USAID | DELIVER PROJECT

Zambia: ARV Supply Chain Costs

Pilot of the Supply Chain Costing Tool

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Abstract
In January 2009, the USAID | DELIVER PROJECT, Task Order 1, conducted an assessment of the cost of the antiretroviral (ARV) supply chain in Zambia.

The survey's overall objective was to cost the logistics systems that distributes the commodities for Zambia's antiretroviral therapy (ART) program using the Supply Chain Costing Tool developed by the USAID | DELIVER PROJECT. This report presents the findings of the costing exercise, as well as the implications from the results for Zambia's ART program; it also illustrates what the Supply Chain Costing Tool does and how its output can be used.

Cover photo: Zambia ARV Logistics System Training of Trainers, September 2006.

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Contents

Acronyms v

Acknowledgements vii

Executive Summary ix

Introduction 1

Costing Approach 3

- Overview 3
- Supply Chain Cost Function 3
- Mapping the Supply Chain 4
- Selective Sampling 4
- Data Collection 7
- Data Collection for Costing out the Zambia ARV Supply Chain 12

Results of Zambia ARV Supply Chain Costs 13

Supply Chain Cost Estimates 19

- Supply Chain Cost Estimates Disaggregated by Tier and Function 19
- Limitations 26

System-wide Observations and Conclusions 27

- Procurement Costs 27
- Storage Costs 27
- Transportation Costs 28

Conclusions 31

Appendices

1. ARV Average Prices for Commodities Procured in 2008 (PipeLine 4.0 Zambia, MSL) 35
2. Sample Facilities by Criteria 37
3. Tier 1 Sample Facilities (US$) 39
4. Lusaka Main District, Supply Chain Costs (US$) 41
5. Mpongwe District, Supply Chain Costs (US$) 43
6. Ndola District, Supply Chain Costing Statistics 45
7. Estimating Total Delivered Costs – Ndola District 47
8. Estimating Total Delivered Costs – Lusaka Main District 49
9. Estimating Total Delivered Costs – Mpongwe Main District 51
10. Estimating Total Delivered Costs – Weighted Average Calculations 53

11. USAID | DELIVER PROJECT Supply Chain Costing Tool Pilot....55
12. Contact List....61

Figures

1. Supply Chain Costing Overview....3
2. Map of Zambia showing Lusaka Main, Ndola, and Mpongwe Districts....5
3. Zambia Supply Chain Structure as used by the Supply Chain Costing Tool....6
4. Value of ARVs through the Tiers (Sampled Facilities Only) in U.S.$2008....15
5. Volume of ARVs through the Tiers (Sampled Facilities Only) in m^3, 2008....16
6. Lusaka Main District Total Supply Chain Costs of Delivery at SDP....22
7. Mpongwe District Total Supply Chain Costs of Delivery at SDP....23
8. Ndola District, District Total Supply Chain Costs of Delivery at SDP (U.S.$)....25

Tables

1. Cross-Facility Comparisons of the Percentages of Delivered Costs....x
2. Facilities Included in the Sample by Tier, Logistic Function, and Facility Type....7
3. Costing Tool Data Collection Discussion Guide Topics....8
4. Data Sources for Costing Inputs....10
5. Supply Chain Costs Comparative Indicators, Definitions, and Formula....10
6. Summary Figures for Value and Volume of ARVs Flowing Through Facilities in the Costing Exercise Sample....14
7. Estimate Total Costs of the Zambian ARV Supply Chain—Tier 1....19
8. Cross-Facility Comparison as Percentage of Delivered Costs....26

Acronyms

ART	antiretroviral therapy
ARV	antiretroviral
CHAI	Clinton HIV/AIDS Initiative
CHAZ	Churches Health Association of Zambia
CIDRZ	Centre for Infectious Disease Research in Zambia
CP	cooperating partner
DCCDS	Directorate of Clinical Care and Diagnostic Services
DFID	Department for International Development (British)
DHO	District Health Office
GFATM	Global Fund to Fight AIDS, Tuberculosis and Malaria
GRZ	Government of Zambia
HACS	HIV/AIDS Commodity Security
HIV/AIDS	human immunodeficiency virus/acquired immunodeficiency syndrome
HMIS	health management information systems
JSI	John Snow, Inc.
LSAT	Logistics System Assessment Tool
LMIS	logistics management information systems
MOH	Ministry of Health
MSL	Medical Stores Limited
NAC	National HIV/AIDS/STI/TB Council
NGO	nongovernmental organizations
PEPFAR	President's Emergency Plan for AIDS Relief
PMTCT	prevention of mother–to-child transmission
SC	supply chain
SCMS	supply chain management systems
SDP	service delivery point
USAID	U.S. Agency for International Development
ZNAN	Zambia National AIDS Network
ZNTB	Zambia National Tenders Board

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Executive Summary

The USAID | DELIVER PROJECT is developing a Supply Chain Costing Tool to assist in-country supply chain managers by providing *big picture* cost estimates for the entire supply chain, as well as the costs for specific supply chain functions. These cost estimates can inform supply chain planning and management, assist advocacy for increased funding for the supply chain, pricing policy design, and support performance assessment. A pilot of the supply chain costing tool was conducted on the Zambia ARV supply chain in three districts: Lusaka, Mpongwe, and Ndola.

The results provide a snapshot of antiretroviral (ARV) supply chain costs at two out of the nine provinces in Zambia. The analysis provided an estimate of the procurement, storage, and distribution costs in the three districts (one in the Lusaka province and two from the Copperbelt province) and 11 antiretroviral therapy (ART) sites (of the 181 total.) The findings are presented by function, by tier, and by overall total delivered costs; which is the cost of procuring, storing, and transporting products from their entry into the country, through all the tiers of the supply chain, to the service delivery point (SDP), where they are dispensed.1 Zambia continues to scale-up the ART program each year, with the goal of achieving near universal access. The supply chain will play an important role in delivering ARVs to all ART sites. As the ART program expands, it will help in planning if a manager understands the costs required to support the ARV supply chain.

To this end, this study is—

1. an assessment and comparison of the supply chain costs of the different agencies operating the ARV supply chain in Zambia, including the Medical Stores Limited (MSL), which supplies the District Health Offices (DHO) and hospitals directly; the Elizabeth Glaser Pediatric Aids Foundation (EGPAF)/Centre for Infectious Disease Research in Zambia (CIDRZ)/Ngansa facility; which takes the place of the Lusaka Main DHO, and the Churches Health Association of Zambia (CHAZ) supply chain.
2. an assessment and comparison of the supply chain costs, by function (procurement, storage, and transportation) at different tiers and facilities (urban/rural, high/low volume) in the supply chain.

The primary finding is that, for the two provinces with complete data, the cost of delivering the ARVs ranges between 7.6–16.1 percent of the value of the commodities, with a weighted sample average of 8.96 percent (see table 1). This has implications for setting handling fees and pricing policies in countries with several supply chain options; it also suggests that where logistics/handling fees are charged based on the value of the goods, costing studies are required to ensure that the fee is appropriately set and to ensure that adequate resources can be provided to successfully execute the supply chain.

1 Typically in logistics, the functions of storage and transport are referred to jointly as *distribution*. However, for the costing analysis where detailed information is required for each function, they are referred to separately.

Table 1. Cross-Facility Comparisons of the Percentages of Delivered Costs

Lusaka Main District	Delivered Supply Chain Costs as a % of Commodity Value	Mpongwe District	Delivered Supply Chain Costs as a % of Commodity Value	Ndola District	Delivered Supply Chain Costs as a % of Commodity Value
Bauleni Rural Health Clinic	9.9%	Mikata Health Clinic	10.4%	Kavu Health Clinic	16.1%
Kara Clinic	9.8%	St. Theresa's Hospital	9.0%	Lubuto HC	8.8%
Chilenje	9.8%			Arthur Davison	7.6%
Mttendere HC	9.4%			Ndola Central Mission Hospital	7.6%

The MSL-DHO model which, geographically, covers all of Zambia—and the MSL-Ngansa/CIDRZ model, which accounts for about half of all the ARVs issued—have similar delivered costs when the delivered cost is the total supply chain cost of procurement, storage, and transportation incurred to deliver a quantity of ARVs to the SDP. In 2008, the MSL-Ngansa/CIDRZ model's (operating in the Lusaka Main district) costs ranged from $5,000–$14,000 for the quantity of ARVs delivered in 2008, while the MSL-DHO model (operating in the Ndola district) ranged from $7,000–$15,000. In terms of costs per $1,000 of ARVs delivered, these figures equate to a range for the Lusaka Main district of $97–$105 and $92–$165 for the Ndola district. The authors of this report are unable to offer firm conclusions about the delivered cost of the third model—the supply chain run by CHAZ—because of data limitations (a lack of procurement costs); but, using the available data, the estimate is $89–$104.

Second, this analysis underlines the importance of understanding and assessing the various handling fees that drive the cost of procurement for the three different agencies in this sample that procured ARVs. Incidentally, these facilities also procured the bulk of Zambia's ARVs in 2008. Procurement costs per $1,000 of ARVs procured ranged from $63–$67. Procurement costs accounted for 72 percent (by weighted average) of the total delivered cost of ARV logistics in 2008, for the sampled facilities. These costs were driven by the Supply Chain Management System (SCMS) project's cost of procurement, which procured 60 percent of Zambia's ARVs in 2008, at $67 per $1,000 of the ARVs procured.

Third, storage costs accounted for 17 percent (by weighted average) of the total delivered costs of ARV logistics in 2008, for the sampled facilities. These costs were driven primarily by labor. ARV logistics management at the SDP level can be carried out by pharmacists, pharmacy technicians, or dispensers; but because most of the SDPs that deliver ART are small health centers, in reality, pharmacy technicians do most of the work. Technicians and dispensers are paid substantially less than pharmacists and, because pharmacists are usually found at tertiary-level institutions only, this analysis found that total labor costs in the tertiary institutions were larger per volume or value of ARVs dispensed than at the health centers.

It should be noted that only two tertiary institutions were included in the sample. In addition, while this study did not attempt to capture the cost of inventory, it is noted that this cost should be captured in the future because of the high value of ARV commodities and the amount of capital that is unavailable to the health systems if commodities are tied up in storage. In the future, the value of this capital should be compared with the cost of a supply chain model, with an increased number of deliveries and a *group* buffer stock on hand at a single storage facility. The sample costing suggests that such a *increased delivery* model, similar to the one used in the Lusaka Main district, could be effective (none of the Lusaka Main facilities visited reported stockouts, even though they are unable to accommodate more than a week's worth of ARVs). Note that the authors of this study are unable to firmly recommend this model because performance data were not collected. Broad estimates suggest that transportation in Lusaka Main cost $37,833 in 2008. Given that the annual value of issued ARVs is over $13,000,000 for this district, this analysis suggests that this model's cost of transportation is several orders of magnitude smaller than the value of three or even a single month of buffer stock. However we note that for this district the volume of ARVs delivered is very high and the distances covered are very short.

Fourth, in 2008, transportation costs accounted for approximately 5 percent (by weighted average) of the total delivered cost of ARV logistics, for the sampled facilities. Further findings on transportation suggests that stand-alone ARV-only transportation of ARVs is not as cost efficient as integrated delivery. The two models of stand-alone delivery had higher transportation costs—CIDRZ and CHAZ ($3 and $40 per 1,000 of ARVs)—than the integrated model, MSL, which also transports essential medicines and other commodities at a cost of $0.89 per $1,000 of ARVs. But, these models cover very different geographical areas. CIDRZ delivers within a 10 kilometer (km) radius, CHAZ delivered to a district more than 700 km away, and MSL covers the entire country, so it is not clear that a direct comparison is valid; only that there would be value in an analysis that covered a broader range of MSL and CHAZ sites. Within Lusaka Main, it is not clear that the Lusaka-based MSL, although it has cheaper unit costs, would be the better transportation option unless it also took responsibility for storing the Lusaka Main drugs and, therefore, could provide an integrated transport model, rather than the CIDRZ stand-alone ARV model. For the facilities that are required to pick up ARVs from district health office storage facilities, this analysis found that the cost to these facilities for picking up their supplies is greater than the cost to the district to deliver them. However, in this small sample size, only three facilities picked up supplies, so this finding may not be representative. Nonetheless, this could have significant implications as Zambia tries to move ART sites closer to the rural populations.

The costs presented in this analysis do not include the cost of ART service delivery—the cost of identifying, counseling, testing, and treating a person living with HIV/AIDS (PLWHA). Separate studies conducted in Zambia looked at the cost of delivering ART services. This report provides only part of the total costs of delivering ARTs, but the specific costing of logistics has not been included in any of the other ART service costing studies conducted to date; therefore, it should be an important addition to the costing work being done.

In the private sector, the cost of getting a commodity to where it needs to be is usually presented as a percentage of its value. There has been some discussion that because ARVs are costly, relative to many other commodities in the health sector, the fee for their handling/logistics should be lower because the fee is based on the value of the goods. This analysis shows the potential usefulness for a tool like the Supply Chain Costing Tool, developed by the USAID | DELIVER PROJECT. It suggests that, for a model like the one used in Zambia, a handling fee for ARVs of 9 percent is reasonable. In addition, this study suggests that supply chain costs for a specific ARV supply chain

may be driven largely by the procurement costs because of the practice of basing handling fees on value; that storage costs are driven by labor rather than the cost of space; and, finally, that integrated transport systems, particularly over large areas, are likely to be significantly less costly than commodity-specific ones.

Introduction

The USAID | DELIVER PROJECT is developing the Supply Chain Costing Tool to assist in-country supply chain managers. It provides *big picture* cost estimates for the entire supply chain, as well as costs for specific supply chain functions. These cost estimates can support supply chain planning and management, advocacy for increased funding for the supply chain, pricing policy design, and performance assessment. A pilot of the costing tool was conducted on the Zambia antiretroviral (ARV) supply chain in three districts in Zambia: Lusaka, Mpongwe, and Ndola.

The results offer a snapshot of ARV supply costs in two out of the nine geographic provinces, which are, in turn, divided into 72 districts. Originally, the costing activity was to be conducted as part of a comprehensive evaluation of the ARV supply chain that would have covered between 10–30 percent of all the antiretroviral therapy (ART) sites in Zambia. The postponement of the comprehensive evaluation meant that the pilot was conducted in a much smaller number of sites—11 out of the 181 sites operating in January 2009. The analysis provides an estimate of the procurement, storage, and distribution costs in the three districts where the 11 sites are located.

Zambia continues to scale-up the ART program each year, with the goal of achieving near universal access. To meet commodity demand, the supply chain will play an important role in delivering ARVs to all ART sites. For planning, as the expansion of the ART program continues, it is helpful to understand the costs required to support the ARV supply chain.

To this end, this study is—

1. an assessment and comparison of the supply chain costs of the different agencies operating the ARV supply chain in Zambia, including the Medical Stores Limited (MSL), which supplies the District Health Offices (DHO) and hospitals directly; the Elizabeth Glaser Pediatric Aids Foundation (EGPAF)/Centre for Infectious Disease Research in Zambia (CIDRZ)/Ngansa facility; which takes the place of the Lusaka Main DHO, and the Churches Health Association of Zambia (CHAZ) supply chain
2. an assessment and comparison of the supply chain costs, by function (procurement, storage, and transportation) at different tiers and facilities (urban/rural, high/low volume) in the supply chain.

Costing Approach

Overview

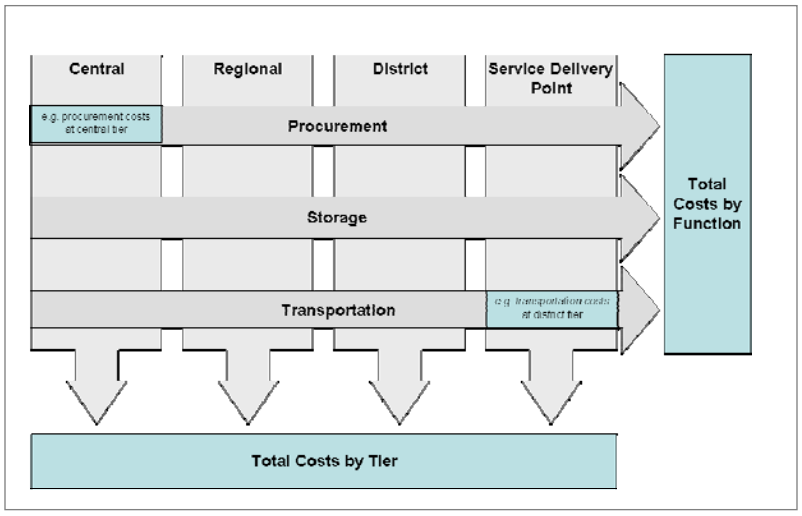
Estimating public sector supply chain costs is complicated for a number of reasons. Typically, public supply chain inputs do not always have documented costs, as financial accounts are not necessarily maintained by function. The complexity of many public sector supply chains can also mean that multiple agencies or administrative units may have some responsibility in ensuring that commodities move along the supply chain. It may not always be possible to capture each of these parts. Finally, the cost of the Ministry of Health (MOH) or donor management may not be captured as *indirect* or *overhead* costs.

To address these complications, we first define the supply chain cost function; we then map the Zambian ARV supply chain—the distribution tiers and functions. We also derive estimates for key inputs using the Zambian civil service pay scales for staff time and accounting conventions for buildings and equipment depreciation.

Supply Chain Cost Function

A literature review (Baruwa and Islam 2008)2, conducted before this study began, identified several relevant approaches to supply chain costing. Figure 1 summarizes the different dimensions of a typical public sector supply chain that need to be captured. It illustrates how different supply chain functions, procurement storage, and transportation can be spread across different administrative levels—from the central to regional and district and to the service delivery point (SDP).

Figure 1. Supply Chain Costing Overview



Source: (Raja, Grace, and Chesley 2000)3

2 Baruwa, Elaine, and Mursaleena Islam. 2008. *Literature Review of Costing Supply Chains and Logistics Systems*. Washington, DC: Abt Associates for the USAID | DELIVER PROJECT.

3 Raja, Sangeeta, Cheri Grace, and Andrew Chesley. 2000. *The Cost of Logistics: Development and Application of a Logistics Cost Model for Public Sector Health Commodities in Ghana*. Arlington, Va.: Family Planning Logistics Management (FPLM)/John Snow, Inc., for the U.S. Agency for International Development.

Typically, we would expect the supply chain cost to comprise direct labor, storage, inventory, equipment, transport, and indirect management costs, distributed across these functions and levels. It should be stressed that this costing exercise estimates the costs of the existing system, with its inherent strengths and weaknesses. The tool does not estimate what costs should be if the system is working efficiently at full capacity. It should also be stressed that we focused on the in-country costs and not international costs associated with various donor and implementing agencies.

Mapping the Supply Chain

To ensure that commodities reach the SDPs, a number of agencies and partners are involved in the ARV supply chain in Zambia. Each agency plays various roles in procuring, storing, and distributing ARVs. The increase in attention from the Government of Zambia (GRZ) and donors to combating HIV and AIDS has led to an increase in the number of funding agencies for ARV drugs. Each funding stream may use a different implementing agency and, then, a different procurement agency. Distribution for the facilities in the costing exercise sample is undertaken through three key channels—the MSL, EGPAF/CIDRZ, and CHAZ—with products dispensed at public and nongovernmental organization (NGO) SDPs. EGPAF funds many of the supply chain activities that CIDRZ performs and will be referenced as CIDRZ in the report because they are the implementing agency.

Selective Sampling

The sample sites were chosen to reflect both the costs of the various agencies who manage ARV supply chains in Zambia, as well as to reflect both urban and rural regions. The sample was not intended to be representative of the national ARV supply chain. Consequently, the analysis in this report represents the costs specific to the facilities visited and their upstream levels in the supply chain. Results are aggregated, where appropriate, to draw conclusions that will be informative to both Zambia's logistics program managers, as well as to the donor partners providing technical assistance to these managers.

To explore the variations within the supply chain, three districts with different supply chain models were chosen for the analysis (see figure 2). Each of these district's logistics models are discussed in more detail in the *Results* section, because these descriptions represent a qualitative output of the tool itself. In summary, two of the districts, Lusaka Main and Ndola, are supplied directly with ARVs stored and transported by MSL; whereas, the facilities evaluated in the final district, Mpongwe, are supplied by CHAZ, which runs a parallel supply system that is not linked to the MSL at any point in the supply chain. (There are other facilities in Mpongwe that the MSL supplies but we did not include them in this sample.) Lusaka Main, a district in the country's capital of Lusaka, is a densely populated urban district with a very high number of registered patients on ART, the highest of all the 72 districts in Zambia. The capital is both a city and a province and it includes three other districts, as well as Lusaka Main; but Lusaka Main is by far the largest in terms of registered ART patients. Ndola and Mpongwe are districts in the Copperbelt province of Zambia, approximately three hours from Lusaka. Ndola is urban, but is much less densely populated than Lusaka; while Mpongwe is a rural district.

Figure 2. Map of Zambia showing Lusaka Main, Ndola, and Mpongwe districts

To collect information on supply chain costs, the team selected a number of *facilities,* which range from the MSL to health centers that handle ARV commodities. A facility can also be a DHO or a partner, such as the Supply Chain Management System (SCMS) project. The term *facility* is used to describe an entity that would have procurement, storage, vehicle, training, or staff costs, and is different from the term *health facility,* which provides clients with ARVs.

The Zambia health system categorizes health facilities into three levels. Level 3 are large referral health facilities, such as hospitals in urban centers. Level 2 health facilities are provincial hospitals, and Level 1 health facilities are found at the district level. Additionally, health centers are found below the district and are not classified into levels.

Facilities within the three districts were chosen to ensure that as many of the different levels of the health facilities were included in the sample as possible: Level 1, Level 3 facilities, and health centers. There were no Level 3 facilities in the Mpongwe district and no Level 2 facilities available in any of the districts.

For the costing analysis, the supply chain is divided into three tiers—the primary or Tier 1 health facilities are national facilities that supply/distribute *down* the supply chain to Tier 2 and below. Tier 2 facilities are district-level facilities. In Zambia, the provincial level is not recognized as a supply chain tier for the ARV drug supply chain, but the provincial pharmacist provides oversight for the district supply chain. Instead, the 72 districts that make up the provinces are considered to be the Tier 2 facilities. Each district has a DHO headed by a District Medical Officer (DMO). These districts may have their own storage facilities and act as *pass through* facilities where ARVs are only in storage for one to two days before being distributed to SDPs within the district. Tier 3 facilities are health facilities that are SDPs. Figure 3 illustrates how the Zambia supply chain is divided into three tiers for costing purposes.

Figure 3. Zambia Supply Chain Structure as used by the Supply Chain Costing Tool

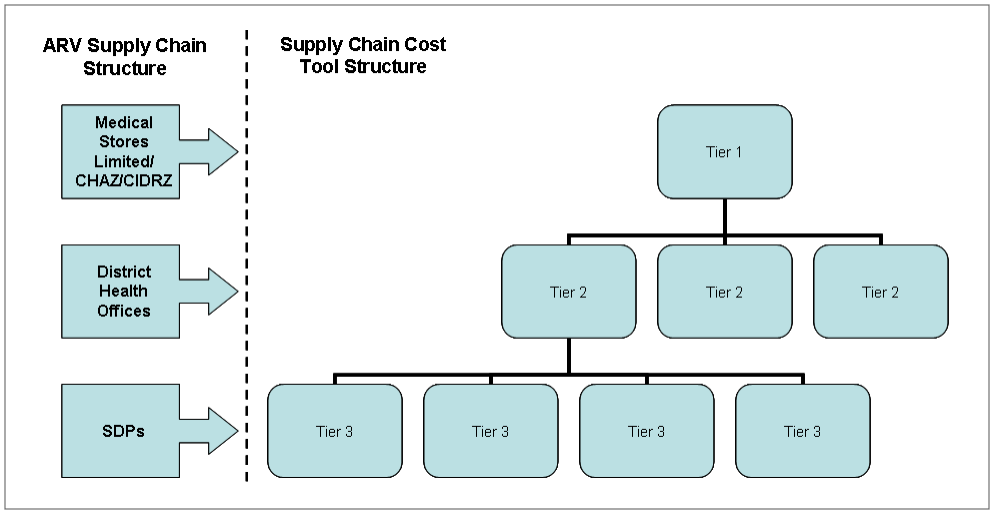


Table 2 lists the names and classifications of all the facilities visited during the study. Tier 1 facilities comprise the organizations at the central level. The MOH funds both the Drug Procurement Office and MSL. The Drug Procurement Office sits within the Ministry of Health; while MSL is funded with a grant from GRZ but is run by Crown Agents, Inc., under a management contract. The SCMS and USAID | DELIVER PROJECT and CIDRZ are bilateral donor partners funded by USAID that provide technical assistance to GRZ. CHAZ is a Zambian NGO that operates a parallel ARV supply chain, supplying certain facilities within Zambia; it also supports a number of public/NGO facilities. These agencies comprise the Zambian ARV supply chain. It should be noted that the Clinton Foundation and UNITAID funded and procured about 25 percent of the ARVs obtained in 2008. Their costs are included in their pricing; the commodities they procure *enter* the supply chain when they are delivered to the MSL facility.

In summary, ARV drugs *flow* from Tier 1 facilities, through Tier 2, down to Tier 3 facilities, but with several exceptions (see the *Results* section). Individual facilities can perform one or all of the three functions in this analysis being assessed for costs: procurement, storage, and transport. Facility types refer to whether the facility is a public- or government-funded facility; in which case, it is the MOH, a DHO, or a public service delivery point, such as a Level 3 facility or a health center. If the facility is not public, then it is a partner in the ARV supply chain that is an NGO or is donor funded, e.g., Kara Clinic or SCMS. It should be noted that Table 2 lists the facilities included in this analysis, but is not a complete list of all the facilities in any of the tiers. For example, there are a total of six ART sites in the Ndola district; the costing team visited four, in addition to the Ndola DHO.

In summary, the study costed the supply chain functions of three Tier 1 facilities:

- the MOH and MSL, which are government-funded facilities
- CHAZ and SCMS, which are classified as *partners* in the ARV supply chain because they are not government funded
- five Tier 2 facilities, which are the three DHOs (where CIDRZ and Ngansa assist the Lusaka Main DHO, hence their classification in Tier 2 thus 3 facilities are 'counted' as providing the DHO function in Lusaka Main.)

- eleven Tier 3 facilities, which are all health facilities and SDPs for ART.

See the annex for a full list of facilities and their sample criteria.

Table 2. Facilities Included in the Sample by Tier, Logistic Function, and Facility Type

Facility Name	Tier Classification	Facility Type	Procure	Store	Transport
Central Level					
Drug Procurement Office, Ministry of Health	Tier 1	MOH	✓		
Medical Stores Limited	Tier 1	MOH		✓	✓
SCMS/USAID | DELIVER PROJECT	Tier 1	Partner	✓		
Christian Health Association of Zambia (CHAZ)	Tier 1	Partner	✓	✓	✓
Lusaka Main District					
Ngansa Pharmaceuticals, Ltd.	Tier 2	Partner		✓	
EGPAF/(CIDRZ) Center for Infectious Disease Research in Zambia	Tier 2	Partner			✓
Lusaka Main, DHMT	Tier 2	District Health Office			
Kara Clinic, Lusaka	Tier 3	Health Centre/NGO		✓	
Mtendere Health Centre, Lusaka Main	Tier 3	Health Centre		✓	
Chilenje, Lusaka Main	Tier 3	Health Centre		✓	
Bauleni Health Centre, Lusaka Main	Tier 3	Health Centre		✓	
Mpongwe District					
Mpongwe, DHO/Mission Hospital	Tier 2	District Health Office			✓
Mikata Health Centre, Mpongwe	Tier 3	Health Centre		✓	✓
St. Theresa's Hospital, Mpongwe	Tier 3	Level 1		✓	✓
Ndola District					
Ndola, DHMT	Tier 2	District Health Office		✓	✓
Arthur Davison Children's Hospital, Ndola	Tier 3	Level 3		✓	
Ndola Central Hospital, Ndola	Tier 3	Level 3		✓	
Lubuto Health Centre, Ndola	Tier 3	Health Centre		✓	
Kavu Rural Health Centre, Ndola	Tier 3	Health Centre		✓	

Data Collection

Both qualitative and quantitative data collection methods were required to determine supply chain costs. The tool required data from interviews with key informants and the collection of reports and

financial data. Supply chain cost data came from a wide range of sources, including logistics reports, transport schedules, expenditure reports, and on-site interviews at each of the facilities sampled.

It was necessary to understand the *system* in place prior to trying to determine the inputs and costs of running the system. In the case of Zambia, the USAID | DELIVER PROJECT office and previous analyses, primarily the 2007 HACS report, provided a clear description of the overall ARV supply chain and the roles played by the many partners who implement and support the program. To supplement this, the costing exercise required data be collected from each partner on the detailed day-to-day activities that each of these partners undertake.

The interviewers (the costing team) used a discussion guide, summarized in table 3, to obtain both quantitative and qualitative data from key informant interviews on key logistics functions.

Table 3. Costing Tool Data Collection Discussion Guide Topics

- Understanding the supply chain functions undertaken by the facility (i.e., procurement, storage, and transportation).
- Outlining the process followed for each function (e.g., delivery schedules for transportation and the timing/schedule of procurement functions).
- Determining staffing and non-labor inputs for each function.
- Determining the costs of the staffing and non-labor inputs for each function.
- Obtaining and interpreting the facility's overhead costs.
- Obtaining the facility's overall target client number (e.g., MSL's clients would be the DHOs; the health center's clients would be the ARV patients).

Key Informant Interviews

A range of respondents were interviewed to collect information. For facilities in Tier 1, where the facility is large enough to have an administrative, financial, logistics/storage, and service delivery team, it was necessary to meet with at least one person in each of those teams. For example, at MSL, the costing team spoke to the head of each relevant department. Using the facility's annual report and payroll documents, the finance officer was interviewed to determine labor and operating costs; the transport officer was interviewed to determine transport processes, labor requirements, distribution schedules, and vehicle running costs; and the warehouse manager was interviewed to determine the processes, staffing levels, and consumables required for carrying out storage activities. In some Tier 1 facilities, it was possible to obtain financial information from a technical staff member by giving the staff member a list of data requirements that would be forwarded to a financial team and then returned to the costing team.

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— the facility carries out. For example, MSL does not conduct any procurement activities; therefore, no further questioning about procurement costs was necessary; the interview then moved on to probe the MSL's storage process. In contrast, the medical procurement office in the MOH does undertake

procurement activities; therefore, further details were obtained from the respondent at the facility around the procurement process—the time it takes to complete a single procurement. Following this data collection, the costing team moved on to determine the staff involved and the inputs (and subsequent) costs associated with the process. The interview ended because the medical procurement office's role in the ARV supply chain ends after the procured commodities are delivered to the MSL.

In many cases, notably for the facilities further *down* the supply chain, such as health centers, very few people were involved in the actual handling of ARVs. It was necessary to only speak to the personnel *in-charge* to obtain permission to talk to staff. Typically, the ARV logistics staff would, in most cases, also be the ART dispenser, usually a pharmacist or pharmaceutical technician. For example, the Mtendere Health Center in the Lusaka Main district employed a single pharmaceutical technician, who was interviewed by the costing team. The technician provided the necessary information required by the costing team for all the health facilities' ARV logistics activities. In this particular case, the technician worked solely on ART logistics and ARV dispensing. This was the case in most of the health centers that the costing team visited. All the SDP facilities' interviews were completed in less than two hours.

Quantitative Data

Quantitative data was obtained through financial reports, financial expenditures, Supply Chain Manager, and interviews. Each function was divided into a labor component, an equipment cost component, and a third *other* section to capture costs specific to the particular function. To estimate staff time spent on managing ARV commodities, they 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. Where salary data were not available, as was the case for some private organizations—e.g., CHAZ—the team used the equivalent civil service salary grade.

Storage was costed directly using a building cost of KW2,000,000 per m^2 (US$2,000) and a depreciation rate of 5 percent, which is the standard rates used for 20-year straight-line depreciation. It should be noted that GRZ/MOH uses a 2 percent rate, implying a 50-year economic life for a building; but the costing team considered the standard rate of 5 percent to be more appropriate. In addition, any labor costs associated with managing ARV stocks, such as stocktaking and ordering, were included under storage costs. The cost of buffer stock and pipeline products were not included in the logistics costs, although some discussion on the potential impact of these costs, particularly for the Lusaka Main district, is included later in the report.

Costs were classified as transportation costs whether the cost was associated with the delivery of ARVs to a SDP, or the cost was associated with a facility's pick-up of ARVs from a storage facility.

Equipment costs were classified as being specific to each costed supply chain function, where possible. However, in many cases, these costs were *embedded* in the operating costs, because the facility used the equipment for supply chain activities related to other commodities. The total operating costs for the facility would then be multiplied by the percentage of space that the ARVs occupy in that facility; so that not all the annual depreciation would be charged to the ARV logistics function, but that cost would still be accounted for. Table 4 lists the documents used to obtain supply chain costs.

Table 4. Data Sources for Costing Inputs

Data Source	Costing Data Obtained
Monthly expenditure reports	Operating costs for each SDP
Supply Chain Manager Requisition/issue voucher monthly reports	ARV quantities (units/packs) issued to all health centers, Level 3 facilities, districts, CIDRZ, and CHAZ
Dispensary daily register	ARV quantities dispensed, number of patients per day to which ARVs are dispensed at SDP level
Annual reports	Operating costs for MSL and all Level 3 facilities

Summary indicators of the costs of the ARV supply chain are presented for each of the facilities visited, specifically the total value and volume of ARVs that passed through these facilities in 2008, as well as the costs of ARV commodity procurement, storage, and transportation incurred by these facilities. The costing data covers the 2008 calendar year. However, some facilities were not able to provide all the data from 2008; in which case, the closest 12 consecutive months were used, e.g., October 2007–October 2008.

Each tier of the supply chain shown in Table 2 is discussed in terms of each of the functions that the facilities perform within that tier and the relevant comparisons. To interpret the cost data that have been collected, Table 5 shows the indicators that the Supply Chain Costing Tool calculated.

Table 5. Supply Chain Costs Comparative Indicators, Definitions, and Formula

Indicator	Definition	Formula
Cost per $ of annual pass through	The total cost incurred by a facility when undertaking all its supply chain functions—the total **value** of commodities passing through it in one year. Care must be taken in its interpretation because some facilities undertake several functions, while others perform a single function.	$\frac{\text{Total costs incurred by the facility for all the supply chain functions it performs in one year (\$)}}{\text{Total \$ value of ARVs passing through the facility in one year}} \times 1{,}000$
Cost per m^3 of annual pass through	The total cost incurred by a facility when undertaking all its supply chain functions—the total **volume** of commodities that pass through it in one year. Care must be taken in its interpretation because some facilities undertake several functions while others perform a single function.	$\frac{\text{Total costs incurred by the facility for all the supply chain functions it performs in one year (\$)}}{\text{Total volume of ARVs passing through the facility in one year}} \times 1{,}000$
Procurement costs per $ of annual pass through	The total cost incurred by a facility when undertaking procurement—the total **value** of the procured commodities that pass through it in one year.	$\frac{\text{Total costs incurred by the facility to conduct procurement activities in one year (\$)}}{\text{Total value of ARVs procured by the facility in one year (\$)}} \times 1{,}000$

Indicator	Definition	Formula
Storage costs per m^3 of annual pass through	The total cost incurred by a facility for storage—the total **volume** of the procured commodities that pass through it procured in one year.	$\frac{\text{Total costs incurred by the facility to conduct storage activities in one year (\$)}}{\text{Total volume of ARVs procured by the facility in one year } (m^3)} \times 1{,}000$
Transportation costs per m^3 of annual pass through	The total cost incurred by a facility for transportation—the total **volume** of procured commodities that pass through it in one year.	$\frac{\text{Total costs incurred by the facility to conduct transportation activities in one year (\$)}}{\text{Total volume of ARVs procured by the facility in one year } (m^3)} \times 1{,}000$
% of delivered commodities value required for supply chain logistics	The total cost incurred by the supply chain activities as a percentage of the value of (SDP) delivered commodities.	$\frac{\text{Total costs incurred by the supply chain to deliver a one year supply of ARVS (\$)}}{\text{Total value of ARVs delivered to an SDP in one year (\$)}} \times 100$

The first two indicators can be used to determine the overall supply chain costs for a given value or volume of delivered ARVs, when used in combination. For example, the results for the Ndola district are presented by function, but they are also aggregated when the supply chain costs for the annual delivered value/volume of ARVs are estimated for that district. The supply chain costs at each tier of the supply chain are combined from Tier 1, through Tier 2, all the way down to each of the Tier 3 SDPs, which are located in the Ndola district.

Not all of the indicators in Table 5 are relevant for every facility included in the costing study; for example, only two facilities in the sample, SCMS and the GRZ's Medical Drug Procurement Office, undertook procurement activities in the period being costed (2008). CHAZ also procured drugs during 2008, but their procurement costs are not included in the analysis because they did not provide any cost data for that activity. The procurement function is analyzed in terms of costs per dollar value because this is the basis upon which many of the fees associated with procurement (e.g., freight or handling) are charged. Similarly, storage and transport are analyzed in terms of costs per $m^{3,}$ stored or transported, as well as the per dollar value. Storage functions are further divided in terms of the cost of the labor required to carry storage in each facility and the percentage of storage facilities costs that are labor costs. As noted above, while all facilities' costs are presented in terms of total costs per dollar and m^3, care should be taken to ensure that the appropriate comparisons are made. For example, comparing the total costs of the Medical Drug Procurement office with the total costs for MSL would be inappropriate because MSL conducts entirely different functions; whereas, a comparison of SCMS costs with those of the GRZ's Medical Drug Procurement office would be appropriate, as both facilities perform only procurement functions.

Data Collection for Costing out the Zambia ARV Supply Chain

A detailed HIV/AIDS Commodity Security (HACS) assessment was conducted in 2007 for Zambia. This document was an excellent source of information for the costing team. The HACS clearly outlined all the partners/partner roles in Zambia's ART program. Typically, the types of people that are able to provide a detailed *big picture* view of this type of program would be the head of the procurement unit in a MOH, the clinical program director of the national HIV/AIDS treatment program, the head of the country's central medical store (or equivalent), as well as the program managers in donor-funded partner institutions like the USAID | DELIVER PROJECT.

Results of Zambia ARV Supply Chain Costs

The results of the Zambia ARV supply chain costing study are presented—

- in summary, for all the facilities in the sample
- in detail, for each of the functions (procurement, storage, and transportation) that occur at each tier of the supply chain
- as comparisons between the appropriate facilities; i.e., the facilities performing the same function.
- Summary Estimates of ARV Volumes, Values, and Flows

Prior to adding any costing information, it is important to understand how much of a commodity flows through the supply chain and where those flows go. This analysis combines the data collected about the structure of the supply chain and the partners involved in the supply chain operations with the commodity quantification data on commodity types, volumes, quantities, and flows. After the sample facilities names, descriptions, and functions have been entered into the costing tool, the tool merges the commodity database data with issues data (obtained from Supply Chain Manager software) to produce a summary of the volume of ARVs flowing through the system and the value of the ARVs flowing through each tier and facility of the system. Table 5 shows the total volumes and value of ARVs flowing through the facilities in Lusaka, Mpongwe, and Ndola. A caveat is that other partners procuring ARVs in Zambia were not included in this sample, table 6 is not a country summary, but it is a summary of the sampled facilities.

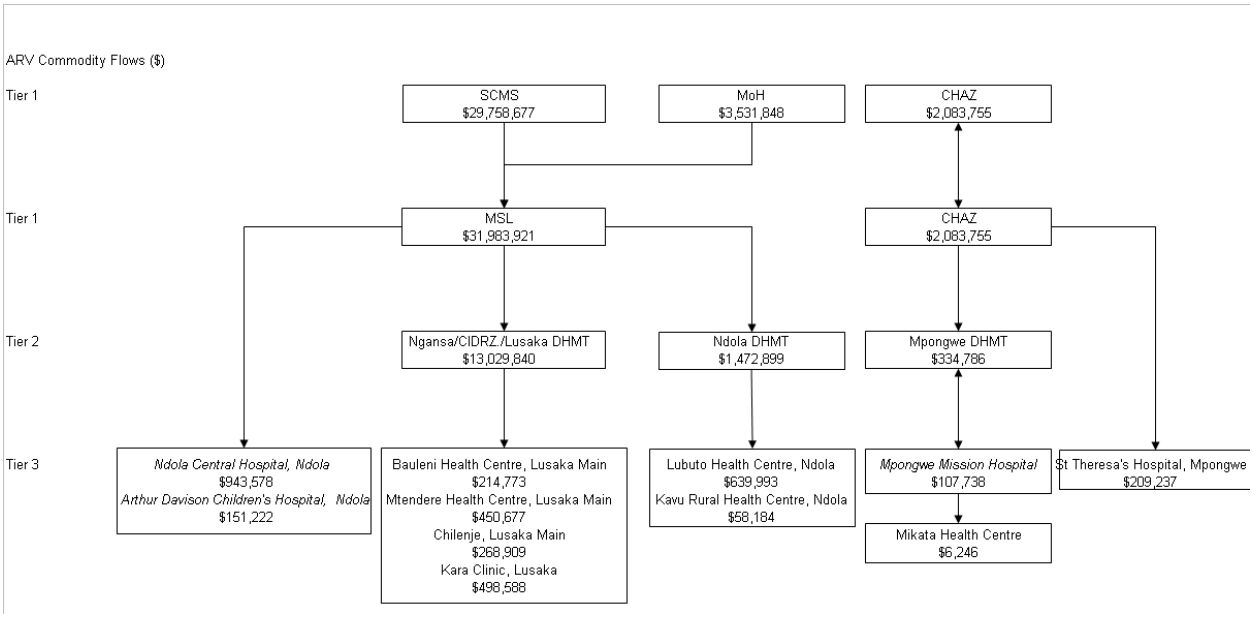
Table 6. Summary Figures for Value and Volume of ARVs flowing through facilities in the costing exercise sample

Facility No.	Facility Name	Tier Classification	Facility Type	Total Value of Commodities (U.S.$ annual)	Total Volume of Commodities (m^3, annual)
1	Procurement and Supply Unit, Ministry of Health	Tier 1	MOH	3,531,848	242.77
2	Medical Stores Limited	Tier 1	MOH	31,983,921	1,109.90
3	Churches Health Association of Zambia (CHAZ)	Tier 1	Partner	2,083,755	74.20
4	Ngansa Pharmaceuticals, Ltd.	Tier 1	Partner	13,029,840	440.87
5	Lusaka Main, DHO	Tier 2	District Health Office	13,029,840	440.87
6	Kara Clinic, Lusaka	Tier 3	Health Centre	498,588	14.40
7	Mtendere Health Centre, Lusaka Main	Tier 3	Health Centre	450,677	13.79
8	Chilenje, Lusaka Main	Tier 3	Health Centre	268,909	7.19
9	Bauleni Health Centre, Lusaka Main	Tier 3	Health Centre	214,773	7.82
10	Mpongwe, DHO/ Mpongwe Mission Hospital	Tier 2	District Health Office	334,786	10.62
11	Mikata Health Centre	Tier 3	Health Centre	6,246	0.39
12	Ndola, DHO	Tier 2	District Health Office	1,472,899	45.17
13	Arthur Davison Children's Hospital, Ndola	Tier 3	Level 3	151,222	8.43
14	Ndola Central Hospital, Ndola	Tier 3	Level 3	943,578	26.76
15	Lubuto Health Centre, Ndola	Tier 3	Health Centre	639,993	19.92
16	Kavu Rural Health Centre, Ndola	Tier 3	Health Centre	58,184	2.05
17	St. Theresa's Hospital, Mpongwe	Tier 3	Level 1	209,237	5.46
18	CIDRZ /EGPAF	Tier 1	Partner	13,029,840	440.87
19	SCMS and USAID | DELIVER PROJECT	Tier 1	Partner	29,758,677	803.93

Figure 4 combines these summary data with the issues data obtained from Supply Chain Manager to show the flow of ARVs through the three tiers of sample facilities by value (U.S.$). The three facilities in the sample that perform procurement activities are SCMS, MOH/GRZ, and CHAZ. SCMS, MOH, CHAZ, and MSL are classified as Tier 1 facilities in the analysis because they operate at the *national* level (as opposed to the district level, such as Ngansa and EGPAF/CIDRZ.) ARVs arriving in the country are delivered to either the MSL or CHAZ storage facilities; these facilities distribute commodities to both Tier 2 storage facilities and Tier 3 SDP facilities. The italicized facilities are ART SDPs that receive ARVs directly, by-passing any district level storage facilities.

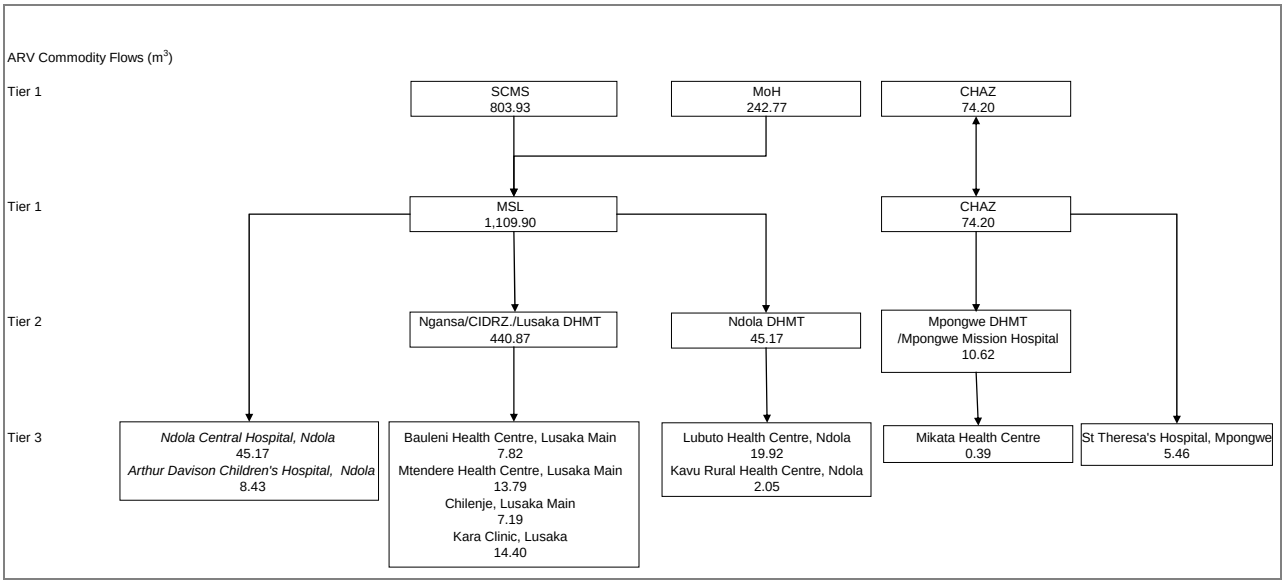
For the Ndola district and its facilities, after the ARVs are procured, they are stored at the MSL and then transported by MSL to the DHO storage facility (Tier 2) or to the large Level 3 facilities (Tier 3), such as the Ndola mission and Arthur Davison. This is an example of the MSL-DHO model of delivery, as the DHO then is responsible for the onward delivery to non-Level 3 SDPs in Tier 3. This model of distribution is the most common in Zambia and it applies to most of the 72 districts. The MSL-Ngansa/CIDRZ supply chain process is a modification of the MSL-DHO model, with the Ngansa storage facility as the Tier 2 storage facility; it is used in just one district, Lusaka Main. As earlier noted, Lusaka has a very high number of ART patients and the DHO does not have the space to store the required quantity of ARV supply in its storage facility. (Figure 4 shows that a very high proportion of all the country's ARV supply goes to the Lusaka Main district.) The third model, the parallel supply chain structure run by CHAZ, is also clearly shown in figure 4; it shows that it distributes just over 5 percent of the value of all the ARVs in the supply chain.

Figure 4. Value of ARVs through the Tiers (Sampled Facilities Only) in U.S.$2008



Because the volume of the commodities being transported is most likely to drive storage and transportation costs within a supply chain system, the flow of ARVs through the sampled ARV supply chain facilities is also presented in terms of its volume. Figure 5 combines these summary data with the issues data obtained from Supply Chain Manager (logistics information system) to show the flow of ARVs through the sample facilities, by volume.

Figure 5. Volume of ARVs through the Tiers (Sampled Facilities Only) in m^3, 2008



Notes:

[a] SCMS procured the majority of Zambia's ARVs procured in 2008. Between SCMS, MOH, and CHAZ, almost all the procurement of ARVs for the public sector ART program was captured in the costing exercise, so this figure is a good approximation of both total and sample costs.

[b] CHAZ appears twice in this flowchart because the total figure for CHAZ captures both its procurement and storage costs. Because the financial information was incomplete, it was not possible to divide the operating costs between the procurement and storage function for CHAZ; therefore, only the total cost is shown here.

[c] SCMS, MOH, and other donors procure the MSL stores' ARVs; however, because the bulk of ARVs in 2008 were SMCS and MOH–funded, this figure is a good approximation of both total and sample costs.

d This figure is the sum of the total costs for each of the facilities that perform logistics function at the Tier 2 level of the supply chain for the Lusaka Main district. The individual figures are $52,257, $37,833, and $8,646 for Ngansa, CIDRZ, and the Lusaka DHMT, respectively.

[e] These facilities are supplied directly from MSL, not through their respective district offices.

[f] CHAZ supplies St. Theresa's but also incurs transportation costs because it must often make extra trips to Lusaka to pick up ARVs.

The flowcharts present value and volume data in an intuitive way that shows the *big-picture* of where the majority of ARVs go and who handles them. For example, from figure 5 it is clear that beyond the MSL storage facility, the Ngansa facility in Lusaka stores nearly half the total volume of ARVs that passed through the ARV supply chain in 2008. CIDRZ fulfills the transport function for this district; it is very important to understand CIDRZ's costs for policy/supply chain design purposes. A reasonable question might be whether or not it would be more efficient for MSL to perform the transportation function in Lusaka Main because they already distribute other commodities to that district, or whether the CIDRZ dedicated ARV transportation model is the more efficient choice.

In addition, the role played by Ngansa is substantial because, unlike the Ndola facility, where the monthly shipment of ARVs is only stored for 2–3 days, Ngansa serves as a storage facility for each of the Lusaka facilities, which means that it stores up to three months of stock for each Lusaka facility. Another interesting observation from figure 5 is the substantial volume of ARVs that go to the Lubuto health center. Having observed that Lusaka is the most densely populated district, it is interesting to note that the Lubuto health center, which would be classified as at least peri-urban, takes delivery of volumes of ARVs that are substantially higher than a Level 3 facility in the same district, the Arthur Davison Children's Hospital, and substantially higher than any other health center in the sample. The closest facility in terms of value and volume is the Kara Clinic in Lusaka, which is also the only facility in the sample that is a dedicated HIV and AIDS SDP; i.e., it provides HIV services only. On closer examination, it was found that the ordered quantity for a single type of

ARV drug more than quadrupled over the course of 2008, prompting a further examination of the facilities ordering history.

Supply Chain Cost Estimates

The total supply chain costs for each of the facilities in the costing exercise sample are shown in appendices 3–6. These costs were estimated by facility; they are the sum of each facility's procurement, storage, transport, and operating costs. It should be noted that costs are shown by facility and, therefore, not necessarily comparable because not all facilities perform all supply chain functions.

Supply Chain Cost Estimates Disaggregated by Tier and Function

While the summary data provides a lot of useful information and context, it is necessary to examine the costs in more detail by tier and function. These data are analyzed both in terms of the total cost of each function and in terms of some supply chain cost metrics (see Table 5). These metrics can be used to compare the costs of undertaking each of the costed functions at each level of the Zambian supply chain. This would be of particular interest where more than one facility is undertaking the same function.

Tier 1: Ministry of Health/GRZ and National Partners

As observed in the notes accompanying table 6, the sample facilities' costs, in some cases, are a good approximation of the costs for isolated parts of the entire system. Specifically, it is noted that SCMS, MOH, and CHAZ together procure most of the ARVs procured in Zambia in 2008 (in 2008, CHAI/UNITAID funded and procured the remaining 25 percent). Therefore, the sum of the individual procurement costs for each of these facilities would be a reasonable approximation of the procurement cost for the entire system. Similarly, MSL and CHAZ provide all the storage that occurs at Tier 1 of the ARV system and, therefore, the sum of their costs is a good approximation of the storage costs for the entire system. Finally, the sample included the MSL, which distributes to the majority of the ARV recipient facilities in Tiers 2 and 3, with the exception of those facilities that receive commodities transported by CHAZ and CIDRZ. Therefore, combining the costs of all the Tier 1 facilities provides a reasonable estimate of the entire Tier 1 costs for the Zambian ARV system (see Table 7); detailed cost breakdowns can be found in Appendix 3.

Table 7. Estimate Total Costs of the Zambian ARV Supply Chain—Tier 1

Facility	Logistics Functions Performed	Total Cost (U.S.$)
SCMS and USAID | DELIVER PROJECT*	Procurement/system strengthening management support including training	2,003,071
GRZ/MOH	Procurement	223,955
MSL	Storage/transport	303,556
CHAZ	Procurement/storage/transport	222,712
Total Tier 1 Costs		2,753,294
Total value of commodities procured		35,374,280

* Note: The SCMS costs included in this figure include SCMS costs incurred outside Zambia at the SCMS office in the U.S. The activities covered in this cost include forecasting and demand planning, functions not carried out by GRZ. Other activities covered include reviewing tenders and negotiating contracts, activities that GRZ carries out. Therefore, SCMS costs cover activities that are similar but not directly comparable to those of GRZ's procurement office.

Procurement: As noted earlier, there are several partners operating in Tier 1 of the supply chain. The pilot did not include all the Tier 1 partners in the sample (note that the sum of SCMS and GRZ procurement is less than the flow through MSL see Figure 4). GRZ's Drug Procurement Office, SCMS, and CHAZ were the sample facilities that carried out procurement activities. (Some partners who conduct procurement activities, such as UNITAID and EGPAF, were not included in the costing analysis, as mentioned earlier, although the costing team did visit the country director for EGPAF as part of the preparation process.) It was confirmed that neither CIDRZ nor EGPAF undertook any scheduled procurement of ARVs in 2008, although an emergency procurement of Trimmune for children was procured in February 2008. No further details of this procurement were available other than that it was a direct purchase from the local CIPLA agent.

SCMS did approximately 60 percent of the procurement in 2008. This figure could change from year to year. For example, the Global Fund will restart funding to Zambia in 2009; GRZ, through the Drug Procurement Office, will do the procurement. Unfortunately, CHAZ was unable to provide any of the data that the costing team requested to determine procurement and operating costs. CHAZ contracts with Crown Agents, Inc., to do its procurement. For the procurement costs, we used a proxy figure of 5 percent for the handling fee charged by Crown Agents, Inc. This estimate is a bench mark used by Crown Agents, Inc., for other procurement actions and does not reflect the actual cost, but instead provides a comparison point.

The procurement costs for SCMS and GRZ are quite similar, but they reflect very different cost structures. SCMS spends $67 to procure a $1,000 worth of ARVs, compared to $63 for GRZ. It should be noted that a direct comparison is not strictly possible because of the significant differences between the two. SCMS is a global procurement program funded by the U.S. government; the project has access to globally negotiated contracts with international suppliers, benefiting from economies of scale. Its costs reflect the higher levels of U.S. and Zambian–based management around the procurement process, including the forecasting and tracking of commodities, negotiation of global contracts with manufacturers, product quality assurance, and design and application of an ERP-based management information system (MIS) to track procurement and international freight and insurance. These are procurement realities—arrangements that are not presently available to the MOH's procurement function.

By comparison, GRZ procured a relatively small amount (both for value and volume) of ARVS in 2008. It is subject to a handling fee of 2–3 percent on each procurement to move commodities from their point of entry into the country to MSL; this fee alone amounted to just over $105,000 in 2008. This fee is on top of the freight charges included in the procurement price paid by GRZ. The smaller volume of procurement means that GRZ does not achieve economies of scale, so its costs are comparatively, higher than SCMS because it performs fewer supply chain procurement activities. For example, it does not incur costs associated with quantification, procurement planning, quality assurance, and procurement execution costs, which are performed by SCMS because the project has the relevant technical capacity.

Storage: Only MSL and CHAZ perform storage functions at the national level; their costs are shown in table 6. Commodities procured by CHAZ are stored at the CHAZ warehouse in Lusaka. CHAZ staff were able to provide some information on the size and number of staff working in the storage facilities. The CHAZ costs can be compared with those for MSL; they appear to be substantially higher when the storage cost per volume figure of U.S.$477 per m^3 when compared

with the MSL costs of U.S.$226 per m^3. MSL operates a much larger store, with approximately 8,000 m^3 storage capacity compared to CHAZ's 450 m^3. It should be noted that the storage costs discussed here do not include operating costs, which have been accounted for separately in Appendix 3. These storage costs do not include the cost of inventory held.

Transport: Only MSL and CHAZ perform transport functions in Tier 1. The costs for MSL were estimated after determining the cost for its entire transportation operation, which conveys essential drugs, HIV test kits, and many other commodities, in addition to ARVs. The costs attributed to ARV logistics were determined using the ratio of the total volume of ARVs transported by MSL over the total volume of commodities transported by MSL (which required the assumption that all MSL trucks depart MSL fully loaded). The ARV transportation costs for MSL of $27,783 is 7 percent of the total transport costs of MSL in 2008, which is $25 per m^3 transported (again excluding operating costs). CHAZ could not provide much information on its transportation operations beyond the length of each ARV distribution trip, the number of trips per month, and the per diem for the driver and officers required for each trip. The costing team had to assume that the salaries of these two staff members are comparable to MSL staff. CHAZ was also unable to provide a distribution schedule, operating costs, or the numbers and cost prices of the vehicles used; therefore, a depreciation charge on the equipment could not be estimated. Using only these limited data, the costing team estimates that CHAZ spends approximately $1,120 to transport one m^3 of ARVs. This estimate is substantially higher than MSL and does not include any depreciation charges on vehicles or maintenance charges. CHAZ supports a total of 22 ART sites, including those in the Mpongwe district, which were included in this analysis. The costing team determined that CHAZ charges the Zambian National AIDS Network (ZNAN) a 2 percent fee to cover its costs of transporting ARVs from its warehouse to ZNAN-supported facilities in Lusaka; but the team was unable to obtain any other details about how often and what volume of commodities was delivered to these facilities in 2008. Given that CHAZ has estimated transport costs equal to 4 percent of the value of the ARVs that passed through it in 2008, this analysis suggested that CHAZ is, to a certain extent, subsidizing its transportation of ZNAN's ARVs

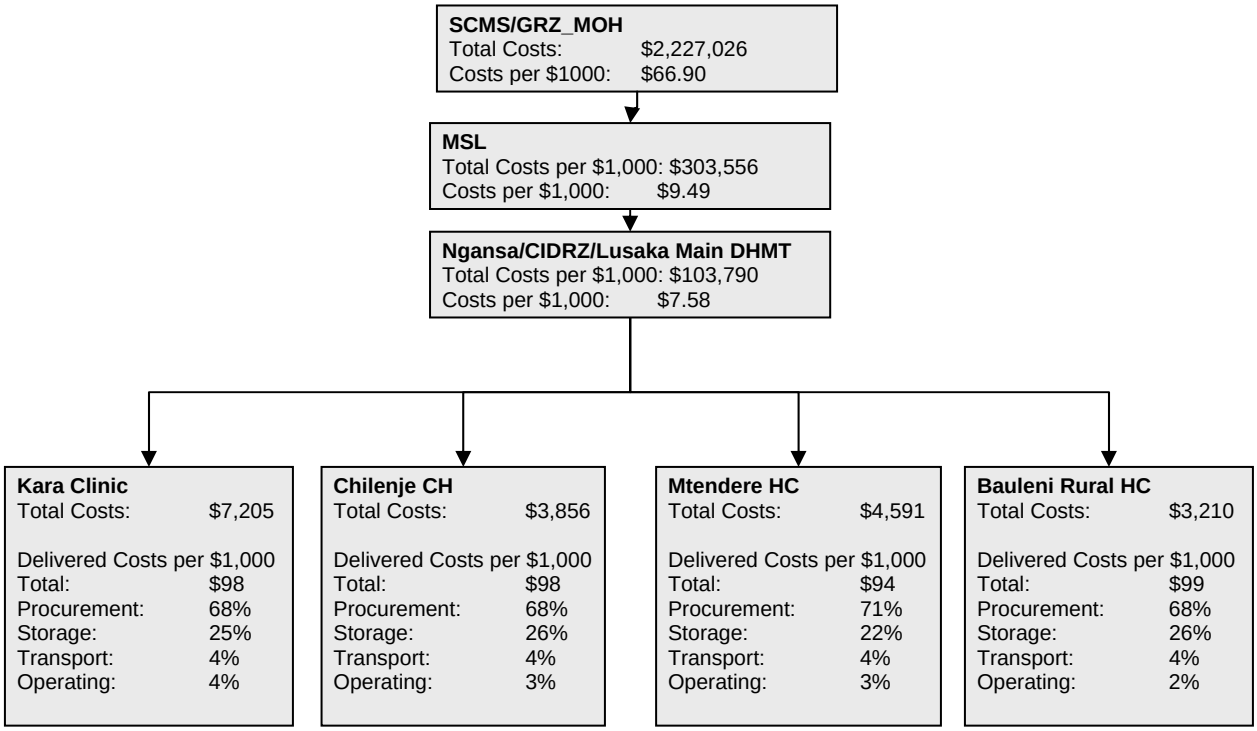
Tier 2: District Health Offices and Tier 3 Health Centers Facilities

The section describes the supply chain costs within each of the three districts that were part of this study—Lusaka Main, Mpongwe, and Ndola—and their facility costs. Cost comparisons are made where appropriate. It should be noted that in the diagrams that follow we adopt a cumulative approach to indicating the supply chain costs for getting the product to the SDP. These costs show the total cost of the procurement and storage costs incurred on commodities at the Tier 1 and Tier 2 facilities, plus the storage and distribution costs incurred at the Tier 3 facilities. So, for example, in the Lusaka Main district, the total supply chain costs of getting the product to the Kara Clinic was $7,205, which is equivalent to 9.8 percent of the cost of the commodities delivered.

Lusaka Main District

Lusaka Main is one of the four districts that make up the Lusaka Province. It is the largest of these districts in terms of it ARV consumption. The supply chain costs for the district are shown in figure 6.

Figure 6. Lusaka Main District Total Supply Chain Costs of Delivery at SDP



Procurement: No procurement activities occurred at any of the Tier 2 facilities in this sample. Emergency procurements may have occurred during 2008, but those interviewed did not consider these orders to be substantial; EGPAF/CIDRZ was the only facility with the capacity and funding to make an emergency procurement. The procurement costs listed relate to the costs incurred in procuring the product through SCMS and GRZ.

Storage: The Lusaka Main district has the highest number of registered ART patients and consumes the largest quantity of ARVs of any of the districts. The district's facilities have very limited storage capacity and are unable to keep more than a week's supply of ARVs in stock; therefore, they need deliveries every week. The lack of storage and the fact that these facilities receive supplies weekly implies that the cost of inventory for this district, which consumes approximately 40 percent of the entire nation's annual supply of ARVs, is relatively low when compared to other districts where facilities store up to three months of inventory. To assist these facilities, a donor partner, EGPAF/CIDRZ, funds the storage and transport of the district's ARV requirements. CIDRZ does not have a storage facility of its own and, therefore, contracts with a private facility, the Ngansa Pharmaceutical Company, to store the district's ARV supplies. An estimated contract value of $50,000 per year was given, but actual contract details were not obtainable from either CIDRZ or Ngansa. This analysis estimates Ngansa's costs at $52,257 for 2008 (see appendix 4). The Ngansa stores a three-months supply of ARVs for each of the district's ART sites, thereby serving as an *extension* of their storage facilities. MSL delivers ARVs to Ngansa; a CIDRZ vehicle makes deliveries, according to the supply vouchers received by the Ngansa facility, from the health centers. It is estimated that the Ngansa facility storage costs are $87 per m^3 stored. It should be noted that the storage costs associated with the Lusaka Main DHO only include labor costs because three officers at this DHO support the ordering and management of ARVs for all the districts ART sites.

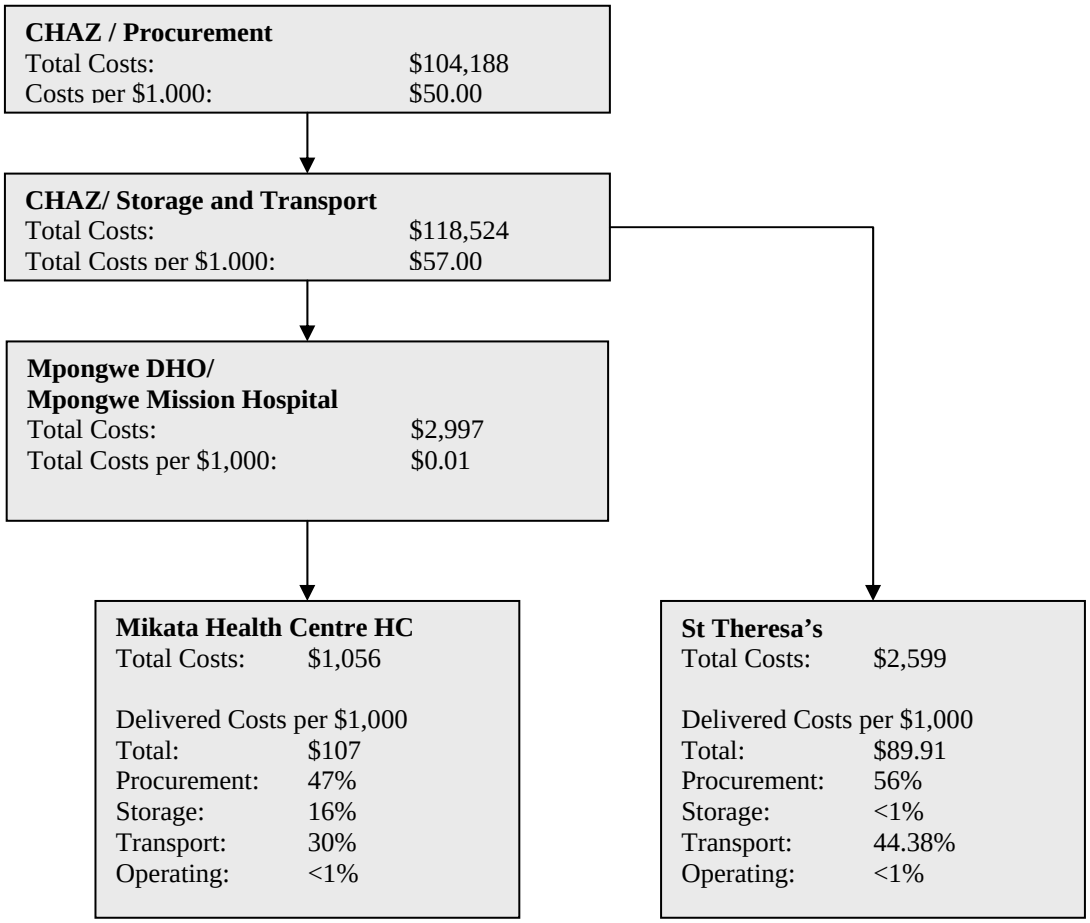
As previously mentioned, the facilities in the Lusaka Main district have very limited storage capacity and, therefore, very small storage costs in terms of the cost of space. However, because storage costs include the cost of labor activities associated with storage, such as stocktaking and ordering, the total storage costs are much larger than just the cost of space; and it accounts for approximately 30 percent of the total delivered cost in the Lusaka Main district.

Transportation: Using ARV dedicated staff and vehicle, CIDRZ does all the transportation of ARVs in the Lusaka Main district . MSL delivers ARVs to Ngansa, then CIDRZ delivers them to facilities every week. It is estimated that each m^3 delivered by CIDRZ in 2008 cost $86 (including operating costs). CIDRZ provided the costing team with a detailed list of monthly expenditures for their transportation activities. None of the facilities in the district reported picking up their ARVs from Ngansa during 2008.

Mpongwe District:

The facilities visited in Mpongwe district are part of the CHAZ supply chain for ARVs. CHAZ supplies these facilities using the CHAZ vehicles from its warehouse in Lusaka. See figure 7 for a summary of ARV supply chain costs for the Mpongwe district.

Figure 7. Mpongwe District Total Supply Chain Costs of Delivery at SDP



Procurement: Procurement is not undertaken at the DHO level in this facility. CHAZ procures on their behalf and delivers their ARVs to the Mpongwe Mission Hospital. As noted earlier, we only used the 5 percent proxy procurement charge for Crown Agents, Inc., procuring for CHAZ. The procurement costs do not include any management costs for CHAZ; therefore, the procurement share of delivered costs is lower at 48 percent and 56 percent for Mikata and St. Theresa's Mission Hospital, respectively.

Storage: The district does not have a storage facility for ARVs; they use the Mpongwe Mission Hospital's ARV storeroom; therefore, the hospital is costed here as part of the district level rather than as a SDP. When the costing team visited it during the pilot, this storage facility had recently been renovated. The ART sites in this district are low-volume rural sites (less than 50 patients a day); therefore, some of the storage costs in these facilities are particularly low. The smallest facility visited, at Mikata, stored all their ARVs on two shelves in a storage room, with each shelf measuring just 6 × 36 inches.

Transportation: The district has vehicles for distribution, but its resources are limited, so the ART facilities' personnel find their own way to the mission hospital; and if there is transport available, they are taken back to their facility. If the facility cannot transport them, they use whatever means are available.

The costing team visited one rural satellite site in this district, the Mikata Health Centre. This small facility sends an *aide* on a bicycle to pick up supplies from the mission hospital, a ride that takes approximately 45 minutes. During 2008, the transportation costs were about $36. For St. Theresa's, where ARVs must be picked up from the CHAZ facility in Lusaka 3–4 times a year, the transportation costs were about $154 per m^3 a year or a total of $839. These two instances where the Tier 1 or Tier 2 facility does not or is unable to perform the transportation function is approximately 38 and 45 percent for the total ARV supply chain costs at Mikata and St. Theresa's, respectively.

Ndola District:

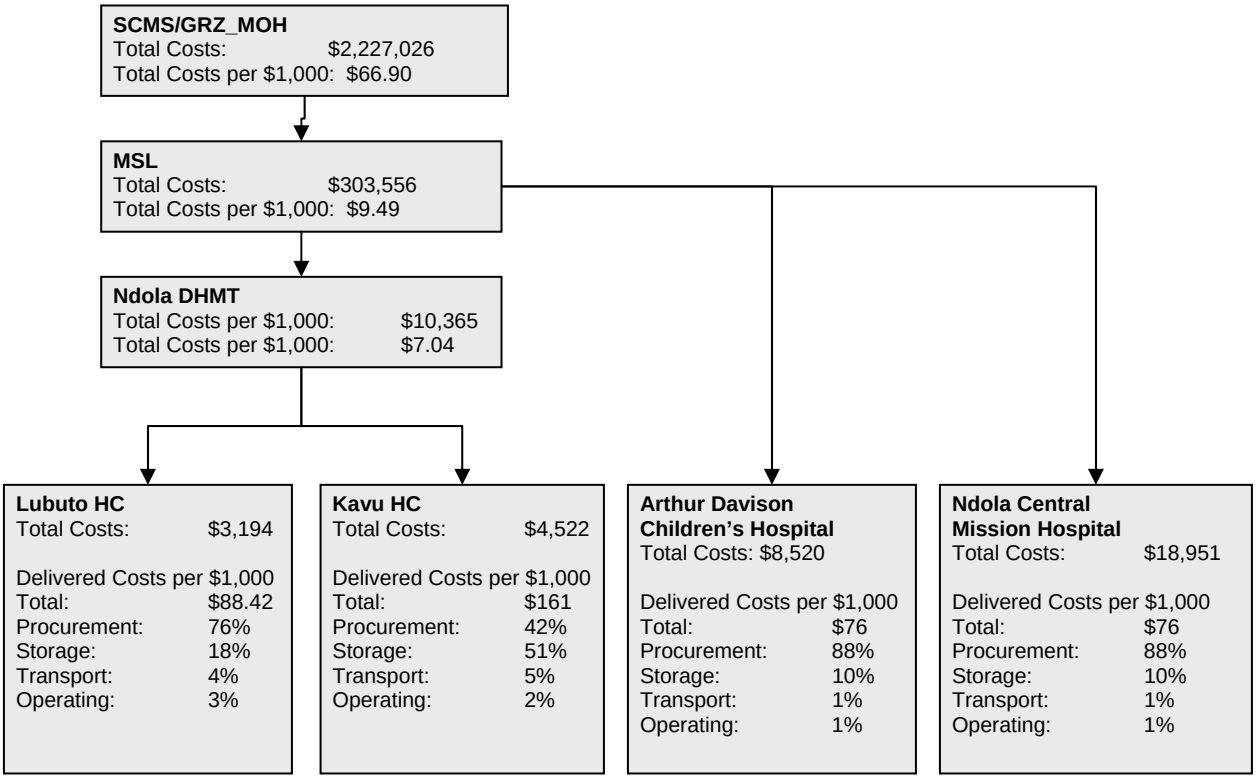
The Ndola district and all three Level 3 facilities receive their ARV supplies directly from MSL. The district has its own warehouse facilities on the grounds of the DHO, which then uses district vehicles to deliver to health centers. The ARVs stay in the district warehouse for only 2–3 days before being delivered to the SDPs. Level 3 facilities receive their ARVs directly from MSL. The Arthur Davison Children's Hospital and the Ndola Central Hospital, being Level 3 health facilities, receive their ARVs directly from MSL; they reported to the costing team that they do not have to make any trips to Lusaka to obtain ARVs.

Procurement: No procurement activities occur at either the Tier 2 or Tier 3 facilities in Ndola. However, for delivered costs, procurement accounts for approximately three-fourths of the costs (Kavu at 43 percent is the exception due to its relatively high storage costs.)

Storage: Ndola has SDPs or sites that represent both urban, high-volume facilities, such as the Ndola Central; a peri-urban high-volume facility, such as Lubuto; and a rural, low-volume facility, Kavu. Arthur Davison and Ndola Central are multi-story referral hospitals. Despite its size and being a tertiary referral institution, the Arthur Davison Children's Hospital runs a relatively small ART clinic with volumes much lower than some of the health centers in Lusaka Main. However, its storage costs are higher than those in Lusaka because of storage labor, which is discussed further under *General Observations*. The Ndola Central Hospital runs the largest ART clinic in the sample and, therefore, has substantial operating costs. Only 0.1 percent of the total operating costs were attributed to ARV for these large institutions because the storage space for ARVs is very small

compared to the size of the entire facility. Operating costs for Arthur Davison were also 0.1 percent of the facility's total operating costs. The relatively high storage costs at the Kavu facility were driven by labor because the ARVs in that facility were managed by two pharmacy technicians, at 41 percent level of effort each, as compared to Lubuto where ARVs are managed by a single dispenser (see Appendix 5). The storage costs are, therefore, not driven by the actual storage capacity because these were 6.05 m^2 at Arthur Davison and 21.22 m^2 at Ndola Central; but both cases still amounted to 10 percent of total delivered cost. Several facilities are in the process of or have already assigned designated storage rooms for ARV drugs. However, given the small costs associated with actual storage space, it is not anticipated that these costs will add substantially to the overall supply chain costs. See figure 8.

Figure 8. Ndola District, District Total Supply Chain Costs of Delivery at SDP (U.S.$)



Transportation: ARVs are delivered by MSL directly to Arthur Davison and Ndola Central; it is noted that transport accounts for a low percentage of the final delivered cost to these facilities. For the other four facilities that dispense ARVs in Ndola, the drugs are delivered by MSL to the Ndola DHO, which then delivers them directly to facilities within 1–2 days of arriving in the Ndola district warehouse. While the Lubuto facility did not report having to pick up their own ARVs during 2008, the Kavu facility did report having to regularly do so during 2008; its fuel costs were then reimbursed by the Ndola DHO.

Cross District Comparisons

Table 7 summarizes the delivered costs in each of the SDPs visited expressed as a percentage of the value of the commodities delivered. For the Lusaka Main district, these costs are between 9.4 percent and 9.9 percent, with the highest cost for the Bauleni rural health clinic (HC). The range is greater for the Ndola district—between 7.6 percent and 16.1 percent, with the highest cost reflecting

higher storage and distribution costs for Kavu HC, as mentioned earlier. For Mpongwe, the range is 10.4 percent–9.0 percent, although these include the 5 percent proxy procurement costs and no CHAZ operating costs (note that the CHAZ costs were not provided), so these costs would likely be higher.

Table 8. Cross-Facility Comparison as Percentage of Delivered Costs

Lusaka Main District	Delivered Supply Chain Costs as a % of Commodity Value	Mpongwe District	Delivered Supply Chain Costs as a % of Commodity Value	Ndola District	Delivered Supply Chain Costs as a % of Commodity Value
Bauleni Rural HC	9.9%	Mikata HC	10.7%	Kavu HC	16.1%
Kara Clinic	9.8%	St Theresa's Hospital	9.0%	Lubuto HC	8.8%
Chilenje	9.8%			Arthur Davison	7.6%
Mttendere HC	9.4%			Ndolsa Central Mission Hospital	7.6%

Limitations

The analysis has a number of limitations. The analysis does not represent a large enough sample to generalize the results for all 181 ART facilities. Therefore, it does not provide a costing estimate for the whole system but rather an incomplete costing of each of the systems that deliver ARVs to the three districts studied. Most of the country follows the system in use in the Ndola district where procurement is done by the GRZ, SCMS project, and CHAI, on behalf of the GRZ or another partner; the commodities are shipped to MSL, which then delivers to the DHO stores and hospitals. The SDPs are responsible for dispensing ARVs. The Ndola analysis provides some insight into how the rest of the country functions but, for several reasons, it cannot be said to be *representative* of all districts. Ndola is relatively close to MSL in Lusaka and the road networks to reach it are extremely good. This contrasts with many regions in Zambia, which are up to 18 hours from Lusaka and even longer in the rainy season when road conditions deteriorate. To reach facilities, some regions require boat trips. For these reasons, the logistics process may differ in other districts, with important costing consequences that would be missed if an attempt was made to generalize this analysis. Therefore, it is reasonable to expect that while transportation costs account for less than 5 percent of the delivered supply chain costs in Ndola, for example, the same indicator for other districts is going to be higher.

Although CHAZ procures only a small percentage of the total amount of ARVs used in the ART program, it would have been beneficial if we had been able to estimate the comparative metrics on cost per m^3 and cost per $1,000 of ARVs distributed through this supply chain to determine how the parallel systems perform cost-wise, as compared to the MSL-led system.

It must be noted that the sample facilities included in this pilot are not generalized for the rest of Zambia because the *rural* facilities were relatively easy to access compared to other rural ART sites in the country where the roads are inaccessible in the rainy season or sites that must regularly be accessed by boat.

System-wide Observations and Conclusions

Procurement Costs

Overall, in the costing sample by weighted average, procurement accounts for 76 percent of the total delivered costs per $1,000 of ARVs across the 11 SDPs. Procurement costs per $1,000 of ARVs procured were $63, $67, and $50 at GRZ, SCMS, and CHAZ, respectively. It should be noted that the CHAZ estimate incorporates only a 5 percent handling fee to Crown Agents, Inc., and no operating costs, unlike SCMS and GRZ. This mean that the costs estimated for CHAZ will likely be higher if the full costs were included in this assessment. These procurement costs are driven by the percentage handling fee charged; these fees do not represent identical services across the three procuring facilities. GRZ pays this fee in-country to get commodities from their point of delivery to MSL. The SCMS handling fee accounts for the cost of out-of-country operations by SCMS in the U.S., plus the in-country SCMS management team. As noted, CHAZ did not provide operating costs. Procurement costs represent the major part of the supply chain costs identified. Scope for possible savings in procurement costs should be examined but not at the expense of program management, forecasting, or quality control. USAID funding of procurement plays a critical role in ensuring product availability and HIV and AIDS commodity security.

Storage Costs

With the very low depreciation rates applied by the Zambian accounting system, storage costs are driven by the labor costs associated with the logistics management of ARVs. The labor costs associated with the management of the ARV supply chain represent more than 80 percent in all Tier 3 facilities (see annexes 4-6). The majority of the storage costs were between $3,000–$4,000 in facilities where a pharmacy technician handled the ARV logistics, regardless of the number of clients or volume of ARVs being stored; but the costs rose to $4,500–$11,141 when pharmacists manage the logistics. Consequently, much of the variation between storage costs in Level 3 and health center facilities is due to pharmacists versus pharmacy technicians rather than to the difference in the costs of the physical storage space at these facilities.

All the Ndola SDPs had labor costs that accounted for 97 percent or more of their storage costs. Ndola Central Hospital and Luboto had annual volumes of 27 m^3 and 20 m^3, respectively; but storage costs of $11,141 and $3,150, respectively. Ndola Central uses three pharmacists at varying levels of effort, while Lubuto uses one pharmacist technician. Similarly, Arthur Davison uses a pharmacist and a pharmacy technician for eight m^3 of ARVs, at a cost of $4,526; while three public facilities in Lusaka have an average volume of 10 m^3, with an average storage cost of $3,625 each, using a single pharmacy technician. It would be useful to examine whether the staff assigned to different facilities are performing other functions and whether the logistics management function can be performed effectively by lower-cost pharmacy technicians rather than the more expensive and scarcer pharmacists. Does the quality of record keeping or the level of product availability

improve with pharmacists rather than pharmacy technicians? Do the pharmacy technicians require a larger investment in staff training?

An additional observation on storage costs is that there are significant economies of scale in the logistic management function. For example, Mikata in Mpongwe is issued just 0.3 m^3 of ARVs a year, while the Mpongwe Mission Hospital is issued 4.3 m^3; but the Mikata ARV management requires 20 percent of one person's level of effort (LOE), while the mission hospital uses a single person at 40 percent. This means twice the LOE is used at Mpongwe for more than ten times the volume of product. This observation may be due to the fact that the ARV logistics system is parallel to the essential medicines logistics management and requires its own training and stocktaking activities, which usually results in each facility having a dedicated member of staff, regardless of the volume of ARVs being managed. Therefore there may be a trade off between cost efficiency and performance that needs to be considered if changes were to be made to the system.

An additional cost incurred by SCMS in Tier 1 is the cost for training all the staff who work in the ARV supply chain in Zambia. This cost was $190,915 in 2008. Of this, $177,248 was the cost of running the nine training workshops during 2008 (including training materials and per diem). During the course of the costing data collection, it was noted in several facilities that staff turnover was a significant problem. Civil service staff can be transferred between facilities and may not necessarily be transferred to ARV logistics duties at their next posting. Therefore, the cost of training must be considered as an on-going cost to the ARV supply chain, rather than merely a *start-up* cost.

Ndola has SDPs or sites that represent both urban high-volume facilities, such as the Ndola Central; a peri-urban high-volume facility, such as Lubuto; and a rural low-volume facility, Kavu. The storage costs are clearly not driven by the actual storage capacity because these were 6.05 m^2 at Arthur Davison, 21.22 m^2 at Ndola Central, 9.80 m^2 at the Lubuto facility, and 6.00 m^2 at Kavu; but Arthur Davison had higher storage costs than Kavu and Lubuto.

Few of the health facilities visited in this study had computers available to assist in their logistics management, but Ndola Central Hospital, Arthur Davison Children's Hospital, Lubuto Health Center, and Kavu Health Center had received computers and air-conditioners to support their storage cooling. The total value of these donations was about $5,000.

Transportation Costs

Of the facilities with transportation costs at Tier 1 and Tier 2, MSL transports the largest volume of ARVs, 1,110 m^3 at a cost of $25 per m^3, CIDRZ transports 441 m^3 at a cost of $86 per m^3, and Ndola DHO transports 45 m^3 at $78 per m^3. Recall that CIDRZ transportation is dedicated to ARVs, whereas MSL's transportation operations are integrated with other commodities. It is also important to note that the CIDRZ delivery occurs only within Lusaka Main—approximately a 10 km radius; whereas, the MSL's two distribution routes that deliver to Ndola cover 750 km each way. For delivered costs, 17 percent of the total delivered cost for Lusaka Main was for transportation compared to 5 percent or less in Ndola, (results for Mpongwe are only for a single, very small rural facility). These findings suggest that integrated delivery can be cost efficient. In addition, this analysis highlights the importance of differentiating between a literal transportation cost that counts fuel by distance measures versus using an aggregated cost of the total transportation function—in this case carried out by MSL—and then proportion costs by volume. It was considered appropriate for this analysis to proportion costs by volume to get the *true* cost, because MSL implements an integrated transportation system. Transportation costs estimated in terms of fuel by distance would have given substantially higher costs being ascribed to MSL for supplying Ndola, compared to Lusaka Main

costs, because of the distances involved. In fact, MSL costs should be lower given their economies of scale. Also, a literal estimate would not account for *non-divisables,* such as driver's time, which would be costed according to days traveled; where, in reality, drivers must be paid monthly salaries, regardless of the distances they drive.

While all the Lusaka Main facilities reported that they did not need to pick up their ARVs at any time in 2008, this was not the case in Mpongwe and Ndola. Where facilities have to make some trips to pick up their supplies, the costs are much higher than they would have been if MSL or CIDRZ had delivered them (estimating costs for CHAZ was difficult because of the limited data). For example, St. Theresa's transportation costs are estimated at \$154 per m^3 (issued 0.33 m^3 in 2008) and Kavu's are \$154 per m^3 (issued 5 m^3 in 2008). Kavu spends substantially more to pick up ARVs (\$154 per m^3) from Ndola than the Ndola DHO spends to deliver ARVs to facilities (\$78 per m^3) (see Appendix 5 for details). No facilities that had to pick up their ARVs complained that it was inconvenient, but this is likely to be a sample bias as the costing team visited facilities that were easily accessible. Had the team visited less accessible facilities, it is likely that the costs and inconvenience of ARVs not being consistently delivered would be much greater. It is important to consider the cost of facilities picking up their own ARVs across the system in aggregate could be substantial, particularly for the less accessible sites where the choice could be between expensive transportation costs or stockouts, which have a detrimental impact on ART patients. These results suggest that increased support at the DHO level to both ensure delivery of ARVs and lower transportation costs for the system.

Conclusions

This costing exercise was conducted to assess the supply chain costs of operating Zambia's ART program. Comparisons of costs have been made between the different models of supply, between high- and low-volume facilities and between rural and urban facilities. In summary, due to economies of scale, the MSL-DHO model, which covers most of Zambia geographically, and the MSL-Ngansa/CIDRZ model, which covers accounts for half of all the ARVs issued, have similar costs. The study was unable to make firm conclusions about the third model—the supply chain run by CHAZ—but the analysis provides no evidence that this supply chain, given its size, must be costlier than the other two models. Similarly, it was found that high-volume facilities tend to have lower delivered costs than low-volume facilities, but this finding may be subject to some selection bias because the high-volume facilities in the sample were usually found in Lusaka and, therefore, had much shorter transportation distances to cover. Notwithstanding, the higher frequency of deliveries to the Lusaka facilities, the total distances covered are significantly shorter than those required to deliver ARVs to the facilities in Mpongwe and Ndola. In addition, because urban facilities tend to dispense to larger numbers of patients per day than rural facilities, costs tended to be lower. It is important to note that, at least for the two large urban facilities included in this sample, some of these cost differences are due to the labor costs of the more skilled staff that tend to manage the ARVs in these facilities. This costing did not combine costs with effectiveness measures, such as those obtained in a LIAT study of a supply chain system. Therefore, it cannot be determine whether the differences in costs will lead to differences in effectiveness of the supply chain, such as whether higher labors costs for more skilled ARV managers results in fewer stockouts; such an analysis could be beneficial to logistics managers. In future studies using the supply chain costing tool, this limitation will be addressed.

In the private sector, logistics costs tend to be presented in terms of the cost of getting a commodity where it needs to be as a percentage of the value of the good. There has been some discussion that because ARVs are costly, relative to many other commodities in the health sector, the fee for their handling/logistics should be lower because the fee is based on the value of the goods. This report finds that for the two provinces with complete data, the cost of delivering the good ranges between 8–16 percent of the value of the commodities, and that procurement accounts for the largest portion of these costs.

This has implications when setting handling fees and pricing policies in countries with several supply chain options. It also suggests that where logistics/handling fees are charged based on the value of the goods, costing studies are required to ensure that the fee is appropriately set and to ensure that adequate resources can be provided to execute the supply chain strategy successfully.

Appendices

Appendix 1: ARV Average Prices for Commodities Procured in 2008 (PipeLine 4.0 Zambia, MSL)
Appendix 2: Sample Facilities by Criteria
Appendix 3: Tier 1 Sample Facilities, Supply Chain Costs (U.S.$)
Appendix 4: Lusaka Main District, Supply Chain Costs (U.S.$)
Appendix 5: Mpongwe District, Supply Chain Costs (U.S.$)
Appendix 6: Ndola District, Supply Chain Costs (U.S.$)
Appendix 7: Estimating Total Delivered Costs for Ndola District
Appendix 8: Estimating Total Delivered Costs for Lusaka Main District
Appendix 9: Estimating Total Delivered Costs for Mpongwe District
Appendix 10: Estimating Sample Weighted Average Total Delivered Costs
Appendix 11: List of Data Inputs Required for Estimating the Cost of a Supply Chain
Appendix 12: Contact List

Appendix 1

ARV Average Prices for Commodities Procured in 2008 (PipeLine 4.0 Zambia, MSL)

Name	Procurement size (total for 2008) in units	Procurement Price (for each procurement	Unit Price (average unit price across all procurements in 2008)
Abacavir 10mg/ml 240ml	-	$ -	n/a
Abacavir 20mg/ml 240ml	6,062	$ 104,330	$ 17.21
Abacavir 300mg 60 Tabs	8,254	$ 227,150	$ 27.52
Didanosine 25mg Tabs[1]	-	$ -	n/a
Didanosine 50mg 60 Tabs[1]	-	$ -	n/a
Didanosine 100mg 60 Tabs	10,808	$ 83,582	$ 7.73
Efavirenz 200mg 90 Caps	8,602	$ 134,302	$ 15.61
Efavirenz 50mg 30 Caps	18,296	$ 48,798	$ 2.67
Efavirenz 600mg 30 Tabs	1,014,816	$ 12,574,111	$ 12.39
Lamivudine 10mg/ml 100ml[2]	94,565	$ 211,193	$ 2.23
Lamivudine 10mg/ml 240ml	94,565	$ 211,193	$ 2.23
Lamivudine 150mg/ml 60 Tabs	34,000	$ 209,924	$ 6.17
Lamivudine/Stavudine 150/30mg 60 Tabs	355,000	$ 2,554,800	$ 7.20
Lamivudine/Stavudine 150/30mg 30 Tabs[3]	355,000	$ 1,277,400	$ 3.60
Lamivudine/Stavudine 40/150mg 60 Tabs[3]	355,000	$ 2,554,800	$ 7.20
Lamivudine/Stavudine/Nevirapine 150/30/200mg 60 Tabs	481,011	$ 3,364,680	$ 7.00
Lamivudine/Stavudine/Nevirapine 150/40/200mg 60 Tabs	22,289	$ 167,168	$ 7.50
Lamivudine/Stavudine/Nevirapine 30/6/5mg 60 Tabs	11,919	$ 29,320	$ 2.46

Name	Procurement size (total for 2008) in units	Procurement Price (for each procurement	Unit Price (average unit price across all procurements in 2008)
Lamivudine/Stavudine/Nevirapine 60/12/200mg 60 Tabs	17,868	$ 88,267	$ 4.94
Lamivudine/Zidovudine 150/300mg 60 Tabs	466,746	$ 4,517,090	$ 9.68
Lopinavir/Ritonavir 80/20mg/ml 300ml	2,636	$ 108,340	$ 41.10
Lopinavir/Ritonavir 200/50mg 120 Tabs	27,828	$ 1,546,832	$ 55.59
Nevirapine 10mg/ml 100ml[4]	77,574	$ 192,493	$ 2.48
Nevirapine 10mg/ml 240ml	77,574	$ 192,493	$ 2.48
Nevirapine 10mg/ml 25ml[4]	77,574	$ 192,493	$ 2.48
Nevirapine 200mg 60 Tabs	725,582	$ 2,698,518	$ 3.72
Stavudine 15mg 60 Caps	23,184	$ 39,040	$ 1.68
Stavudine 1mg/ml 200ml	50,000	$ 79,600	$ 1.59
Stavudine 20mg 60 Caps	21,384	$ 41,162	$ 1.92
Stavudine 30mg Caps[5]	21,384	$ 41,162	$ 1.92
Stavudine 40mg Caps[5]	21,384	$ 41,162	$ 1.92
Tenofovir/Emtricitabine 300/200mg 30 Tabs	787,250	$ 17,450,084	$ 22.17
Zidovudine 10mg/ml 100 ml[6]	54,200	$ 81,450	$ 1.50
Zidovudine 10mg/ml 240 ml	54,200	$ 81,450	$ 1.50
Zidovudine 100mg 100 Caps	17,356	$ 110,817	$ 6.38
Zidovudine 300mg 60 Tabs	11,700	$ 84,240	$ 7.20
Tenofovir 300mg Tabs[7]	787,250	$ 17,450,084	$ 22.17
Indinavir 400mg Tabs[8]	27,828	$ 1,546,832	$ 55.59

[1]Not procured during 2008 and none distributed to facilities during 2008.

[2]*Lamivudine 10mg/ml 100ml* not procured during 2008 but some quantity was distributed to facilities, therefore prices take to be the same as the 240ml presentation.

[3]*Lamivudine/Stavudine 150/30mg 30 Tabs*[3] not procured during 2008 but some quantity was distributed to facilities, therefore prices take to be the same or directly proportional to the Lamivudine/Stavudine 150/30mg 60 Tabs presentation.

[4]*Nevirapine 10mg/ml 100ml* not procured during 2008 but some quantity was distributed to facilities, therefore prices take to be the same as the 240ml presentation.

[5]*Stavudine 30mg Cap* not procured during 2008 but some quantity was distributed to facilities, therefore prices take to be the same as the 20mg presentation.

[6]*Zidovudine 10mg/ml 100 ml* not procured during 2008 but some quantity was distributed to facilities, therefore prices take to be the same as the 240ml presentation.

[7]*Tenofovir 300mg Tab procured by* CHAZ during 2008 and some quantity was distributed to facilities. Price taken to be the same as the Tenofovir/Emtricitabine 300/200mg 30 Tabs presentation.

8 *Indinavir 400mg Tabs* not procured during 2008 but some quantity was distributed to facilities, therefore prices take to be the same as Lopinavir/Ritonavir 200/50mg since Ritonovir, also a Protease Inhibitor, not available in Zambia's ARV system in a 'non-combination' form.

Appendix 2

Sample Facilities by Criteria

Facility Name	Supply Chain Flow	Volume	Rural/ Urban
Drug Procurement Office, Ministry of Health	MSL – DHO, MSL – Ngansa/CIDRZ	Both	Both
Medical Stores Limited	MSL – DHO, MSL – Ngansa/CIDRZ	Both	Both
SCMS/ USAID | DELIVER PROJECT	MSL – DHO, MSL – Ngansa/CIDRZ	Both	Both
CHAZ, Church Health Association Zambia	CHAZ	Both	Both
Ngansa Pharmaceuticals, Ltd	MSL – DHO, MSL – Ngansa/CIDRZ	Both	Both
(CIDRZ) Center for Infectious Disease Research in Zambia	MSL – DHO, MSL – Ngansa/CIDRZ	Both	Both
Lusaka Main, DHMT	MSL – DHO, MSL – Ngansa/CIDRZ	High	Urban
Kara Clinic, Lusaka	MSL – DHO, MSL – Ngansa/CIDRZ	High	Urban
Mtendere Health Centre, Lusaka Main	MSL – DHO, MSL – Ngansa/CIDRZ	High	Urban
Chilenje, Lusaka Main	MSL – DHO, MSL – Ngansa/CIDRZ	High	Urban
Bauleni Health Centre, Lusaka Main	MSL – DHO, MSL – Ngansa/CIDRZ	High	Urban
Mpongwe, DHMT	CHAZ	High	Rural
Mpongwe Mission Hospital	CHAZ	High	Rural
Mikata Health Centre, Mpongwe	CHAZ	Low	Rural
St. Theresa's Hospital, Mpongwe	CHAZ	High	Rural
Ndola, DHMT	MSL – DHO	High	Urban
Arthur Davison Children's Hospital, Ndola	MSL –Hospital	High	Urban
Ndola Central Hospital, Ndola	MSL – Hospital	High	Urban
Lubotu Health Centre, Ndola	MSL – DHO – Health Center	Low	Rural
Kavu Rural Health Centre, Ndola	MSL – DHO (Health Center picks up)	Low	Rural

Appendix 3

Tier 1 Sample Facilities (US$)

	Procurement and Supply Unit, Ministry of Health	Medical Stores Limited	CHAZ, Churches Health Association Zambia	SCMS/DELIVER PROJECT
Total value of commodities passing through	$3,531,8848	$31,983,921	$2,083,755	$29,758,677
Total volume of commodities passing through (m^3)	243	1,110	74	804
Procurement Costs	173,955	N/A	104,188	2,003,071
Storage Costs	N/A	250,732	35,394	N/A
Transport Costs	N/A	27,783	83,130[1]	N/A
Operating Costs	50,000	25,041	N/D	0
Total Costs	223,955	303,556	222,712	2,003,071
Cost per $ of annual pass through	63.41	9.49	106.88	67.31
Cost per m^3 of annual pass through	923	273	3,002	2,492
Procurement Cost per $1000 of ARVs	49.25	0	N/D	67.31
Storage Cost per m^3 of annual pass through	N/A	226	477	N/A
Storage Labor Cost	N/A	89,810	26,545	N/A
% Labor/Total Storage Costs	N/A	36%	75%	N/A
Cost per m^3 transported	N/A	25	1,120	N/A

Notes:
Function costs do not include operating costs
N/A: Not Applicable if facility does not perform that function
N/D: No data or incomplete data available to costing team
[1]CHAZ were only able to provide limited data on transport costs but nothing on procurement or storage other than the size of their storage facility.

Appendix 4
Lusaka Main District, Supply Chain Costs (US$)

	(CIDRZ) Center for Infectious Disease Research in Zambia	Ngansa Pharm. Ltd	Lusaka Main, DHMT	Kara Clinic, Lusaka	Mtendere Health Centre, Lusaka Main	Chilenje, Lusaka Main	Bauleni Health Centre, Lusaka Main
Total value of commodities passing through	$13,029,840	$13,029,840	$13,029,840	$498,588	$450,677	$268,909	$214,773
Total volume of commodities passing through (m^3)	441	441	441	14	14	7	8
Procurement Costs	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Storage Costs	See Ngansa	38,577	8,646	6,316	4,124	3,608	3,143
Transport Costs	37,833	See CIDRZ	0	0	0	0	0
Operating Costs	0	13,700	0	889	467	248	67
Total Costs	37,833	52,257	8,646	7,205	4,591	3,857	3,210
Number of patient ARV prescriptions filled a day	N/A	N/A	N/A	1700[3]	80-150	80-150	45
Procurement Cost per $1000 of ARVs	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Storage Cost per m^3 of annual pass through	See Ngansa	87	20	439	299	502	402
Storage Labor Cost	See Ngansa	34,332	8,646	6,080	3,776	3,558	3,049
% Labor/Total Storage Costs	See Ngansa	89%	100%	96%	92%	99%	97%
Cost per m^3 transported	86	0	0	0	0	0	0

Notes:
Function costs do not include operating costs
N/A: Not Applicable if facility does not perform that function
N/D: No data or incomplete data available to costing team
[1]Lusaka Main DHO has no storage facilities for ARVs but has staff that perform monitoring activities and support health facilities with ordering activities
[2]CIDRZ, a large organization that provides a very wide range of support to the ARV program, performs the transportation function, getting ARVs from Ngansa to the Lusaka Main health facilities, all CIDRZ costs captured under transport and their operating costs are assumed to be minimal.

[3] Number of registered patients on ART

Appendix 5

Mpongwe District, Supply Chain Costs (US$)

	Mpongwe, DHMT	Mpongwe Mission Hospital	Mikata Health Centre	St. Theresa's Hospital, Mpongwe
Total value of commodities passing through	$334,786	$107,738	$6,246	$209,237
Total volume of commodities passing through (m^3)	11	4	0.39	8
Procurement Costs	0	0	0	0
Storage Costs	N/A	2,631	976	1,114
Transport Costs	0	94[3]	36	839
Operating Costs	0	272	44	646
Total Costs	0	2,998	1,056	2,599
Number of patient ARV prescriptions filled a day	-	25-40	3-5	70-80
Procurement Cost per $1000 of ARVs	0	0	0	0
Storage Cost per m^3 of annual pass through	N/A	604	2,530	204
Storage Labor Cost	0	2,033	973	980
% Labor/Total Storage Costs	N/A	77%	100%	88%
Cost per m^3 transported	0	22	92	154

Notes:

Function costs do not include operating costs

N/A: Not Applicable if facility does not perform that function

N/D: No data or incomplete data available to costing team

[1]Mpongwe DHO does not have storage facilities for ARVs. The ARVs are delivered directly to the Mpongwe Mission hospital where a pharmaceutical technician manages them.

[2]The Mpongwe DHO Officer provided costs for the transportation activities performed by the DHO. However there was no distribution schedule available. At the Mpongwe Mission Hospital, the costing team was informed that health facilities pick up their supplies from the hospital (hence the costs observed at Mikata) and if there is a vehicle available, they may be taken back to their facility by a DHO vehicle. The costing team is there unable to determine costs since this activity is random and unrecorded.

[3]These costs are related to the faxing of supply vouchers to the LMU of SCMS monthly.

Appendix 6
Ndola District, Supply Chain Costing Statistics

	Ndola, DHMT	Arthur Davison Children's Hospital, Ndola	Ndola Central Hospital, Ndola	Lubuto Health Centre, Ndola	Kavu Rural Health Centre, Ndola
Total value of commodities passing through	$1,472,899	$151,222	$943,578	$639,993	$58,184
Total volume of commodities passing through (m^3)	45	8	27	20	2
Procurement Costs	N/A	N/A	N/A	N/A	N/A
Storage Costs	4,176	4,526	11,141	3,150	4,164
Transport Costs	3,521	N/A	N/A	0	315
Operating Costs	2,668	3,994	7,810	44	46
Total Costs	10,365	8,520	18,951	3,194	4,522
Cost per $ of annual pass through	0.70	5.57	1.97	0.47	7.77
Cost per m^3 of annual pass through	228	1,000	696	153	2,207
Number of patient ARV prescriptions filled a day	N/A	40-50	150-200	80-90	30-35
Procurement Cost per $1000 of ARVs	0.00	0.00	0.00	0.00	0.00
Storage Cost per m^3 of annual pass through	92	537	416	158	2,032
Storage Labor Cost	4.071	4,367	10,585	2,893	4,158
% Labor/Total Storage Costs	97%	96%	95%	92%	100%
Cost per m^3 transported	78	0	0	0	154

Notes:
N/A: Not Applicable if facility does not perform that function

N/D: No data or incomplete data available to costing team

Appendix 7

Estimating Total Delivered Costs – Ndola District

	Procurement Unit		SCMS		Total	
		per $1000		per $1000		per $1000
Value of Commodity	$ 3,531,884		$ 29,758,677		$ 33,290,561	
Volume of Commodity	243		804		1047	
Procurement costs	$ 173,955	$ 49.25	$ 2,003,071.49	$ 67.31	$ 2,177,026	$ 65.39
Operating Costs	$ 50,000	$ 14.16	$	$	$	$ 1.50
Total	**$ 223,955**	**$ 63.41**	**$ 2,003,071**	**$ 67.31**	**$ 2,227,026**	**$ 66.90**

Tier 1	**MSL**	
Value of Commodity	$ 31,983,921	
Volume of Commodity	1110	
Logistics Costs		per $1000
Storage	$ 250,732	$ 7.84
Inventory	$ -	$ -
Transport	$ 27,783	$ 0.87
Operating	$ 25,041	$ 0.78
Total	**$ 303,556**	**$ 9.49**

Tier 2	**Ndola DHMT**	
Value of Commodity	$ 1,472,899	
Volume of Commodity	45.17	
Logistics Costs		per $1000
Storage	$ 4,176	$ 2.84
Inventory	$ -	$ -
Transport	$ 3,521	$ 2.39
Operating	$ 2,668	$ 1.81
Total	**$ 10,365**	**$ 7.04**

Tier 3	**Lubuto HC**		**Kavu Rural HC**		**Ndola Central Hospital**		**Arthur Davison**	
Value of Commodity	$ 639,993		$ 58,184		$943,578		$151,222	
Volume of Commodity	20		2		27		8	
Logistics Costs		per $1000		per $1000		per $1000		per $1000
Storage	$ 3,150	$ 4.92	$ 4,161	$ 71.51	$ 11,141	$ 0.01	$ 4,526	$ 0.03
Inventory	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Transport	$ -	$ -	$ 315	$ 5.41	$ -	$ -	$ -	$ -
Operating	$ 44	$ 0.07	$ 46	$ 0.79	$ 7,810	$ 0.01	$ 3,994	$ 0.03
Total	**$ 3,194**	**$ 4.99**	**$ 4,522**	**$ 77.72**	**$ 18,951.00**	**$ 0.02**	**$ 8,520**	**$ 0.06**

SDP	**Lubuto HC**		**Kavu Rural HC**		**Ndola Central Hospital**		**Arthur Davison**	
Delivered Cost by Function		per $1000		per $1000		per $1000		per $1000
Procurement Costs	76%	$ 66.90	42%	$ 66.90	88%	$ 66.90	88%	$ 66.90
Logistics Costs								
Storage	18%	$ 15.60	51%	$ 82.19	10%	$ 7.85	10%	$ 7.87
Inventory	0%	$ -	0%	$ -	0%	$ -	0%	$ -
Transport	4%	$ 3.26	5%	$ 8.67	1%	$ 0.87	1%	$ 0.87
Operating	3%	$ 2.66	2%	$ 3.38	1%	$ 0.79	1%	$ 0.81
Total	**100%**	**$ 88.42**	**100%**	**$ 161.14**	**100%**	**$ 76.41**	**100%**	**$ 76.44**
	% Value	**8.8%**	**% Value**	**16.1%**	**% Value**	**7.6%**	**% Value**	**7.6%**

Appendix 8
Estimating Total Delivered Costs – Lusaka Main District

	Procurement Unit		SCMS		Total	
		per $1000		per $1000		per $1000
Value of Commodity	$ 3,531,884		$ 29,758,677		$ 33,290,561	
Volume of Commodity	243		804		1047	
Procurement costs	$ 173,955	$ 49.25	$ 2,003,071.49	$ 67.31	$ 2,177,026	$ 65.39
Operating Costs	$ 50,000	$ 14.16	$	$ 4.41	$ 50,000	$ 1.50
Total	**$ 223,955**	**$ 63.41**	**$ 2,003,071**	**$ 71.72**	**$ 2,227,026**	**$ 66.90**

Tier 1	**MSL**	
Value of Commodity	$ 31,983,921	
Volume of Commodity	1110	
Logistics Costs		per $1000
Storage	$ 250,732	$ 7.84
Inventory	$ -	$ -
Transport	$ 27,783	$ 0.87
Operating	$ 25,041	$ 0.78
Total	**$ 303,556**	**$ 9.49**

Tier 2	**Lusaka Main/Ngansa/CIDRZ**	
Value of Commodity	$ 13,029,840	
Volume of Commodity	441	
Logistics Costs		per $1000
Storage	$ 52,257	$ 4.01
Inventory	$ -	$ -
Transport	$ 37,833	$ 2.90
Operating	$ 13,700	$ 1.05
Total	**$ 103,790**	$ 7.97

Tier 3	**Kara Clinic**		**Chilenje Rural HC**		**Mtendere Clinic**		**Bauleni Rural HC**	
Value of Commodity	$ 498,588		$ 268,909		$ 450,677		$ 214,773	
Volume of Commodity	14		7		14		7	
Logistics Costs		per $1000		per $1000		per $1000		per $1000
Storage	$ 6,316	$ 12.67	$ 3,608	$ 13.42	$ 4,124	$ 9.15	$ 3,143	$ 11.69
Inventory	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Transport	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Operating	$ 889	$ 1.78	$ 248	$ 0.92	$ 467	$ 1.04	$ 67	$ 0.25
Total	**$ 7,205**	**$ 14.45**	**$ 3,856**	**$ 14.34**	**$ 4,591**	**$ 10.19**	**$ 3,210**	**$ 11.94**

SDP	**Kara Clinic**		**Chilenje Rural HC**		**Mtendere Clinic**		**Bauleni Rural HC**	
Delivered Cost by Function		per $1000		per $1000		per $1000		per $1000
Procurement Costs	68%	$ 66.90	68%	$ 66.90	71%	$ 66.90	68%	$ 66.90
Logistics Costs								
Storage	25%	$ 24.13	25%	$ 24.88	22%	$ 20.61	26%	$ 26.10
Inventory	0%	$ -	0%	$ -	0%	$ -	0%	$ -
Transport	4%	$ 3.77	4%	$ 3.77	4%	$ 3.77	4%	$ 3.77
Operating	4%	$ 3.62	3%	$ 2.76	3%	$ 2.87	2%	$ 2.15
Total	**100%**	**$ 98.42**	**100%**	**$ 98.30**	**100%**	**$ 94.15**	**100%**	**$ 98.91**
	% Value	**9.8%**	**% Value**	**9.8%**	**% Value**	**9.4**	**% Value**	**9.9%**

Appendix 9
Estimating Total Delivered Costs – Mpongwe Main District

	CHAZ	
		per $1000
Value of Commodity	$ 2,083,755	
Volume of Commodity	74	
Procurement costs	$ 104,188	$ 50
Operating Costs	$ -	
Total	$ 104,188	$ 50

Tier 1	**CHAZ**	
Value of Commodity	$ 2,083,755	
Volume of Commodity		
Logistics Costs		
Storage	$ 35,394	$ 17
Inventory	$ -	0
Transport	$ 83,130	$ 40
Operating	$ -	0
Total	$ 118,524	$ 57

Tier 2	**Mpongwe DHMT/Mpongwe Mission Hospital**	
Value of Commodity	$ 334,786	
Volume of Commodity	11	
Logistics Costs		per $1000
Storage	$ 2,631	$ 0.01
Inventory	$ -	$ -
Transport	$ 94	$ 0.00
Operating	$ 272	$ 0.00
Total	$ 2,997	$ 0.01

Tier 3	**St Theresa's**		**Mikata Health Centre**	
Value of Commodity	209,237		$ 6,246	
Volume of Commodity	5		0.39	
Logistics Costs		per $1000		per $1000
Storage	$ 1,114	$ 0.01	$ 976	$ 0.16
Inventory	$ -	$ -	$ -	$ -
Transport	$ 839	$ 0.00	$ 36	$ 0.01
Operating	$ 646	$ 0.00	$ 44	$ 0.01
Total	$ 2,599	$ 0.01	1056	$ 0.17

SDP	**St Theresa's**		**Mikata Health Centre**	
Delivered Cost by Function		per $1000		per $1000
Procurement Costs	56%	$ 50.00	47%	$ 50.00
Logistics Costs				
Storage	0.01%	$ 0.0053	16%	$ 17.15
Inventory	0.00%	$ -	0%	$ -
Transport	44.38%	$ 39.8983	37%	$ 39.90
Operating	0.00%	$ 0.0031	0%	$ 0.01
Total	100%	$ 89.91	100%	$ 107.06
	% Value	9.0%	% Value	10.7%

Appendix 10

Estimating Total Delivered Costs – Weighted Average Calculations

	Lubuto HC	Kavu Rural HC	Ndola Central Hospital	Arthur Davison		
Sample weighted average (SWA) by value	19%	2%	27%	4%		
SWA for % procurement costs	14%	1%	24%	4%		
SWA for %storage costs	3%	1%	3%	0%		
SWA for % transport costs	1%	0%	0%	0%		
SWA for % operation costs						
SWA for Total Delivered Cost as a % of Total Delivered Value of Commodities	1.64%	0.27%	2.09%	0.34%		
(cont)	Kara Clinic	Chilenje Rural HC	Mtendere Clinic	Bauleni Rural HC	Mikata HC	AVERAGE/ (TOTAL)
SWA by value	14%	8%	13%	6%	0%	(100%)
SWA for % procurement costs	10%	5%	9%	4%	0%	75%
SWA for %storage costs	3%	2%	3%	2%	0%	17%
SWA for transport costs	1%	0%	1%	0%	0%	6%
SWA for % operation costs						2%
SWA for Total Delivered Cost as a % of Total Delivered Value of Commodities	1.43%	0.77%	1.23%	0.62%	0.02%	8.96%

Note: CHAZ facilities not included due to the lack of available data on procurement costs.

Appendix 11

USAID | DELIVER PROJECT Supply Chain Costing Tool Pilot

List of Data inputs required for estimating the Cost of a Supply Chain

TC: Total Cost	All costs assumed to be annual		
SC: Supply Chain			
Information Systems	At present it is assumed that these costs will fall under labor costs under the procurement function rather than as a separate category. This assumption may be re-assessed after the pilot exercise so placeholders are included at the end of the table.		
Quality Assurance	At present it is assumed that these costs will fall under labor/supervisory costs under each of the procurement, storage and transport categories rather than as a separate category. This assumption may be re-assessed after the pilot exercise so placeholders are included at the end of the table.		
LOE: Level of effort (as %) spent on HIV SC-related activities			

Output Metric	Notes	User Input Metrics
Total Cost of Supply Chain		TC Procurement +TC Storage +TC Transportation
		(See above regarding information systems and quality assurance)
	This is how the costs will be aggregated to obtain the total cost of procurement/storage/transportation at each tier of the system:	Labor costs+ Non labor-operating costs + Capital costs + Other
TC Procurement		
Labor cost	Labor costs should be obtained from a standard civil service salary scale. This way only the grade and LOE needs to be collected from each facility rather than having to include questions on salary.	Personnel Types
		Personnel Salary
		Personnel Level of Effort spent on SC-related procurement activities (%)
		Personnel Benefits
		Annual training expenditures related to SC procurement activities
Non-labor operating cost	It is anticipated that these expenditures are available at the facility level. E.g. Average or annual expenditure on telephone calls. Cost of space may be a capital cost if the value of the space is to be captured using the value of equivalent land/building rather than an equivalent rent.	Telephones
		Postage
		Courier
		Printing
		Security
		Supplies
		Utilities
		Cost/rent equivalent per sq. feet per annum * Area in sq feet allocated to procurement offices
Commodity Value	If complete commodity data are available from the MSL/PSU then it may not be necessary to collect them at the facility level unless there is reason to believe that the figures differ and there are costs associated e.g. wastage, damage, loss etc.	Commodity Name
		Commodity Quantity Procured
		Unit price at which commodity X is procured
Custom Fees		Commodity Prices
		Custom rates (It may be that a single rate is used for all commodities and so this would simplify to a single percentage.)
Taxes		Commodity Prices

Output Metric	Notes	User Input Metrics
Insurance		If applicable
		Tax rate if applicable.
Freight Fees		Freight Rates if applicable
		Commodity Prices
		Freight rate, specifically the rate charged for commodities up to the point of entry into the country only. Rates may be based on price or volume.
TC Storage		
Labor	Labor costs should be obtained from a standard civil service salary scale. This way only the grade and LOE needs to be collected from each facility rather than having to include questions on salary.	Personnel Types
		Personnel Salary
		Personnel LOE spent on SC-related storage activities (%)
		Personnel Benefits
		Annual training expenditures
Non-labor operating cost	It is anticipated that these expenditures are available at the facility level. E.g. Average or annual expenditure on telephone calls. These non-costs do not include any capital costs which are captured in other sections.	Telephones
		Postage
		Courier
		Printing
		Security
		Supplies
		Utilities
		Fuel
		Cost/rent equivalent per sq. feet per annum * Area in sq feet allocated to office space for storage-related personnel
		Other expenses
Handling	This equipment will count as capital costs. For each of these items the quantity, age and cost of the equipment will be collected and the depreciation calculated.	Forklifts
		Hand pallet trucks
		Carts
		Wheelbarrows
		2-wheeler
		Other

Output Metric	Notes	User Input Metrics
		Shelves/Racks
		Refrigerators
		Cold room
		Safe/vaults
		Other
		Supplies
Space		Square meterage of storage space
		Length (meters)
		Breadth (paces/meters/feet)
		Value per square meter; if no rent or payments currently made on the space, then use rent of equivalent space in equivalent location
		Percentage of space used for SC storage purposes and that is paid for out of the SC budget
TC Transportation		
	Note: Specific maintenance costs to be estimated under operating costs and labor costs i.e. costs will be counted under rent and mechanic salaries and so on therefore there is no row for maintenance.	
Labor	Labor costs should be obtained from a standard civil service salary scale. This way only the grade and LOE needs to be collected from each facility rather than having to include questions on salary.	Personnel Types
		Personnel Salary
		Personnel LOE
		Personnel Benefits
		Annual training
Non-labor operating cost	It is anticipated that these expenditures are available at the facility level. E.g. Average or annual expenditure on telephone calls.	Telephones
		Fuel
		Cost/rent equivalent per sq. feet per annum * Area in sq feet allocated to office space for storage-related personnel
		Other expenses
Vehicles	For each of these items the quantity, age and cost of the equipment will be collected and the depreciation calculated.	Vehicle Types
		Vehicle Cost
		Percent of time vehicle is used for SC transport purposes

Output Metric	Notes	User Input Metrics
Information Systems		
Labor	Labor costs should be obtained from a standard civil service salary scale. This way only the grade and LOE needs to be collected from each facility rather than having to include questions on salary.	Personnel Types
		Personnel Salary
		Personnel LOE spent on SC-related storage activities (%)
		Personnel Benefits
		Annual training expenditures
Quality Assurance		
Labor	Labor costs should be obtained from a standard civil service salary scale. This way only the grade and LOE needs to be collected from each facility rather than having to include questions on salary.	Personnel Types
		Personnel Salary
		Personnel LOE spent on SC-related storage activities (%)
		Personnel Benefits
		Annual training expenditures

Appendix 12

Contact List

Contact	Title	Organization
Albert Lupupa	Chief Purchasing and Supplies Officer	Drug Procurement Office, Ministry of Health
Tom Brown	Director of Logistics	Medical Stores Limited
Mulenga Muleba	Deputy Country Manager	Crown Agents - Zambia
Edward Kabwe	Director of Finance and Administration	Medical Stores Limited
Abel Phiri	Transport Manager	Medical Stores Limited
Kwasi Torpey	Director, Technical Support	ZPCT
Gail Bryant	Senior Advisor, Pharmaceutical Management	ZPCT
Yebo Gondwe		ZPCT
Lona Mwenda	Program Officer	ZPCT
Kelly McCoy	Project Manager	CIHDZ
Joshua Kasimba		CIHDZ
Chipupu Kandeke	Manager, Pharmaceutical Services	CHAZ, Church Health Association Zambia (CHAZ)
Shadreck Malupenga	Logistics	CHAZ, Christian Health Association Zambia
Osward A. Nyenda	Manager, Operations	Ngansa Pharmaceuticals, Ltd
Bjorn von Hofsten	Director, Pharmacist	Ngansa Pharmaceuticals, Ltd
Maxwell Kasonde, Morgan Phiri	District Pharmacy Programme Coordinators	Lusaka Main, DHMT
Jack Menke	Program Manager	Kara Clinic, Lusaka
Mrs. Chileshe	In-charge, ARV Pharm. Technician	Mtendere Health Centre, Lusaka Main
Happy Chiporu, Mosia Muhango	In-charge, ARV Pharm. Technician	Chilenge, Lusaka Main
Mrs. Mtonge, Lisa Siame	In-charge, ARV Pharm. Technician	Bauleni Health Centre, Lusaka Main
Dr. Isaac Banda	Director	Mpongwe, DHMT
Gladys Mpagwe	ARV Pharm. Technician	Mpongwe Mission Hospital
Florida Mumba, Esther Zimba	In-charge, ARV Pharm. Technician	Mikata Health Centre
Sister Chanshi	Director, ARV Pharm. Technician	St. Theresa's Hospital
Mercy		ZPCT, Ndola

Contact	Title	Organization
Lilian Nyerbwa	Manager, Planning	Ndola, DHMT
James Simulwke	Pharmacist	Ndola, DHMT
Chiryimba Musonda	Pharmacist Technician	Ndola, DHMT
Ignatius Chikoti	Assistant Accountant	Ndola, DHMT
Matthew Mwute, Hanzooma Hatwiko	Head of Pharmacy Dispensing ARV Pharmacist	Arthur Davidson Children's Hospital, Ndola
Dr. Dande Malawo, Dr Masase, Mwape Kunda, Royd Ngoma	Executive Director, Clinical Director, Dispensing ARV Pharmacist, Store Pharmacist	Ndola Central Mission Hospital
Mrs Mwambi	Nurse In-Charge	Lubutu Health Centre, Ndola
Sister Elizabeth Njovu	Nurse In-Charge	Kavu Rural Health Centre, Ndola
Deborah Connor	Country Director	EGPAF
Mbaweni Mwanza	Deputy Director Finance and Administration	SCMS and USAID | DELIVER PROJECT
Peter Lisulo	Senior Public Health Logistics Officer	SCMS and USAID | DELIVER PROJECT
Walter Proper	Country Director	SCMS and USAID | DELIVER PROJECT
Wendy Nicodemus	Senior Technical Advisor	SCMS and USAID | DELIVER PROJECT
Paul Kamuna	Public Health Logistics Officer	SCMS and USAID | DELIVER PROJECT
David Papworth	Deputy Country Director	SCMS and USAID | DELIVER PROJECT

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