Rural	High	Bulawayo City		X	X
Nketa RHC	Tier 2. SDP Level	Clinic	Urban	High	Bulawayo City		X	X
Pelandaba MC	Tier 2. SDP Level	Clinic	Urban	High	Bulawayo City		X	X
Luveve MC	Tier 2. SDP Level	Maternity Clinic	Urban	Highs	Bulawayo City		X	X
UBH CH	Tier 2. SDP Level	Central Hospital	Urban	High	Bulawayo City		X	X

Note: A function is also marked with an X even if the partner funds a particular function but does not participate in the day-to-day implementation of that function.

Appendix C

PHC Commodity List

MOH original request item lines	UNICEF	UNICEF	UNICEF	23/02/09 - from CO Final		Total No. of Kits Needed = 5000	First shipment = 1265 kits (ordered as setpack instead of kit)	Balance Qty = 3735 kits (to be shipped as kit S9906760)
						5000	1265	3735
	Material number	Item Short description	UOM	Qty	Value			
						Total Qty that should be in stock to fulfil		
3	S1505046	Amoxici.pdr/oral sus 125mg/5ml/BOT-100ml	BOT-100ml	10	5.40	50000	12650	37350
1	S1505040	Amoxicillin 250mg caps/tabs/PAC-1000	PAC-1000	5	132.90	25,000	6,325	18,675
31	S0512111	Bandage,gauze,8cmx4m,roll	EA	30	2.10	150000	37950	112050
2	S1520011	Benzylpenicillin powder for inj. 3g (5M U) vial/BOX-5	BOX-50	2	74.92	10000	2530	7470
37	S0709210	Cannula,IV short,18G,ster,disp	EA	100	13.00	500000	126500	373500
38	S0709230	Cannula,IV short,24G,ster,disp	EA	100	15.00	500000	126500	373500
4	S1555700	Ciprofloxacin 250mg tabs/PAC-10	PAC-10	15	3.15	75000	18975	56025
33	S0523005	Compress,gauze,10x10cm,n/ster/PAC-100	PAC-100	3	4.95	15000	3795	11205
32	S0519600	Cotton wool,500g,roll,non-ster	EA	6	9.30	30000	7590	22410
6	S1544400	Doxycycline 100mg tabs/PAC-1000	PAC-1000	3	72.66	15,000	3,795	11,205
17	S1501000	Epinephrine inj 1mg/ml 1ml amp/BOX-10	BOX-10	1	1.57	5000	1265	3735
7	S1546315	Erythromycin 250mg tabs/PAC-100	PAC-100	50	131.50	250,000	63,250	186,750
39	S0330011	Gloves,exam,latex,medium,disp/BOX-100	BOX-100	15	37.05	75,000	18,975	56,025
18	S1552115	Glucose hyperton.inj 50% 50mL vl/BOX-20	BOX-20	1	11.65	5000	1265	3735
21	S1552106	Glucose inj 5% 500ml w/giv.set/BOX-20	BOX-20	1	18.80	5000	1265	3735
11	S1552300	Hydrochlorothiazide 25mg tabs/PAC-100	PAC-100	30	26.70	150,000	37,950	112,050
19	S1555280	Lidocain inj 2% 50ml vial/BOX-5	BOX-5	2	6.50	10000	2530	7470
24	S1545200	Methylergom. inj 0.2mg/ml 1ml amp/BOX-10	BOX-10	1	0.52	5000	1265	3735
8	S1555650	Metronidazole 250mg tabs/PAC-1000	PAC-1000	6	32.28	30,000	7,590	22,410
Altern. for 35 - 36	S0747420	Needle,disp,19G(1.1x40mm),ster/BOX-100	BOX-100	8	13.36	40000	10120	29880
Altern. for 35 - 36	S0747432	Needle,disp,21G(0.8x40mm),ster/BOX-100	BOX-100	6	8.94	30,000	7,590	22,410
13	S1555990	Paracetamol 125mg/5ml elixir/BOT-60ml	BOT-60ml	100	34.00	500000	126500	373500
12	S1555965	Paracetamol 500mg tabs/PAC-1000	PAC-1000	5	17.35	25,000	6,325	18,675
29	S1553105	Povidone iodine sol 10%/BOT-500ml	BOT-500ml	4	8.52	20000	5060	14940
42	S0521425	Sachet,tablet,plastic,10x16cm/PAC-100	PAC-100	30	21.60	150,000	37,950	112,050
16	S1562020	Salbutamol oral inh. 0.1mg/ds 200ds	EA	20	23.00	100000	25300	74700
22	S1560812	Sod.lact.comp.inj 1000ml w/g.set/BOX-10	BOX-10	1	15.79	5000	1265	3735
23	S1564326	Sodium chl.inj 0.9% 500ml w/giv.s/B0X-20	BOX-20	1	20.53	5000	1265	3735
10	S1537130	Sul.met.+trim.pdr/o.s.240mg/5ml/BOT100ml	BOT-100ml	60	25.20	300000	75900	224100
5	S1537100	Sulfameth.+trimeth.400+80mg tabs/PAC-500	PAC-500	36	163.08	180,000	45,540	134,460
Altern. for 35 - 36	S0782205	Syringe,dispos,2ml,ster/BOX-100	BOX-100	7	14.63	35000	8855	26145
Altern. for 35 - 36	S0782405	Syringe,dispos,5ml,ster/BOX-100	BOX-100	7	18.13	35,000	8,855	26,145
34	S0503010	Tape,adhesive,Z.O.,2.5cmx5m	EA	20	3.40	100000	25300	74700
30	S1510000	Tetracycline eye ointment 1%/TBE-5g	TBE-5g	100	17.00	500000	126500	373500
40	S0481053	Thermometer,clinical,digital 32-43C	EA	0	-	0	0	0
41	S0621000	Tongue depressor,wooden,dispos./BOX-500	BOX-500	1	2.33	5000	1265	3735
20	S1543805	Water for inj 10ml amp/BOX-50	BOX-50	12	52.08	60000	15180	44820
		Weight of additional 7 products is 7.5kg per Institution, Cost USD 62.26		1	62.26	5000	1265	3735
	S9012024	Double-wall ctn.60x40x50 cm, 0.120 m3		2	9.16	10000	2530	7470
	S8942200	Pre-pack Carton, 21cdm		2	0.98	10000	2530	7470

Appendix D

Detailed Approach, Assumptions, and Results

This appendix presents more detail on the approach, assumptions, and results presented in the report. Some sections of the report cover the material in sufficient depth that they do not need to be presented again.

Supply Chain Costing Tool Definitions

Procurement covers any labor directly related to the ordering and management of bids/tenders for commodities. In addition, any fees for handling, demurrage, customs taxes, or other charges are included under procurement costs. An example of a handling fee would be the 5 percent of the value of goods procured that is charged by the Supply Chain Management System (SCMS) project to cover the cost of procuring HIV-related products. This fee covers SCMS's labor and activities when they procure these commodities in the United States. Quantification, where the quantity of commodities to be procured is determined through meetings and analysis, is included as a separate cost under management, rather than under procurement.

Storage covers any labor directly related to the receipt and management of goods into a storage facility by health workers or warehouse staff (e.g., completing logistics form, ordering commodities, lifting, loading, or counting), whether the storage facility is a warehouse; e.g., NatPharm, or ZNFPC warehouses, or a storage room at a health facility. Other costs considered under storage include the cost of the space (capital or rental), as well any equipment required. If the space is a government facility, or other space that does not require rent to be paid, then its cost is determined by depreciating the cost of building the space. For example, if the cost of building a square meter of storage is \$1,000, then the annual cost of that space, given a useful life of 20 years, is \$1,000 divided by 20 or \$50 a year per square meter.[1]

If storage space is being rented—e.g., ZNFPC renting storage space at a NatPharm facility—then the annual rent is included as a cost under storage. This rent may be an all inclusive charge that includes handling and labor costs incurred by the leaser. An example of this is the rental charge paid by ZNFPC to NatPharm for the rent of 500 m^2 of space to store family planning commodities that cannot fit in the ZNFPC warehouse. For this analysis, storage space costs were estimated using a building cost of \$2,000 per m^2; a straight line depreciation over 25 years of useful life was used to estimate an annual charge.

[1] For example, if the cost of building a square meter of storage is U.S.\$1,000, then the annual cost of that space, given a useful life of 20 years is \$1,000 divided by 20 which is \$50 a year per square meter.

Transportation covers any labor, equipment, or operating costs that are incurred when the fleet of vehicles deliver the commodities. The labor costs include any salaries or per diem paid to drivers or supervisory staff, as well as any administration staff time required to manage the fleet. Equipment costs cover both the depreciation charge made for each vehicle, which is based on the value of the vehicle at purchase, and its useful life. Typically, the useful life for vehicles is five years. In addition to these costs, are the costs of insuring and maintaining the vehicles, such as regular maintenance services and tires, as well as the cost of fuel.

Management costs capture all the remaining activities required to run a supply chain, as well as the operating costs incurred by each partner and facility that is part of the supply chain. The remaining activities include quantification, the management of an LMIS, the supervision of the delivery system, and any administrative costs related to managing the system. This also includes any training costs incurred for the staff that work in the system. Finally, the operating costs incurred by each partner, or health facility, are included in management costs. These operating costs include line items, such as electricity, water, security, printing and supplies.

These operating costs may be apportioned in relation to the share that the supply chain operation for the target commodities takes up in the entire operation of the facility. For example, storage space in a rural health center may only account for 5 percent of the total space occupied by the facility. Therefore, only 5 percent of the facilities operating costs would be counted and included as a supply chain cost in the study. Experience from data collection/supply chain costing studies to date have found that it is rare for a storage facility to constitute any substantial proportion of the total area; therefore, typically between 1 percent and 5 percent of total operating costs are counted. Less than 1 percent can be used for large referral hospitals, which typically have very large operating costs but very small storage facilities when their size is considered in relation to the total size of the hospital.

DTTU Commodities

The DTTU system currently supplies the family planning and HIV commodities that are listed in table 28, including the name of the agent that procures the commodities. The main rationale for conducting the costing study is to determine the cost of running the DTTU when additional commodities are added to the system and to compare those costs with the cost of delivering the same commodities using an alternative system.

Methodology

Sampled Facilities

A sample of facilities was selected to ensure geographical representation and to ensure that each type of facility was included. The sample of facilities covered the two largest cities in Zimbabwe, Harare and Bulawayo; the two sampled provinces included Manicaland, which is the most eastern province with the densest population of health facilities; and Matabeleland South, a sparsely populated southwestern province. The data collection team visited 29 of the approximately 1,404 facilities.

Table 28. DTTU Commodities and Their Procurement Agents

Commodity	Quantification/Procurement Agent	Funding Agent
Family Planning Commodities		
Panther condom	SCMS_DELIVER/CAZ	USAID
Female condom	SCMS_DELIVER/CAZ	USAID
Control pill	CAZ/SCMS_DELIVER	DFID
Secure pill	CAZ/SCMS_DELIVER	DFID
Petogen	CAZ/SCMS_DELIVER	DFID
HIV commodities		
Determine HIV test kits	LSU/SCMS_DELIVER/Various	Various
Determine chase buffer	LSU/SCMS_DELIVER/Various	Various
SD Bioline HIV test kits	LSU/SCMS_DELIVER/Various	Various
Insti HIV test kits	LSU/SCMS_DELIVER/Various	Various
Nevirapine solution	LSU/SCMS_DELIVER/Various	Various
Nevirapine tablets	LSU/SCMS_DELIVER/Various	Various

Table 29. Sampling Framework

Facility Type	Number in Country	Number in Sample
Central/university hospitals	6	2
Provincial hospitals	7	3
Maternity clinics	40	5
District hospitals	48	2
Rural hospitals	110	1*
Clinics	706	10
Rural health centers	487	6
Total	**1,404****	**29**

Note: *More than one rural hospital was chosen for the sample, but on arrival the data collection team found that some facilities had been *down-graded* to clinics or health centers.

**Several specialist facility types were not included, such as homes, private clinics, satellite, and family health services because there were few examples of each in the country, or none within a reasonable distance for the data collection teams' routes, which followed the DTTU schedule/routes during the time of the data collection.

Storage Results for Scenario 1 and 2

Overall, the slight difference in cost between the scenarios is due to the lower level of effort being used to manage goods at the facilities on a quarterly schedule. Team leaders' costs are paid by both ZNFPC (salaries) and CAZ (per diem). ZNFPC and NatPharm incurred all the non-labor storage costs in tier 1. ZNFPC has its own storage facility but it is not large enough; therefore ZNFPC rents 500 meters of storage space from NatPharm, at a cost of \$6.00 per m^2 per month. All the HIV-related commodities are stored at NatPharm. Table 30 shows a comparison of storage costs between ZNFPC and NatPharm. It shows that ZNFPC's storage costs—including the operating costs and labor costs for its central warehouse in Harare and its warehouse in Masvingo, where some family planning commodities are stored for distribution in Manicaland—are approximately twice as high as NatPharm. NatPharm's storage charges include the labor required to load and unload delivery vehicles.

Table 30. Comparison of Storage Costs between ZNFPC and NatPharm

	Total Storage Costs (U.S.$)	Cost per m² Per Year (U.S.$)	Cost per m² Per Month (U.S.$)
ZNFPC with depreciated cost	57,999	140	12
414 m²			
ZNFPC assuming warehouse >25 years old	24,879	60	5
414 m²			
NatPharm	36,000	72	6
500 m²			

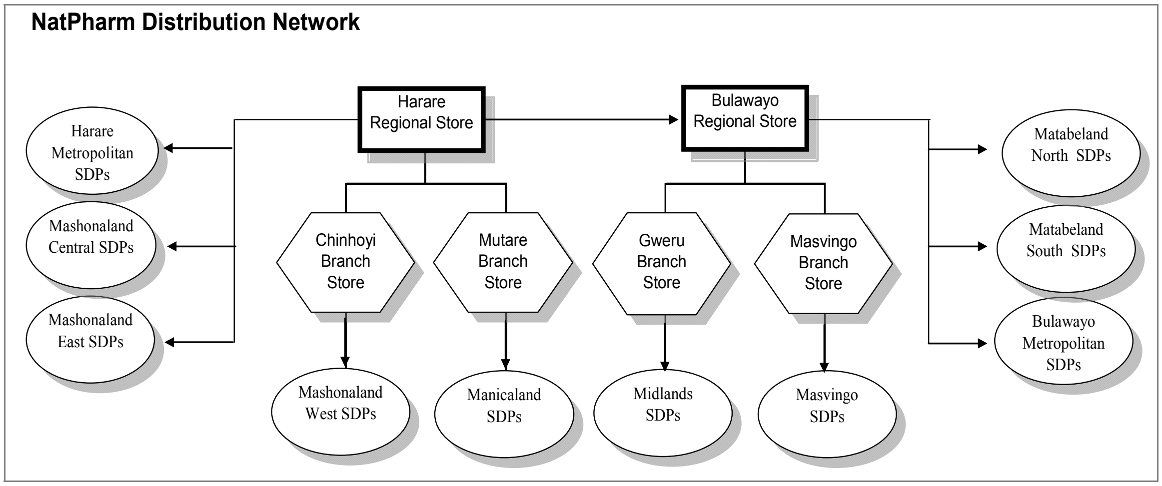
Because the ZNFPC's facility cannot store any additional products, it would be worth considering the difference between the $12 a month cost and NatPharm's $6.00 charge. This new storage space would have to be costed at the $12 per square meter rate.

Essential Drug System

EDS Structure and Background

NatPharm has historically operated a pull order system for essential drugs. Health facilities issue requisition orders for the products needed, which are then sent by post or delivered in person to their district pharmacy manager, which is located at the district hospital. The orders are then processed, checked, and consolidated at the district before being transmitted to the local NatPharm branch store for fulfillment. The four branch stores then obtain their products from one of the two regional stores. Figure 12 summarizes the NatPharm supply chain.

Figure 12. NatPharm Distribution Network



Each branch supplies neighboring districts and SDPs. Harare and Bulawayo regional stores also supply their neighboring districts and SDPs, as well as supplying adjacent branch stores. Harare also supplies the Bulawayo regional store. Bulawayo also receives commodities directly from local and international suppliers. In Zimbabwe, there are 62 districts with 1,250 primary care facilities. SDPs are classified as—

A—central and provincial hospitals, including referral hospitals

B—district hospitals, where the district pharmacists are located; they are responsible for supervision of facilities in their district

C—rural health facilities that include clinics and larger rural hospitals.

The ED pull system unraveled as the economic crisis undercut NatPharm's ability to procure products, retain staff, and operate their supply chain. Similarly, the MOH had limited resources to pay salaries and fund training and supervision. With product availability at the regional and branch stores diminishing, facilities stopped ordering and soon stocked out of essential supplies. In many facilities, the only products available were those supplied through the DTTU and PCP distribution.

In response, donors have supported emergency donations and distribution in many ways. UNICEF, with DFID funding, is distributing 44 essential drug items in a kit to each of the 1,250 primary health care facilities. The kit is packaged in eight boxes that are assembled in Copenhagen and then shipped to the regional and branch stores. The first round of distribution took place between August and September, with the second round currently underway, and a third planned for the beginning of 2010. DFID and ECHO are considering funding the kits for another year. The contents of the kit are listed in appendix C. UNICEF has provided NatPharm with eight trucks to support the distribution of kits.

As the economic situation improves, NatPharm is procuring a limited amount of supplies from its own resources, for which it charges a percentage to facilities. NatPharm charges facilities a 6 percent storage and distribution fee on products purchased by external donors. However, the lack of products available at the NatPharm stores meant that some of the district and provincial hospitals have reverted to purchasing small amounts from local suppliers. Rural health facilities do not have that option, and several facilities visited said they were stocked out of 60 percent of the items they need.

Cursory inspections of the stores at five selected health facilities in Mutare who received the kit indicated improved levels of product availability compared to a year ago but stockouts of many items continue.

Current EDS Challenges

Visits to the NatPharm Branch store in Mutare and four facilities in Manicaland identified several issues affecting the current system. These must be addressed if the ED pull system is to return to its former levels of performance.

Primary Health Care Facilities

Staff work load: As more health commodities are available in clinics, local communities are making greater use of clinics for their primary care needs. During morning visits to primary clinics in Odzi and Headlands, both clinics had more than twenty clients waiting for the nurse and nurse's aid. More clients arrived during our visit. This affects staff capacity to maintain store records and storage conditions, and to complete the required requisition orders.

Record keeping: In the facilities visited, we saw rudimentary logs of inventory with commodity deliveries listed. We did not see any evidence of calculation of consumption, months of stock on hand, or losses and adjustments. It was also not clear how the UNICEF kits were logged—as individual items or as a whole kit.

NatPharm is also working with the Global Fund and the USAID | DELIVER PROJECT to implement the Zimbabwe Informed Push (ZIP) program for distributing malaria and tuberculosis drugs. The project has seconded three trucks to support the ZIP rollout.

Storage facilities: Storage was rudimentary, usually a small storeroom or two adjacent to the nurse's office. The condition of the store was indicative of how well the store was managed and the level of the nurse's work overload. In one facility, the store seemed adequately organized and tidy, but a little cramped, as the volume of products arriving from Mutare Branch increased. In another, there was less order, with more opened boxes, general disorder, and untidy. Some boxes of expired products had been pushed to the clinic from an unspecified bilateral donor.

Transmission of requisitions: Historically, requisition forms were sent by ZimPost from rural facilities to their local district hospital. With the postal service also affected by economic conditions, facilities now use local transport to send the necessary forms; either using a staff member's visit to the district hospital or making a special trip by bus. There was a general shortage of requisition forms in the facilities visited; rural sites were using exercise books to write down their orders.

District Hospital

Requisition processing and supervision: The district hospital staff mentioned that processing requisitions usually took about a week to complete, including some analysis of consumption of commodities. While visits to each facility each quarter was ideal, the lack of transport made this difficult. When the Mutare branch has product in stock, it usually takes three weeks to have orders filled.

Storage: Consists of several separate rooms located throughout the hospital; appeared to be very crowded, with some boxes stored dangerously high on shelves.

Branch Store

Storage capacity: The Mutare branch store is well managed and has added new storage capacity to the original building. The receiving store is relatively full; products are stacked in the aisles between racks. Part of the original store can be converted to provide additional storage. With 13 staff, this is only half the staff it used to have. Additional casual labor is hired to help unload deliveries. Budget permitting, additional full-time staff should be recruited.

Transport: The Mutare branch has one truck that makes the UNICEF kit distribution run, as well as its regular supply runs. Another truck will be needed when Manicaland is added to the ZIP system rollout. A lack of transport at the district level impedes supervision and support for recordkeeping.

Connectivity with the regional store. The Mutare branch has a dial-up connection to the Harare regional store server that allows them to view available inventory through the Navision system. However, the connection is frequently interrupted during power outages. This affects the time required for the Mutare branch to place orders.

Order fulfillment: When products are available, it typically takes the Mutare branch one week between receiving the requisition and making deliveries. Forms sent from the PHC facilities via the district usually take at least one month to arrive at the store.

Management Costs

Management costs relate to the costs associated with managing the supply chain at each level, at each facility. The costs are largely represented by the time the facility staff take to manage its stock, including recordkeeping, calculating monthly consumption, preparing forecasts and requisition forms, receiving goods, and storing commodities. Time spent on the LMIS at each level is also included under management costs. Other LMIS costs for software, forms, and printing are covered under other costs. The level of effort assumes quarterly ordering and deliveries. At each level, the level of effort required is multiplied by the assumed average remuneration rate, assumed number of staff, and assumed number of facilities for a total management cost at each level. The increase in time assumed for management in scenario 6 reflects the counterparts' estimation of additional time needed to manage both the DTTU and PHC products. Table 31 presents scenario 5 and scenario 6 assumptions.

Table 31. Key Management Assumptions

	Proportion Time EDS (%)	Days a Month Per Person	Percentage Time EDS (%)	Days a Month Per Person
	Scenario 5		Scenario 6	
A Class facilities	5	1	9	2
B Class facilities	9	2	14	3
C Class facilities	5	1	7	1.5
Stores	32	7	41	9
DPS	9	2	14	3
Staff salary	Monthly remuneration (U.S.$)			

	Proportion Time EDS (%)	Days a Month Per Person	Percentage Time EDS (%)	Days a Month Per Person
	Scenario 5		Scenario 6	
Pharmacist	370			
Pharm tech	330			
Dispensary assistant	200			
Sister-in-charge	270			
DPS	750			
NatPharm Harare	715			
NatPharm stores	436			

Institution	Location	Facility #	Current Staff	Scenario 5 Total Cost (U.S.$)	Scenario 6 Total Cost (U.S.$)
DPS–MOH	Harare	1	5	4,091	6,136
NatPharm	Harare	1	44	120,120	154,440
	Bulawayo	1	25	41,618	53,509
	Mutare	1	13	21,641	27,825
	Chinhoyi	1	12	19,977	25,684
	Gweru	1	12	19,977	25,684
	Masvingo	1	12	19,977	25,684
MOH Facilities					
A–Provincial hospitals		14	1 Pharmacist	2,825	5,651
		14	2 Pharmacy techs	5,040	10,080
		14	3 Dispensary assistants	4,582	9,164
B - District hospitals		66	1 Pharmacist	26,640	39,960
		66	1 Pharm tech	23,760	35,640
		66	2 Dispensary assistant	28,800	28,800
C - Primary health care		1,250	1 Sister-in-charge	184,091	368,182
		1,250	1 Dispensary assistant	136,364	272,727
Total all facilities				**659,503**	**1,089,167**

Procurement Costs

For the present analysis, we adopted the UNICEF administration fee as the cost of procurement for the PHC commodities. Moving forward, this cost could be reduced if other procurement mechanisms are used. As the procurement costs for the DTTU partners shows, this could vary from 5 percent for Crown Agents standard rate to the 2.6 percent rate agreed-to with DFID for DTTU, or the 5 percent for SCMS and 1 percent for the USAID | DELIVER PROJECT. It was not possible to estimate NatPharm's procurement costs. We, therefore, assumed that UNICEF will continue to do the procurement and their 9 percent administrative fee will be used.

Table 32. Transport Assumptions

Transport Assumptions	
Assumed load level	100%
Fuel km per liter	3
Fuel cost per liter	$ 1.20
Daily T&S	$30.00
Vehicle service per 10k km	$2,000
Driver monthly salary	$ 372.50
Warehouse store hand	$ 342.50
Depreciation	20%
Annual insurance 8-ton	$655
Value of truck	$90,000

Store	Kilometers per run	Delivery period
Bulawayo	9,423	17
Harare	9,487	23
Masvingo	6,610	16
Mutare	6,070	16
Gweru	5,570	16
Chinhoyi	7,030	13
Inter-branch transfers	9,423	22
Total	44,190	

Transport Costs

Transport costs capture the total cost of delivering products from the various Nat Pharm regional and branch stores to the MOH health facilities. It includes the cost of vehicle depreciation, insurance, and maintenance, as well as fuel costs and the salary and per diem cost of drivers and warehouse store hands that accompany each delivery. A cost per kilometer is derived based on the estimated number of miles driven to serve all facilities in one run from each NatPharm store. Table 32 summarizes the main transport assumptions made. The stores are assumed to make quarterly trips to deliver the products, while the interbranch transfers are assumed to be once a month. These generate total estimated transport costs of $264,518. With an estimated 44,190 km traveled each delivery period, this totals $0.83 per km driven. In scenario 6, we assumed the additional DTTU commodities would increase the vehicle load by an additional 66 percent, so transport costs were increased accordingly.

Supervision Costs

The cost of supervision relates to the time and out-of-pocket expenses required at each level to manage facilities at the lower levels (see table 33). District hospitals supervise the PHC clinics in their districts, provincial hospitals supervise their district hospitals, and the NatPharm regional stores supervise their branch stores. NatPharm headquarters also does a monthly audit of the Bulawayo regional store. Costs include staff time, transport costs, and per diem. District supervisors are assumed to conduct a supervision visit to each facility once a quarter, with only one supervisor per visit. During this trip, they are assumed to collect facility requisitions. We have, therefore, not assumed any additional costs

Table 33. EDS Supervision Time

	Supervision (%)	Days a Month
A Class facilities	23	5
B Class facilities	23	5
NatPharm HQ	45	10
Harare & BYO	23	5
Other stores	5	1
DPS	27	6

associated with transmitting requisitions through the system. We have not included any investment costs for district vehicles, but we have included vehicle operating costs, including depreciation.

Another key assumption is the number of kilometers each district pharmacist drives each month on supervision visits. This is assumed to be 3,000 km per quarter for district supervisors and 6,000 for supervisors at the branch stores visiting their districts. We also assume that there are no per diem costs for supervision visits because facilities are close enough to be visited in one day. The total cost of supervision is $552,249, with $70,799 incurred by NatPharm, and $481,450 by the MOH.

Storage Costs

Storage costs are determined on the assumption that a minimum six months of stock is maintained as a buffer at the Harare and Bulawayo stores. NatPharm charges a $6.00 per month per square meter. Analysis done for the DTTU costing suggests this should be closer to $11 per month per square meter. The storage costs assume existing storage facilities are adequate; the current accounting depreciation rate of 5 percent is used.

Training Costs

Training costs probably represent a major cost driver in any pull system. Regular training is required to ensure that staff know how to do their jobs. Typically, all staff attend one training course a year; these can vary from $12,000 for a one-week course for PHC nurses to $75,000 for a three-week course for provincial hospital pharmacists. We assume that a total of 1,410 staff from different MOH facilities and 50 NatPharm staff would be trained each year. Supply chain training probably cover a range of products, including items not included in the EDS PHC C list. We assumed that only part of the training cost would be apportioned to the PHC commodities. For PHC facility staff, the one-week course is assumed to be 50 percent attributable to the PHC products ad 50 percent to other products. For district, provincial, and NatPharm staff the courses are assumed to be 33 percent attributable to PHC products. These percentages were discussed at the stakeholder's workshop, assuming that other product groups would be managed in the system. Accommodation and per diem costs represent the largest single cost element in training costs.

Other Costs

For other costs, we have taken a simple budget number that does not include the cost of computers, or other hardware, but rather operating budgets for miscellaneous office items. This includes printing requisition forms, managing the LMIS, and other consumables.

Limitations

The main limitation with the approach adopted is that it is potentially very sensitive to the assumptions being made. Changes in assumptions around the management, supervision, and training can have a major impact on results because these are major cost drivers. Discussions with stakeholders identified a number of adjustments in assumptions; these need further validation.

Scenario 6 Assumptions

Scenario 6 involves adding the DTTU commodities to the EDS pull system. For simplicity, we have assumed that the same structure of costs would be adopted as in scenario 5. The main differences are that we increased the level of management, transport, and storage to reflect the additional products being moved through the system. For simplicity, we doubled the management time at each level, doubled the number of delivery rounds, doubled the supervision time, and doubled the percentage of training costs associated with the new system. We used the DTTU procurement costs associated with the earlier scenarios. These assumptions will be reviewed with stakeholders in-country.

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