USAID | DELIVER PROJECT

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Estimating the Global In-Country Supply Chain Costs of Meeting the MDGs by 2015

Technical Brief

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USAID | DELIVER PROJECT, Task Order 1
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Abstract
This concept note outlines a costing model, cites available information sources, and identifies data gaps for estimating globally the in-country supply chain costs to meet the Millennium Development Goals by 2015. Using available information, we develop an approach for estimating the variable costs for in-country distribution costs based on a series of assumptions. We also propose a tool and approach to validate these assumptions and develop an approach for estimating the capital costs required to handle the expected increase in volume of commodities as MDG targets are met

Cover photo: A mother and her child in Balykchi, Uzbekistan. JSI. 2006.

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ACRONYMS

ACT	artemisinin-based combination therapy
AIDS	acquired immune deficiency syndrome
ARVs	antiretrovirals
CMS	Central Medical Stores
DTTU	Delivery Team Topping Up
EPI	Expanded Program on Immunization
FPLM	Family Planning Logistics Management Project
GIVS	Global Immunization Vision and Strategy
GNI	gross national income
HIV	human immunodeficiency virus
IDA	International Development Association
ISO	International Organization for Standardization
LMU	Logistics Management Unit
LMIS	Logistics Management Information System
LPI	Logistics Performance Index
MDG	Millennium Development Goal
M&E	monitoring and evaluation
MOH	Ministry of Health
NGO	nongovernmental organization
PPP	purchasing power parity
QA	quality assurance
SC	supply chain
SCMS	Supply Chain Management System Project
SDP	service delivery point
UNICEF	United Nations Children's Fund
USAID	U.S. Agency for International Development
WHO	World Health Organization

INTRODUCTION

Attaining the health-related Millennium Development Goals (MDGs) in 49 International Development Association (IDA) countries requires substantial additional funding and support. Estimates of the in-country distribution costs are required to complement estimates of the health service delivery and associated essential health commodity costs. Health commodity supply chains require both capital and recurrent expenditures to cover the cost of purchasing, storing, and distributing essential health medicines and supplies. They also require management support to improve the efficiency and effectiveness of distribution systems to ensure health commodity availability. The challenge in developing a global estimate of supply chain costs is that there is limited information on the true costs of in-country distribution systems. A related challenge is that too often these costs are either neglected or underestimated. A third challenge is estimating how supply chain costs will evolve over time as volumes increase as more health commodities move through the health system chain to meet MDG requirements. How is the cost of infrastructure and new capacity factored in? What scope is there to determine efficiency gains?

This concept note outlines a costing model, cites available information sources, and identifies data gaps. Using available information, we develop an approach for estimating the variable costs for in-country distribution costs based on a series of assumptions. We also propose a tool and approach to validate these assumptions and develop an approach for estimating the capital costs required to handle the expected increase in volume of commodities as MDG targets are met.

COSTING MODEL

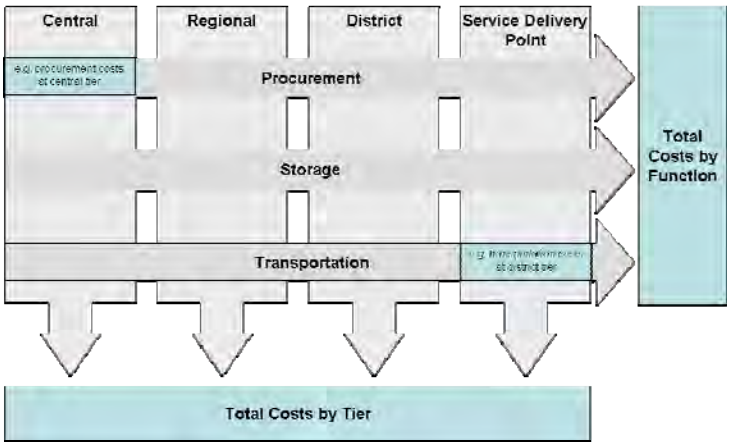
There is typically no routine collection or estimation of distribution costs for public health systems in developing countries. The cost of purchasing, storing, and distributing essential health medicines and supplies is often fragmented across different organizations and administrative levels within government as well as nongovernmental organization (NGO) and private providers. A quick survey of available analysis has identified a number of public health supply chain studies with estimates of supply chain (SC) costs varying from 13 percent of product cost in Ghana to 44 percent of the value of the bed nets for a bed net delivery project in Liberia (Project estimate, see Annex A).

Typical costing methodologies examine supply chain costs, including the cost of procurement, central storage, and distribution through different levels down to service delivery points (SDPs). These costs will vary for different products such as Expanded Programme on Immunization (EPI), which requires a cold chain, and bulk items such as bed nets, particularly if these are delivered to households. The USAID | DELIVER PROJECT is piloting a methodology that costs different SC functions at different tiers. This tool was piloted in Zambia in January 2009; we illustrate its scope in Figure 1.

Supply chain cost estimates of existing systems tend to include the variable costs of ensuring product availability based on existing infrastructure, which may include some depreciation or capital replacement costs for warehousing and transport. It typically does not include the investment costs for expanding infrastructure to meet increased commodity volumes for meeting MDG targets.

In most instances, management costs, including the management of information, are incorporated into the different supply chain functions—procurement, storage, and transportation. There may be some management costs, however, that are outside each function but related to supply chain management that need to be included, such as a Logistics Management Unit (LMU) that oversees the total supply chain.

Figure 1. Supply Chain Functions and Tiers, Illustrated



Source: Raja, Grace, and Chesley. 2000 (adapted from Christopher 1998).

The types of questions the supply chain-costing tool will answer

- What is the total cost of the supply chain?
- What is the cost of the supply chain at each tier (central, regional, district, etc.)?
- What is the cost of specific SC activities (procurement, storage, distribution, management information systems, etc.)?
- How do SC costs vary by region?
- How does the value/cost of a commodity compare with the cost of distributing that commodity to the end user?

FACTORS AFFECTING THE GLOBAL ESTIMATION OF SUPPLY CHAIN COSTS

Application of a cost estimate to the 49 priority countries presents a number of challenges. As noted above, cost estimates do not exist for each country. Therefore, countries will need to be grouped according to common characteristics and proxy estimates used to determine the typical cost parameters that apply to them. Common characteristics will include:

- Geography, both the size and difficulty of transport within a country
- Economic development and economic competitiveness

Logistics costs as a proportion of the cost of business tend to decline as systems and economies become more efficient, competitive, and developed. Logistics costs in poorer, underdeveloped economies with inefficient infrastructure monopolies will be higher than they are in more open and competitive economies. Similarly, costs in failed states will be even higher because the distribution system needs to be built from scratch and security costs may be higher. For example, as previously cited, the in-country cost of bed net distribution to households in Liberia was 44 percent (project estimates) of the landed cost of the nets themselves.

In most cases, available logistics system cost estimates relate to existing systems. As the MDG target report shows, most countries are failing to achieve their targets, in part because they are failing to

provide the necessary commodities. Meeting the MDG targets will require an increase in the volume of commodities handled, greater efficiency in handling them, and an increase in effectiveness in reaching clients at the last mile. The improvements needed to increase product availability require new investment and management support to reduce the marginal variable costs of distribution in the future. Physical investments will include new warehouse space and transport fleets, and management improvements might include establishing or strengthening LMUs and computerized logistics management information systems as well as better supervision of and training at lower levels in the supply chain. The closer a country is to reaching its MDG targets, the fewer SC efficiency and effectiveness gains will be needed and the lesser this investment will be. So, for example, health SC costs in Nepal for meeting MDG 5 are likely to be closer to existing costs because Nepal is relatively closer to achieving its MDG 5 targets. Countries that are further away are likely to require more investment in SC improvements.

As we already noted, health commodities have different characteristics and associated distribution needs and costs. These include product bulk, the need for cold or cool chain distribution, and security for high-value items, and controlling against counterfeit and poor-quality products. These different requirements necessitate estimating the costs for different SC segments that may be associated with different health programs and MDG targets.

SUGGESTED APPROACH

With limited actual data on costs, how can we estimate the SC cost of meeting the MDGs in terms of the recurrent costs? Given available data, we propose a three-step approach. We complete Step one in this paper:

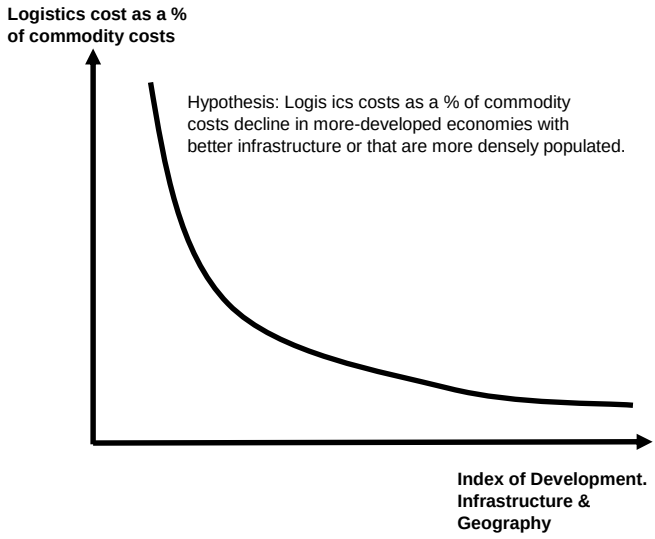
- Step one: Develop a global SC costing projection model that uses the limited available data to generate estimates of recurrent costs as a proportion of commodity costs. Make a series of assumptions to classify countries according to their economic development levels and geographic challenges. Identify how well countries are attaining their MDGs and how their logistics systems are performing. Make an investment estimate based on the likely infrastructure and management costs required to improve performance.
- Step two: Select three or four countries to estimate actual costs using the USAID | DELIVER PROJECT tool. Zambia has taken place; select other countries to cover as wide a range of countries as possible. Also, do a more widespread survey of costing approaches for different programs.
- Step three: Use the new country data to adjust the assumptions and parameters in the model to revise the model. Finally and where possible, classify health commodity costs by major health program—MDG target.

GLOBAL SUPPLY CHAIN COSTING PROJECTION MODEL

The underlying hypothesis is that the cost of health logistics declines in relation to how efficiently an economy and health system operate. Thus, logistics costs in developed economies in relation to the value of the commodities moved through their system will be lower than they are in less developed countries. Further, in comparing developing countries, factors such as the size of the country, proportion of roads that are paved, and whether the country is a failed or post-conflict state will all add to the logistics cost of doing business or meeting the MDG targets. Figure 2 illustrates the

hypothetical relationship between logistics costs as a percentage of commodity costs and a combined index of economic development, infrastructure, geographic, and stability indicators. As a reference point, U.S. logistics costs for a range of industrial and retail sectors as a percentage of sales, were estimated in 2000 as being 9.44 percent, while the U.S.grocery sector has estimated logistics costs of 6.9 percent, and (various) pharmaceuticals have logistics costs of 4.5 percent. The last figure reflects the relatively higher cost-to-volume ratio of the medicines and high U.S. drug prices. The United States ranks 14th in the Logistics Performance Index (Arvis et al. 2007), partly because of its larger geographic size than other higher ranked developed economies; Singapore ranks first.

Figure 2. Logistics Costs and Development



There are a number of assumptions behind this hypothesis. In reality, there may be three or four separate relationships, depending on the condition and availability of supply chain infrastructure. One might interpret this as different short-term cost relationships based on the level of capital infrastructure, economic development, and efficiency. This is shown in Figure 3, where countries are clustered according to their level of development and infrastructure. Moving from one short-term curve to another would require investment in infrastructure, staff, and management resources. The supply chain for failed states may also require a response modeled after humanitarian assistance rather than one that relies on the public sector.

Figure 3. Country Clusters

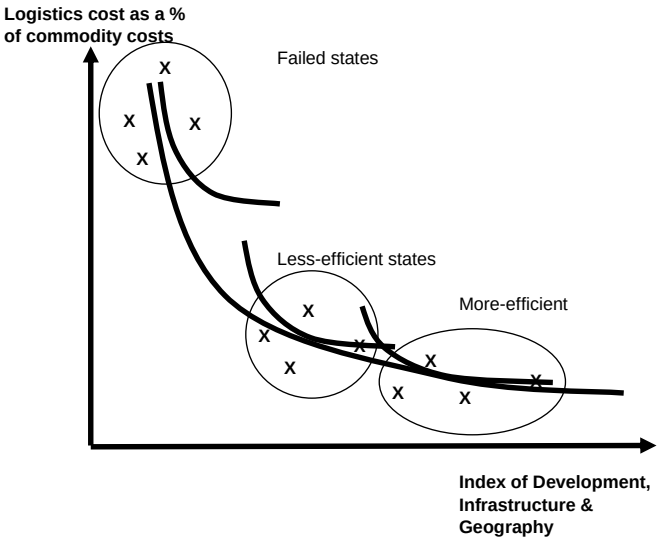
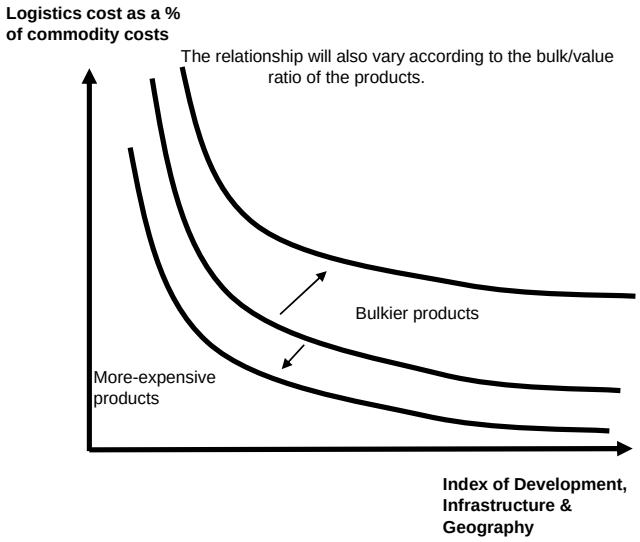


Figure 4. Bulk and Value Variability



Furthermore, the curve may be different for high, volume, low-value commodities and high–value, low-volume commodities; see figure 4.

AVAILABLE COST DATA

The availability of cost data is limited. We have identified a number of estimates undertaken by the USAID | DELIVER PROJECT and earlier DELIVER and Family Planning Logistics Management (FPLM) projects in different commodities and different countries. Table 1 below summarizes the cost estimates by country and commodity group and indicates the costs included in the estimation. While these costs are not entirely comparable, they do provide some reference points for economies that, with the exception of Zimbabwe, are in similar stages of development. We also include some reference points for Lesotho and Egypt.

Table 1. Summary of Cost Estimates for Select Countries by Product Group

Country	Product	Procurement	Storage	Distribution	Management	LMIS	Selected Logistics cost %*	Note
Bangladesh	Contraceptives			x			1%	Bangladesh contracts out 50% of its distribution to private transport providers; see Annex A
Malawi	ACT		x	x	x	x	18%	Includes program management but not MOH staff costs; see Annex A
Uganda	Contraceptives			x			3%	Transport study (Abdallah, Healey, and O'Hearn 2002)
Nigeria	ARVs			x			4.8%	Transport from CMS to tertiary and secondary sites by an NGO contractor
Liberia	Bed nets	x		x	x		44%	Household delivery of bed nets, of which 8% was for procurement and QA testing, and 36% was in country distribution; see Annex A
Zimbabwe	Condoms			x	x	x	12%	DTTU excludes MOH staff costs (Bunde et al. 2007)
Ghana	Essential Health commodities	x	x	x	x	x	13%	Health Supply Chain Costing Study (Huff-Rouselle and Raja 2002)
Egypt			x	x	x		6%	Excludes MOH staffing costs (Abdallah and Wilson 2002)

Zambia	ARV	x	x	x	x	x	16.1% rural SDP 9.0% to 10.4% urban SDPs	Health Supply Chain Costing Study (Baruwa, Tien, and Sarley 2009)
Honduras	Essential drugs			x			6.5%	NGO distribution costs. (Gribble et al. 2006)

*** The costs shown for each country relate to the components indicated by "x."**

The detailed cost study in Ghana estimated the following cost shares for the supply chain: procurement -7 percent; storage - 73 percent; and distribution - 20 percent.

In addition to this information, as seen in Table 2, a survey of project countries identified the following charges Central Medical Stores applied to commodity values for clearance, storage, and distribution. These costs do not necessarily reflect the full economic cost of the services provided, as it is unclear whether capital costs are included. Nonetheless, they do reflect variable costs for procurement, clearance, storage, and distribution.

Table 2. Survey: CMS Charge for Logistics Services

Country	Procurement & clearance	Storage & distribution	Distribution to	Total Cost
Lesotho	No	Clearance, storage, and delivery	Service delivery points	16% (4% for ARV)
Nepal	No	Medical Stores charges 4%, but it should be higher—at 10%, includes clearance	Service delivery points, but more expensive for internal air transport	10%
Malawi	No	12.5%, includes clearance	Clearance, storage, and distribution to districts	12.5%
Mozambique	2%	8%, includes M&E and pharmacovigilence	Distribution from central to provincial	10%
Rwanda	No	9%, includes clearance	From airport to regional warehouses	9%
Tanzania	4% includes clearance	15%	Distribution to district level	19%
Uganda	2.2% just clearance	10%,	Distribution to district level plus 3% for SDP delivery	15.2%
Zimbabwe (pre-emergency)	no	Distribution only	Limited distribution to SDP	12%

Note: Statistics for Table 2 came from the USAID DELIVER | PROJECT field offices.

UNFPA charges a 5 percent procurement charge, while USAID's Supply Chain Management System (SCMS) project incurs 6.9 percent. Most countries quoted above do not distribute below the district level, and Mozambique only distributes to the provincial level. These distribution costs from provinces to districts and districts to service delivery points would add significant additional costs, depending on fuel costs, infrastructure and geography. Available transport estimates for in-country

distribution vary: 6.5 percent in Honduras, 4.8 percent in Nigeria, 3 percent in Uganda, 2.6 percent in Ghana, and 1 percent in Bangladesh. One other key factor is that the supply chain systems in most of the above countries are not working well. They need additional management, and systems strengthening is required, which could require additional recurrent costs for operating LMUs.

In Table 3 we derive estimates for costs for three supply chains. The cold chain costs are derived from the Global Immunization Vision and Strategy (GIVS) costing spreadsheet from the World Health Organization (WHO) (Wolfson et al. 2008). These costs were estimated over a 10-year period, and we have taken the average costs for a subset of countries. In comparison, VillageReach, an NGO working on last mile delivery of vaccines in Mozambique, provided estimates for its distribution operations that amounted to 18.5 percent of the value of product distributed (Allen Wilcox, email communication, February 2009). We then derive costs for essential drugs delivered to the SDP based on the data in tables 1 and 2. Where applicable, we have added a 5 percent procurement fee and 5 percent cost for distribution from the district to the service delivery point. For example, the cost in Rwanda, as seen in Table 2, is 9 percent. To this, we have added 10 percent for estimated procurement and distribution costs, for a total of 19 percent. Finally, we add 13 percent to the essential drugs costs to reflect the additional bulk delivery costs of bed nets to households.

Table 3. Derived Costs for Three Supply Chains

	Cold Chain	Essential Drugs	Bed Nets to Households
Bangladesh	2%	12%	25%
Ghana	6%	13%	26%
Liberia	28%	31%	44%
Malawi	4%	23%	36%
Mozambique	23%	30%	43%
Nepal	19%	15%	28%
Rwanda	19%	19%	32%
Senegal	12%	17%	30%
Tanzania	25%	24%	37%
Uganda	12%	23%	36%
Zimbabwe	24%	29%	42%

In January 2009, a detailed analysis in Zambia for antiretroviral (ARV) supply chain costs found that the costs for procuring and delivering ARVs to urban and rural SDPS ranged from 9 percent to 16.1 percent of commodity value (Baruwa, Tien, and Sarley 2009). Most urban SDPs sampled incurred costs of 9.8 percent or 9.9 percent. Of these costs, the largest share in urban areas went to procurement costs (70 percent), followed by management and storage (25 percent) and transport (5 percent). Therefore, transportation and storage accounted for a greater share of costs in rural areas.

RANKING AND CLUSTERING COUNTRIES

To rank the 49 IDA countries, we constructed an index to reflect their economic and infrastructure development, geography, and the effectiveness of their public sector and health sectors. The variables we used include:

- Geographic size—population density
- Transport infrastructure—index based on the LPI for logistics infrastructure and logistics competence
- Economic performance and competitiveness—index of per capita gross national income (GNI) PPP (purchasing power parity)
- Public sector performance—governance index

We gave each variable an equal weight in a combined index, and correlation analysis between the variables highlighted that the variables were positively correlated but not significantly so. Table 4 presents the ranking of the 49 IDA countries.

Appendix B presents the normalized data for each indicator, along with the country ranks. Table 4 summarizes the country clusters based on a combination of the relative rank of each country according to the index and an expert review to identify any potential anomalies. Guinea ranks higher due to its LPI scores, but knowledge about the situation in-country suggests adding it to a lower cluster than its index score suggests. With these clusters, and with the information gleaned from available sources on costs, we have derived a range of recurrent logistics by cluster.

Table 4. Country Ranking

Country Cluster	Logistics System Condition	Examples of Logistics Costs
Failed States/Post-Conflict		
Congo, Dem. Rep. Korea, Dem. Rep. Central African Republic, Afghanistan, Myanmar, Somalia	No or very limited public health infrastructure in place. Substantial health systems strengthening and infrastructure investments required. Humanitarian-type response is the only option in the near to medium term; work with UNICEF on logistics costs.	No data points; informal estimates from a humanitarian organization for lower-value bulk items suggest they could be as high as 100%; reference to UNICEF is advised.
Post-Conflict/Limited-Resource		
Niger, **Liberia**, Sierra Leone, **Zimbabwe**, Guinea-Bissau, Tajikistan, Solomon Islands, Ethiopia, Chad, Burundi	These countries have more infrastructure or systems in place than the failed states do, which would allow a partial public sector response that would still require substantial investment but could also be contracted out to NGO and private logistics service providers.	The cost of procurement and distribution to households of bed nets in Liberia was 44% of commodity values. The DTTU system in Zimbabwe costs an estimated 25%.
Less-Developed Economies/Geographically Challenged		
Papua New Guinea, Lao PDR, Eritrea, **Rwanda**, Comoros, Nepal	Public sector systems do exist and work but are either not efficient or are	The ACT distribution in Malawi is estimated to have

São Tomé and Principe, Haiti, Togo, Mozambique, **Tanzania** Côte d'Ivoire, Mali, Burkina Faso Madagascar, **Malawi,** Guinea*	challenged. Nonetheless, the infrastructure is in place to allow a mixed public-private response.	cost 17%, while medical stores charge 22.5% for essential drugs. For medical stores in Tanzania, an estimated 24% covers procurement, storage, and distribution to SDPs.
More-Developed/Less Geographically Challenged		
Zambia, Uzbekistan, **Uganda**, Kenya, **Nigeria**, Yemen, **Ghana**, Kyrgyz Republic, **Benin**, Cambodia, **Senegal**, Gambia, Mauritania, Pakistan, **Bangladesh**, Vietnam	These countries have the most-developed public and private sector infrastructure and capability to expand existing logistics systems to meet increased commodity handling needs.	The Ghana SC cost estimate is 13%; this was conducted before the advent of ARV and ACT in the system. Bangladesh is estimated at 12%.

Note: Boldfaced countries have data points.

Based on these clusters of countries and available evidence, we propose the ranges described in Table 5 be applied. These ranges need to be validated with more thorough cost analysis, and they do not include infrastructure costs for expanding the reach of programs to meet MDG targets. That investment cost may be more marginal for the more-developed group of countries and will be considerably greater for the less-developed and post-conflict countries. The failed states will require a humanitarian-type approach with investment in storage and transportation associated with this situation.

Table 5. Ranges of Logistics Costs

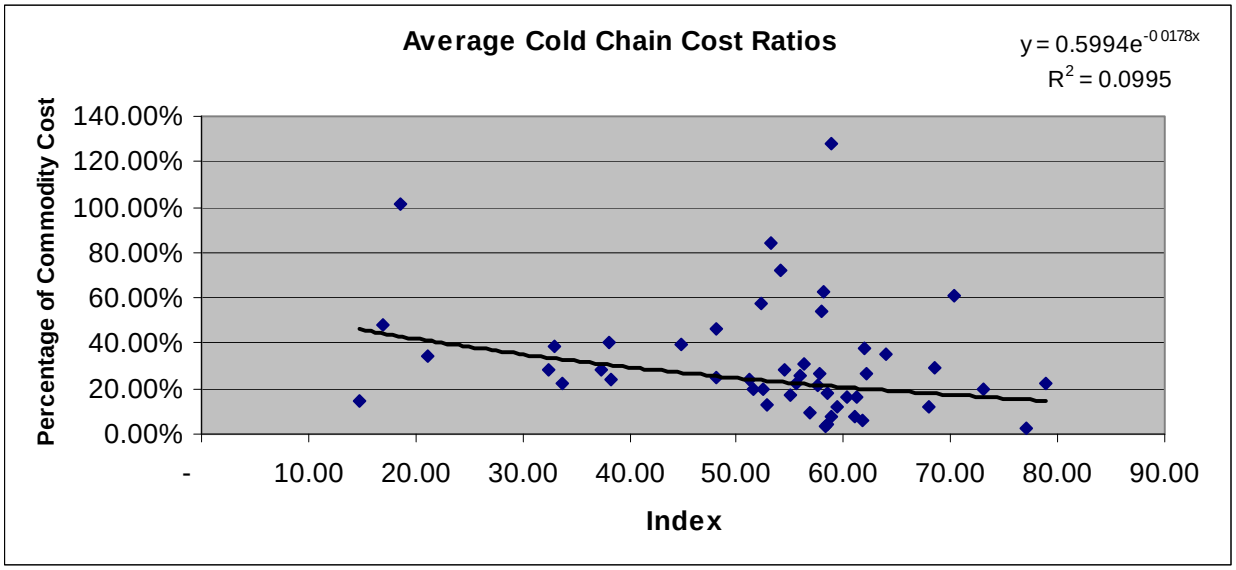
Country Cluster	Investment Requirements	Identified Examples	Essential Drugs SC Costs as % of Commodity Cost (range)	Cost of Household Delivery of Bed Nets
Failed and post-conflict states	Humanitarian-type response needed as very limited infrastructure is available.	No data	Greater than 50% likely, depending on the commodity.	Greater than 63%
Post-conflict and limited-resource states	Substantial investment required or NGO/humanitarian response.	Liberia 31% Zimbabwe > 25% (requires further work)	25%–35%	38%–45%
Less-developed and geographically challenged states	Larger capital investment required in the supply chain.	Tanzania 24% Malawi 22.5% Rwanda 19%	20%–25%	30%–38%
More–developed states	Marginal capital investment required.	Uganda 22.2% Zambia ARV: 9.9% urban SDP, 16.1% rural SDP Ghana 13% Bangladesh 12%	12%–20%	25%–30%

Combining data from tables 1, 2, 3 and 4 with those in Annex B suggests the cost parameters in Table 5 for essential drugs for each country cluster. As we do not have data points for the humanitarian countries listed, we need to consult UNICEF and other emergency relief agencies.

Rwanda and Uganda are clustered based on different indicators, so, although Uganda seems to have a higher rank, its established costs are higher than those of Rwanda.

The relationship between the index and identified cost estimates is plotted in Figure 5. While these estimates are limited, and in several cases incomplete, the visually fitted line reveals the negative correlation between the two variables. To validate these assumptions, we need more concrete estimates. Ideally, we should estimate the costs for a country in each cluster.

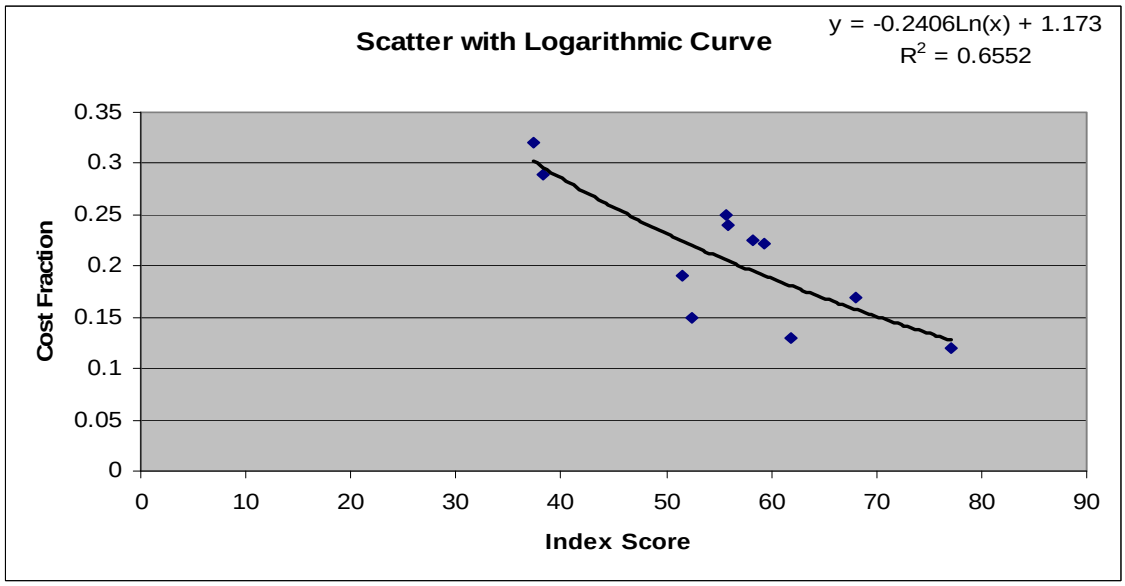
Figure 5. Average Cold Chain Cost Ratios



It is more difficult to classify the analysis of cold chain costs provided in the GIVS costing model as the costs vary considerably from year to year and country to country.

Figure 6 provides a cross-tabulation of the average cost ratio and the index.

Figure 6. Cold Chain Cost Scatter



OTHER RECURRENT COST ISSUES

One must factor several other issues into the commodity estimates:

- Include a proportion for product wastage, losses, and returns in the commodity estimates.
- Commercial logistics costs are also estimated for commodities as a rate per kilogram or cubic meter. High–value/low-volume products like ARVs will incur lower logistics costs as proportion of value than will bulky, low-cost items such as bed nets.
- One-time additional stock needs to be included in the commodity estimate for filling the pipeline initially, meaning that countries will need to order a sufficient quantity of commodities at the outset to fill the supply chain pipeline and meet consumption needs. Each country should calculate these individually, based on its inventory and transport policies.
- Countries will need to include buffer stock in the commodity estimate to counter unforeseen events such as a spike in demand or delayed shipments. Each country should calculate this individually, based on its inventory and transport policies.

Table 6. Ranking of Countries by Estimated Logistics Costs

Economy	Code	Total Index	Logistics Cost Ratio %	Minimum and Maximum Predicted Value Base on Alternative Models		Average Cold Chain Costs Based on GIVS Costing
Failed and Post-Conflict States						
Congo, Dem. Rep.	ZAR	14.74		59.86%	119.10%	14.40%
Korea, Dem. Rep.	PRK	16.91		55.77%	98.63%	48.27%
Central African Republic	CAF	18.56		53.02%	86.86%	100.98%
Afghanistan	AFG	21.14		49.14%	72.64%	34.27%
Myanmar	MMR	32.50		36.36%	40.27%	28.37%
Somalia	SOM	32.97		35.94%	39.49%	38.53%
Post-Conflict and Limited-Resource States						
Niger	NER	33.65		35.33%	38.40%	22.66%
Liberia	LBR	37.33	32.0%	32.24%	33.30%	28.04%
Sierra Leone	SLE	38.00		31.71%	32.50%	40.04%
Zimbabwe	ZWE	38.32	22%	31.46%	32.12%	24.41%

Economy	Code	Total Index	Logistics Cost Ratio %	Minimum and Maximum Predicted Value Base on Alternative Models		Average Cold Chain Costs Based on GIVS Costing
Guinea-Bissau	GNB	44.85		25.53%	26.79%	39.39%
Ethiopia	ETH	48.03		22.92%	24.75%	24.89%
Chad	TCD	48.10		22.86%	24.71%	46.46%
Eritrea	ERI	51.16		20.55%	22.88%	23.75%
Rwanda	RWA	51.54	19.0%	20.27%	22.65%	19.45%
Comoros	COM	52.35		19.70%	22.19%	57.60%
Haiti	HTI	54.02		18.55%	21.26%	72.04%
Guinea	GIN	58.55		15.72%	18.86%	17.80%
Less-Developed and Geographically Challenged States						
Nepal	NPL	52.42	15.0%	19.64%	22.15%	19.42%
Tajikistan	TJK	52.84		19.35%	21.91%	12.64%
São Tomé and Principe	STP	53.28		19.04%	21.66%	83.95%
Solomon Islands	SLB	54.39		18.30%	21.05%	28.75%
Togo	TGO	55.03		17.88%	20.71%	17.34%
Mozambique	MOZ	55.62	25%	17.50%	20.39%	22.53%
Tanzania	TZA	55.89	24.0%	17.33%	20.25%	25.46%
Côte d'Ivoire	CIV	56.33		17.05%	20.01%	30.92%
Burundi	BDI	56.79		16.77%	19.77%	9.21%
Mali	MLI	57.53		16.32%	19.39%	21.85%
Burkina Faso	BFA	57.74		16.20%	19.28%	26.58%
Madagascar	MDG	57.87		16.12%	19.21%	54.24%
Papua New	PNG			16.00%	19.11%	62.67%

Economy	Code	Total Index	Logistics Cost Ratio %	Minimum and Maximum Predicted Value Base on Alternative Models		Average Cold Chain Costs Based on GIVS Costing
Guinea		58.07				
Malawi	MWI	58.22	22.5%	15.91%	19.03%	3.58%
Zambia	ZMB	58.47		15.76%	18.90%	4.63%
More-Developed Economies						
Lao PDR	LAO	58.82		15.56%	18.73%	128.19%
Uzbekistan	UZB	58.89		15.52%	18.69%	7.58%
Uganda	UGA	59.31	20.2%	15.29%	18.48%	11.95%
Kenya	KEN	60.39		14.69%	17.94%	16.69%
Nigeria	NGA	61.02		14.35%	17.64%	7.98%
Yemen, Rep.	YEM	61.20		14.25%	17.55%	16.06%
Ghana	GHA	61.81	13.0%	13.94%	17.25%	6.23%
Kyrgyz Republic	KGZ	61.87		13.90%	17.22%	37.84%
Benin	BEN	62.05		13.81%	17.14%	26.74%
Cambodia	KHM	63.96		12.88%	16.24%	35.28%
Senegal	SEN	68.01	17%	11.14%	14.62%	12.21%
Gambia, The	GMB	68.47		10.96%	14.49%	29.36%
Mauritania	MRT	70.34		10.28%	13.96%	60.77%
Pakistan	PAK	73.02		9.44%	13.27%	19.38%
Bangladesh	BGD	77.12	12.0%	8.42%	12.31%	2.32%
Vietnam	VNM	78.94		8.07%	11.92%	22.29%

Note: Haiti and Guinea (highlighted) are reclassified as post–conflict, limited-resource states because the LMI scores overestimate their logistics and infrastructure capacity.

ESTIMATING CAPITAL COSTS

PURPOSE

The purpose of this costing model is to estimate fixed infrastructure (capital) investment costs for storage and transport of products that the 49 IDA countries require to meet their Millennium Development Goals by the year 2015.

METHODOLOGY

We undertook a linear approximation based on a number of assumptions to derive the warehouse and transport investment costs related to the volume of commodities, expressed in pallets. A key driver for both storage and transport is volume. The final unit of measure we used to calculate costs is that of a standard transport pallet, measuring 1 cubic meter (based on International Organization for Standardization [ISO] standard pallets) with an area of 80 cm x 120 cm and an expected height of approximately 100 cm. This comes to 0.94 m3 and was rounded to 1 m3.

WAREHOUSE COST

We developed a spreadsheet that transforms the quantity of one specific product into cubic meters. We entered all of the product quantities required, by year, by each country (individually), in this fashion, providing a total product quantity per year that can be translated into annual pallet requirements using a standard formula.

We assume purchasing occurs annually, but receiving would occur evenly during the year. We also assume distribution to the next level occurs quarterly. This means that the total annual pallet requirements are then divided by four, providing a quarterly pallet throughput requirement for actual storage. That is the number of pallets expected in storage at any given time.

Based time step = 1 year

Annual inflow throughput = Q

Receiving Frequency = every 3 months (or ¼ year)

Therefore, the Inflow = Q/4 = I

Assuming 10 percent stock requirement for buffer and 10 percent for staging (total of 20 percent), the total Inflow (I) should be increased by 20 percent.

Maximum number of pallets in storage at any given time = I × 1.20

Example: In the case that country C requires 320,000 bed nets at 400 per pallet, the annual throughput equals 800 pallets, therefore the amount of warehouse space needed would be 800/4 = 200 pallets. Adding 20 percent for buffer and staging, the actual space required represents the equivalent of 240 pallets.

We assume a pallet to measure 1 m^3, so that county requires 240 m^3 of warehousing space for bed nets at all times.

Each product's pallet capacity requirements are aggregated with all the others to determine a country's total warehouse space needed for all of the product categories in the scope for this study.

Cost Calculations

The only data point we have is for construction of and equipping a warehouse in Mozambique. Costs in other countries could be very different. For a warehouse with the capacity of approximately 2,000 pallets at any one time, with adequate pallet racking, forklifts, hand pallet trucks, and industrial ladders, the estimated cost came to $10 million, averaging $5,000 per pallet.

I × 1.20 x $5,000 = total cost for warehouse space at any one time

This cost represents the total space and is not disaggregated by number or location of warehouses. Each country needs to calculate this cost individually, taking into account the geography and transport capacity.

TRANSPORT COST

Calculation Methodology

The number of vehicles required is based on the volume calculated above, for example, pallet throughput numbers.

The vehicle capacity and cost are based on one single vehicle:

Nissan Diesel UD 70A

Trailer is 555 cm long, 225 cm wide, and 195 cm high.

Assuming no stacking, trailer may hold up to 10 of the above ISO-standard pallets.

Estimated cost: $68,000

The first step is to divide the number of pallets for the quarter by the number of pallets per vehicle. In the case of the Nissan, it is 10 pallets/vehicle. This give us our vehicle capacity requirement.

Then we calculate the number of vehicle usage days: five days per week, minus holidays and days for maintenance. Our estimate is 57 days per quarter. Since the vehicle comes back empty, the actual number of vehicle usage days in a quarter is 28.

For the total number of vehicles required, we divide the vehicle capacity requirement by the number of vehicle usage days (Total number of vehicles required = Total vehicle capacity required/28 days of vehicle use).

Our assumptions do not take into account location and distances between warehouses and facilities or distribution routes or the number of days one vehicle may take to deliver one truckload. Each country should make this calculation.

Example: From our example above, if 200 pallets of bed nets must be moved each quarter, divide 200/10 = 20 vehicle worth of transport. Divide this by 28 days of actual vehicle use. In our example, we require one vehicle only. If the vehicle takes more than one day to deliver the full truckload, additional vehicles would be required.

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APPENDIX B

ECONOMIC DEVELOPMENT AND INFRASTRUCTURE INDEX

	Economy	LPI Infrastructure Score[1]	LPI Logistics Competence[1]	Index Population Density[2]	Index GNI per Capita[3]	CS Index Governance Score[3]	Total Index
1	Congo, Dem. Rep.	5.00	5.00	0.48	2.26	2.00	5.00
2	Korea, Dem. Rep.	5.00	5.00	3.58	1.00	2.33	5.00
3	Central African Republic	5.00	5.00	0.13	5.76	2.67	5.00
4	Afghanistan	8.80	8.34	0	1.00	3.00	8.80
5	Myanmar	13.52	13.34	1.31	1.00	3.33	13.52
6	Somalia	13.04	15.01	0.25	1.00	3.67	13.04
7	Niger	13.34	0.20	4.90	4.00	13.34	0.20
8	Liberia	13.34	0.61	2.26	4.00	13.34	0.61
9	Sierra Leone	12.74	1.48	5.14	4.00	12.74	1.48
11	Zimbabwe	14.74	0.62	-	8.00	14.74	0.62
10	Guinea-Bissau	13.34	0.85	3.66	9.00	13.34	0.85
12	Tajikistan	13.34	1.30	6.07	12.28	13.34	1.30
13	Solomon Islands	12.14	0.15	9.96	11.45	12.14	0.15
17	Ethiopia	17.81	0.75	4.05	12.55	17.81	0.75
18	Chad	11.14	6.71	6.69	14.76	11.14	6.71

[1] Adapted from World Bank. 2007. "Logistics Performance Index". The World Bank. http://info.worldbank.org/etools/tradesurvey/mode1b.asp (accessed January 2009).
[2] Adapted from Geohive. 2009. "Geohive Global Statistics". http://www.xist.org/default1.aspx (accessed January 2009).
[3] Adapted from USAID | DELIVER PROJECT, Task Order 1. 2006. *Contraceptive Security Index 2006*. Arlington, VA.: USAID | DELIVER PROJECT, Task Order 1.

	Economy	LPI Infrastructure Score[1]	LPI Logistics Competence[1]	Index Population Density[2]	Index GNI per Capita[3]	CS Index Governance Score[3]	Total Index
14	Burundi	17.61	6.11	8.95		17.61	6.11
15	Papua New Guinea	13.87	3.47	8.09	12.83	13.87	3.47
16	Lao PDR	12.67	0.86	13.31	10.00	12.67	0.86
19	Eritrea	16.00	17.81	0.75	4.05	12.55	51.16
20	Rwanda	12.24	11.14	6.71	6.69	14.76	51.54
21	Comoros	19.68	17.61	6.11	8.95		52.35
22	Nepal	14.16	13.87	3.47	8.09	12.83	52.42
23	São Tomé and Principe	17.60	20.01	2.99	12.68		53.28
24	Haiti	17.12	14.07	6.29	8.95	7.59	54.02
25	Togo	18.00	16.01	2.10	6.23	12.69	55.03
26	Mozambique	16.64	15.74	0.49	5.37	17.38	55.62
27	Tanzania	16.00	12.81	0.78	9.34	16.97	55.89
28	Côte d'Ivoire	17.76	15.87	1.09	12.37	9.24	56.33
29	Mali	15.20	14.74	0.18	8.09	19.31	57.53
30	Burkina Faso	15.12	15.54	0.98	8.72	17.38	57.74
31	Madagascar	17.04	13.34	0.61	7.16	19.72	57.87
32	Malawi	17.04	17.08	2.13	5.84	16.14	58.22
33	Zambia	16.00	16.27	0.29	9.49	16.41	58.47
34	Guinea	18.64	17.81	0.69	8.72	12.69	58.55
35	Uzbekistan	16.00	14.34	1.09	18.91	8.55	58.89
36	Uganda	17.36	17.01	2.33	7.16	15.45	59.31
37	Kenya	17.20	15.41	1.17	11.98	14.62	60.39
38	Nigeria	17.84	15.87	2.91	13.77	10.62	61.02
39	Yemen, Rep.	16.64	14.67	0.77	17.12	12.00	61.20
40	Ghana	18.00	11.67	1.79	10.35	20.00	61.81
41	Kyrgyz Republic	16.48	15.67	0.48	15.18	14.07	61.87
42	Benin	15.12	17.08	1.46	10.19	18.21	62.05
43	Cambodia	18.40	16.47	1.45	13.15	14.48	63.96
44	Senegal	16.72	18.21	1.15	12.76	19.17	68.01

	Economy	LPI Infrastructure Score[1]	LPI Logistics Competence[1]	Index Population Density[2]	Index GNI per Capita[3]	CS Index Governance Score[3]	Total Index
45	Gambia, The	18.64	20.01	2.74	8.87	18.21	68.47
46	Mauritania	17.60	18.01	0.05	15.64	19.03	70.34
47	Pakistan	18.96	18.08	3.70	20.00	12.28	73.02
48	Bangladesh	18.32	15.54	20.00	10.43	12.83	77.12
49	Vietnam	20.00	18.68	4.70	19.84	15.72	78.94

Note: We have interpolated yellow cells to complete indices where there are no available data.

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