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# Guide to Public Health Supply Chain Costing

## A Basic Methodology



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**USAID | DELIVER PROJECT, Task Order 4**
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**Abstract**
On several occasions since 2004, the USAID | DELIVER PROJECT has conducted supply chain costing exercises and, with the assistance of partner projects and ministries of health, has adapted a commercial best practice into a methodology for informing policy and operational decisionmaking for public health supply chains. This guide lays out a general methodology for supply chain costing irrespective of software tools chosen to support the analysis.

Cover photo: Top left—vaccines being unloaded from a truck in Indonesia; Top right—family at a health clinic in Ochanga, Uganda; Bottom—international currency.

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# Contents

Tables

# Acronyms

| | |
|---|---|
| ACT | artemisinin-based combination therapy |
| AIDS | acquired immune deficiency syndrome |
| ARV | antiretroviral [drug] |
| CMS | central medical store |
| CFO | Chief Financial Officer |
| DPS | Department of Pharmaceutical Services |
| DTTU | Delivery Team Topping Up |
| EDS | essential drug system |
| GFATM | Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria |
| HIV | human immunodeficiency virus |
| LIAT | Logistics Indicators Assessment Tool |
| LMIS | logistics management information system |
| LOE | level of effort |
| LSAT | Logistics System Assessment Tool |
| $m^3$ | cubic meter |
| MOH | Ministry of Health |
| NGO | nongovernmental organization |
| PMTCT | preventing mother-to-child transmission |
| SCCT | Supply Chain Costing Tool |
| SDP | service delivery point |
| SOP | standard operating procedure |
| SOW | scope of work |
| TB | tuberculosis |
| USAID | U.S. Agency for International Development |
| ZIP | Zimbabwe Informed Push |
| ZNFPC | Zimbabwe National Family Planning Council |

# Acknowledgments

The authors wish to express their appreciation to the numerous project partners and staff that have supported the development and piloting of the project's supply chain costing work to date.

# Introduction

Supply chain costing is a point-in-time assessment conducted to estimate the costs attributable to the activities that make commodities available to end customers. It is not the same as an audit, as it does not rely only on accounting records; instead, it builds an estimate from numerous sources. It is also not the same as a budgeting exercise, as it requires collection of actual cost figures from the system for analysis.

This guide details—

- The reasons for conducting a supply chain costing exercise
- The USAID | DELIVER PROJECT's recommended supply chain costing methodology
- Recommendations and considerations for conducting a supply chain costing activity

## Intended Audience of this Guide

This guide can inform any partner that manages or supports public health supply chains. Ministries of health, technical assistance partners, or nongovernmental organization (NGO) operating distribution systems can all benefit from conducting a costing exercise and can use the material presented in this guide to support their efforts.

This guide serves as a companion to the project's manual for the Supply Chain Costing Tool (SCCT), an Excel-based software application that supports supply chain costing analysis efforts. However, this guide presents a methodology that does not assume use of any particular costing software.

## Why Cost the Supply Chain?

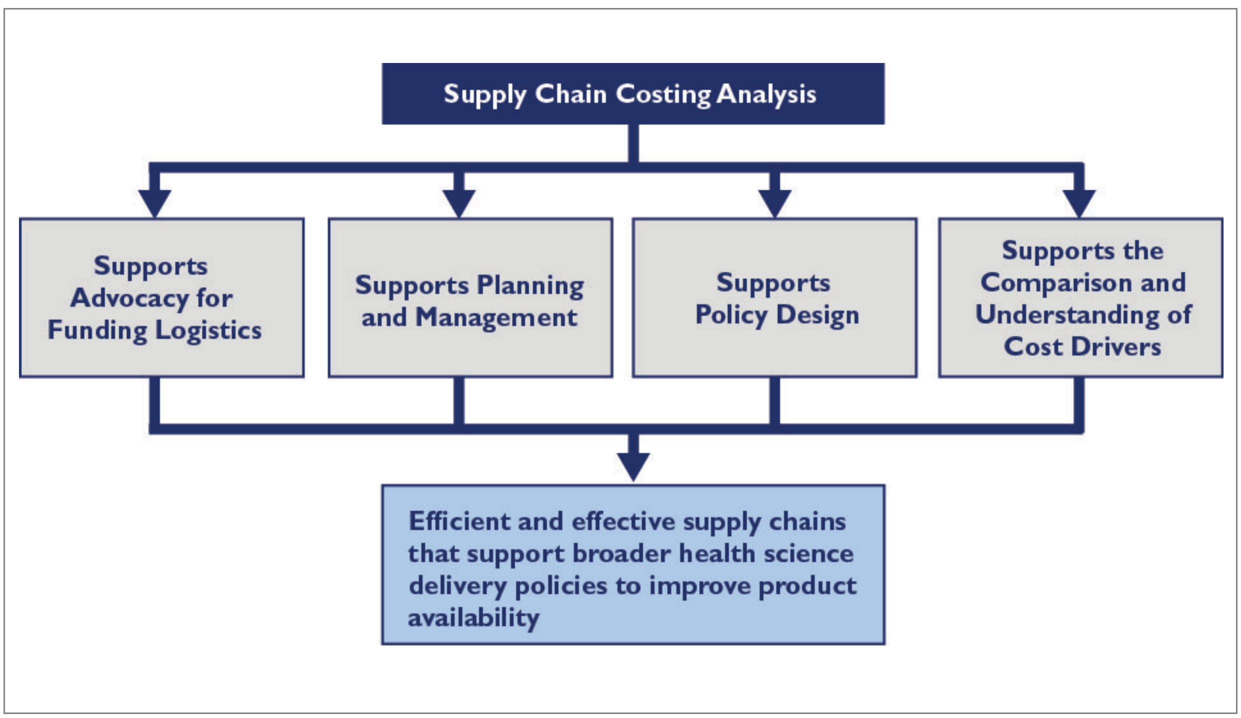
Essential health commodities such as medicines and contraceptives are key to improving health outcomes in developing countries, and strong supply chains play a critical role in making those commodities available where and when users need them. Knowing the total costs of the system can provide useful information to assist governments and partners in meeting the financial requirements of operating and strengthening a country's supply chain. Understanding the cost drivers of the supply chain can also help managers supervise and monitor their systems (figure 1). It can also map out the organizations that support and fund the supply chain.

The results of a supply chain costing exercise can be used—

- *To advocate and plan for funding:* Knowing the costs of the supply chain is essential to ensuring adequate financing and helping countries work towards increased sustainability of the supply chain system. A costing exercise can provide guidance on the costs at each tier (central, regional, service delivery point) and how much it costs to deliver commodities from the central level to the health facility. This also helps in estimating the incremental costs of scaling up drug programs. Governments can use this information to determine whether current budgets are sufficient and to plan for the appropriate level of investment.

- *To better design, plan, and manage systems:* A costing exercise can provide useful insight into cost drivers—those elements of the system that most influence costs—and thus support strategic supply chain management and planning decisions.
- *To inform decisionmaking on supply chain policies and financing:* A clear view of costs can help partners, governments, and central medical stores allocate the appropriate funding for managing or distributing commodities. Good cost information can also be the basis for negotiating outsourcing agreements for functions such as transportation or warehousing, as governments and donors often set supply chain fees on little actual evidence. Cost information can help set more realistic prices and margins for commodities that use a cost recovery. The approach estimates the actual delivered cost of getting a product to a service delivery point (SDP), enabling partners to base pricing policies or cost recovery strategies on specific supply chain costs rather than an arbitrary percentage of commodity values that may or may not be a good approximation of the actual costs incurred.
- *To provide a clearer understanding of the sources of funding for the supply chain:* A costing exercise helps provide stakeholders with a clear understanding of the different functions being performed by different development partners. It provides a clearer definition of the resources being used to perform supply chain functions and what volumes of goods are being distributed through the supply chain. It provides an integrated view of the supply chain and can help partners fine tune their contribution, identifying where additional resources might be available and how these can be prioritized. For example, knowing the cost of the supply chain can help countries more accurately request funds for improving the supply chain under initiatives such as the Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria (GFATM).

**Figure 1. Supporting Health Services with Effective and Efficient Supply Chains**



## What Specific Analysis Questions Can Supply Chain Costing Answer?

Another way to consider the importance of supply chain costing is to look at the specific questions a costing assessment can answer. These might be questions specifically posed by country health program partners as they consider funding or design issues for their systems. Table 1 summarizes these questions across three areas of analysis.

### Table 1. Supply Chain Questions Addressed by a Costing Assessment

| **1. Understanding total costs and costs aggregated across different levels, functions, and partners** |
|---|
| • What is the total cost of the supply chain?<br>• What is the total cost of procurement, storage, transportation, and management across the supply chain?<br>• What share of supply chain costs covered by the various partners (e.g., ministry of health, a central medical store [CMS], donors, NGOs, and implementing partners)? |
| Most public health supply chains are characterized by multiple partners responsible for different and sometimes overlapping functions. A costing assessment can help define the total cost of the supply chain, including functions that may be underfunded. Additionally, different organizations are involved at different levels or serve different functions of the supply chain system in the country. Some of those organizations may have explicit cost information, whereas others may not. A costing assessment allows the collection of information for individual organizations to give a whole system cost. It also allows the estimation of costs for organizations that may not collect explicit cost data. |
| **2. Making cost comparisons** |
| • If there are parallel supply chains, what are the comparative delivered costs of each system?<br>• What are the supply chain costs of different health facilities within the supply chain? |
| A costing assessment can be used to help analyze options for integration, segmentation and reducing delivery costs. It can help the user compare the supply chain costs of the sampled health facilities to determine any major cost differences. |
| **3. Understanding cost drivers** |
| • What supply chain function accounts for the highest proportion of cost?<br>• What is the cost of different components within a supply chain function? What scope is there to reduce component or function costs?<br>• How does system design influence cost? If alternative approaches are being considered for supply chain system design, how do their investment and operating costs compare? |
| For instance, two options are being considered for a supply chain system design. Option A involves strengthening district management and supervision of facility staff who are responsible for managing stocks and placing orders. The other adopts a vendor-managed inventory approach with investment in trucks, computers, and dedicated trained delivery teams. Cost drivers for Option A may well be the cost of training and supervising staff in all the facilities served. In comparison, the cost driver for Option B will be the investment in vehicles and equipment and the fuel for the trucks and per diems for the delivery team. |

## Who Are the Potential Users of Information Generated by a Costing Exercise?

The target audience and potential users of a costing exercise's results are—

- Government agencies that participate in public health supply chain activities, including ministries of health, departments of planning, ministries of finance, CMSs, and other government parastatal agencies.
- Multilateral, bilateral, and private donors and development partners that finance, manage, or support in-country public health supply chains, which can include vertical systems that may be supporting particular health programs like human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS), or malaria.
- Current or potential donor partners who donate commodities or fund commodity procurement, such as the GFATM, or donors supporting basket funding for the health sector.

Costing exercises should be scoped and planned based on the interests and concerns of these potential users to make sure the exercise will be responsive to their needs.

## Costing Exercise Considerations

When conducting a supply chain costing exercise and analyzing the findings, it is important to keep in mind the limitations and envision how the findings are to be used.

### *Costs Reflect Current Supply Chain Performance*

The main objective of the approach outlined in this paper is to cost the current *as-is* supply chain. This means that total current costs reflect the costs of the current level of performance, which may be high or low. Cost is one piece of data that can be used along with other data points to attempt to assess system performance. Once robust data on the current system (including stockout information) has been collected, stakeholders can develop and compare metrics based on different scenarios, using agreed-upon assumptions related to the design of the system, number of products included, changes in labor, etc. If used for this purpose, further work would be needed to define the appropriate metrics. In addition, where there is uncertainty about the impact of changes, additional sensitivity analysis is required.

### *Costing Does Not Constitute Network Optimization*

Supply chain costing is not equivalent to supply chain optimization (i.e., where to locate regional distribution centers or how to configure transport routes to minimize supply chain costs). Such analyses are better suited to specialized optimization modeling software and typically require scenario development and information on truck and storage capacities and locations, in addition to costs. Nonetheless, a costing exercise can provide critical data to feed into optimization analysis. For example, a costing exercise can capture the cost of running existing storage facilities and transport networks. This information can then be used to create scenarios where additional storage space is added into the supply chain and alternative transport schedules analyzed using an optimization model.

# Supply Chain Costing Methodology and Framework: What Data Should Be Collected?

## Overview of Recommended Methodology

The supply chain costing methodology recommended by the project takes a micro-costing or a "bottom-up" approach to estimate the cost of performing each supply chain function at each level (or tier) of the supply chain. The costs are then aggregated to determine the total cost of the supply chain.

**Figure 2. Supply Chain Costing Framework**

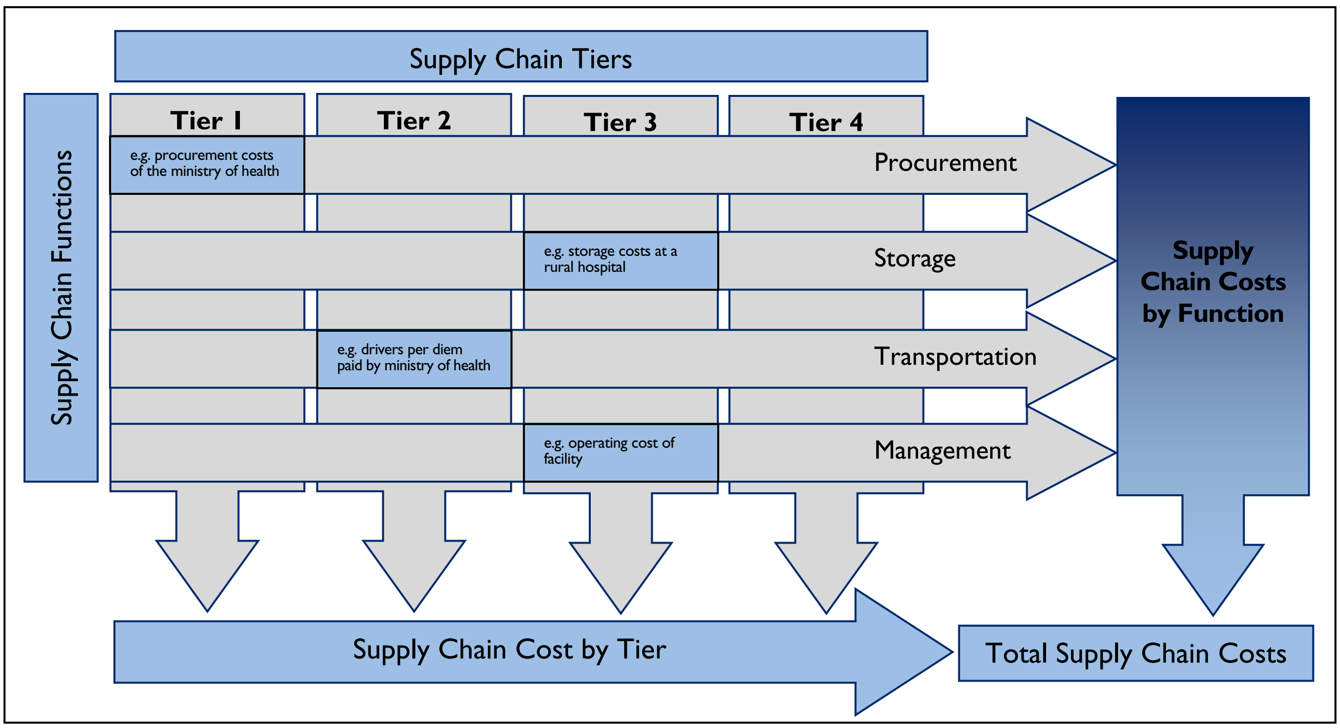



Figure 2 is adapted from the work of Martin Christopher, which was first adapted to cost Ghana's public health supply chain (Christopher 1998; Huff-Rousselle and Raja 2002). The figure shows how the costs of a supply chain can be described in terms of tiers and functions.

Total Supply Chain Cost by Tier in figure 2 refers to the total costs of every function performed by each tier of the supply chain. An example of a tier 1 cost could be the cost of procuring family planning commodities for a country by the procurement division of the Ministry of Health (MOH).

An example of a tier 2 cost could be the storage costs incurred by a regional medical store. A tier 3 cost could be the staff time spent each month conducting physical inventory of its commodities. Some functions, such as management, may be performed across all tiers, whereas others such as transport may only be performed by one or two tiers. Total costs can be delineated by other categorizations, such as grouping supply chain facilities by facility type, region, or by any other relevant category.

Total Delivered Cost is defined as the total in-country cost for acquiring and delivering a unit of some commodity to the end user. This cost includes—

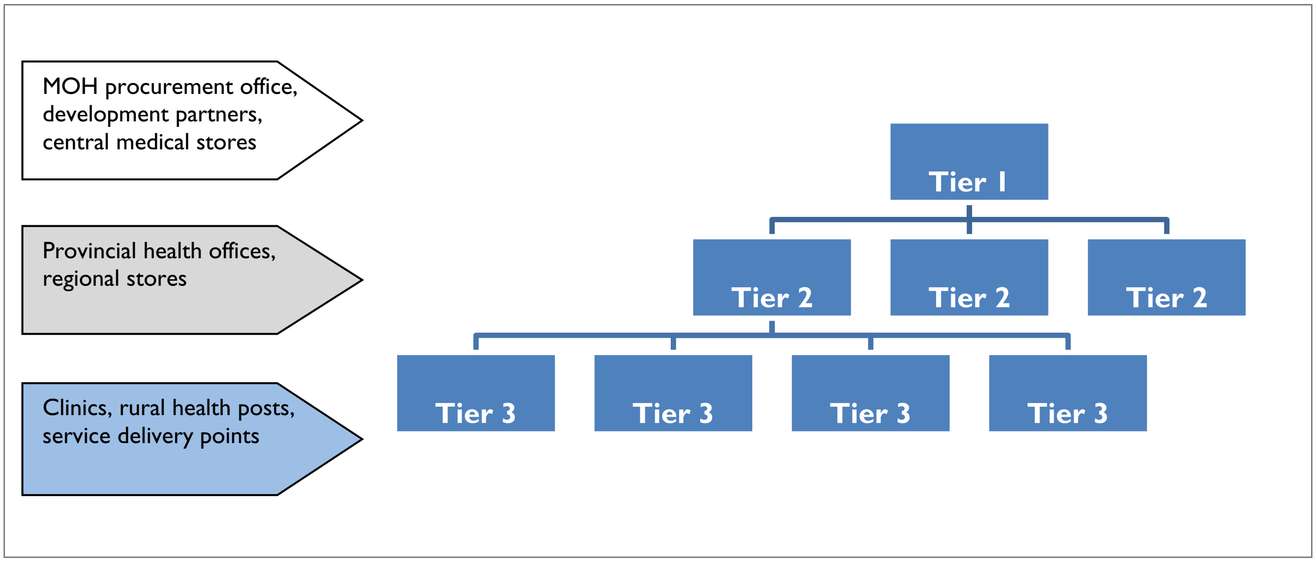
- the cost of procuring that unit at whatever tier the cost was incurred (usually tier 1)
- the cost of storing that unit at every point where storage occurred as the commodity was distributed through the supply chain
- the cost of transporting that unit between each storage point in the supply chain, up to and including storage at the end point of the commodity's journey (usually the last tier)
- management operating costs of that unit at each tier (total delivery costs do not include labor for quantification, quality assurance, training, or logistics management information system [LMIS]).

When setting up a costing assessment, understanding three elements will help the user organize the approach and make sure all necessary data are captured: supply chain structure, supply chain functions, and commodity throughput.

## Supply Chain Structure

Public health supply chains are usually characterized by several tiers (figure 3). There are typically at least two tiers and sometimes as many as four. The first tier (tier 1) is made up of national facilities or organizations that do in-country procurement, central storage, and distribution to lower levels. In systems with additional tiers, the first-tier facilities provide commodities to intermediate facilities such as regional stores (tier 2) that are responsible for storage and that may then deliver to a subsequent tier (tier 3; e.g., SDPs) that then dispenses them to clients. Costing the full supply chain requires that the assessment capture data at each tier of the system, and potentially across multiple parallel systems. Where several parallel supply chains exist, it is important to capture costs from facilities at different tiers in each supply chain.

**Figure 3. Supply Chain Structure: An Illustrative Example**




## Supply Chain Functions

The costs of the supply chain are organized into four main supply chain functions (Table 2). Costing should capture the expense of conducting these activities as they occur within each tier of the supply chain structure, as described above.

**Table 2. Functions of the Supply Chain**

| | |
|---|---|
| **Procurement** | • Procurement-related tasks performed in-country<br>• Time spent on identifying reliable supplies of good quality, competitively priced products by the management of bids and tenders and on executing procurement contracts with desirable suppliers |
| **Storage** | • Receiving and warehousing of commodities<br>• Time spent by health facility staff on receiving or picking up commodities, conducting physical inventory, completing logistics management forms, and performing other commodity-management activities |
| **Transportation** | • Moving goods from one facility to another through the use of vehicles owned by the facility, hired vehicles such as courier companies, or public transport |
| **Management** | • Supervision and coordination of all supply chain activities by logistics managers and supervisors responsible for providing monitoring of staff who manage commodities<br>• Training of supply chain staff and commodity managers<br>• Quality assurance of commodities at point of entry into a country and monitoring of product quality through the supply chain until delivery to the end user<br>• Managing supply chain data using LMIS<br>• Quantifying* which products and what quantity of commodities are required by the health facilities in the service delivery system.<br>• Operating and training costs |

*Quantification is a pre-procurement activity but is classified under management for the purposes of this methodology. In most countries, quantification is a multipartner activity; this differentiates it from procurement, which is undertaken by each partner individually with more circumscribed costs.

## Commodity Throughput

Providing a sense of scale for supply chain costs requires that the user understand the level of commodities handled by the system. The availability of value, volume, and weight data for commodities is essential for a costing analysis.

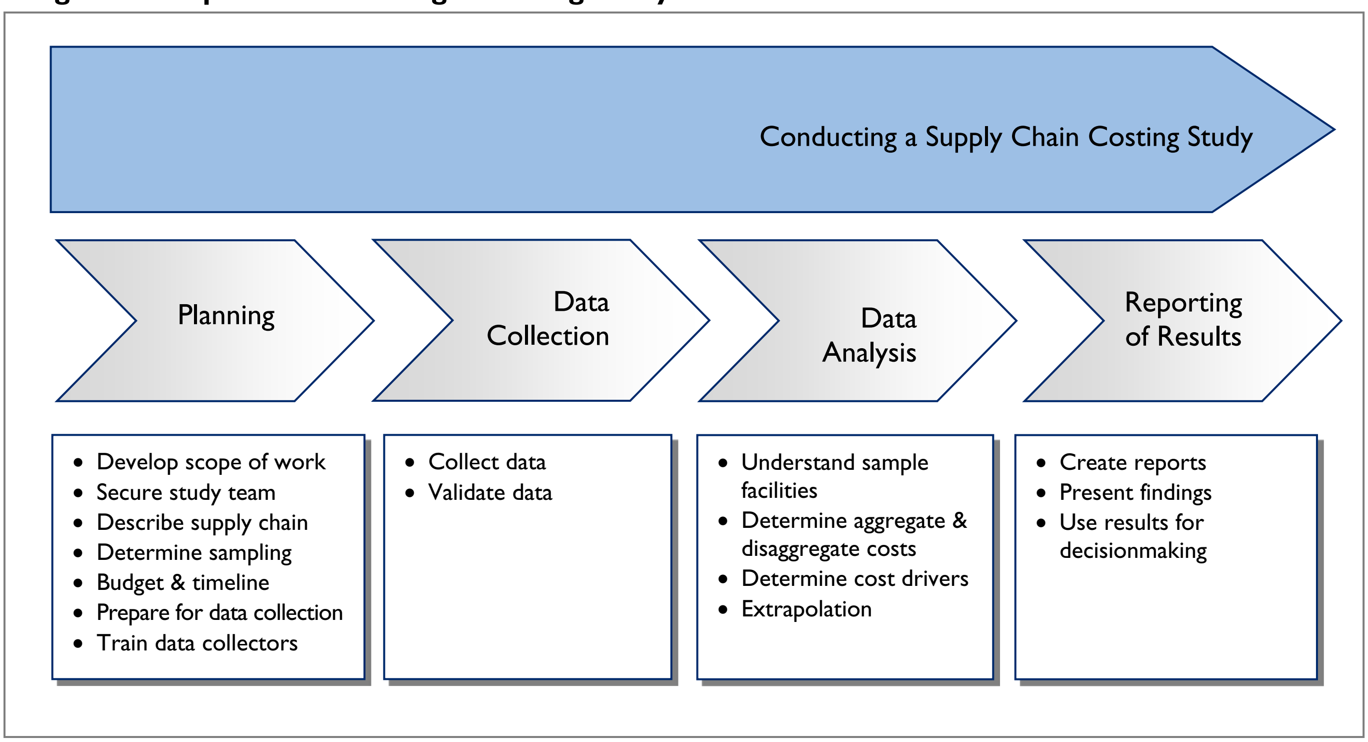
Commodity throughput can be defined as the total number of units received plus the total number of units shipped or consumed, divided by two. This definition applies for the entire system and for each facility at all different levels in the supply chain. To calculate the average costs of delivery, throughput data should be collected alongside supply chain cost data.

# How to Conduct a Supply Chain Costing Exercise

This chapter walks through the entire supply chain costing process (figure 4), describing important steps in the activity. Based on the experiences of several supply chain costing applications, the process includes four main steps that lead to a successful assessment:

- planning
- data collection
- data analysis
- reporting of results

**Figure 4. Steps for Conducting a Costing Study**




## Planning for Supply Chain Costing

The planning phase for a supply chain costing study ensures that partners' expectations are aligned and that necessary resources are in place prior to the assessment. Planning involves the series of steps described below.

## Step 1: Develop a Scope of Work

The scope of work (SOW) defines the parameters of the costing exercise according to the specific goals and needs of the government or other requestor. The SOW should be developed as part of a scoping exercise with key stakeholders to ensure that the purpose, expectations, and objectives are clear and agreed to. The scope outlines which supply chain (or supply chains) will be costed, as there may be multiple parallel supply chains functioning in a country. The SOW should determine if there is interest in costing a set of commodities that support a specific program (i.e., family planning, HIV) or, more broadly, in costing all commodities. The SOW also determines whether all functions of the supply chain—procurement, storage, transportation, and management—will be part of the exercise. The purpose, objectives, deliverables, timing, and methodology of the costing exercise should be included in the SOW. A sample SOW is presented in appendix 2.

## Step 2: Secure Study Team

A data collection team is required to conduct a thorough costing survey. The number of data collectors required depends on the eventual number of facilities to be visited compared to the time available; as an example, a costing study in Rwanda that visited around 45 facilities in a week and a half required four teams of two data collectors each. The initial team should include a lead pair of researchers consisting of at least one logistics specialist and one costing specialist to conduct the planning, data collection for tier 1, analysis, and report writing. The lead researchers should then split up and team with other data collectors to do field data collection. Each data collection team should have familiarity with the country's supply chain, familiarity with logistics terms and definitions, knowledge of costing and budgeting concepts and terminology, experience using Excel, good interview and communication skills, should be organized and self-motivated. The skills required may be available within the MOH, or the assessment team may need to engage in-country consultants or implementing partners with this expertise. Regardless, it is critical that the process include MOH counterparts with mandates for the costing study.

## Step 3: Describe the Supply Chain

Describing the supply chain is a critical step in planning the costing activity. This step determines the scope of the data collection, the timeline, and the budget for the activity. The supply chain can be mapped out based on document review and qualitative interviews with key, in-country supply chain partners. Several of these partners should be approached in advance to set up an interview to provide critical information for the costing work and to review the assumptions and results. Key aspects of the flow of the supply chain should be understood:

1. *Identifying the total number of facilities within the public health supply chain:* This includes all facilities or entities that carry out or support any supply chain function within the public health supply chain, such as the CMS, development partners, government offices, public health service delivery sites, or private contracted firms. The way a facility is classified or categorized by the MOH should be determined, including how the MOH classifies SDPs (i.e., rural or urban), the type of services and functions provided in each facility, and whether the facilities are MOH, NGO, or semi-private institutions. This information is needed to determine the sample size and to scale up costs for the total system. At a minimum, all central level entities that support the supply chain should be part of the sample. Implementing partners who provide funding for commodities and technical assistance to the supply chain in-country should also be included in the sample for the exercise.

2. *Defining the set of commodities delivered by the supply chain that will be costed*: This information is necessary to ensure that costs are attributed properly and that the average supply chain cost of delivering commodities can be calculated. If only a subset of products handled by a supply chain is being considered, such as contraceptives in an integrated supply chain, cost information for all products may need to be covered; the share of costs for the target commodities are then allocated according to their relative share of total value, volume, and weight.
3. *Mapping the relationships between different facilities in the supply chain*: This includes determining which facilities have responsibility for which functions of the supply chain, where each facility receives its commodities from, and to whom it delivers commodities. It is also important to map out within the supply chain which development partners support facilities that perform supply chain functions.

## Step 4: Determine Sampling

Costing requires physically conducting surveys at health facilities. Once the supply chain has been outlined, the next step is determining the number and type of facilities that must be visited to collect cost and commodity data. Most public health supply chains are designed with a tier structure. Typically, facilities in tier 1 account for a substantial portion of the total costs of the supply chain and, for this reason, we recommend that all facilities classified as tier 1 be included in the sample. We also recommend that tier 1 costs always be analyzed and presented distinctly from the other tiers of the supply chain.

The sample size will be unique to each country and depends on the number of tiers, distinct geographic regions, facility types, and different supply chain channels being costed. Several criteria should be considered when choosing sample facilities at levels below tier 1:

1. *Geography*: If there is substantial geographic variation, it is important to have representation from all the different types of geographical characteristics, because some areas may have differing transportation costs and/or different supply schedules. An example would be areas that are hard to reach for reasons of distance, terrain, or issues related to seasonality (e.g., weather). There should be geographical representation of lower-tier facilities and, if necessary, representation of each type of facility in situations where there are multiple types of facilities.
2. *Population density:* A variety of areas with differing population densities should be included in the costing. Heavily populated regions may have special needs, such as very large storage facilities or very large vehicles for transportation due to the high number of patients. If it can reasonably be hypothesized that this characteristic has cost implications, then this criterion should be kept in mind when choosing sample facilities. Similarly, some less densely populated areas should be included, as facilities in these areas they may have higher transport costs.
3. *Presence of parallel systems:* Where countries have multiple supply chains to deliver the same commodities, each should be costed, tracking the flow of commodities from the point of entry into the country to the final SDP. For example, if a donor supports distribution of products with private sector or NGO partners and the government procures and distributes through its own public supply chain system, facilities in both models should be sampled. Complete representation enables comparison between them and also allows estimation of total supply chain costs for the country.

**Examples of Facility Types**

- local government clinic
- rural health center
- teaching hospital
- regional hospital
- maternity center

4. *Types of health facilities:* Countries tend to have a range of health facility types. Tertiary, secondary, and primary health facilities should all be represented in the sample for data collection. At least one tertiary/referral SDP should be included for each region/state/province represented, and at least one of each supply chain model should be included if more than one model operates. There will be between 5 and 20 facility types in a country (see box). However, many of these will be unique types (e.g., a national orthopedic hospital) of which there is only one, so it is only necessary to identify distinct sample groups as long as facilities have significantly different scopes of service. Typically, the sample should include both rural and urban health facilities. In addition, secondary and tertiary facilities are typically urban, but if this is not the case, urban/rural representation is necessary for these SDP types, as well. For the costing analysis, it is the SDPs that make up the largest proportion of facilities in the supply chain that must be well represented in the facility sample. Typically, the smallest facilities in the country are the most numerous (e.g., rural health centers, village health posts, local government clinics), and these should therefore represent the largest portion of the total sample.
5. *Cost of conducting the costing exercise:* Although stakeholders might be inclined to visit a large sample of facilities, the cost of doing so should be considered. The additional cost of adding more facilities should be offset against the marginal utility of getting additional facilities and the likelihood that additional facilities capture new types of information. As an example, a costing study in Rwanda that sought to cost the entire public health supply chain included central partners, 10 out of 30 district pharmacies, 7 out of roughly 40 district hospitals, and 25 out of roughly 500 primary health centers.

## Step 5: Choose a Data Collection Tool

As with any assessment, costing data should be collected using a standardized tool. Data collectors should be trained to use this tool and should be trained to ensure that data is collected and entered the same way across collection teams. The USAID | DELIVER PROJECT's Supply Chain Costing Tool (available at www.deliver.jsi.com) includes an Excel-based survey that can facilitate this process.

The Supply Chain Costing Tool offers a few distinct advantages to developing a collection tool and database from scratch: the tool includes a guided approach to calibrating the data collection survey, a function for automatically importing completed surveys, and it automatically calculates numerous reports. However, the tool does require a certain amount of Excel familiarity. This tool is most appropriate when conducting an assessment focusing on a limited product scope (for example, a family planning program) and when resources are limited for building a new survey and database from scratch. The tool is less adept at managing assessments that have a wide commodity scope (i.e., covering 100 products or more) and may not serve as the tool of choice when resources are available to develop a more customized tool.

A basic Excel site survey used by the costing tool is also available from the USAID | DELIVER PROJECT and may improve costing efforts even if the costing tool itself is not used.

The choice of data collection tool should be made early in the planning stages for a supply chain costing, as it may influence the resources required for data collection and analysis.

## Step 6: Develop a Budget and Timeline

A budget outlining the costs of conducting the study is required by the funder of the activity. Factors affecting the cost of a costing activity include—

- team composition
- sample size for data collection
- length of data collection time period.

If the supply chain costing study is conducted by a core technical team of four members, we estimate that the core team can complete the study in approximately six to six and a half weeks, accompanied by a data collection team (table 3).

**Table 3. Proposed Timeline for Conducting a Supply Chain Costing Study**

| Task | Time to complete task |
|---|---|
| Planning | 1.5 weeks |
| Define scope of work; stakeholder scoping discussion | 1 day |
| Determine sample size | 2 days |
| Budget | 0.5 day |
| Logistics planning (scheduling meetings and field visit) | 2 days |
| Document review | 2 days |
| Data collection | 2–3 weeks |
| Survey training for data collectors | 0.5 day |
| Tier 1 | 1 week |
| Tiers 2–4 | 1–2 weeks |
| Analysis and Report Writing<br>Dissemination of and validation of results | 2 weeks |
| **Total** | **6.5 weeks** |

## Step 7: Preparation for Data Collection

The following tasks should be undertaken prior to the start of the data collection:

1. *Notify stakeholders:* All the necessary partners and stakeholders of the supply chain should be notified about the study and invited to an introductory stakeholder meeting where the activity and methodology can be presented, previous applications described, and the objectives for the current study identified, shared, and—if necessary—refined. This forum also presents an opportunity to share the data requirements for the study with the partners, all of whom should be contributing data in some form. Individual meetings with key stakeholders are also recommended. Financial data are usually sensitive and stakeholder buy-in is critical to successful data collection.
2. *Schedule meetings/data collection visits*: A letter of introduction from a government department is critical, because financial data is being requested. These letters should be distributed prior to the visits and preferably should include the names of the data collection team, the purpose of the study, the date of the visit, and a short list of the types of documentation that the data collectors would like to see (see the section on Data Sources).

3. *Schedule data collection:* Typically, data collection teams need to cover the length and breadth of the country in a very short period. Scheduling these journeys is an important activity. Transportation and lodging arrangements for the teams must also be made.

### Step 8: Train Data Collectors

Once the team is secured and the scope outlined, the technical lead for the study needs to conduct a training of the data collectors to—

- familiarize them with the purpose and objectives of the costing exercise
- orient them to their roles and responsibilities
- provide an overview of the software tools being used, if applicable
- help them understand what information they will be responsible for collecting (see sections below), how to record and collect the information, and who they will be interviewing
- teach data collectors how to use and complete the surveys/data collection tools; where to find procurement, storage, transportation, and management costs, and commodity data; and understand who they be interviewing
- discuss how to contact the team leader with questions about the surveys and for troubleshooting
- conduct practice interview sessions either with each other or through a field visit at a medical store or health facility to practice completing the surveys
- review the data collection schedule and administrative details.

## Data Collection

Detailed cost data should be collected at each function and for each tier of the supply chain. This section describes some considerations to be aware of when collecting this data, which includes labor, space and building costs, asset depreciation, and management/overhead costs. A general approach should be to collect this cost data while tagging it to its relevant function, facility, and tier within a database so this data can be aggregated and analyzed along these lines.

As mentioned above, the USAID | DELIVER PROJECT has developed an Excel-based costing survey to collect all of the data described in this section. This survey can be used in its Excel format to expedite analysis or also in hard copy to ensure standardized data collection.

### General Data Sources

The costing exercise requires the collection of information from both quantitative and qualitative data sources. The following sections present recommended approaches to collecting the right data; additional sources are listed in appendix 3.

- Quantitative data sources for financial and commodity throughput information may come from annual financial reports, periodic balance statements, commodity databases, health facility records, service invoices, or distribution schedules. Specific examples of these are noted in the sections below.

- Qualitative data sources are obtained from interviews with key informants such as ministry of health staff, health facility workers, government staff based at the regional and district levels, CMS personnel, development partners, and NGOs that can provide supply chain costing data.

In estimating supply chain costs, it is important to balance the ease of collecting information and the desire to be comprehensive in capturing costs with the likely accuracy of the information being collected. As Terry Pohlen stated at the Council for Supply Chain Management Professionals annual meeting in Chicago in 2009 when talking about supply chain costing, "It is better to be approximately right than precisely wrong." In some settings, information is either not available or impossible to estimate. If assumptions need to be made to cover for missing data, these need to be explicitly stated. To the degree possible, the assumptions used should be reviewed and validated by local counterparts.

## Labor Costs

Labor costs are estimated for each function of the supply chain. Labor costs can be difficult to assess for several reasons. Staff being interviewed may not know or may not wish to share salary data with data collectors. One approach to this is to collect salary grade information for each staff member while at the facility (table 4). Before traveling to the field, the data collection team should obtain a copy of the civil service salary schedule.

Another difficulty can arise when development partners utilize expatriate staff whose salaries may be an order of magnitude higher than local salaries; there is often reluctance to share this information. The user can include civil service proxy grades, bundle staff, or use an average salary so that individual salaries are not shared. Using proxy civil service salary will reflect, in most cases, a lower cost estimate—this would likely be the cost if the host government took over the supply chain.

**Table 4. Basic Costing Data Collected for Supply Chain Labor Costs**

| | |
|---|---|
| **Position** | Names of staff should not be used when collecting data, only the position and civil service grade held. It is not appropriate to share salary information without the permission of the specific staff member. |
| **Annual salary** | Annual salary and all nonsalary benefits should be included. Typically, respondents do not know the currency value of all their benefits—a civil service salary scale/document, if available, would be a more appropriate data source. |
| **Number of staff providing support to the supply chain** | If several clerks work on the supply chain but each is paid a different salary, it may be possible to enter an average salary. Otherwise, each staff member should be entered into that facility's survey. |
| **Number of hours worked per week (or other standard time period)** | Should be specific to each supply chain activity. For example, time spent on transportation activities should be kept separate from supervision time. |

Additional questions need to be asked to disaggregate personnel time if the costing exercise is looking at one type of commodity within a system that has some degree of service integration. This is especially the case at the health facility level where staff are responsible for managing many commodities. If the exercise is assessing antiretrovirals (ARVs), for example, then the health worker will need to make an estimation of the proportion of their time they spend on only ARV commodities. Table 5 outlines the approach that must be used to establish the time spent on supply chain activities by health workers. Notice that this approach leads to a final estimation of time spent by determining intermediate variables or pieces of information rather than by requesting the worker to give an outright estimation of time spent. Units of time used to measure labor effort should be standardized across respondents to ensure accurate comparisons and to support a reasonable estimate of annual costs. Further information on management labor costs are provided in the description of Management Labor costs below.

**Table 5. Calculating Personnel Time Spent on Supply Chain Activities**

| | |
|---|---|
| **Question to interviewee** | How much time do you spend managing ARV commodities?<br>(Illustrative tasks could be filling out logistics management forms [e.g., bin cards, stock cards, order forms], conducting physical inventory, reviewing logistics management forms.)<br>Assume 40 hours worked per week and 8 hours per day total for each full-time staff member. |
| **Possible answers** | Conversion into hours per week |
| **2 hours per day** | 2 hours × 5 days = 10 hours a week |
| **4 hours per week** | = 4 hours a week |
| **2 days per month** | 2 days × 8 hours = 16 hours a month<br>divide by 4.33 to get hours per week<br>= 3.7 hours a week |

## Space or Building Costs

Capital costs such as buildings, vehicles, and equipment used for storage and management must be included as part of the costing exercise. Public health supply chains typically utilize government-owned buildings. There is no cost associated with the use of these buildings as far as the budget is concerned. Nonetheless, the cost of these assets should be included for two reasons:

1. The replacement cost of these assets needs to be factored in and is not zero. Buildings depreciate and, depending on the depreciation schedule, warehouses and stores should be renovated or replaced over time. In many countries, the accounting life of a building may be between 20 and 30 years. In reality, the building will typically need renovation, rebuilding, or refurbishment before this time.
2. In the event of damage, the cost of using another building may not be zero, at which point space costs will become an actual cash expenditure on rent.

Governments use a building cost estimate, established for their buildings, to determine how much a new building would cost. This cost typically varies by region, and may be different in the capitol city than in rural areas. These estimates should be obtained from a ministry of works and housing or a ministry of health planning department. Typically, space used for logistics activities can be estimated in a three-step process:

1. Estimate the storage space (in square meters, $m^2$) where the commodities are stored and also where logistics management activities occur (ie, offices)
2. Apply the standard government construction replacement cost to estimate the total value of the storage space
3. Convert this to an annual cost by applying the financial depreciation rate for buildings (i.e. 0.05%/year in the case of 20-year accounting life); in some cases, if buildings are depreciated over too long a period in a country's accounting code, a shorter more economic depreciation rate may be needed.

## Equipment Costs and Depreciation

Straight line depreciation (see appendix 1) can also be used to estimate the cost of operating fixed assets (e.g., vehicles and equipment). The information required for the costing is the price of the fixed asset at purchase and the expected working life when purchased. Government facility vehicles and equipment have set depreciation rates and implied useful life, which the government uses to account for its capital and that is frequently used within a country by other implementing partners/facilities. Partners should always be asked what depreciation rates they use; this will usually be readily available in their audited accounts.

The data required to determine an annual charge or an annual depreciation charge are shown in table 6.

**Table 6. Example of Basic Costing Data Needed for Estimating Supply Chain Equipment Depreciation Cost**

| | |
|---|---|
| **Type of equipment** | 10-ton truck |
| **Number of equipment units** | 1 |
| **Cost or purchase price** | $25,000 |
| **Accounting life** | 4 years |
| **Annual depreciation charge** | = 1 × (25,000/4)<br>= $6,250 |

Other types of equipment may have longer or shorter accounting lives that should be used for this estimation.

Another cost to consider is when a donor has funded technical assistance support over several years to design, introduce, and manage a system. The value of previous-year investments can be treated as an investment cost that should be depreciated or shared over multiple years. In these cases, the total estimated cost of the project technical assistance may be amortized over a four- or five-year period.

## Transport Running Costs

In addition to labor and depreciation cost for vehicles, transport operations also incur direct costs for fuel, maintenance, per diems, and sometimes private provider fees. At each facility that manages transport, data collectors should determine the total average costs per trip and multiply this by the number of trips taken in a year. This may require asking the survey respondent to describe the typical product transport process in detail, including staff time, fuel used, per diems allocated, or fees paid to private providers. Routine maintenance and garage space for vehicles should also be included.

When conducting a costing assessment for a subset of the total commodities handled at facilities, transport costs should be allocated to the analysis commodities based on their proportional volume or weight or by the proportion of total space taken up by the commodities in the delivery vehicle. This last approach requires measuring the total capacity of the vehicles used for product delivery. This approach is important for determining the transport costs of a subset of the total commodities, as transport costs are driven more by volume and weight than value.

## Management Costs

### Management Labor Costs

As previously shown in table 2, management includes activities such as quantification, LMIS oversight, supervision, and training. The MOH, CMS, or development partner may have staff that perform tasks that would be categorized under the management function, such as conducting forecasts and quantifications, supporting the LMIS through data entry, reviewing logistics reports, conducting supervision visits to monitor the management and quality of reporting and commodity management, or conducting trainings on logistics or standard operating procedures (SOPs). Other management-related costs to oversee the supply chain, such as per diems for supervision visits or forecasting workshops, should be captured, as well.

### Management Operating Costs

As part of management costs, a costing assessment should also include overhead operating costs related to logistics activities at a facility. Examples include utilities (e.g., electricity and water), security, and facility maintenance. Only line items that could reasonably be expected to relate to the supply chain overhead should be counted. For example, a large hospital's operating costs might include overtime labor, drug and lab commodity costs, and other costs that are hospital costs that are unrelated to the supply chain. These costs should not be counted toward the overhead figure used for the supply chain costs, as they will greatly overestimate the overhead required for the storage space at these facilities.

Because most facilities perform mainly clinical activities, in most cases the administrative function of a facility covers several other nonlogistics-related functions. It will therefore be necessary, before the exercise begins, to determine criteria for apportioning these costs to the supply chain functions. It will also be necessary to apply these criteria consistently throughout the exercise. For example, the user may determine the total overhead for a facility and then apportion a percentage of the total overhead to the supply chain according to square footage, number of employees, or any other basis that is considered most appropriate—if the facility is 5,000 square feet, has a storage facility of 500 feet (10 percent of total area), and has a total overhead charge of $1,000 per year, 10 percent of the overhead costs—or $100—may be assigned as the operating costs of that facility in the supply chain costing exercise. However, it will frequently be the case that no one at the facility knows the square footage of the buildings that make up the facility, or the facility may be so small that the overhead charges are negligible. In such cases, it may be necessary to simply take a given percentage of operating costs and apportion that percentage to all facilities.

However, there may be issues with this approach for facilities with very high operating costs (e.g., referral or teaching hospitals). Because these types of facilities have operating costs that may be several orders of magnitude larger than smaller health facilities (possibly over a million U.S. dollars compared to a few thousand dollars for small health posts), using the same percentage may not be appropriate. In such cases, a smaller percentage may be assumed. Although there may be no way of accurately capturing this cost, the important considerations when implementing a costing study is that the percentage used is *consistent* for similar facilities and that the *assumptions are clearly stated*. This is critical: if some facilities show very large supply chain costs for small quantities of commodities, the user must be able to determine whether operating costs account for a substantial proportion of the supply chain costs. If so, they may be overly sensitive to the percentage of operating costs used.

## Collecting Throughput Data

As mentioned in section 2, commodity throughput data should be collected alongside cost data to support the calculation of average costs. For example, knowing that supply chain activities cost $1,000 during the course of a year at a particular facility might be interesting on its own, but knowing that those $1,000 of costs were incurred managing $5,000 worth of commodities now allows the user to know that the average supply chain cost at that facility was 20 percent of commodity value. This figure enables comparisons to other facilities and other programs, and allows for scaling up of results from sampled sites to the whole system. Similar calculations using total product volume or total product weight handled can also strengthen a costing analysis.

Determining total throughput (the average of the total amount received and the amount issued or dispensed) requires access to historical LMIS records. Ideally, quantity throughput records are available in a central database for all products within the scope of the analysis. However, in developing countries, this may not be the case due to poor facility reporting rates, use of paper-based recordkeeping and reporting, or having an LMIS that only focuses on tracer products and not the full set of commodities. Additionally, many central LMIS databases do not distinguish individual SDPs.

When verified central database records are not available, the next best option is to examine stock cards at each facility surveyed for the commodities being included in the analysis. This requires that stock cards are in use and properly completed. For each product of interest at each facility surveyed, data collectors add the quantity received and the quantity issued or dispensed and take the average to calculate throughput quantity.

Both of these approaches require that the assessment team identify the total value, volume, and weight for throughput quantities. Commodity unit value can be obtained from central procurement partners or from product price lists in drug revolving programs. Unit volumes and weights can either be obtained by physically measuring commodities at the warehouse, or using the USAID | DELIVER PROJECT product master list, available at www.deliver.jsi.com.

However, in situations where the full range of public health commodities is included in the analysis, examining stock cards may not be a viable option. Most essential medicines programs have hundreds of unique stockkeeping units, and these may differ in size or packaging across regions if procured locally. Examining stock cards for each of these products at each facility would be extremely time-intensive and may still present challenges when making comparisons across facilities. In these cases it is likely preferable to work with product financial records, which should exist if facilities pay for the commodities they receive. This may still present challenges in calculating throughput volume and weight, but this approach offers a much less labor-intensive method for identifying throughput value.

### Validate Data

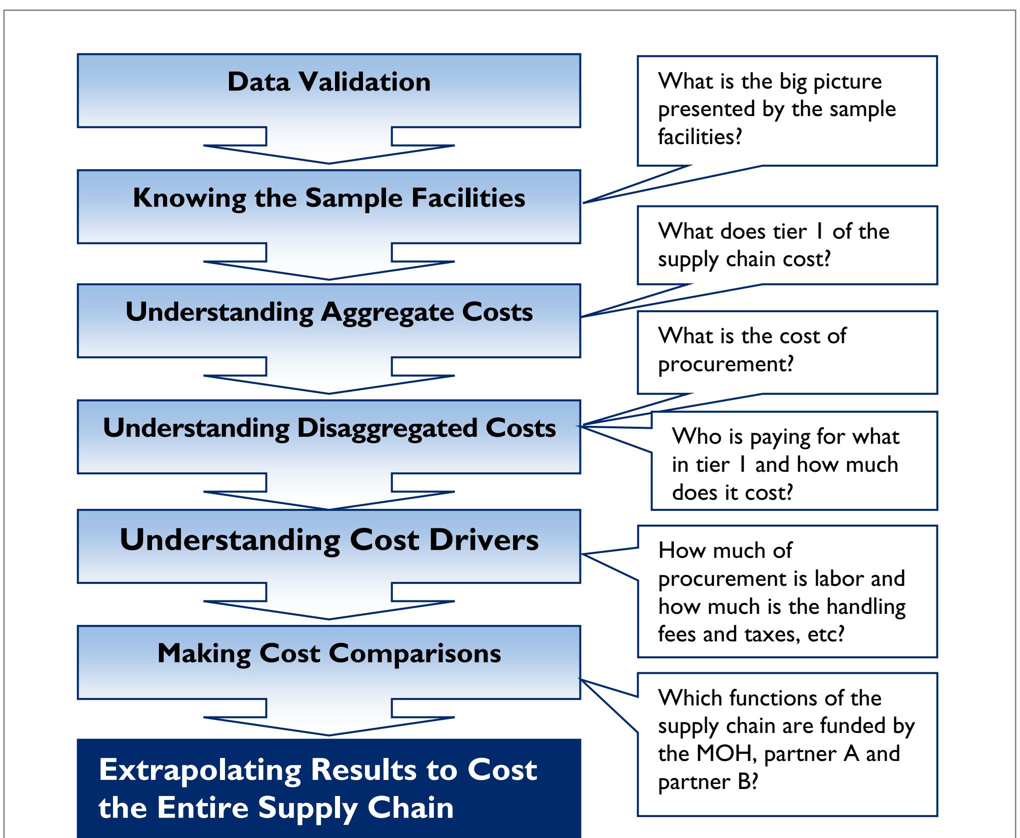
Once data collectors have completed their facility surveys, we recommend bringing them together and hosting a small workshop. This workshop can be an opportunity to have the data collectors enter their hard copy surveys into electronic form, eliminate errors, call their respondents to double-check discrepancies, and to make sure the teams conducted the data-collection process in a consistent manner. Use the workshop to make sure that results have been entered using consistent currencies, time units, and commodity units for throughput, and that teams have collected results using the same approaches.

Data collectors can also provide guidance on potential use of assumptions. The analysis team can ask the data collectors in person if they have questions about survey results, and at this stage the data collectors can also provide valuable input into the initial analysis.

## Data Analysis

After completing data collection, entry, and cleaning, the user is are ready to analyze the data to identify key results and build evidence for recommendations. Unless a specialized software tool such as the SCCT is being used, this stage may also require data manipulation to build results tables. Once basic results have been produced and validated, a general public health supply chain costing analysis approach is laid out in figure 5, which includes sample questions that can be answered by having the data collection team look at their results.

**Figure 5. Analyzing Supply Chain Costs**



Looking at sample facilities should provide a basic understanding of how much supply chain activities cost compared to the commodity throughput handled. Big picture questions could include, "What's the average supply chain cost?" or "are mark-up fees sufficient to cover logistics costs?"

Using the framework laid out in figure 2, it should be straightforward to calculate aggregated and disaggregated costs to estimate average costs by tier, function, and function per tier. Distinct average costs should also emerge for each facility type included in the analysis. Looking at costs by facility type, check to see whether the results are consistent and logical (for example, it is logical that total costs are higher at hospitals than at small health facilities or that costs per value of throughput are lower at hospitals than at smaller facilities). When facing outliers (for example, having one health facility that had supply chain costs twice as high as the facility with the next highest costs), double-check that costs were calculated correctly. Once validated, the outlier may be labeled as atypical or nonrepresentative, but it is generally not acceptable to eliminate the figure from analysis.

Looking at costs and other cost metrics across facility types can reveal insightful trends. Table 7 lists various cost metrics that should inform any supply chain costing study. Depending on the exact scope of the analysis and the exact research questions that interest stakeholders, some metrics may be of particular importance. However, examining results from as many perspectives as possible can yield unexpected and valuable insights.

**Table 7. Basic Supply Chain Cost Metrics**

| **Total supply chain costs** | | | |
|---|---|---|---|
| Cost per $ of annual pass through | | | |
| Cost per $m^3$ of annual pass through | | | |
| Cost per kg of annual pass through | | | |
| Procurement costs per $1,000 of commodities | | | |
| Storage costs per $1,000 of commodities | | | |
| Transport costs per $1,000 of commodities | | | |
| Management costs per $1,000 of commodities | | | |
| **Total procurement costs** | **Total storage costs** | **Total transport costs** | **Total management costs** |
| Procurement costs: labor | Storage costs: labor | Transport costs: labor | Management labor costs for quantification |
| Procurement costs: misc | Storage costs: space | Transport costs: per diems | Management labor costs for logistics training |
| Cost per $1,000 of procured commodities | Storage costs: equipment | Transport costs: fuel | Management labor costs for quality assurance |
| | Cost per $m^3$ stored | Transport costs: equipment | Management labor costs for LMIS |
| | Cost per kg stored | Transport costs: vehicle | Management labor costs other |
| | | Transport costs: misc | Management operating costs |
| | | Cost per $m^3$ transported | Management costs: misc |
| | | Cost per kg transported | |
| | | Total km | |

## Cost Driver Analysis

A key part of every supply chain cost analysis lies in understanding how cost components influence total costs. A cost driver is a variable that is closely correlated to total costs—that is, changes in total costs can be explained by changes in the cost driver. For example, in a transport operation, total costs might show little correlation to the total value handled but instead might be influenced by the total metric volume handled. In this case, the added metric volume requires additional vehicle trips, which increases fuel and driver time. Cost drivers can vary depending on the supply chain design and local environment: costs in a large country with many small SDPs may be driven by fuel for transportation, whereas supply chain costs in a smaller, densely populated country may be driven by labor for storage. Identifying cost drivers helps partners understand what shapes costs to their system, identifies possible areas for cost-saving changes, and aids in scaling up cost estimates from the sampled facilities to the entire system.

Having looked at costs at a big picture level, the next step is to disaggregate tier and facility level costs into their components. An initial step in understanding cost drivers is to see if any one of these four functions accounts for a large proportion of costs relative to the other functions, and whether this function is sensitive to change in the quantity of goods passing through the system.

Figure shows a simple breakdown of supply chain costs for tier 1 of the supply chain. In this example, transportation accounts are nearly half of the costs, followed by procurement, storage, and management. Given this finding, the next step would be to investigate what makes up the cost of transportation.

**Figure 6. Supply Chain Cost Analysis for All Tier 1 Facilities, by Function**

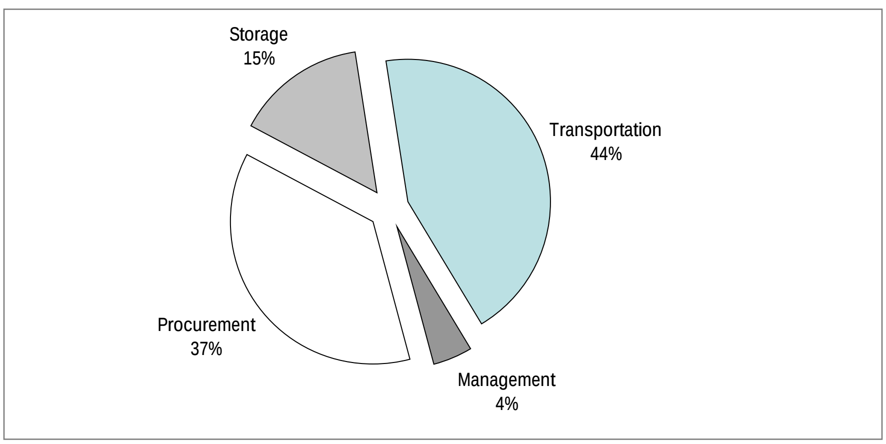
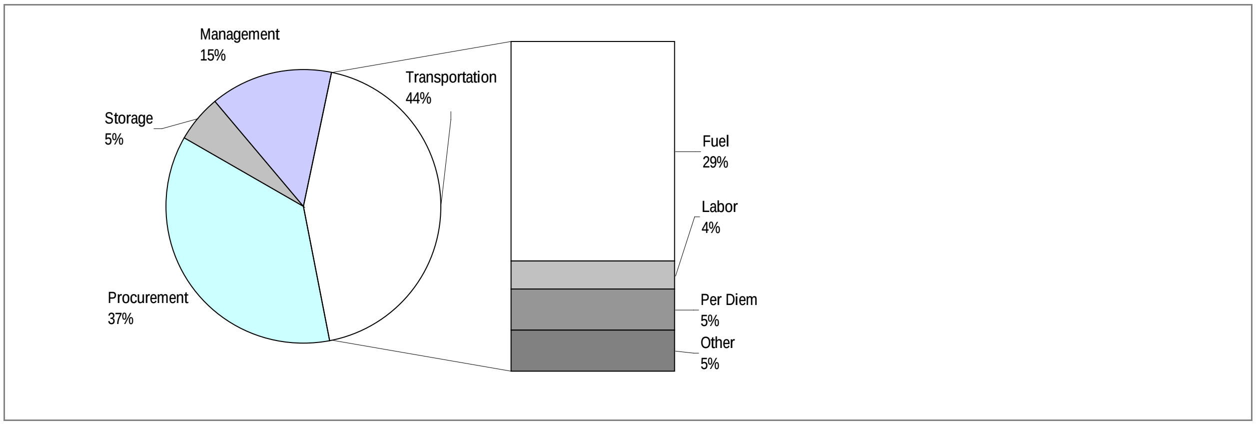



Figure shows the cost drivers for transportation in tier 1. It can be seen that the largest cost or line item component of transport is fuel costs, which account for 29 percent of the total cost of the supply chain. The same process would then be conducted for procurement to see if any particular item is driving procurement costs.

**Figure 7. Supply Chain Cost Driver Analysis**




This analysis can be conducted for each of the tiers to see how costs may be similar or different at the provincial or regional levels. A regression analysis between cost driver figures and total costs at each facility can help statistically validate a potential cost driver.

## Extrapolation of Results to Cost the Total Supply Chain

Cost data collected from sample facilities can be analyzed for cost drivers and initial results, but estimating total system costs requires extrapolation of sample data.

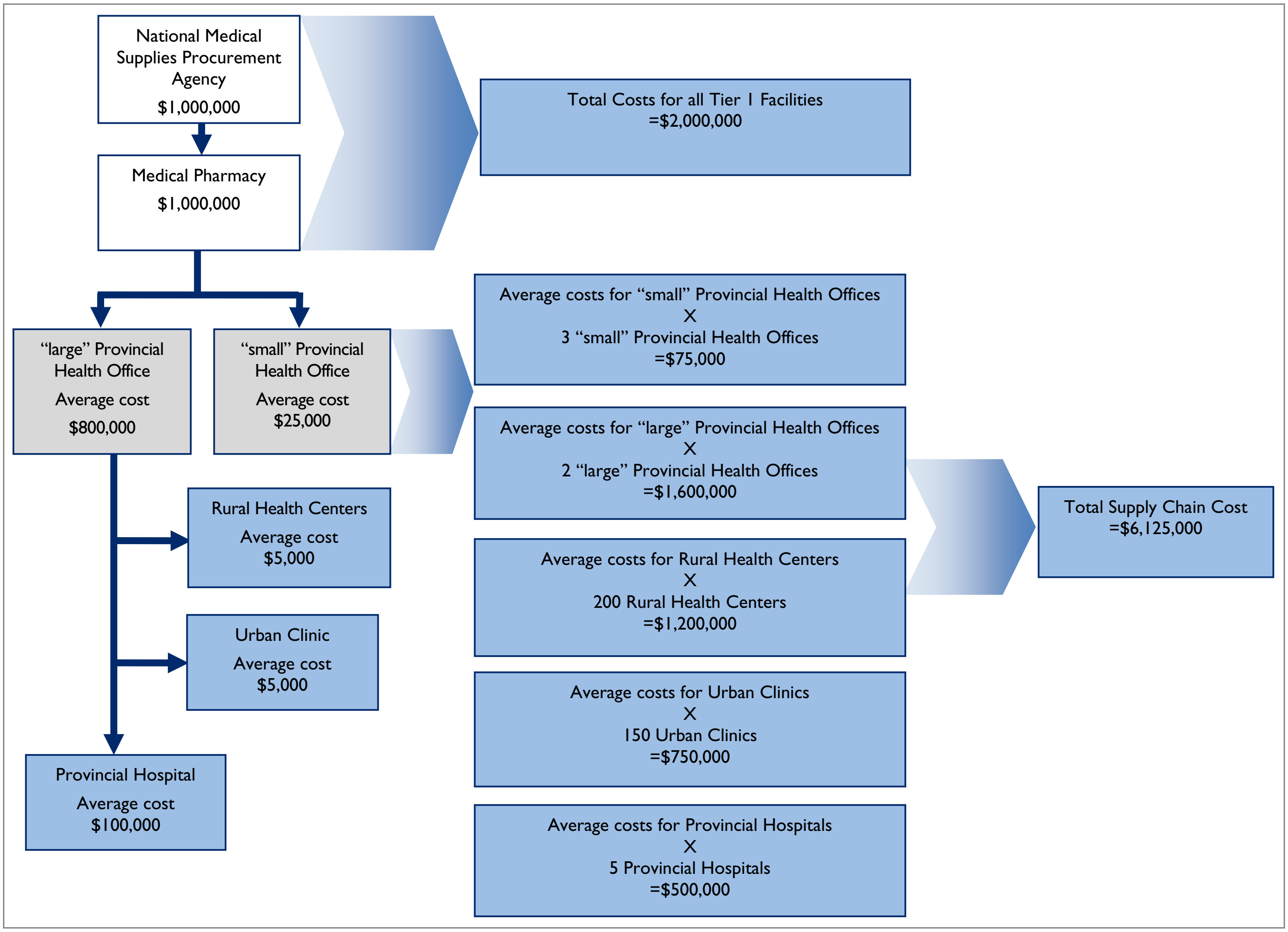
First, it is important to make sure that all the facilities that have been categorized as being part of a homogenous or similar group really are similar in terms of costs. The data validation process should have confirmed this. Decide if any outliers in the group should be excluded from the group or reclassified into another more appropriate category.

In the simplest form of extrapolation, the second and final step is to multiply the average costs of each facility type by the total number of facilities of that type that exist in the supply chain system. For example, if sample average costs of rural clinics were $6,000 per year and there were 200 rural clinics in the system, total costs for that facility type would be 200 × $6,000. Figure 8 illustrates this extrapolation calculation and also suggests a way to display this data clearly.

Other data might be used to support an extrapolation calculation as long as that data represents the entire system and it can be reasonably matched to sample data. For example, if total system throughput value is known for each system tier, sampled average cost ratios can be applied to that. In this example, if rural clinics had an average cost-to-product-value ratio of 18 percent and total product value handled by rural clinics was $3,000,000, the total costs for the rural clinics would be 18 percent of $3,000,000. If there are several data sources, another approach might be to try several extrapolation methods and compare the results.

The process outlined in this section produces a result that is extremely sensitive to cost drivers. The user must complete all the preceding steps and analysis to ensure that the facility types have been categorized correctly and the cost drivers of the system have been understood before attempting an extrapolation.

**Figure 8. Total Supply Chain Costs, Extrapolating the Average Costs of Facility Types**

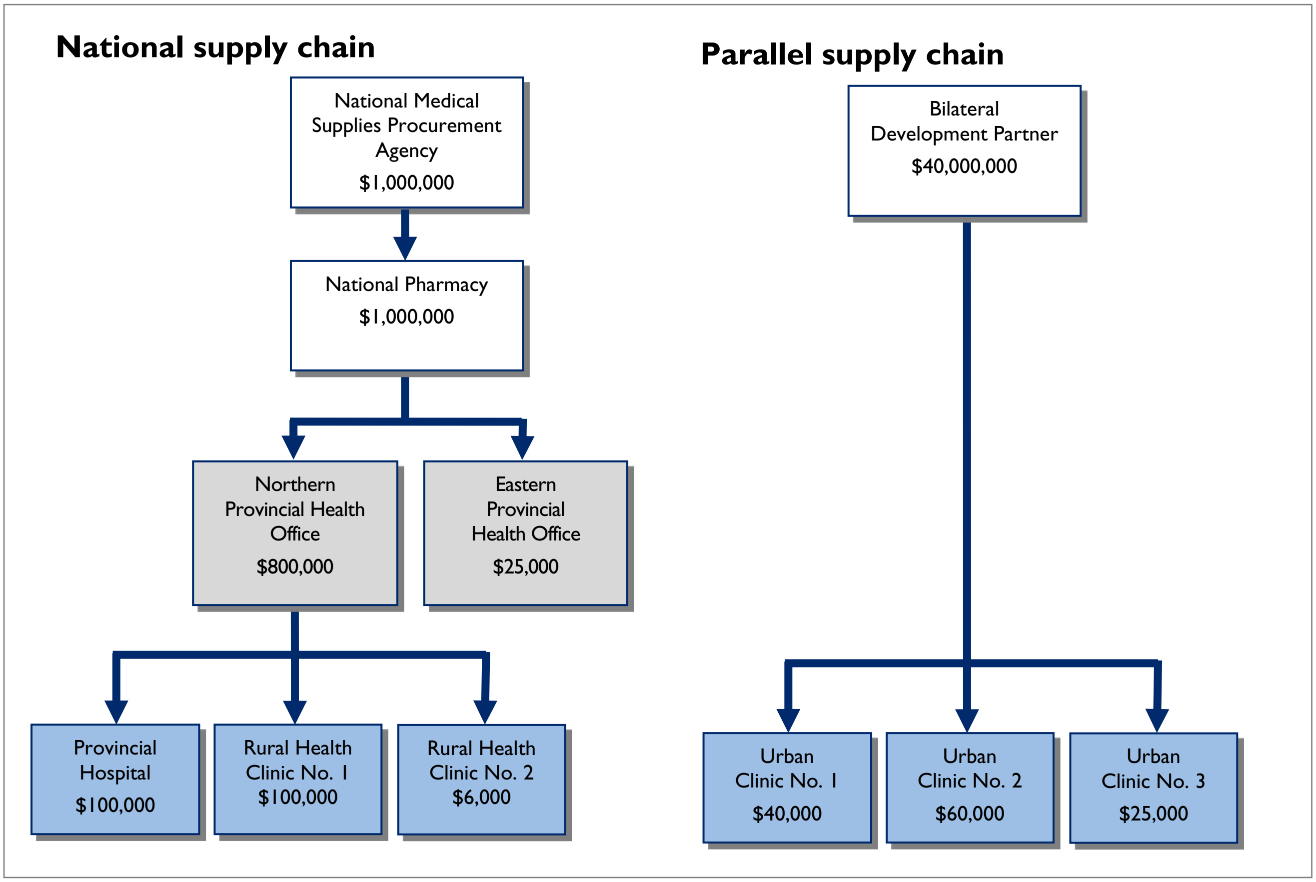



## Reporting of Results

Data can be copied and pasted from spreadsheets to display tabular results. However, some costing results are more clearly and intuitively displayed graphically. The information the user wants to share and compare will determine how best to present the data.

Figure provides an example flowchart, which effectively communicates costs as associated with individual entities in a supply chain:

**Figure 9. Supply Chain Flowcharts of Value of Commodity Throughput**



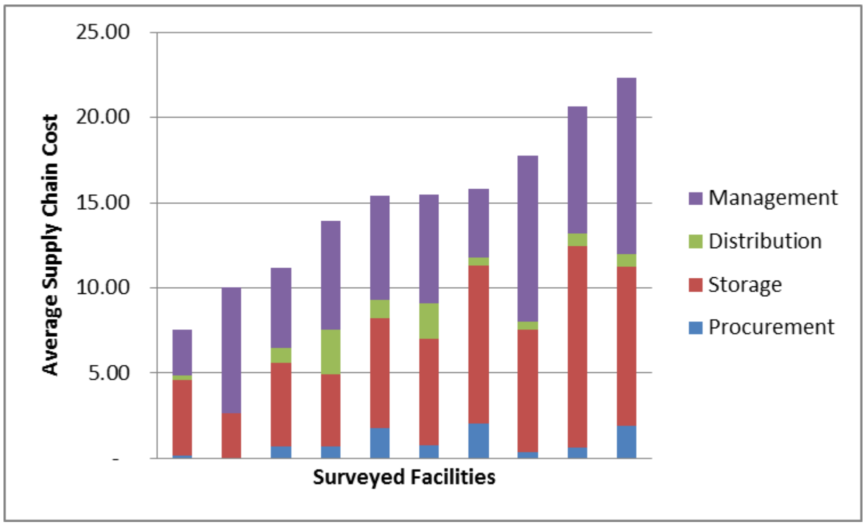

As the flowchart demonstrates:

- Tier 1 facilities are shown in white, tier 2 facilities (provincial level) are shown in grey, and tier 3 facilities (the SDPs) are shown in blue
- The supply chains deliver different values of commodities to SDPs
- The two supply chains support different facilities (rural vs. urban)
- Urban health clinics issue much higher total values of commodities than do rural ones
- The provincial hospital requires much higher commodity values than do health centers
- The two supply chains have different supply chain structures, with the parallel structure bypassing provincial health offices.

A table of these data would not convey the differences between the facilities, pathways, and volumes as clearly as a flowchart does. These flowcharts can be created showing volume, weight, or cost instead of commodity values. Flowcharts also have the added benefit of showing how commodities are linked through the chain of facilities, and they can prove especially helpful when depicting a system that sources commodities from different entities or that sends some commodities to particular levels.

Bar charts and pie charts can also help convey comparative ratios or sources of costs. Figure 10, for example, shows both total average and per-function cost per sampled facility.

**Figure 10. Sample Bar Chart: Average Supply Chain Cost Per Dollar of Commodities Handled**




# Using Cost Findings for Decisionmaking

## Applications of Supply Chain Costing Data

A critical measure of success for any assessment is the degree to which the collected and analyzed information informs future decisionmaking. Once the results are processed, the user should initiate discussions with stakeholders on how the costing study can inform fee setting, outsourcing decisions, or internal operations. Table 8 summarizes some of the key questions that supply chain costing can help address.

**Table 8. Key Supply Chain Costing Applications**

| Key applications of supply chain costing | Strategic or tactical decision making | Purpose |
|---|---|---|
| Understanding total cost and the distribution of these across partners, functions, and tiers | Strategic | Understanding how different partners in a supply chain operate and contribute to delivered costs and how reorganization of functions and responsibilities across partners and tiers could reduce supply chain costs. Can some functions be contracted out to attain defined service levels at a lower cost? |
| Making cost comparisons | Strategic | Compare two or more alternative supply chains in a country to determine which one provides defined service levels for the lowest cost. Compare costs to those in comparable |

| Key applications of supply chain costing | Strategic or tactical decision making | Purpose |
|---|---|---|
| | | countries for similar commodities. |
| | Tactical | Benchmark and compare delivered costs across facilities in a country to identify factors contributing to lower costs. Can practices in the lower-cost facilities be copied elsewhere? |
| Understanding cost drivers | Tactical | What inputs or functions incur most costs? What scope is there to reduce these costs? What are the most expensive inputs? How can use of these inputs be minimized, or can they be substituted with less-expensive inputs? How do costs change if expensive inputs are reduced? |

Strategic questions typically relate to the stakeholders that can influence how a supply chain is designed and implemented. For example, should an MOH or CMS be responsible for storage and distribution or should the government contract a parallel private or NGO third party logistics provider? Should a vendor-managed inventory system be adopted or should a pick-up system be used? What should the CMS charge the GFATM or donors for handling donated products?

Tactical supply chain questions are typically asked of a given supply chain to understand how it can run more cheaply. Tactical questions examine the key cost drivers and what changes in operations can reduce cost. For example, in Zimbabwe the supply chain costing analysis found that the cost of delivery could be lowered by moving to a quarterly rather than bimonthly delivery schedule.

Although costing analyses in the public and private sector have similarities, there are also important differences. Public health supply chains, unlike their counterparts in the private sector, are not driven by a commercial profit motive. Private supply chain cost analysis seek to identify cost savings that can contribute to improved efficiency and shareholder value. Companies can identify where their customers are concentrated and maximize service to those while focusing less on hard-to-reach clients with less purchasing power. Commercial supply chain operators may be able to trade off service levels and costs to get the right balance between what a customer pays for a product and a given supply chain service level.

In the commercial world, inventory holding costs can be a major supply chain cost driver, and reducing these can lead to lower supply chain costs. Such moves can, however, risk delays in meeting unexpected customer demand. Successful commercial supply chains understand their costs and are able to put a price to different service levels and charge customers accordingly. For example, as illustrated below, commercial online stores such as Amazon.com offer their customers a choice of delivery options and costs. This flexibility places the onus on the customer to decide what service level they want and what cost they are willing to pay for it. Note that in the example below (figure 11), the cost is not shown until a service level is selected.

**Figure 11. Delivery Options Offered through Commercial Online Stores**


Most public health supply programs set program service level and product availability targets first, and only then turn their attention to supply chain costs. Maintaining and improving service delivery levels is typically the main objective, with costs examined in this context. Ensuring product availability at 95 percent or greater may be a programmatic requirement for products that should be in full supply such as for ARVs, artemisinin-based combination therapy drugs (ACTs) and contraceptives. This may be a requirement irrespective of geography or location. Although reducing the associated supply chain costs may be possible, cost-reducing actions that risk lowering product availability (e.g., cutting inventory levels) are unlikely to be acceptable. Reducing deliveries for hard-to-reach geographic areas may also not be an option. There may also be limited flexibility for charging MOH clients, particularly for more expensive emergency orders.

Understanding public health supply chain costs is a necessary step to ensuring product availability. It can help ensure that sufficient budget resources are set aside at each tier to meet storage and delivery costs. It can also help in the identification of opportunities for reducing the costs of meeting desired program service levels.

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## Appendix A

# Glossary of Supply Chain Costing Terms

Some of the definitions have been adapted from the USAID | DELIVER PROJECT document "Guidelines for Assessing Costs in a Logistics System: An Example of Transport Cost Analysis" (Abdallah 2004).

| Term | Definition |
|---|---|
| Average cost | Total cost divided by total throughput (the total number of units received plus units shipped, divided by two).<br>For example, the average cost per unit of tier 1 is $0.05 per $1.00 worth of commodity if the total cost of tier 1 is $1,000,000 and the total value of the throughput is $20,000,000 (compare with *Unit cost.*). |
| Capital costs | Resource that are used over several years and are therefore only accounted for in any one year by a depreciation charge (see *Depreciation charge*) |
| Cost driver | Factor that affects the cost of a function. Influenced by the frequency and intensity of the demands placed on the resource and the state (conditional) of available resources (e.g., frequency of orders in a logistics systems; level of knowledge of logistics staff). |
| Depreciation | The decline in value of a physical asset resulting from normal usage and from age. The Supply Chain Costing Tool (SCCT) uses straight line depreciation, meaning that the value by which the good decreases over the course of a year of its useful life is equal to the purchase price of the good divided by its useful life.<br>For example, a car bought for $10,000 with a useful life of five years decreases in value by $2,000 each year; after five years it is considered to have a value of zero (even if in reality it could still be sold for some positive sum, in accounting terms it is valued at zero). |
| Depreciation charge | The accounting value (as reported in a financial annual report or accounting audit) that represents the annual cost of a good whose total useful life is more than one year. The value is equal to one year's worth of depreciation (see *Depreciation*). |
| Direct costs | Costs that can be explicitly identifiable with a particular service or area.<br>Examples of direct supply chain costs are hospital supplies, labor costs for logistics personnel, and fuel. |
| Facilities | The term *facility* in the SCCT and manual refers to a single institution that carries out at least one function (see *Function*) in the supply chain. This is not to be confused with the term *health facility,* which would apply to only a service delivery point (SDP). Each SCCT facility must have its own survey completed for importation into the tool. |

| Term | Definition |
| --- | --- |
| Function | A function consumes human and financial resources of a facility and represents the inputs of that facility. In the SCCT, the four functions are procurement, storage, transportation, and management. |
| Indirect costs | Costs that are not directly paid for by a program (e.g., volunteer labor). Sometimes referred to as overhead costs, this is incorrect because overhead costs (e.g., electricity) are paid for and therefore included in costs directly. |
| Integrated supply chain | A product-integrated supply chain distributes more than one type of commodity.<br>For example, a supply chain that delivers family planning commodities, essential medicines, and human immunodeficiency virus (HIV) commodities would be product-integrated (compare with *Vertical supply chain*). |
| Logistics management information system (LMIS) | A system of records and reports that are used to collect, organize, and present logistics data gathered across all levels of the system (USAID \| DELIVER PROJECT, Task Order 1 2011). |
| Operating costs | Resource used and replaced, in one year's time (e.g. personnel salaries, medicines, supplies, gasoline, medicines.) Non-labor operating costs refer to resources used for a supply chain function only, for example fuel used for transportation, and does not refer to resources used for the whole facility, for example electricity. |
| Overhead | Refers to institutional operating costs which are resources used and replaced, in one year's time (e.g. electricity, hospital director salaries). |
| Pull system | In a requisition (pull) system, the lower-level facility orders commodities as it needs them, pulling supplies through the chain.<br>In a requisition system, the person who receives the supplies calculates the quantities of supplies required (USAID \| DELIVER PROJECT, Task Order 1 2011). |
| Push system | In an allocation (push) system, the higher-level facility decides what commodities to push down the chain and when to move them.<br>In an allocation system, the person who issues the supplies calculates the quantities of supplies required (USAID \| DELIVER PROJECT, Task Order 1 2011). |
| Throughput | The total number of units received plus the units shipped or consumed, divided by two (Vitasek 2010). Also, a measure of warehousing output volume (weight, number of units). |
| Unit cost | Cost of one unit of output (e.g., the cost of storing $1.00 worth of commodity at a facility in tier 2 could be $0.02.)<br>Unit cost should not be confused with average cost (i.e., if the cost of storage varies between facilities in tier 2 then the average cost would be the total cost of storage in tier 2, summed across all the tier 2 facilities, divided by the total value of commodities stored by the facilities in tier 2, also summed across the tier 2 facilities; compare with *Average costs*). |
| Vertical supply chain | A vertical supply chain is one that distributes only one type of commodity (e.g., family planning commodities). A vertical supply chain typically exists as a parallel system to other supply chains within a country (compare with *Integrated supply chain*). |

# Appendix B

# Sample Scopes of Work

## Co-team Lead: Logistics Specialist (6 weeks level of effort [LOE])

- Skill set: Experience working on supply chains in developing countries and knowledge of all supply chain functions including procurement, transport, storage, information systems, training, and quality assurance. Familiarity with Excel and PowerPoint. Experience conducting logistics system assessment tool (LSAT) or logistics indicators assessment tool (LIAT) exercises are desirable.
- Responsibilities:
  1. Review all background supply chain documents relevant to the proposed study
  2. Write up the scope of work for the study, including the specific questions being addressed and which tiers and functions are being included
  3. Write up the supply chain structure, roles, and responsibilities of the facilities within the supply chain to be costed
  4. Calibrate the SCCT model to represent the supply chain
  5. Determine the sample criteria and sample facilities to be included, ensuring that these are appropriate for the questions that the study must answer
  6. Quality assurance of the data collected
  7. Data analysis and interpretation
  8. Report writing and presenting

## Co-team Lead: Costing Specialist (6 weeks LOE)

- Skill set: Experience with costing studies, accounting or economics. Advanced Excel skills are required to troubleshoot and locate data entry errors, though programming skills are not necessary. Some basic knowledge of supply chain activities is useful. Experience conducting LSATs or LIATs is desirable.
- Responsibilities:
  1. Review all background supply chain documents relevant to the proposed study
  2. Write up the supply chain structure, roles, and responsibilities of the facilities within the supply chain to be costed
  3. Determine the sample criteria and sample facilities to be included, ensuring that these are appropriate for the questions that the study must answer

4. Quality assurance of the data collected and identification of any incorrect data.
5. Data analysis and interpretation
6. Report writing and presenting

## Data Collectors (2–3 weeks LOE)

- Skill set: Logistics experience. Familiarity with the specific supply chain being costed. Ideally, this person should have worked with the supply chain with either a development partner or at a government level that requires oversight of the supply chain system. This person should also be familiar with the commodities being delivered by the supply chain. Experience conducting LIATs or LSATs is desirable. Ability to open, save, and close Excel files and enter and delete data is necessary.
- Responsibilities:
  1. Attend supply chain costing tool survey training and become familiar with the questions that the study is addressing and familiar with all the questions in the survey and able to navigate through the survey's Excel worksheet
  2. Conduct costing survey at facilities; enter data directly or from paper-and-pen surveys into the electronic surveys
  3. Collect any necessary documentation such as budgets and expenditure reports from facilities in either electronic or paper form
  4. Collect any commodity management data and be able to abstract that data from electronic or paper sources (e.g., be able to aggregate delivery invoices to obtain the total number of each commodity received by facilities each year)

## Appendix C

# General Data Sources

The following tables (tables 9 through 12) list data sources that can be used to obtain costing information. These may be modified and provided to potential respondents at facilities to allow them to prepare for the data collection process when they are visited.

**Table 9. Procurement Costs, Inputs, and Data Sources**

| Procurement costs | Input metric | Data source |
|---|---|---|
| Labor | • Personnel types<br>• Personnel title or civil service grade<br>• Personnel LOE spent on supply chain-related procurement activities (%) | • Interviews with procurement staff<br>• Interview with chief finance officer (CFO) or equivalent<br>• Interview with in-charge of a health facility (if any commodities are purchased directly by health facilities)<br>• Government civil service pay scale |
| Fees | • Customs fees<br>• Clearing agent fees<br>• Commodities taxes/duties<br>• Insurance<br>• Inspection fees at port of origin<br>• Handling charges | • Interview with procurement staff<br>• Bills of laden, receipts |

**Table 10. Storage Costs, Inputs, and Data Sources**

| Storage costs | Input metric | Data source |
|---|---|---|
| Labor | • Personnel types<br>• Personnel title or civil service grade<br>• Personnel LOE spent on supply chain-related storage activities (%) | • Interviews with storage or warehouse managers and personnel<br>• Interview with CFO or equivalent<br>• Interview with in-charge of a health facility<br>• Interviews with health facility staff responsible for logistics management<br>• Government civil service pay scale |
| Storage space | • Square meter of storage space<br>• Length (meters)<br>• Breadth (paces/meters/feet)<br>• Value per square meter; if no rent or payments currently | • Interview with CFO or equivalent<br>• Interview with in-charge of a health facility<br>• Interviews with health facility staff responsible for logistics management<br>• Physically taking measurements of storage |

| Storage costs | Input metric | Data source |
|---|---|---|
| | made on the space, then use rent of equivalent space in equivalent location | space<br>• Interviews or records from department physical infrastructure or equivalent |
| Equipment | • Forklifts, etc. | • Interviews with storage or warehouse managers and personnel<br>• Financial records and reports<br>• Physical inspection of facility |

**Table 11. Transportation Costs, Inputs, and Data Sources**

| Transport costs | Input metric | Data source |
|---|---|---|
| Labor | • Personnel types | • Interviews with transportation officer, managers<br>• Interviews with regional or district management officer or in-charge of facility<br>• Facility annual financial records and reports |
| Transport specific costs | • Fuel<br>• Maintenance costs<br>• Insurance<br>• Other expenses | • Interviews with transportation officer, managers<br>• Interviews with regional or district management officer or in-charge of facility<br>• Facility annual financial records and reports |
| Vehicles | • Vehicle types<br>• Vehicle cost<br>• Vehicle age<br>• Depreciation rate | • Interviews with transportation officer, managers<br>• Interviews with regional or district management officer or in-charge of facility<br>• Facility annual financial records and reports |

**Table 12. Management Costs, Inputs, and Data Sources**

| Management costs | Input metric | Data source |
|---|---|---|
| Labor | • Personnel types<br>• Personnel title or civil service grade<br>• Personnel LOE spent on supply chain-related procurement activities (%) | • Interviews with procurement staff<br>• Interview with CFO or equivalent<br>• Interview with in-charge of a health facility (if any commodities are purchased directly by health facilities)<br>• Government civil service pay scale |
| Operating costs | • Utilities costs<br>• Security costs<br>• Building maintenance | • Interview with CFO or equivalent<br>• Interview with in-charge of a health facility<br>• Interviews with health facility staff responsible for logistics management |

# Appendix D

# Case Studies

In this appendix we present some case studies that illustrate how to analyze cost data and how to use supply chain cost data for decisionmaking. These are drawn largely from recent work undertaken by the USAID | DELIVER PROJECT.

## Case Study 1: What Should We Charge the GFATM for Delivering Commodities?

This first case describes a hypothetical situation. The next Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria (GFATM) round proposal deadline is fast approaching. The Ministry of Health's (MOH's) Department of Pharmacy Services (DPS) has coordinated inputs from its various implementing partners and determined both the commodity forecasts and procurement pipeline to meet the needs for its HIV and acquired immune deficiency (AIDS) treatment program, its family planning and condom needs, and its malaria treatment program. DPS needs to include adequate budget for the storage and distribution of these products to SDPs. What should we charge the GFATM?

The Central Medical Stores (CMS) confirm that they have the capacity to store the commodity volumes included in the GFATM proposal. They also believe that by rearranging use of their existing fleet and spending more on maintenance and driver training, they can also ensure delivery to health district stores nationwide with the addition of three new vehicles. For budget purposes, they believe that the existing charge they levied on the last GFATM procurement round will need to be increased to 7 percent of the cost of commodities. CMS explains that the 7 percent charge is an average that is calculated across the full range of commodities the CMS handles. An additional capital investment of $225,000 for the three new trucks will also be required.

Does DPS have sufficient information to submit its GFATM proposal? What does the 7 percent charge on commodities include? How is it calculated? If this includes amortization for existing trucks, is there double counting of the new trucks with the capital budget? Does the 7 percent cover all of the supply chain costs required for the distribution system to work? Where do clients actually receive their needed commodities?

Ideally, the CMS has detailed information on its actual operating costs that it can use to justify the 7 percent charge. If not, an analysis of actual costs incurred in central storage and distribution to the district health centers would be necessary. These costs should cover all aspects of CMS direct and indirect costs and should be compared to the throughput of commodities distributed to the district level. This would provide an average figure for CMS management, storage, and distribution costs compared to the dollar value of commodities handled. This may be expressed as $70 of supply chain costs for every $1,000 in delivered commodity value, or 7 percent.

Given that the GFATM application includes high-value commodities such as antiretrovirals (ARVs) and artemisinin-based combination therapy drugs (ACTs), applying the simple 7 percent average may overestimate the real costs. In this case, some adjustment may need to be made based on the relationship of the average unit value of all commodities handled by the CMS in relation to the average value of commodities included in the GFATM proposal. The illustrative adjustment shown in the box suggests that a lower percentage charge of 5 percent may be appropriate.

The operating costs of new trucks needs to be included, and this should cover their driver salary benefits, per diem, maintenance charges, fuel, insurance, and amortization costs. In accounting terms, the vehicles should have a productive life of at least four years. The amortization cost is an accounting tool that sets aside the replacement value of the capital over four years so that a new vehicle can be purchased after four years. The up-front capital investment can be shown separately.

**Illustrative adjustment of supply charge based on commodity value.**
The CMS handle $50 million in commodities, and this represents a distributed throughput volume of 16,082 $m^3$ and an average value per $m^3$ of $3,109. Supply chain costs are estimated at $3.5 million. The GFATM application is for $10 million worth of commodities, but these are more expensive as they include ACTs and ARVs. The volume to be distributed will be 2,381 $m^3$ at an average value of $4,200 per $m^3$. Applying a 7 percent charge on value may be an overestimate. With a smaller volume to be transported, an adjustment for unit value would give $3,109/$4,200 × 7 percent = 5 percent as an adjusted charge.

The adjusted 5 percent charge covers distribution to the district level, but is that sufficient? If ARV therapy sites are limited to district hospitals, this may be appropriate for the HIV and AIDS commodities. The malaria and family planning commodities and condoms are likely to be distributed below the district level to primary care SDPs. What are the costs of this last-mile distribution? What about the costs of storage and management of commodities at the districts and management at the SDPs? If the LMIS is to function, then staff need to be trained and supervised and transport expenses paid to the lower levels. These costs need to be included for consideration in the GFATM application. A costing study survey can be used to gather the supply chain costs at the district and SDP tiers.

Depending on the commodities and geographic factors, this could add another 10 percent or more in costs. Some of these costs may be covered as part of the MOH normal program costs, but the transport, supervision, and training would represent real marginal costs incurred for the additional GFATM commodities. Ideally, these should be estimated—and mechanisms should be established—to fund last-mile delivery and management.

Supply chain costing can strengthen GFATM proposals. The costing study can also give the GFATM confidence that the budget proposed is based on a rigorous approach. Detailed analysis should capture not just the management, storage, and distribution undertaken by the CMS but also the costs incurred at the last mile. If a CMS charges an average cost as a percentage of commodity value, this will need to be adjusted if more expensive commodities are being purchased. If last-mile costs are estimated, these funds need to be disbursed to ensure last-mile transport, storage, and management takes place.

**Key Costing Steps to Determine the Correct Charge to the GFATM:**

- Review CMS costs carefully and compare these to commodity throughput.
- Compare the average value of commodities the CMS usually handles to the average value procured by the GFATM.

- Examine the costs of commodities delivered to each type of SDP likely to receive GFATM commodities.

## Case Study 2: Comparing Alternative Delivery Models

This second case study describes how supply chain costing was used in Zimbabwe. The Delivery Team Topping Up (DTTU) system is a vendor-managed inventory system implemented with support from John Snow, Inc. and Crown Agents initially in response to the economic crisis in Zimbabwe (USAID | DELIVER PROJECT 2008). Funded by U.S. Agency for International Development (USAID) and the Department for International Development, the system is managed by the Zimbabwe National Family Planning Council (ZNFPC) for 11 commodities including condoms, contraceptives, and test kits for HIV and AIDS. The DTTU involves a mobile warehouse with a driver and delivery team leader who visit facilities to take stock and bring stock levels up to their maximum based on the calculation of average monthly consumption. Data are entered on a ruggedized laptop that does the necessary calculations, and this is then fed into a central logistics management information system (LMIS). When product is available in the national pipeline, clinics served by the DTTU consistently achieve over 95 percent product availability year round. Responsibility for managing supplies is thus shifted from overworked clinical staff and is managed by a small group of DTTU staff. As Zimbabwe's economy recovers, questions were raised about the cost of the DTTU approach and whether re-establishing a more traditional pull system for essential drugs would be a lower cost option.

What is the cost of DTTU delivery, and is this greater than an alternative more traditional system in which facility staff calculate and transmit orders to the districts and central level? How can we compare the DTTU with a system that has not been fully functional for a number of years? How would the costs of the DTTU system change if more products were added and deliveries changed from a bimonthly to quarterly schedule?

The starting point for the analysis was to apply the project's SCCT and associated assessment methodology to the DTTU (Sarley, Baruwa, and Tien 2010). This involved collecting information from DTTU partners on their operational costs and following a delivery route to look at the time and resources required by delivery staff and facility staff. As this is a centrally managed program, much of the costs are incurred at the national level. The analysis captured the costs of DTTU management, the direct costs of DTTU deliveries, and the associated costs incurred at facilities. Once the initial data were collected, a series of scenarios were constructed with different assumptions for delivery schedule and commodity volumes and values to reflect an expanded product list. This required sitting with the DTTU management to determine how truck routes, loads, and the associated delivery team workloads would be affected. Using the initial data collected for the existing DTTU supply chain, the assumptions were used to recalculate costs for each scenario.

For comparison purposes, the costs of running a traditional pull system for primary care Essential Drugs System (EDS) were assembled. As the system was not actually functioning, this could not be collected on the basis of actual observed activities or financial operating details. Rather, the assessment team identified unit costs based on stakeholder discussions and constructed a budget for operating the system. The team then made comparisons with the DTTU costs for similar commodity volumes and assuming similar service delivery and product availability targets. The team also held several stakeholder workshops to validate the EDS scenarios, as these were assumption driven. Table 13 presents the tier 1 or central level costs and commodity throughput associated with the DTTU, assuming that 55 commodities are delivered on a quarterly basis.

**Table 13. Example of DTTU Scenario Costs**

| | Costs to deliver 55 commodities | Function as % of total supply chain costs |
|---|---|---|
| Total value of commodities passing through | $14,720,506 | |
| Total volume of commodities passing through ($m^3$) | 7,624 | |
| Total weight of commodities passing through | 1,426,196 | |
| Procurement costs | $54,760 | 3% |
| Storage costs | $243,671 | 13% |
| Transport costs | $649,355 | 45% |
| Management costs | $330,157 | 39% |
| **Total cost** | **$1,277,943** | |
| Cost per $ of annual pass through for tier 1 | $.09 | |

The costs incurred at the tier 2 service delivery level were estimated to be another $0.107 per dollar of commodity handled to give an estimated total cost of $0.197 per dollar delivered for this DTTU scenario. In comparison, the Essential Drug scenario estimated that the costs per function incurred at the tier 2 or SDP level were far greater for the primary-care based EDS, with training and supervision as significant costs (Table 14).

**Table 14. Comparison of Scenario 4 and Scenario 6**

| **Commodity value** | **$14,720,506** | **$13,953,301** |
|---|---|---|
| | **DTTU** | **EDS pull** |
| **Cost component** | **Scenario 4 (U.S.$)** | **Scenario 6 (U.S.$)** |
| Management | 0.14 | 0.18 |
| Transport | 0.04 | 0.03 |
| Storage | 0.02 | 0.05 |
| **Total** | **0.197** | **0.265** |

The comparison of a DTTU delivery model with an EDS handling similar commodities showed that the DTTU approach actually operated with lower average costs. It should be noted that the difference in commodity values between the two systems reflected that the EDS delivered to only Ministry of Health (MOH) sites, whereas DTTU also covered some nongovernmental organization (NGO) facilities. The analysis helped policymakers realize that when they were previously comparing DTTU costs, they were only focusing on the tier 1 or central costs. The tier 1 costs of the DTTU are in fact greater than the tier 1 costs of the EDS system. DTTU trucks and delivery teams are more expensive than those operated by NatPharm, the CMS in Zimbabwe. This conclusion, however, did not capture the entire supply chain costs, and it ignored the costs incurred at tier 2. The EDS tier 2 costs were significantly higher than those for the DTTU, as there was a nationwide requirement for training and supervision that did not exist with the DTTU (table 15).

**Table 15. Tier 1 and Tier 2 Costs for a DTTU and EDS Scenario**

| Supply chain costs | DTTU | EDS |
|---|---|---|
| Tier 1 (U.S.$) | 1,223,183 | 963,295 |
| Tier 2 (U.S.$) | 1,674,479 | 2,731,229 |
| Total (U.S.$) | 2,897,662 | 3,694,524 |

Discussions with stakeholders further refined the conclusions, confirming that the results were valid for the volume of commodities analyzed. As Zimbabwe's economy continues to recover, increasing volumes of products for primary care facilities could be similarly handled by replicating the vendor-managed approach of the DTTU. New transportation schedules have since been rolled out for malaria and tuberculosis (TB) products. This approach may be less practical for wider essential drug resupply at secondary hospital settings, where the range of products required may be more efficiently handled by the EDS.

This case study shows that supply chain costing can be used to collect and compare cost data from alternative delivery systems. However, it is important to ensure comparability. For functioning supply chain systems, this can be done by creating a base dataset and adjusting it for different delivery assumptions. Where a comparison is to be made with a hypothetical system, ensuring consistency in individual costs and stakeholder agreement in building assumptions is important to ensure buy-in to results. It is important that stakeholders understand the limitations of each scenario being compared. In ensuring a fair comparison of DTTU and EDS delivery in Zimbabwe, it was important to compare similar product bundles and to not draw conclusions beyond the product volumes used in the study.

## Case Study 3: Identifying Cost Drivers, DTTU and EDS

When comparing two different supply chain delivery options, it is important to understand the factors affecting their respective costs. In Zimbabwe, the comparison of the DTTU and EDS system hinged on understanding how the inputs for each approach differed and how their costs changed as the volume of products moved by each delivery mechanism changed. We examine here the factors behind the costs associated with each function and tier for each delivery system.

Before the cost analysis was completed, the common assumption was that the DTTU would be more expensive, as measured by cost per value of commodity. Yet the analysis showed otherwise—why was this? What were the factors contributing to the higher costs for the EDS system? Table 16 highlights the key differences in system design and the associated cost drivers for the DTTU and EDS.

**Table 16. Cost Drivers for DTTU and EDS**

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

With the DTTU system, the vehicle and associated costs of the delivery teams (including their per diems) were key cost drivers. With two people on each delivery route, the salary costs were greater than the delivery approach used by the EDS. Furthermore, because the delivery team spent longer working at each facility, fewer facilities could be seen on one day, requiring delivery teams to spend longer in the field with greater per diem costs. Deliveries were also made to each facility nationwide.

In comparison, EDS only delivered to the district level with facilities either coming to collect their products from the district or receiving them during district supervision visits. There are fewer delivery staff costs but greater costs associated with each facility managing their products. With high staff turnover at the facilities, there is a greater need and expense to retrain everyone. Greater supervision is needed both to ensure that facility staff manage their products and to facilitate product delivery. Table 17 presents a comparison of tier 1 and tier 2 costs by function for the DTTU and EDS scenarios; the table shows that, for both scenarios, most costs are incurred at the lower levels. Although tier 1 costs are similar for the two scenarios, the tier 2 costs are almost double for the EDS scenario. In the EDS scenario, transportation only costs 3 percent of the commodity value, whereas management at the ADPs accounts for 15 percent. It should be noted that under the DTTU scenario, the tier 2 storage costs include some management time as well.

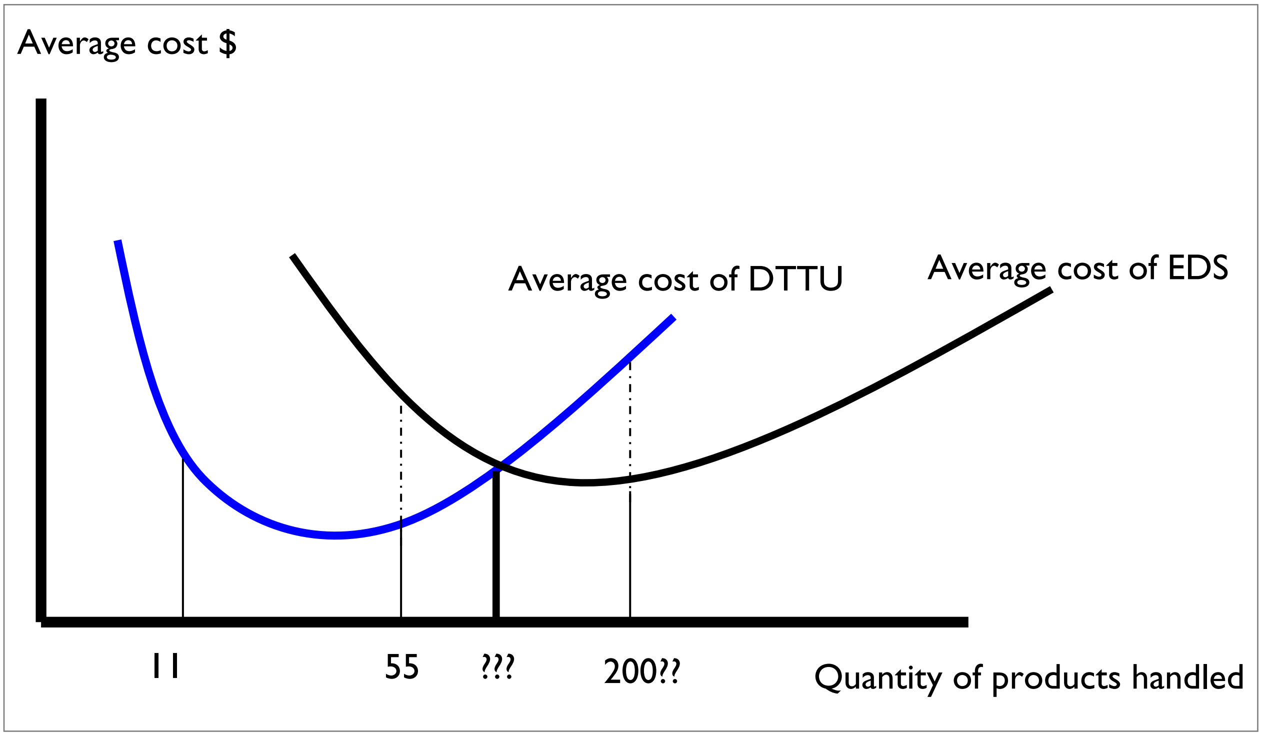
**Table 17. Comparison of Cost Per Dollar Value of Commodity, DTTU Versus EDS Supply Chain System, Zimbabwe**

| DTTU scenario | Tier 1 | Tier 2 | Total |
|---|---|---|---|
| Storage costs | $0.02 | $0.08 | $0.09 |
| Transport costs | $0.04 | $ - | $0.04 |
| Management costs | $0.02 | $0.04 | $0.06 |
| Total costs | $0.08 | $0.11 | $0.19 |
| EDS scenario | Tier 1 | Tier 2 | Total |
| Storage costs | $0.01 | $0.05 | $0.05 |
| Transport costs | $0.03 | $ - | $0.03 |
| Management costs | $0.03 | $0.15 | $0.18 |
| Total costs | $0.07 | $0.20 | $0.27 |

The average costs for the 55 products in this study appear to be lower for the DTTU than the pull EDS—can the same be said for a larger number of products?

The simple answer is that the analysis comparing the 55 products does not directly provide an answer. There is no guarantee that the average cost of a DTTU with an expanded product portfolio will remain lower than the average cost of a pull EDS as more products are added based on the analysis being conducted. When the 44 products were added to the 11 in the current DTTU, the products' average costs actually increased marginally. Would they increase further if more products were added? At some point, as more products are added to the DTTU system, the time needed to do product counts at facilities, and then to sort through and unload the needed commodities from the truck, will increase. This will also increase per diem costs and, at some point, the DTTU average costs may exceed the costs of a pull EDS. In other words, as the number of products transported on the DTTU trucks increases, it becomes easier to do the pick and packing in the larger fixed warehouse than in the mobile warehouse operating on the back of a truck. This phenomenon is illustrated in figure 12.

**Figure 12. Relationship between Average Cost and Quantity of Products in the DTTU and EDS**




An alternative approach to expanding the number of products delivered through a vendor-managed approach is to increase the number of delivery runs dedicated to specific product groups. This is the approach currently being implemented in Zimbabwe with the Zimbabwe Informed Push (ZIP) System. Malaria and TB commodities have been added as a programmatic product group. An analysis of the costs of that program relative to those of the DTTU would help confirm whether delivery costs are comparable.

Understanding cost drivers can help determine the right approach for supply chain system design. Lower-level management, supervision, and training costs are a major cost driver for a traditional pull supply chain. Most of these costs are either hidden or underfunded, affecting system performance. For the limited products in full supply this is not a cost efficient design. Conversely, although a vendor-managed inventory approach appeared to have higher observable tier 1 costs for transport and management, the costs incurred at the lower tiers were minimized.

For more information, please visit deliver.jsi.com.

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