

Evaluation
of Health
System
Transport
Capacity
and
Demand
Mozambique
Case Study

June 2014



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VillageReach is solely responsible for the content of this report.

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List of Acronyms

3PL	Third-party logistics Provider
4PL	Fourth-Party Logistics Provider
AfDB	African Development Bank
ANE	Mozambique National Roads Administration
ASTROCAMA	Mozambique Association of Road Freight Transport Companies
CAPEX	Capital Expenditure
CMAM	Mozambique Central Medical Store Administration (<i>Central de Medicamentos e Artigos Medicos</i>)
CHAI	Clinton Health Access Initiative
DAF	Mozambique Administration and Finance Board
DANIDA	Danish International Development Agency
DFID	UK Department for International Development
DPS	Direcção Provincial de Saúde / Provincial Department of Health(Mozambique)
eLMIS	Electronic Logistics Management Information Systems
EPI	Expanded Program on Immunization
FAO	Food and Agriculture Organization of the United Nations
FEMATRO	Mozambique Road Transport Federation
FTL	Full Truckload Shipping
GAVI	Global Alliance for Vaccines and Immunization
GoM	Government of Mozambique
LMIS	Logistics Management Information System
LMIC	Low-, Middle-income Countries
LNG	Liquid Natural Gas
LPG	Liquid Petroleum Gas
LTL	Less Than Truckload Shipping
MEDIMOC	Mozambique National Medical Supplies Importer
MISAU	Mozambique Ministry of Health
MTC	Mozambique Ministry of Transport and Communications
NGO	Non-governmental Organization
NVS	National Vaccine Store
OECD	Organization for Economic Co-operation and Development
OPEX	Operating Expenditure
PAV	<i>Programa Alargado de Vacinação</i> (Expanded Program on Immunization - Mozambique)
PESS	<i>Plano Estrategico do Sector da Saúde</i> (MISAU Five Year Strategic Plan 2014-2019)
SADC	Southern African Development Community
UGEA	<i>Unidade Gestora Executora de Aquisições</i> (Acquisitions Execution Management Unit)
USAID	United States Agency for International Development
WHO	World Health Organization

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Executive Summary

Across sub-Saharan Africa, tens of thousands of health centers serve rural communities; many of these facilities are located at considerable distance from district and regional storage facilities that supply the health centers. Well-managed transport is critical to the successful operation of this supply chain that originates at national stores. But for many health systems in the region, current practices and resources are inadequate to provide reliable and sustainable transport to support the distribution of medical commodities.

This report examines current conditions of transport fleets and logistics practices managed by the Mozambique Ministry of Health (MISAU), evaluates the health system's transport ability to fulfill its goals, and considers the unique business environment and practices of private transport operators in Mozambique in order to suggest conditions under which private sector transporters could support MISAU's freight transport and distribution requirements.

In considering the option to outsource transport, the analysis in this report makes no bias in favor of leveraging commercial operators to provide transport capacity. While the private sector may provide higher-quality assets and supporting technology to improve logistics performance, health systems procuring transport service must also be adequately trained in the management and oversight of these resources. This would require significant investment by health systems to develop the professional capabilities to manage external resources. In the case of vaccine transport, the ministry of health (MoH) must have the expertise and be accountable for providing adequate training and to supervise contractors.

This paper asks these specific research questions:

1. What are the ministry of health's existing resources and procedures to manage the distribution of medical commodities in the country?
2. What are baseline performance expectations/requirements for this freight transport and distribution system?
3. What key performance and resource gaps exist between current and desired performance?
4. What opportunities are there to engage carriers and 3PLs to support MISAU's distribution needs?

This report was conducted with primary consideration of the *vaccine* supply chain. However, because of the nature of how MISAU is organized, and the typical practice of applying shared distribution resources to distribute vaccines and other commodities - particularly at the lower levels the supply chain - much of investigation was devoted to looking beyond PAV in order to understand the conditions and views of the supply chain for pharmaceuticals and other medical commodities.

Key findings from this assessment include:

- The burgeoning growth of the transportation sector is linked to increasing demand from the emerging extractive industries that are expanding operations in northern Mozambique. East-West transit corridors linking Mozambique's major ports to neighboring countries are expected to expand significantly as regional trade increases.

- There are chronic shortages of MISAU transport vehicles in the districts, with indications of severe over-reporting by provincial administrations of the share of functional vehicles at the district level.
- Current levels of CAPEX funding for MISAU national and provincial transport fleets provincial are insufficient to replenish fleets with new vehicles in order to maintain an average vehicle age of 3-4 years.
- Delays in payments for approved, budgeted expenditures has significant impact on the ability of transport managers to maintain and operate vehicle fleets.
- The established practice of district health system vehicle fleets owned and managed by the provinces limits the ability of the districts to allocate transport assets according to their priorities.
- In rural areas, poor road quality and limited transport service infrastructure (fuel depots and commercial mechanic/repair facilities) raise the cost for and limit the participation of commercial transport companies in many of the communities in which health centers are located.
- The severe shortage of logistics personnel and the limited number of vehicles at the district level makes comprehensive logistics planning for DPS all but impossible, with districts defaulting to ad hoc distributions.

1. Overview of Study

1.1. INTRODUCTION

For millions living in rural communities across sub-Saharan Africa, the need for access to critical health services goes unfulfilled. While tens of thousands of rural health facilities have been constructed to serve these communities, both the facilities and the capacity of the personnel assigned to them are often insufficient to meet the demands of the communities.

These facilities are faced with many challenges: most operate off-grid and require alternate fuel supplies to support lighting, refrigeration and sterilization; health workers assigned to these posts work long hours serving patients, and also may be required to conduct additional support activities beyond administering care, including the collection of medical commodities from district depots if supplies are unreliable. Additionally, many of these facilities are located at great distances from district storage facilities, and are only accessible via unpaved roads that are challenging to navigate and require hours to reach, especially during raining season.

While there are many influencing factors on delays in distribution and stock outs of critical medical commodities, insufficient transport is a significant contributor. In Mozambique, freight transport fleets are a critical component of healthcare, owing to the vast geography and great travel distances that the country's roadways traverse. Reliable and regular distributions of medical commodities are crucial for rural health facilities to have stable inventories.

Mozambique has approximately 17.5 million living in rural areas, based on an estimated 69% share of the country's total population (World Bank, 2012). The country has seen rising levels of economic activity within the last decade due to the discovery of large reserves of natural gas and increasing mining activity in the north. Because of this economic stimulus, and owing to its unique geographic position as an export access corridor for many countries in the Southern African Development Community (SADC), Mozambique's road transport network is expected to experience significant investment to meet demands of the commercial sector. Despite this economic stimulus, Mozambique remains one of the poorest countries in the world, with 54% living below the poverty line. Life expectancy is 52 years (World Health Organization, 2012) with per-capita annual spending on healthcare at \$35, placing it near the bottom of WHO country rankings.

The country and its circumstances therefore provide an important context in which to consider opportunities for public health systems to leverage private sector transport.

This report reviews current transport practices within MISAU and highlights existing trends in commercial transport, to present considerations in which the two sectors could collaborate to achieve an increase in both the reliability and efficiency of the distribution of medical commodities.

The report is prepared with specific consideration to the requirements of vaccine distribution in Mozambique. In Mozambique, PAV (*Programa Alargado de Vacinação - Expanded Program on Immunization*) has responsibility for the management of the vaccine supply chain. However in practical terms the institution does not possess complete control of the distribution of vaccines from the provincial level to the district and to the health center, because it relies on common shared transport assets of each province to provide some logistical support. At the district level, transport assets, personnel, plus expenditures to support distribution (e.g. fuel, per diems, maintenance) are required to support the delivery of vaccines, essential medicines and other commodities.

Because of this shared approach, research for this report looked beyond the vaccine supply chain, and also considered the health system supply chain of essential medicines, pharmaceuticals and other commodities.

VillageReach Experience

VillageReach has worked throughout sub-Saharan Africa and in India to develop, test and refine key innovations that improve the performance of health systems. The organization focuses on the *last mile* of distribution to the service delivery layer, where capacity limitations in personnel, functioning assets plus lack of funding can have significant negative impact on the performance of the health system overall. Since 2001, VillageReach has engaged with the Mozambique government to help improve the performance of the health system by: streamlining logistics; implementing data collection, management and reporting systems and other supporting technologies; and by developing shared infrastructure with the private sector.

VillageReach is partnering closely with the government of Mozambique (GoM) to design, test and scale an improved supply chain and management process in order to achieve more effective, efficient distribution, with the objective of building the capacity of the districts to carry out health logistics activities.

With expertise in supply chain and logistics, human resources capacity building, information systems and business creation and investment – and with more than a decade of field experience – VillageReach is applying its unique field experience to inform the development and application of new innovations that strengthen vaccine supply chain performance in GAVI countries.

1.2. METHODOLOGY

Information collected for this study was obtained through both primary and secondary research methods. The scope of this research covers a review of the circumstances of MISAU's transport demand and current operation but does not include a comprehensive, quantitative assessment of transport capacity and challenges, which will require more extensive surveys of multiple districts and access to financial data and detailed information on operations that was not available for this assessment.

The University of Venda¹ has researched transport challenges in rural sub-Saharan Africa extensively. Faculty and students from the School of Environmental Sciences conducted a literature review of rural logistics in southern Africa and contributed to the development of the research outline that served as a guideline to support the in-

¹ [University of Venda](#) Thohoyandou, South Africa

person interviews. This report also references the following studies of VillageReach's work to improve Mozambique's rural health system that reveal important findings concerning health system performance gaps associated with transport and logistics:

- *Evaluation of the Project to Support PAV In Northern Mozambique, 2001-2008* (2008).
- *Comparison of Costs Incurred in Dedicated and Diffused Vaccine Logistics Systems - Cost-Effectiveness of Vaccine Logistics in Cabo Delgado and Niassa Provinces, Mozambique* (2009).
- *Logistics Systems and Management Assessment in Sofala, Manica and Tete Provinces* (2012).
- *Districts Logistics Capacity Study - Examining the Capacity of 53 Districts in Mozambique to Carry Out Health Logistics and Supply Chain Activities* (2013).

To understand the specific influences on transport performance in the health system and prevailing circumstances of the private sector, a field study in Mozambique was conducted by VillageReach staff during October/November 2013 and January/February 2014. A series of interviews was conducted with parties responsible for the management of health service delivery, and with private sector parties engaged in freight transport, distribution and logistics services (see Table 1).

1.3. INFORMATION SOURCES – INTERVIEWED ORGANIZATIONS

Because of the tiered approach to distribution of medical commodities by MISAU – whereby separate administrations within the ministry (national, provincial and district) are responsible for facilities and fleet management – interviews were conducted at each of these layers to provide as comprehensive a view as possible of key transport challenges faced by the flow of commodities throughout the supply chain. In Mozambique, private sector transporters are observed to operate similarly to the structure of fleet management at MISAU – companies tend to operate within a single level only: nationally or provincially or at the district level – therefore interviews were arranged with companies operating at each layer. Additional interviews were conducted with transport services and roads management-related government administrations and associations to gain an understanding of the current status of road transport in the country. VillageReach also met with bilateral aid and other agencies that partner with MISAU on health system distribution programs.

Table 1: Interviewed Organizations

Supply Chain Layer	Interviewed Organizations
National	National Roads Administration (ANE) Association of Road Freight Transport Co.s (ASTROCAMA) Central Drugs and Medical Supplies Procurement Service (CMAM) Medical Supplies Importer (MEDIMOC) Ministry of Health <ul style="list-style-type: none"> • Expanded Program on Immunization (PAV) • Transport Department Third Party Logistics Providers

Province	Gaza, Maputo Direcção Provincial de Saúde/Provincial Department of Health (DPS) PAV Gaza, Maputo DPS Transport Departments Ministry of Transport and Communications Regional Third Party Logistics Providers
District	Ministry of Health Rural Hospital Leadership Administration & Finance Local Third Party Logistics Providers
MISAU Partner Organizations	Clinton Health Access Initiative (CHAI) Danish International Development Agency (Danida) John Snow Inc. UK Department for International Development (DFID) United States Agency for International Development (USAID)

Two provinces were selected for field study in order to provide more intimate comparisons and contrasts at the provincial and district levels. Gaza and Maputo provinces were selected because of differences in population density, travel distances, and general commercial activity that serve as variable inputs in evaluating the performances of the health system and commercial transport in each province. While both provinces have populations approaching 1.5 million, Gaza has considerably lower population density, with an area (75,709 sq. km.), 300% of Maputo Province (22,693 sq. km.). Together, the provinces provide critical road transportation links to South Africa south via the Maputo Corridor and west to Zimbabwe.

Figure 1: Political Map of Mozambique.



Source: <http://www.ezilon.com/>

2. Mozambique's Road Transport Sector

2.1. ECONOMIC DEVELOPMENT – SIGNIFICANCE OF ROAD INFRASTRUCTURE

Mozambique faces a unique challenge to develop its transportation infrastructure in the next decade in response to a burgeoning extractive industry, and because of its anticipated critical role in supporting trade expansion in southern Africa. Due to its geography, the country has historically served as an important conduit for neighboring countries needing access to the deep water ports in Beira, Nacala and Maputo: 70% of goods transit in the Southern African Development Community (SADC) goes through Mozambique² to reach these key ports that serve as gateways to export markets. The future growth of neighboring SADC countries is highly dependent on improvements in Mozambique's infrastructure.

Mozambique itself is also placing great demand on its own infrastructure, and attracting additional foreign investment, owing to the discovery of large coal and natural gas reserves in the north. Mozambique owns approximately 1/3 of all new oil and gas discovered worldwide in 2012 and is forecast to become the second-largest exporter of LNG by 2015³. The new large gas reserves will result in the development of new LNG terminals on the coast and will also spur the addition of new gas-fueled power plants to address current gaps in electricity. The terminals and the plants will require development of new and/or upgraded access routes to the facilities. The increase in coal production will also drive the need for improved regional and rural access routes, especially in the north⁴.

These increases in domestic and regional outputs have resulted in optimistic economic forecasts: the African Development Bank (AfDB) expects Mozambique to achieve annual growth in 2013 and 2014 of 8-8.5% (AfDB, 2011), similar levels to the dramatic pace of the Chinese economy over the past decade. China itself is expected to provide impetus for the development of infrastructure in Mozambique: in 2010 the country became Mozambique's second largest investor and has announced plans for over US\$13 billion to develop ports, roads and the energy sector. The AfDB's investment in the country also reflects the needs for improved transport infrastructure: 49% of its current investments (2011) are devoted to transport⁵.

Much of the broader public dialogue on Mozambique's infrastructure development has focused on large-deal investments and projects. However, an important anticipated result of the dramatic growth of extractive industries is the positive impact this growth could have on the development of small- and medium-sized enterprises (SMEs). The AfDB estimates approximately 43% of the private sector workforce is employed by SMEs today, with turnover of these businesses totaling nearly \$1 billion. Transport is as yet still severely under-represented in the SME sector (Table 2), at only 1% of the businesses, and valued at \$39M, or 4% of total turnover. Both the AfDB and the Mozambique government see SME development as strategic to "promoting social inclusive growth." As rural development progresses we would expect more small-scale regional and district-based carriers and 3PLs will be launched to address demand for freight transport.

² [Africa Gearing Up](#). PricewaterhouseCoopers, 2013.

³ From Promise to Performance – Africa Oil & Gas Review. PricewaterhouseCoopers, 2013.

⁴ Republic of Mozambique: Country Strategy Paper 2011-2015. African Development Bank, 2011.

⁵ Ibid.

Table 2: Distribution of SMEs by Economic Activity

Sector	SMEs per Sector		Total Business Volume		
	#	%	MZN (000)	USD	%
Agriculture/Forestry	617	2%	343,000	\$11.4M	1%
Manufacturing	2,828	10%	10,814,000	\$360M	39%
Construction	232	1%	2,211,000	\$73.7M	8%
Trade	16,357	57%	6,323,000	\$210.8M	24%
Transport	322	1%	1,173,000	\$39M	4%
Hotel/Restaurants	5,739	20%	1,686,000	\$56.2M	6%
Others	2,380	9%	5,052,000	\$168.4M	18%
Total	28,474	100%	27,601,000	\$920M	100%

Source: African Development Bank, 2011.

2.2. ROAD NETWORK MANAGEMENT AND DEVELOPMENT

Mozambique's roadways extend 35,000 km., of which an estimated 23,668 km. is classified⁶. Approximately 80% of roads in Mozambique are unpaved, with this percentage at nearly 100% at the district level in rural areas. Road conditions in the districts can be hazardous and in some cases passage is not possible during rainy season (December – March).

Table 3: Mozambique Roadway Development –Select Data (2012)

Length of total roadway network	35,000 km.
Total length of new construction and maintenance of classified roadways	23,668 km.
Increase in construction of passable district roads	2,689 km.
Roads (primary, secondary, tertiary, country) categorized in good/ acceptable condition	72%
Rural population living within 2 km. of a tertiary road	32.7%
Rural population living within 2 km. of a country road	80%
Share of funding of ANE: government-donations-international loans	52%-18%-30%

Source: ANE National Report 2012

Larger freight vehicles (10 ton+) can only be supported on the nation's major reinforced paved highways and regional routes; rural district roads typically only support a maximum of 2 - 5 tons. (DPS primarily operates 1 - 1.5 ton 4x4s to serve communities and health centers accessible via country road networks).

The National Roads Administration (ANE) was one of several institutions created in the past 15 years to improve transport network performance, efficiency and participation rates in the country. ANE is responsible for road maintenance and new construction, managing a dedicated road fund covering road development and improvement at the national, provincial and district levels. Expenditures in 2012 under the *Integrated Road Sector Program* totaled \$382 million (ANE Annual Report 2012).

⁶ Roads declared by roads administration for a specific public purpose or use.

Chokwe-Xai Xai Regional Highway, Gaza Province.



VillageReach 2014.

To support road construction and maintenance, the country relies on levies on fuel, road taxes and tolls, plus separate, non-transport tax revenues. Mozambique is also a recipient of significant bilateral and multilateral aid in support of infrastructure development, including roadways. Road conditions are poorer, and construction has generally been less active, in the northern provinces where there is a larger share of rural inhabitants. However, since 2010 the construction of new public and private roadways has increased as a result of the growing presence of extractive industries operating in Cabo Delgado, Niassa and Tete provinces.

The ANE relies heavily on outside support to fund its operations: 48% of the organization's budget is sourced from external donations and loans. To help enable districts to define their own infrastructure priorities, starting in 2012 each district received an annual maintenance budget of MZN2,000,000 (\$66,666). We were not able to verify the specific use of these funds and their availability to the districts.

Figure 2: Mozambique Road Infrastructure



Source: AICD Interactive Infrastructure Atlas for Mozambique (www.infrastructureafrica.org)

ANE also responds to the need for emergency repairs as a result of environmental disasters. However, from a review of the organization's 2012 programs, it is clear that the scale of damage from flooding and other weather-related conditions far exceeds the resources of the government to respond to them, with rural communities facing a much higher share of the negative impact, owing to predominantly unpaved roadways in these communities. In 2012, an estimated \$13.3 million in emergency repairs was required to respond to weather-related damage to the nation's roadways, primarily unpaved roads. However, ANE was able to fund emergency works totaling \$4.6 million, or approximately 34% of the estimated requirement. In Gaza, with estimated repair costs of \$1.74 million, the province was able to access \$547,000 (31% of need) to support emergency road repairs. In Maputo Province, the cost of emergency repairs was estimated at \$5.8 million of which only \$2.3 million (40%) in repairs was completed.

While the rate of increase in the size and quality of the nation's road network is improving, demand for better road conditions far exceeds the country's current capacity to respond and there continues to be a significant backlog of maintenance of transport infrastructure. Poor road conditions impact community access to essential services, as well as growth and development of commerce, the predictability of transport and ultimately raise the cost of transport for both operators and consumers of transport services.

2.3. COMMERCIAL TRANSPORT SECTOR

2.3.1. Registration and Management

Mozambique registered approximately 490,000 vehicles as of 2012. By type of vehicle, the *National Land Transport Institute* (INTT) statistics⁷ also show that there are 305,286 light vehicles, 103,564 heavy vehicles, 5,653 truck tractors, 13,552 trailers and 13,785 motorcycles. There are approximately 650,000 issued drivers' licenses for the country. While the total is still small, the increase in the driving population has been significant: in 1998 there were only 260,000 registered drivers. In 2012, approximately 51,000 new licenses were issued to commercial and public service drivers. These totals do not reflect (undocumented) assumptions of a portion of the driver population operating personal and commercial vehicles without registration and insurance. In rural areas, it is common for informal businesses to operate illegal taxi, bus and freight services, delivering people to work and produce to market.

**Informal Rural Bus Service.
Maputo Province**



VillageReach 2013.

⁷ <http://www.macauhub.com.mo/en/2013/09/18/mozambique%E2%80%99s-vehicle-fleet-increases-by-over-832-pct-between-1990-and-2012/>

In addition to demands for improvement in road transport by key sectors such as mining and oil & gas, the commercial transport sector itself is seeking improvements in the market conditions and economics for freight transport and distribution.

Figure 3: Defining Logistics Providers vs. Carriers

This report makes a distinction between carriers, third-party logistics providers and fourth-party logistics providers in the transport sector. For the purposes of this report, the following definitions are applied.

Carrier

Asset-based carrier, which owns the means of transportation, e.g. trucks, vans, etc.

Third-party logistics provider – 3PL

Asset-based organization that provides comprehensive outsourced freight distribution services, including warehousing, transloading, terminal operations, etc.

Fourth-Party Logistics Provider – 4PL

Non-asset-based integrator that assembles the resources, capabilities and technology to create and manage multiple 3PLs and carriers to provide comprehensive supply chain solutions⁸.

These independent associations are responsible for advocating the broader interests of commercial transport to the government of Mozambique.

- **The Mozambique Road Transport Federation (FEMATRO)** serves as an advocacy organization to promote the value of and investment in road transport. FEMATRO incorporates regional and provincial road associations in the country, to present a unified voice to the government from the commercial sector concerning freight rates, freight security, fuel costs, road infrastructure, road safety, freight security, driver interests, law enforcement, and labor relations.
- **The Association of Road Freight Transport Companies (ASTROCAMA)** serves as an intermediary between the commercial road transporters and the government. As advocates for the private sector, the association primarily represents the interests of larger freight carriers, working with national, regional and municipal governments to advocate for fair road taxes and positions favorable to private sector transport. ASTROCAMA also serves as a coordinating entity for tenders issued by the private and public sector and cited this example:

The Mozambique Leaf Tobacco Company operates its business in partnership with a network of 120,000 growers. Tenders for the freight transport of leaf tobacco are issued annually, coordinated by ASTROCAMA. Larger carriers bid on the tenders and then assume responsibility for selecting and coordinating with many smaller regional and district carriers to move the product from rural communities to processing facilities.

⁸ These distinctions are based on standard definitions that differentiate the practices of less- and more-sophisticated freight transport businesses. The clear differences in service are important to highlight in considering what level and type of freight transportation services currently exist in Mozambique, and which levels of service are necessary in the future if the conveyance (and warehousing) of medical commodities is to be outsourced to the private sector. These differences are also important in considering *what expertise the health system requires* in order to gain the greatest benefits from outsourcing.

ASTROCAMA's membership is now dominated by larger logistics providers, and has reduced its numbers from more than 70 carriers in 2003 to approximately 20 today, reflecting consolidation in the industry for national-level logistics providers. The largest transporters in the country, including *Lalgy* and *SuperSteel*, possess fleets of 100-1,000 vehicles of various tonnage. These companies dominate freight transport and distribution across Mozambique's major thoroughfares, and typically coordinate with smaller carriers for contracts requiring access to/from rural areas.

In response to a request for data on Mozambique's transport capacity, ASTROCAMA indicated it intends to develop a national database of carriers and pricing in the future, and is seeking the financial resources to fund the initiative.

2.3.2. Commercial Freight Costs

Reliable, current industry data on the cost of transport of goods in Mozambique is not available. The market is now fully privatized: independent transporters charge prices based on demand/supply market dynamics. But prices can vary widely, depending on the company, its geographic base, the size of its fleet, its core level of operation (national, provincial, district) and route selection. There are three key influences on pricing that make it a challenge to determine:

- 1) The informal market for freight and people transport (which is assumed to be sizeable, given broader estimates of the state of the informal economy in Mozambique⁹), particularly in rural communities – this leads to a lack of transparency in pricing generally and pricing pressure on legitimate businesses.
- 2) Strong demand and weak customer service policies – there are instances of transport (i.e. single-load) service customers having their freight off-loaded before reaching its destination because the 3PL received a higher bid for its services, even as it is engaged in service for its first customer.
- 3) Mozambique's unique geography – a significant volume of equipment is trucked north to support mining, oil & gas and construction. Transporters charge full rates for outbound but are willing to accept significantly lower rates for return trips (for one-way distances of 2,000+ km.). As an example, a national 3PL noted that it charges MZN130,000 for 25-ton full truckload (FTL) freighting (i.e. the full capacity of the truck is consumed by a single customer) from south-north (approx. 2,300 km.), but is willing to accept MZN45,000 for the return in order to capture some margin from the trip south¹⁰.

The following private sector prices for the transport of cotton and tobacco, published by the Food and Agriculture Organization of the United Nations (FAO) and the Organization for Economic Co-operation and Development (OECD) are offered as *known costs* in the agriculture sector, with a view to suggesting price ranges for *freight transport in rural areas*. The pricing, ranging from MZN1.2 - MZN3.6 (\$.04-.12) per tonne per kilometer, does not include additional transaction or add-on costs that logistics providers typically as these can vary widely across regions. These prices also reflect contract agreements for multi-location distributions, not incidental transport (one-trip) engagements. These prices were recorded in 2010, reflecting five-year (2005-2010) average annual increases in freight costs of approximately 9.2% (cotton)

⁹ The World Bank (2011) cites National Institute of Statistics Data (2006), estimating as much as 87.5% of the rural workforce operates informally.

¹⁰ Comparative price/tonne/km. for these two legs are MZN2.26/US\$.08 (northbound) and MZN.78/US\$.03 (southbound).

and 1.5% (tobacco). Incidental and example pricing for freight transport was also recorded from some logistics companies interviewed for this report. (see *Carriers and Third-party Logistics Providers* section, below)

Table 4: Cotton, Tobacco Rural Freight Costs (MZN, 2010)

Location/Distance		Cotton		Tobacco	
Farm - Factory	Distance	Price/tonne/ distance	Price/tonne/ km.	Price/tonne/ distance	Price/tonne/ km.
	200 km.	726	3.63		
	500 km.			605	1.21

Source: Monitoring African Food and Agricultural Policies (MAFAP, 2012, 2013)

2.3.3. Carriers and Third-party Logistics Providers

The broad range of freight transport and distribution companies operating in Mozambique covers two separate profiles: carriers offering simple hire of their vehicles (including driver) for customers to transport their freight from point A to point B, and 3PLs that offer integrated services to plan and make more efficient the storage and transport of commodities. As with 3PLs in other countries, scale is an important variable for success, in order to achieve economies of scale and competitive (low) unit costs of transport.

The larger 3PLs, running routes on the country's north-south highways and east-west to connect to ports in Nacala, Beira and Maputo, typically operate with support of satellite and/or cellular communications tracking, and are insured, providing protection to customers for theft and accidents. Because of the scale of their operations, most of the larger operators own multiple facilities for both regional storage and to park and service their vehicles. Due to the growing extractive sector and the current construction boom, many of these businesses are seeking to diversify from conventional freight services and adding heavy equipment vehicles (excavators, dump trucks, etc.) to capture a greater share of commercial services for the construction industry.

Mozambique Freight Companies - Characteristics

While there are many differences between 3PLs operating at national and provincial, and typically less sophisticated carriers servicing district levels, the following are observed circumstances for transport companies that operate at various levels.

High costs of entry to achieve large-scale business growth.

Mozambique applies an average import duty of 9% for vehicles (SADC, 2012). However duties vary widely depending on the class of vehicle¹¹. Because of these inflated prices, and owing to growing demand for vehicles and other equipment, there is a sizeable used-vehicle market: cars, trucks and heavy equipment are sourced from Japan and Korea, where, strict standards are in place for the regular maintenance and evaluation of vehicle performance.

¹¹ VillageReach has experienced duty of nearly 30% of the total value of vehicles it has purchased for its work in Mozambique (all-terrain, 4x4s).

Negotiated pricing: no standard load/distance charges.

All private sector organizations interviewed for this evaluation noted the road freight sector does not have consistent or standard pricing for load/distance, owing to regional differences in pricing and inflated demand for transport in the past three years. A survey of regional road freight data and incidental pricing mentioned during interviews suggests a broad range in pricing: from \$.10 –\$1.50+/tonne/km. More precise estimates of prevailing market pricing could be determined by conducting more extensive interviews with a larger pool of 3PLs.

High variable operating costs.

Transporters interviewed noted high operating costs for their businesses. Independent data suggests variable costs (fuel, tires, maintenance) are inflated in Africa - reaching levels close to European freight companies. These high costs are attributed to typically low vehicle capacity, the extended use of (older model) vehicles, poor maintenance practices, and poor road conditions¹² (AICD, 2008). This implies that businesses with older fleets and those operating in rural areas with rougher road conditions will have higher cost structures than businesses operating on routes with primarily higher-quality surfaces using new fleets. (Note this also suggests that the aged DPS fleets – see Table 9 – are operating at relatively high cost/km.)

Self maintenance.

All companies interviewed for this report conduct their own maintenance, other than for highly technical work. Two of the companies interviewed began business as mechanical repair service companies, and each concluded that they could retain a competitive advantage for their freight business by maintaining their own vehicles. Both owners noted that demand for quality mechanic service is far greater than current supply. Both businesses eventually stopped providing repair services as their transport and distribution grew to become the dominant elements of their businesses. Mozambique has a reputation for poor-quality auto mechanic standards – and stories abound in the marketplace of unsuspecting owners having *new* equipment in their vehicles switched out for *old* by disreputable mechanics. There are no vocational training programs for young aspiring mechanics; the only avenue is to join a business and learn on the job.

High driver turnover.

Companies interviewed cited personnel quality as the greatest risk to their business. Attracting and retaining reliable drivers and mechanics requires business owners to keep very close to the day-to-day operations, making it difficult to manage strategically and expand to scale. One company cited an average retention rate of 10-20% for drivers after 3 months: because of the boom in the sector, employees continually seek new opportunities, and owners will fire employees they feel they cannot trust.

¹² Variable costs represent the bulk of total transport costs in Central and West Africa, with a minimum average ratio of 70/30 for variable/fixed costs; the main components of variable costs are fuel and tires (AICD, 2008).

Classes of Freight Companies

Table 5 provides a view of profiles for road freight companies operating at the national, provincial and district levels, based on interviews with the private sector conducted during the research period. The defining characteristics for these classes may differ regionally within Mozambique, depending on the size and location of businesses, and in comparison with other countries. However, based on this assessment there is a clear difference in the scope and scale of the businesses according to their primary level of operation. For example, freight operators based at the district level tend to derive most of their business from agriculture and construction sectors, and engage with customers for largely single-trip transport; larger national operators provide service to a much broader range of commercial sectors requiring longer-term service agreements, and in turn, may have the opportunity to differentiate their service offering to include the provision of non-freight carrying vehicles (e.g. large equipment rental).

Table 5: 3PL, Carrier Profiles: National, Provincial, District.

Level of Operation	Operating Environment & Markets	Scale (# of vehicles & freight capacity)	Services	Success Factors
National	National/regional <ul style="list-style-type: none"> • Import/export • Services sector • Mining, oil/gas • Agriculture • Construction • Industry/manuf. 	100 – 1,000 Fleet (5 – 40 ton)	<ul style="list-style-type: none"> • Transport and distribution. • Freight and heavy equipment. • Mechanical repair. 	<ul style="list-style-type: none"> • Multiple facilities (commodities & vehicle storage, maintenance) • Differentiated services. • Servicing multiple sectors.
Regional/Provincial	National/regional/district <ul style="list-style-type: none"> • Services sector • Agriculture • Construction • Industry/manuf. 	15 - 100 (1 – 40 ton)	<ul style="list-style-type: none"> • Transport and distribution. • Mechanical repair. 	<ul style="list-style-type: none"> • Single or multiple facilities (typically vehicle storage, maintenance only). • Independent maintenance.
District, Local	District/regional <ul style="list-style-type: none"> • Agriculture • Construction 	< 15 fleet (1-10 ton)	<ul style="list-style-type: none"> • Transport only. 	<ul style="list-style-type: none"> • Independent maintenance. • Concentrated ownership (family).

Source: VillageReach interviews and estimates.

3. Mozambique Ministry of Health Distribution Systems

3.1. OVERVIEW

Medicines, health products and other commodities provided by MISAU are distributed throughout the country according to the prevailing administrative divisions of the country: national->province->district. The majority of commodities enter the country via the two main ports at Beira and Maputo, facilitated by as many as 40 private importers. Beyond the public sector, the importers also serve a growing number of private hospitals and pharmacies. Within the ministry of health, *Central de Medicamentos e Artigos Medicos* (Central Drugs and Medical Supplies Procurement Service - CMAM) is responsible for the purchase and supply of essential medicines and related medical supplies.

The *Centro de Abastecimento* (CA) administration is responsible for the supply chain for health equipment (e.g. syringes, diagnostic equipment, hospital beds, etc.) and utilizes primarily the same supply chain assets (storage and transport) as CMAM.

The vaccine supply chain operates separately from that for pharmaceuticals and equipment, and is administered under PAV. PAV manages its supply chain in largely the same tiered approach as CMAM and CA, with some vaccine storage facilities co-located with CMAM facilities at the provincial level. However at the district level vaccines typically are stored at separate locations owing to unique refrigeration requirements and the separate distribution system.

3.2. RURAL HEALTH CENTERS

Mozambique has built a network of approximately 1,400¹³ rural health centers across the country to support its largely rural population. A significant majority of these facilities are off-grid and dependent on alternate fuel supplies – liquid propane gas (LPG), solar – to meet their energy requirements. These facilities are typically modest buildings with limited storage capacity. Health workers stationed at the facilities are often overburdened in providing care, which limits time dedicated to tracking inventories to ensure effective stock management, as well as other duties.

Distances from the provincial capital to district facilities, and from district storage facilities to the health centers, vary widely (Table 6). In Gaza Province, 134 rural health centers are an average of 47.5 km. from a district storage facility; more than 15% are located at distances greater than 75 km. from a district depot. Road conditions to the health centers can be challenging and travel times can be extended. Seasonal flooding during the rainy season requires typically 4x4-traction vehicles to navigate the routes. Because of extreme road conditions and long driving distances, some health centers are only accessible during dry season.

¹³ The number of active rural health centers varies from year to year as facilities open and close due to personnel changes, logistics and environment challenges, and planning priorities. This report uses a figure of 1,400.

Rural Health Center, Maputo Province.

VillageReach 2013

Table 6: Travel Distances in Gaza Province.

District	Distance from Provincial Capital Storage Facility (Xai Xai) to District Capital Storage Facilities (km.)	# of Health Centers/District	Average Distance from District Storage Facility to Health Center (km.)
Bilene	60	19	26
Chibuto	74	14	90
Chicualacuala	454	10	94
Chigubo	286	6	95
Chokwe	121	21	29
Guija	135	8	29
Mabalane	220	7	34
Manjacaze	59	20	35
Massangena	578	11	70
Massingir	248	3	36
Xai Xai	0	15	30

Source: Gaza DPS, 2013.

3.3. VACCINE SUPPLY CHAIN

Mozambique's vaccine supply chain is defined in terms of its main distribution points: national, provincial, district, and health facility. Vaccines are stored at the National Vaccine Store (NVS) and transported to provincial stores each quarter with quantities based on requisitions submitted by each province.

Mozambique coordinates the distribution of \$9 million of vaccines annually (PAV, 2013). Historically, PAV has freighted vaccines to the seven northern provinces by air and to the 3 southern provinces (Gaza, Inhambane, Maputo) and Maputo City by road transport. However, in 2013 PAV also used road transport to the north in part, due to high costs (primarily) and limited capacity of air transport.

As is the practice for non-vaccines, provincial health authorities (DPS) assume responsibility for the capacity building, monitoring, supervision and technical support for vaccine logistics from the provincial depots to the districts. Distribution vehicles use cold boxes – no refrigerated vehicles are available for PAV use – to ensure temperatures are maintained to preserve the efficacy of the vaccines.

The head of PAV defines the organization's responsibilities as coordinating vaccine distribution to the health center, however PAV has insufficient vehicles of its own to support distributions to each facility, and must rely on vehicles assigned to the provinces (operating in districts).

The district-level administrations within MISAU are responsible for the provision of transport vehicles to deliver vaccines (and other commodities) to health centers. In practice, however, districts do not always have sufficient transport capacity to make distributions, which requires health workers to leave their health centers and travel to the district stores to collect vaccines and other supplies. The impact on distributions as a result of limited transport capacity at the district level is exacerbated by the lack of management control PAV has over vehicles used at the district level. In its 2013 *District Logistics Capacity Study*, VillageReach noted that there is "... no uniform standard or policy for carrying out logistics at the district level."

VillageReach Dedicated Logistics System (DLS)

In the four provinces of Cabo Delgado, Gaza, Niassa, and Maputo, VillageReach has collaborated with PAV to develop a distribution system for vaccines that helps reduce the exposure to insufficient transport capacity at the provincial and district level.

Core to the approach is the use of small teams focused specifically on transport, logistics, cold chain, stock management, supportive supervision and improved information management. The teams are based at the provincial level, but are responsible for ensuring vaccines reach all the way to the health center. A key rationale for the system is to create economies of scale in the transport system. To support vaccine distributions, three distribution vehicles and one supervision vehicle operate in each of the four provinces. The distribution vehicles carrying vaccines and syringes also deliver other commodities, effectively reducing the need for separate transport for vertical programs. By using this delivery system for other medical commodities, the transport and distribution costs are reduced¹⁴.

¹⁴A VillageReach cost study (2009) determined that the DLS system was 17% more cost-effective and 21% less expensive per vaccine dose delivered.

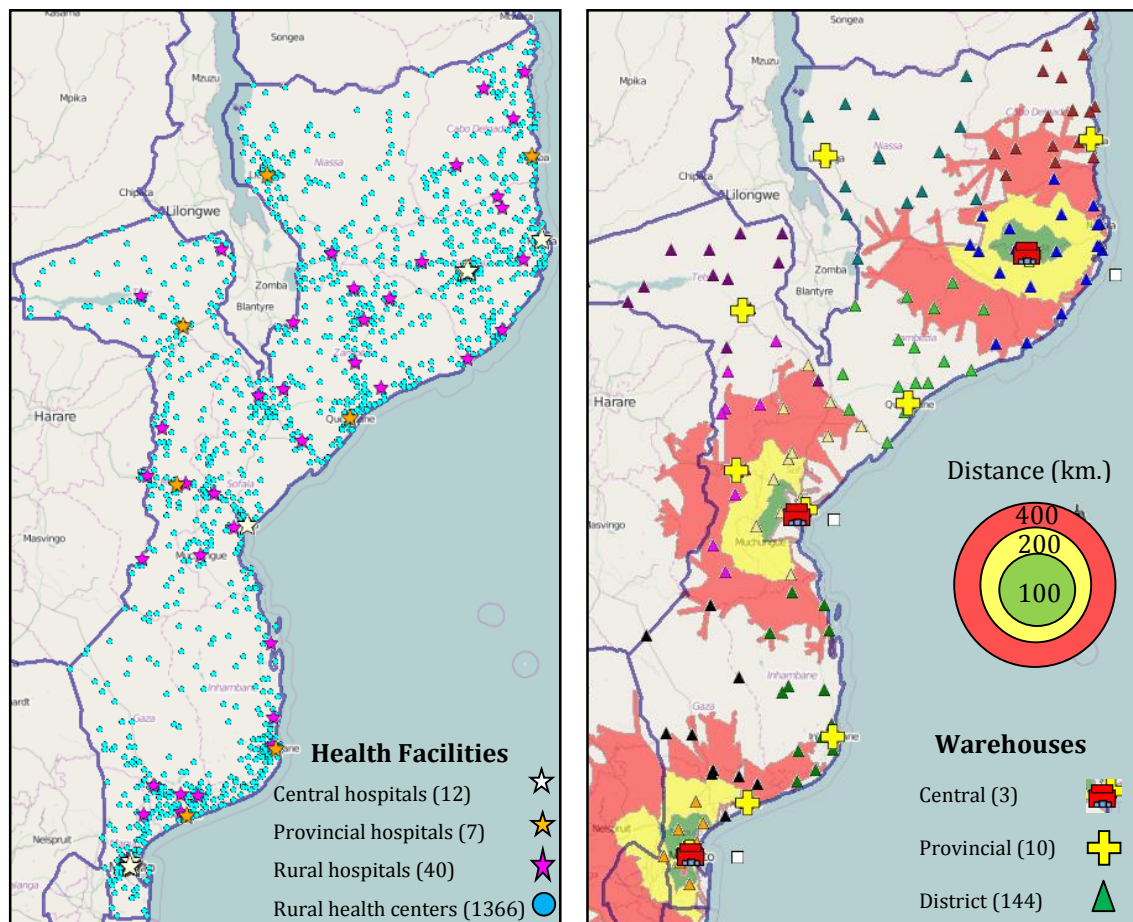
3.4. PHARMACEUTICAL SUPPLY CHAIN

3.4.1. Procurement & Import

MEDIMOC

Responsibility for the import of medicines into Mozambique was held by MEDIMOC as a monopoly owned by the state until 2007, when the market was privatized. After privatization, MEDIMOC became a semi-private importer (a portion of its ownership is still held by the government of Mozambique) that today competes with as many as 40 other registered importers to serve both the public health system and an estimated 150 private pharmacies, most of which are in Maputo City.

Figure 4: Pharmaceutical Supply Chain – Health Facilities, Warehouses.



Source: Llamasoft 2014

Today, most importers do not possess significant facilities for storage or fleets for freight transport and distribution: commodities are moved directly to customers' storage facilities. MEDIMOC previously possessed large storage facilities and a fleet of logistics vehicles to distribute to all 10 provinces. Today, the organization rents storage as needed and owns a single 4-ton transporter to supplement the capacity of its customers' transport fleets.

CMAM

The *Central de Medicamentos e Artigos Medicos* (Central Medical Store Administration – CMAM) is responsible for the procurement of essential medicines and pharmaceuticals for the government health system. CMAM issues tenders for importation and then assumes responsibility for coordinating internal country distribution, including the use of commercial transport companies through issued tenders. The administration stores commodities at three central medical store (CMS) locations across the country: Maputo City, Beira, and as of late 2013 at a new facility in Nampula City to serve the north (Fig. 4). Commodities are trucked from these facilities to each of the ten provincial warehouses and to regional and city hospitals. From the provincial depots, commodities are transported to storage facilities in each of the 148 districts. Each district is responsible for distribution to its rural health facilities, which number from two or three to as many as several dozen per district. However, because of limited transport capacity in the districts, in practice health centers themselves are often required to find transport to make collections from the districts.

3.4.2. Transport/Distribution Obligations

CMAM operates its own vehicles and uses commercial transport companies for distribution to the provinces' stores and to other major health facilities. For 2011, nearly 200 separate distributions were conducted from the Beira and Maputo ports to provincial stores using commercial transporters. Travel distances range from 50 km. to over 2,300 km., translating to hundreds of thousands of kilometers logged annually. In 2011, CMAM provided nearly \$1 million in outsourcing payments to 3PLs and carriers for distribution of commodities to the provinces.

Table 7: CMAM Transport Routes and Costs (2011).

Route Origin	# of Trips	Value	
		MZN (000)	US\$
Beira	64	5,897	\$197,000
Maputo	135	23,838	\$795,000
Total	199	29,735	\$992,000

Source: Strategic Plan for Pharmaceutical Logistics. 2012

3.4.3. Logistics Resources – Vehicles and Staffing

CMAM has a national staff of approximately 100, the majority of which are based in Maputo, however the number of personnel engaged in supporting the distribution of pharmaceuticals is effectively much greater, considering the role provincial DPS staff play in the management and storage of medical stocks. But despite the national importance of its function, and despite its primary logistics functional role, CMAM does not employ any logisticians (see Table 8). The gap between required and existing capacity is significant: in 2010, CMAM conducted an examination of needed resources and determined a minimum of 116 logisticians would be required to support its current scope and scale of activities¹⁵.

¹⁵ Strategic Plan for Pharmaceutical Logistics (PELF), 2012.

Table 8: CMAM Staff by Level of Education and Training.

Level/Areas	Total	Pharmacy	Admin.	IT	Accounting	Other
Higher Level	19	10	5	2	0	2
Mid Level	32	6	18	1	4	3
Basic Level	1	0	1	0	0	0
Assistants/ Trainees/ Drivers	53	0	0	0	0	53
Total	105	16	24	3	4	58

Source: Strategic Plan for Pharmaceutical Logistics. 2012

(CMAM's *PELF* plan, referenced below, cites the historical tendency to view the medicine supply function as primarily a role for pharmacists, not logisticians, and notes that there is no formal career path in logistics at the ministry. The chronic shortage of logistics professionals in the ministry of health has also been documented by VillageReach in its partnership with PAV.)

In consideration - and despite the lack of data available to quantify the capacity gap that results from the lack of logisticians - it is intuitive that little proactive resource and logistics planning would be possible by CMAM. Distributions are likely not optimized owing to the lack of technical planning expertise. It is therefore not currently possible, for example, to project *desired* efficiency and cost-benefit gains that could be realized with the employment of external logistics support.

MISAU's Department of Transport lists eight vehicles it operates that are dedicated to CMAM's distributions:

- Two 10-ton
- Six double-cabin pick ups

CMAM also operates two mini buses managed by the transport department. Average age of CMAM's logistics vehicles is 6 years. CMAM's vehicles are part of a much larger fleet: MISAU's department of transport operates 124 vehicles of which more than 20 are used for distributions by multiple ministry of health programs; it is assumed CMAM has use of additional vehicles within this fleet on occasion. As noted above, CMAM employs commercial freight transport and distribution companies to support distribution to the provinces. Details of this fleet and its capacity were not provided by CMAM.

3.4.4. Strategic Priorities – Capacity, Efficiency, Decentralization

In 2012, CMAM undertook an examination of its strategic priorities with a view to increasing its capacity and achieving sustainable improvement. With support from a number of partner organizations, including the Clinton Health Access Initiative (CHAI), DFID, and USAID, the *Strategic Plan for Pharmaceutical Logistics (PELF)* was completed in mid-2013. The plan, which takes its direction from MISAU's 2014-2019 Five Year Strategic Plan (PESS), reflects CMAM's chief priority to improve basic healthcare services through a *decentralized system* of distribution. The plan provides this description of the chief aim of its new strategic priorities, with noted emphasis on improving capacity and efficiency:

To ensure that vital and essential medicines and health products are safe, effective and of approved quality, are available in sufficient quantities and in good condition, at the time and in the amounts needed to prevent, diagnose or treat priority health problems among the population, and at the lowest possible cost to the patient and his or her community.

In support of this aim, the plan highlights this specific objective for improvements in distribution and transport:

Health products are transported safely and within the set periods, ensuring correct circulation flow, at all levels of the supply system and at the lowest possible cost (efficiency). This activity must, whenever possible, be outsourced to allow institutional attention to be focused on the core functions.

The reference to outsourcing reflects the established view within MISAU that, owing to limited transport and distribution capacity at lower levels of the health system, decentralization can only be possible through the use of externally capitalized and managed resources.

Additional specific objectives point to needs for system-wide improvements in financing, logistics management information systems (LMIS), warehouse infrastructure, storage and stock control and human resources.

In January 2014, the PELF plan was endorsed by CMAM, and work began on the implementation plan, scheduled for completion by mid-2014¹⁶.

¹⁶In conjunction with its work to assess capacity and capabilities of the country's supply chain for vaccines, and its success in enabling PAV to streamline its distribution practices, VillageReach has been invited to serve on CMAM's technical working group (GTT) to contribute to the development of its implementation plan.

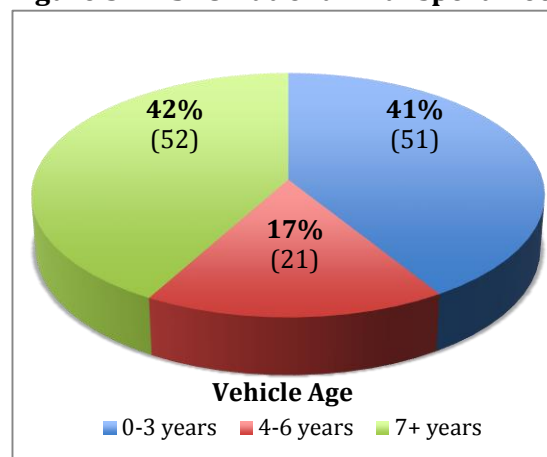
4. Ministry of Health Transport Capacity

The ministry of health oversees the use of government vehicles through dedicated fleet management functions at both the national and provincial levels. In the districts, where there is a lower percentage of functioning vehicles vs. official fleet capacity than at higher levels of the supply chain, there are few formal fleet management practices. This section provides a review of the practices and challenges faced by each layer of supply chain in managing its transport function.

4.1. NATIONAL

In Maputo, the MISAU Department of Transport operates a fleet of 124 vehicles to support distributions and administrative activities, and for ambulance service; approximately 20 of this total are used for freight transport and distribution only, although administrative vehicles may be used for distributions if there is need for additional capacity. The department was unable to indicate what share of the vehicles is currently operating, however more than 40% of the vehicles are seven years or older (Fig. 3). Of the 20 distribution vehicles, five are one- to 10-ton freight vehicles (two of which are devoted to CMAM), the remainder are double-cab, pick-up trucks with limited storage capacity. A variety of funding sources and/or MISAU administrative groups supply/utilize this fleet, including CMAM.

Figure 5: MISAU National Transport Fleet.



Source: MISAU Department of Transport

Fleet Management

The head of the transport department observed that the majority of the fleet is primarily suited to supporting freighting of equipment, not medicines, and noted the department has no refrigeration vehicles to transport vaccines. There are no PAV-dedicated vehicles in the MISAU transport department fleet.

The head of the department's description of the use of the vehicles is similar to the use of a motor pool: use of the fleet is based on requisitions issued by groups within MISAU. The department's explanation of the use of the fleet suggests there are minimal set schedules for distributions using the fleet. Maintenance of the fleet is conducted by commercial vehicle mechanics. The transport department provides a quarterly report to the *Mozambique Administration and Finance Board* (DAF) concerning the use of vehicles in order to track expenditures against budget. VillageReach was unable to access these reports and the transport department's annual budget, both of which required DAF approval.

4.2. PROVINCE

Each province is responsible for the management of the fleet vehicles, covering insurance, maintenance, technical training, the purchase and the retirement (used-vehicle sale or scrap scale) of expired vehicles.

In its annual report for 2013¹⁷, Gaza DPS' transport department noted the following key constraints limiting effective management of its fleet:

- Severe wear and tear on the fleet: due to the poor conditions of rural access roads.
- High incidence of accidents: the 100-vehicle fleet experienced accidents at an average annual rate of 8% from 2008-2013. Nearly 50% of these are listed as serious, requiring extensive repairs and delays in return to service.
- Limited OPEX: limited funding and slow payments (see *Funding Allocations/Financial Flows* section, below) to the districts for maintenance, repairs and insurance impacted the up-time of the vehicles for distributions.
- Lack of appropriate vehicles: insufficient supply of vehicles for specific uses (e.g. 4x4s to navigate rough rural terrain).
- High maintenance and repair costs: due to the lack of suitable mechanical repair services¹⁸.
- Unannounced postponement of support resources: e.g. funding, fuel, parts, etc. ... without prior communication to the transport sector .
- Lack of spare parts: due to funding shortages.
- Limited information systems: to ensure active tracking and accountability for the proper use of vehicles.

Table 9: Gaza, Maputo DPS Fleet Profile.

Vehicles	Gaza Province			Maputo Province		
Average Age of Logistics Fleet	7 years			10 years		
	Total	Functioning	Est. CAPEX (USD)	Total	Functioning	Est. CAPEX (USD)
Logistics Vehicles Single-, Double-cabin Pick-ups (4x4s)	59	55	\$3,874,500 - \$5,535,000	41	27	\$2,985,500 - \$4,265,000
Ambulance	24	22		17	7	
Mini Bus	4	4		7	3	
Administrative	19	15		12	5	

Source: Gaza, Maputo DPS, 2013. VillageReach estimates.

To develop an estimate of the capital expended to purchase provincial transport fleets, a simple calculation was made using an estimate of the original purchase price of new vehicles, multiplied by the number of vehicles in each category. The CAPEX totals in Table 9 are based on the following price assumptions¹⁹:

¹⁷ Issued January 20, 2014

¹⁸ Gaza and at least some of the northern provinces with extensive rural geography have limited access to high-quality and cost-effective mechanical repair facilities in rural areas.

¹⁹ Logistics vehicle costs are based on VillageReach's purchases for similar vehicles.

- Logistics vehicles (single-, double-cabin: pick-up trucks) \$50,000
- Ambulances: \$65,000
- Minibus: \$90,000
- Administrative: \$40,000

The estimates provide a range, from 70% - 100% of the calculations, in order to factor in price inflation. More exact estimates would require access to the original prices paid for each vehicle. No estimate is made of the *current* value of each provincial fleet based on average depreciation values because of the difficulty in estimating the actual functioning condition of the vehicles. (VillageReach has observed a large number of vehicles at provincial and district facilities that are not currently functioning, included in which are a number it appeared would only hold scrap value.)

4.3. DISTRICT

The operation of transport at the district level differs fundamentally from transport at the national and provincial levels, according to these key observations:

- 1) Significantly fewer actual vehicles are in operation compared with the official provincial fleet capacity.

Districts interviewed cited severe shortages of functioning transport vehicles, with operational vehicles for logistics at levels as low as 10-15% of official fleet capacity cited by the provincial fleet managers. Table 10 cites data collected from districts in Gaza and Maputo provinces: in two of the districts only one vehicle is currently functioning to support distributions, for 14 (Maputo) and 21 (Gaza) health centers, respectively. This shortage of functioning vehicles at the district level is corroborated in findings from a VillageReach evaluation of Manica, Sofala and Tete provinces²⁰. In 18 districts across the three provinces, there were found to be no functioning vehicles allocated to logistics.

DPS Vehicles at District Health Facility.



VillageReach 2012.

²⁰ *Logistics Systems and Management Assessment in Sofala, Manica and Tete Provinces*. VillageReach, 2012.

In VillageReach's 2013 *District Logistics Capacity Study* that surveyed 53 districts in Cabo Delgado, Gaza, Maputo and Niassa provinces, only 4% of districts were found to have closed vehicles that are 100% allocated to medicine/vaccine distributions.

2) Vehicles are a shared resource.

Due to the limited number of vehicles available, and the generally limited budgets provided at the district level, there is little logistics planning: vehicle use is typically based on immediate demand rather than as a result of scheduled planning²¹.

3) Few personnel are devoted to logistics.

VillageReach was unable to identify any personnel devoted to logistics planning or management of transport assets at the district level. (This lack of qualified logistics personnel was noted as a significant gap within CMAM at the national and provincial level also, see Table 8.) *Monitoring* and management of vehicles was observed to be the responsibility of DPS district administration and finance personnel, but this function did not include proactive logistics planning concerning the use of vehicles.

Table 10: Gaza, Maputo District Fleet Profile.

District, Province	Matola City, Maputo	Chokwe, Gaza	Chicumbane, Gaza
Population	830,000 (includes Matola City)	200,000	240,000
# of Health Centers	14	21	14
Avg. distance to health center (km.)	No data	29 km.	30 km. (est)
Fleet	9 logistics 3 ambulances 1 administrative	10 logistics 5 ambulances	No data
Functioning vehicles	2 logistics 1 ambulance 1 administrative	1 logistics 2 ambulances	1 logistics 2 ambulances
Year of most recently allocated vehicles	No data	6 years	4 years

Source: VillageReach interviews.

Districts appear to view ambulances as a priority: ambulances tend to receive more regular maintenance and equipment updates than distribution vehicles and as a result are often the only vehicles available for use in any capacity.

²¹ VillageReach's 2013 *District Logistics Capacity Study* noted that "... the districts often rely on a mix of transportation methods or a combination of vehicles to collect medicines/vaccines and carry the distributions out, since the districts' access to closed vehicles varies so much from month to month."

4.4. FUNDING ALLOCATIONS/FINANCIAL FLOWS

In order to access funds to maintain and operate fleet vehicles, managers are required to submit requisitions to the Acquisitions Execution Management Unit (UGEA), which has the primary procurement responsibility within the government across national, provincial, district and municipal administrations. In addition to its core responsibilities covering development of procurement plans, and administrative support for tenders, UGEA also effectively as the gate-keeper for individual requests for use of funds to apply against purchases. The approval process fleet managers experience can be lengthy and ultimately may negatively impact the performance of MISAU's transport function.

The requisitions are reviewed by UGEA and either denied or passed up to the Administration and Finance Board (DAF) for release of funds. The MISAU and DPS fleet managers explained this can be a very lengthy process – two–three months is not uncommon - effectively resulting in vehicles being parked for long periods. District administrators indicated they can wait even longer for responses for requests of funds ... it is unclear if districts are experiencing bias in favor of administrators higher up in the supply chain. The explanation of both the process for review and the reasons for delays is unclear for this report: we were unable to schedule meetings with DAF representatives to understand the perspectives from the finance administration. However, what is evident is that excessive delays in funds being released would need to be addressed in order to engage private transporters as outsourcing partners. Freight companies typically have a standard 30-day payment period for services rendered.

5. Energy Logistics Services for Health – VidaGas Case Study

There is precedent for outsourcing of logistics-related services by provincial health authorities in Mozambique. Since 2002, the private company, VidaGas, based in Nampula City, has been providing liquid propane gas (LPG) fuel to support ministry of health energy requirements.

The business was created and capitalized by VillageReach and *Fundacao para o Desenvolvimento da Comunidade* (Foundation for Community Development - FDC) in order to supply fuel for off-grid health centers that serve rural communities throughout the region. In 2009, the company received additional investment from Oasis Fund, a social investment fund based in Switzerland.

VidaGas currently has contracts with DPS in Cabo Delgado, Nampula and Zambezia provinces, supporting a total of 400 health centers serving an estimated population of more than 6 million. The business also supplies the private sector in these provinces and in Niassa and Tete provinces.

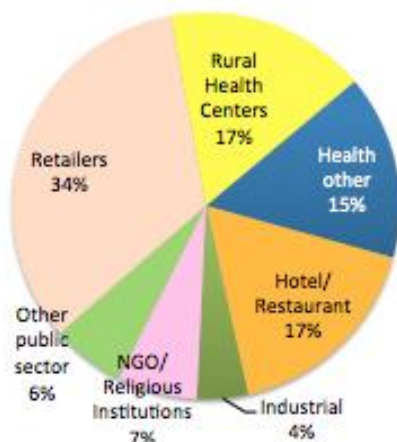
From the beginning, VidaGas sought fuel buyers from the private sector to develop a diversified customer base that would ensure a sustainable financial model to ensure future support for the ministry of health. Today the company’s customer base is dominated by commercial ventures (Fig. 4) and has a growing number of individual customers served by the company’s network of 30 retailers.

VidaGas Facilities: Nampula, Pemba.



VillageReach 2012.

Figure 6: VidaGas Customer Base – Share of Shipments.



Source: VidaGas

In 2013, VidaGas shipped more than 700 metric tons of propane – making it the largest supplier in the north. The company has seen demand for its service increase by approximately 35% annually since 2009, well ahead of national annual consumption growth of 8.5% for the same period.

VidaGas is the only facilities based supplier of LPG in northern Mozambique - competing suppliers service the northern region by transporting cylinders from Maputo. The company manages its distribution through filling facilities located in Mocuba (Zambezia), Nampula City (Nampula), and Pemba (Cabo Delgado). Gas is loaded from importer facilities in Maputo City, and two freightliners transport 20-ton tankers to the three northern facilities, where the gas is off-loaded into stationary tankers.

Each month an average of four trips are made to the north covering a single-trip distance of approximately 2,400 km. From the facilities, a fleet of two- and five-ton freight transporters deliver 5.5 kg., 11 kg., and 45 kg. gas cylinders to commercial businesses, retailers, and to district storage facilities managed by each DPS. Each district administration is responsible for the store of gas at their facility for and delivery to health centers. Rural health facilities use the gas to power refrigerators, and lighting and sterilization equipment, consuming an average of two 5.5 kg. cylinders per month.

VidaGas sells the propane to the DPS at market rates. Contracts are renegotiated annually, with payments required monthly. Since the company was formed, it has experienced occasional delays of payment due to slow funding to the provinces. In a number of instances the company has had to reduce and/or cancel distributions due to extended delays (three+ months) in payment.

Distribution vehicles operate on set schedules of delivery, based on tracked consumption patterns and customer requirements. VidaGas's customers do experience stock outs of gas on occasion, primarily owing to unanticipated increases in consumption – however the company has largely been able to address fluctuations in demand because of the reserves it stores at the facilities. Simple maintenance activities for the fleet are managed internally, with repairs and equipment replacement conducted by outside mechanic service companies.

6. Discussion

Road transport is critical to the health and well being of communities across sub-Saharan Africa. Because of the underlying economics of rail and air in the region – in particular high CAPEX – that limit market participation and the reach of freight services using those methods, road transport is the most cost-effective means to convey freight to the largest possible population in sub-Saharan Africa.

The Mozambique National Roads Administration is charged with increasing road access for all communities throughout the country. Based on its most recent annual reporting, the ANE has documented insufficient funding to complete its annual objectives for road development and improvement.

The impact of insufficient road infrastructure development is not only seen in terms of transport access: poor-quality infrastructure also impacts the cost of delivery. We note the unique and **harsh use conditions of vehicles operating in rural sub-Saharan Africa**. Independent data from assessments of the private sector in the region suggests higher transport costs can be expected due to rough terrain and seasonal weather that results in greater wear and tear on vehicles and higher incidence of accidents.

However, Mozambique's transport sector is a growing industry. Freight transport companies operating at the national and provincial levels are responding to growing demand by the oil and gas sectors to move goods and equipment north to their facilities. The country's largest transport ventures cover routes across all of Mozambique, although they typically limit their services to the district level and above – and do not serve more remote rural routes – according to the primary locations of their customers.

Regionally, the Southern African Development Community is projected to expand trade within the region and to increase exports to outside markets accessed via Mozambique's major east coast ports. Both **increased regional trade and the extractive sector are expected to influence demand for and investment in improvements to Mozambique's road infrastructure**. Depending on the degree of investment and development in regional road infrastructure, and the degree of government support, rural communities may ultimately gain better access to road transport as a by-product of the growing demand from commercial users of roads.

The cost structure for commercial logistics providers and carriers in Mozambique and sub-Saharan Africa more broadly is characterized as having high variable operating costs and typically lower fixed costs (especially salaries and facilities). A primary influence on the high variable costs is the state and quality of road conditions, which result in higher rates of fuel consumption and purchases of tires, for example. We observe that this suggests **regional transport companies operating primarily on secondary, tertiary and country roads will therefore have higher cost/route structures than national businesses focusing on primary routes**.

The Mozambique Ministry of Health's transport function is limited in capacity and performance by a number of elements (see Table 11).

Table 11: Primary Contributors to Underperformance of DPS Transport Function.

Prioritized Elements	Impact
Chronic transport capacity shortage in districts	<ul style="list-style-type: none"> No proactive, comprehensive logistics planning. Ad hoc distributions are standard. High unit cost of delivery. Ambulances used for distributions.
Insufficient CAPEX to purchase new vehicles	<ul style="list-style-type: none"> Replacement rate less than 50% of vehicle expiry rate. Severely aged fleets. High per-vehicle maintenance costs due to over use.
Delays in payment for approved, budgeted expenditures	<ul style="list-style-type: none"> Insufficient funds for fleet operations, covering fuel, driver per diems, maintenance/repairs, insurance, etc.
Disconnected financial management practices	<ul style="list-style-type: none"> District expenditures not tracked at the provincial level. Reliable estimates of transport OPEX not easily determined due to shared costs at district level.
Weak underlying road and transport services infrastructure	<ul style="list-style-type: none"> Requires highly rugged (expensive) vehicles to navigate rural routes. Maintenance/repair services not easily accessible, especially for provinces with large rural communities
Shortage of logistics personnel	<ul style="list-style-type: none"> Efficiency, optimization planning not practiced.

Key among these is the **degree of fleet capacity shortage, particularly at the district level**. While official provincial fleet lists include all vehicles owned by the DPS, the lists do not accurately reflect the number of vehicles that are functional and available for use. The gap between official tallies and the number of vehicles that are functional is found to be very high in some instances: for some districts visited, only 20% of vehicles are operational. With such significant difference, we observed that:

- ad hoc distributions become the norm ... fleets with such little capacity essentially operate continually in *emergency mode*, conducting urgent deliveries; and
- ambulances become the default logistics vehicles for some districts ... districts place a higher premium on a functioning ambulance than a logistics vehicle, therefore ambulances are used for distributions when they are not carrying patients.

Under such circumstances, it is evident that districts find it all but impossible to conduct comprehensive logistics planning because of the limited number of vehicles, and because of the **limited logistics personnel available** to support the function. Excessive use of the few vehicles available is also likely to increase cost per delivery, due to higher wear and tear on the vehicles. We did not collect data to support this assumption.

The **purchase of vehicles severely lags the rate of vehicle expiry**. This was evident at the national, provincial and district levels. We assume an average life-span of four years for logistics vehicles²² (given the harsh driving conditions and rough terrain in

²² DPS officials in Maputo Province stated a preference to replace vehicles after 3 years.

which they are used), after which they would not operate optimally (in terms of fuel consumption, rate of parts replacement, etc.). However, the average age of some fleets is nearly *double* this limit, which results in fewer rolling vehicles at any given time due to a higher incidence of mechanical problems and correspondingly higher repair charges.

We also noted the significance of *all* vehicles operating in the provinces being owned by DPS – which limits the independence of districts to determine optimal times for sale and purchase. A striking result of districts not being able to manage their own assets is the large numbers of scrap vehicles we observed sitting at health facilities; in a number of cases vehicles had been sitting in the same position for several years. The districts placed no operational value in these vehicles, but were also unable to monetize the value of them through sale to support, for example, the future purchase of new vehicles.

The fluid and predictable release of funds is a critical component for asset-based enterprises in order to ensure the assets retain their value of service for their projected lifespan. Fleet managers at the national, provincial and district levels all cited periodic and in some cases severe **delays in the release of funds** for regular repairs and equipment replacement, as well as for fuel, driver per diems, insurance and other typical operating expenses. Fleet managers must submit requests to Acquisitions Execution Management Unit (UGEA) to review and then forward to the Administration and Finance Board (DAF) for funding. This paper-based process can become extended if there are qualifying questions from UGEA or DAF about a request. The Maputo DPS fleet manager cited an example of a 3-month wait for the release of funds to purchase a set of tires for a vehicle²³. Such lengthy delays can result in effective reductions in the value of the assets during their lifespan. This slow provision of payments can be especially impactful for managers in charge of vehicles running routes through remote, rural areas, where a vehicle breakdown can mean the difference between having no and any capacity for distributions.

Beyond specific shortages of funding to support fleets, we observed limitations placed on fleet managers and district administrators responsible for government vehicles because they are often **unable to source reliable financial data** on their operations that would enable performance evaluations, and because they may have inadequate skills and training to practice sound financial management. We were unable to isolate specific transport costs within the ministry because of the high incidence of shared use of vehicles, lack of documentation (i.e. accurate trip logs) and because record keeping does not adequately categorize full and true costs for transport. This issue is fundamental to the consideration of outsourcing transport in the future: the ministry of health must be able to benchmark current transport costs in order to determine what it is willing to pay in the future to gain improvements in capacity and efficiency.

²³ The health system is not the only government ministry to experience funding delays. ANE cited similar delays as a key factor in it not achieving 100% of planned road construction and repairs during 2012, where the use of private contractors is required.

7. Opportunities

The following recommendations primarily address long-term strategic priorities the MoH must address as it seeks to improve the overall quality and capacity of its transport function, with a view to engaging external transport service providers.

1. Update assessment of true fleet capacity within DPS fleets. Our research reveals a discrepancy between the official fleet lists of the provinces and functionally available vehicles available in the districts. Findings suggest a significant difference. District audits in each province would reveal the true current transport capacity for an entire province, and also expose prevailing practices of the use of vehicles, indicating, for example, the period of time vehicles have been non-functioning. Findings from the district audits would support long-term planning goals, but also detail critical gaps in transport that must be addressed urgently.

2. Benchmark vehicle use. Currently, fleet managers at the provincial and national level are unable to fully document the use of their vehicles. As a result there is incomplete data on fuel consumption, distance and destination logs, and maintenance, damage and repair histories for vehicles. To consider *outsourcing the transport function to the private sector and evaluating its competitive benefits*, a more accurate benchmarking is necessary of the current use of vehicles, the attendant costs, and overall performance.

3. Establish dashboard and key performance indicators (KPIs) for optimal fleet operation. Transportation management at the national and provincial levels of the health system are challenged in developing optimal, efficient fleet operation due to a general shortages of vehicles. As a result, management activities are primarily limited to administrative tasks (e.g. issuing requisitions for repairs and equipment, and responding to unique requests for use of vehicles). The establishment of core KPIs and a regular (monthly, quarterly) dashboard report would enable proactive logistics planning and support goal setting and achieving performance improvement over time.

4. Manage district fleet assets independently. District health managers are *accountable* for distribution of vaccines and other commodities, but do not have *responsibility* for the transport assets used for distributions. In particular, ownership of vehicles is held at the province, which limits prevents appropriate asset management to reflect district priorities. MISAU is assessing options to further decentralize services through its five-year *PESS* strategic plan. Providing districts with ownership and full decision-making responsibility of their vehicles would enable greater degrees of accountability and performance evaluation.

5. Conduct district logistics audits. At various functional levels of the health system, transport managers note shortages in availability and resources for functioning vehicles vs. the total number of vehicles officially listed on fleet manifests. However, these noted gaps do not suggest the optimal number of

vehicles that would be necessary to ensure more efficient logistics operations. Conducting independent audits of current logistics practices, including route planning, vehicle use, etc. – especially at the district level – would help support either future requests by MISAU for additional vehicles it will own and manage directly, or to outsource the transport function to the private sector.

6. Establish logistics management positions and supporting training. This report cites the severe shortage of professionally trained logistics managers for all levels of MISAU's supply chain, and notes there is no current job description within CMAM, for logistics managers. Identifying these roles is critical for both direct management of an internal transport function, and for outsourcing.

7. Streamline budgeting and financial approval processes. The transport function within MISAU operates with great uncertainty due to the vagueness of budget management and funds availability. To enable greater accountability at lower levels of the health system supply chain, managers require greater funds management flexibility and more reliable (shorter) response times to requests for financing. We note performance in MISAU due to ineffective funding practices extend well beyond the transport function.

8. Establish private sector engagement practices to support outsourcing. To determine the optimal use of 3PLs and carriers to distribute MISAU commodities, the ministry must establish base-minimum performance levels, monitoring practices to develop data in support of ongoing evaluations, and set incentives and responses to deter poor performance (e.g. withhold payment) by private carriers.

9. Evaluate private sector transport capacity. This report and other supporting research cite broad differences in the capacity, performance, and technical quality of private sector transporters across different geographies in sub-Saharan Africa, and within Mozambique. To determine the practical benefit of engaging with the private sector, and determine ideal partners for the MoH, audits of 3PLs in the unique geographies proposed for outsourcing must be conducted to ensure an accurate assessment.

8. Conclusion

The Mozambique Ministry of Health struggles under the weight of an overly tiered supply chain it does not have the personnel and expertise to manage efficiently and an asset-heavy transport function that it is unable to provide the capital to upgrade. In the context of this system, many rural Mozambicans do not have access to even the most basic healthcare. MISAU recognizes the challenges it would face in continuing to support the current model – and the missed opportunity to broaden access to healthcare. In response it is pursuing a path of decentralization and private sector engagement in order to capture greater efficiencies and develop a more sustainable and equitable path for improvement.

Conversely, the private sector in Mozambique is experiencing one of the fastest rates of growth in Africa, with newly discovered natural resource reserves spurring demand for more employment in the north, and increases in infrastructure investment and development. Both of these factors will serve as catalysts to help develop the country's entrepreneurial class. Because of the expected increase in demand for improved access (to markets, public services and other transport links), a key sector that will gain further investment and develop entrepreneurs is transportation. And while the main north-south corridor and east-west routes linking major ports to much of SADC will be a near-term focus, the economic benefits of improving transport infrastructure and services could have far-reaching, long-term benefits for the health of the nation.

Today MISAU is unprepared to take advantage of the improving transport sector: it has not yet developed the expertise, or invested in communications, employee training and other elements to professionalize its logistics capabilities. However there are significant benefits to be gained for MISAU from improving its financial systems and moving to a professional management role in which it oversees external transport capacity.

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Appendix – Interview Schedule/Interviewed Organizations

November 18, 2013

Maputo City, Maputo

- Dr. Jorge Tomo, Chairman, MEDIMOC.
- Mr. Zedequias, Chief of National Transport Department, MISAU.
- Dr. Benigna Matsinhe, Director, PAV.

November 19, 2013

Matola City, Maputo

- Mr. Paul Manhique, Councilor, Ministry of Transport and Communications, Matola City.
- Mr. Antonio Siteo, Head of Human Resources for Health, Women and Society (PAV) Matola City.
- Mr. Benjamin, Provincial Chief of Transport, Maputo DPS.

Maputo City, Maputo

- Mr. Saul Walker, Senior Health Advisor, DFID Mozambique.

November 21, 2013

Maputo City, Maputo

- Mr. Paulo Nhaducue, Director, CMAM.
- Mr. Mbate Pedro Matandalasse, Head of Health Programs, DANIDA Mozambique.
- Mr. Luis Ramos, Managing Director/Owner, TTI Transportes.

November 22, 2013

Maputo City, Maputo

- Mr. Manuel da Cruz – Executive Secretary, ASTROCAMA.

Matola City, Maputo

- Ms. Silvia Duvane - Technical Medicine - Center for Health and Maternity Services, Matola City, Maputo DPS.
- Ms. Marieta Baptist, Public Administration, Matola City, Maputo DPS.

November 27, 2013

Maputo City, Maputo

- Mr. José Bonde, Geographer, ANE.
- Mr. Avelino Machava, Manager, Maintenance, ANE.

November 29, 2013

Maputo City

- Mr. Custodio Mondlane, Procurement and Supply Chain Manager, CHAI.
- Mr. Dan Stoker, Supply Chain, Accenture Development Partnerships.
- Mr. Sameer Ranchod, Supply Chain, Accenture Development Partnerships.

January 28, 2014

Xai Xai City, Gaza

- Mr. Celso Macamo, Provincial Chief of Transport, Gaza DPS.
- Mr. Ossuman Adam – Owner, Adam’s Transport.

January 29, 2014

Chicumbane, Gaza

- Dr. Herculano Nhamussa, District Medical Officer, Chicumbane Rural Hospital.

Chokwe City, Gaza

- Mr. Arao Zandamela, Chief, Ministry of Transport and Communications, Gaza.
- Dr. Lus Nhaia, Director of Administration and Finance, Chokwe Rural Hospital.
- Mr. Pedro Chambal, Owner, Chambal Transportes.

January 30, 2014

Maputo City, Maputo

- Mr. Kevin Pilz, Senior Supply System Strengthening Advisor, Central Medical Stores, Ministry of Health, Mozambique (seconded from USAID).

February 4, 2014

Maputo City, Maputo

- Ms. Lise Ellyin - Mozambique Country Director, Clinton Foundation.
- Mr. Custodio Mondlane, Procurement and Supply Chain Manager, CHAI.
- Mr. Alex Lloyd - Technical Consultant, CHAI.

February 5, 2014

Maputo City, Maputo

- Mr. Dimitri Peffer, Deputy Country Director, Health Systems Development, JSI.