Project Last Mile

Project Last Mile: Mozambique

Final Phase 1 Project Report

Presented to: CMAM
Prepared by: Project Last Mile

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FRONTLINE MARKET RESEARCH IN AFRICA

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Section 1: Executive Summary and Project Overview

1.1 Executive Summary

The primary objective of the project was to build the capacity of CMAM to be able to advance the Strategic Plan for Pharmaceutical Logistics (PELF) in Network Optimization, Outsourced Distribution and Logistics Capability Development by providing key input and insights based on Coca-Cola Sabco local expertise and experience.

The Project Overview indicates the status of delivery against all of the elements of the contract per the revision of 23 March 2017. Due to the nature of the work, some of the deliverables in the Outsourced Distribution and Logistics Management Capability Development workstreams have been delivered together with this report, after the originally estimated completion date of June 2017. Regular Steering Committee meetings have been held throughout the project and supported by detailed reports released ahead of each meeting.

This report details the processes followed, learnings and recommendations for the Route Optimisation workstream. Complete Route Optimisation studies were conducted on the current district-based distribution model and the proposed Intermediary Warehouse (IW) model for Gaza, Tete and Inhambane provinces. Based on those learnings and methodology a simulated exercise was undertaken for the remaining 8 provinces of the country including Maputo City.

The future IW recommendations are based on working both within the provincial boundaries and on an optimized basis ignoring provincial boundaries. The additional mileage to be travelled, additional resources and costs of working within the provincial boundaries are included in the report.

The vehicles required (type and number by province), investment and annual distribution costs for direct distribution have been calculated and are compared to the cost of using outsourced distribution. A second scenario is also presented in this report still based on optimized routing but taking account of longer delivery stop times and potential delays on the routes. A recommendation is also made in terms of the size of each of the 30 IWs.

The total annual direct vehicle and labour cost of distribution on the current model from Provincial warehouses to District Warehouses to Health Centres amounts to $2,146,277 as compared to on an optimized basis on the future Intermediary Warehouse model of $2,084,337. The cost saving is even greater when considering even just the annual operational cost of running 30 Intermediary Warehouses versus the current operating cost of the 148 DDM's and 11 provincial warehouses.

When looking at quantifiable factors only, outsourced distribution is about 10-15% more expensive than direct distribution when factoring in direct costs, variable costs and 3PL profit margin. However it is necessary to factor in other non-quantifiable factors when evaluating direct versus outsourced distribution. The non-quantifiable factors are likely to far outweigh the marginal theoretical cost benefit that has been calculated. It is recommended that CMAM continue to pursue outsourced distribution as the preferred method for last-mile distribution.

PLM was engaged directly with Outsourced Distribution only in Tete province and in conjunction with Village Reach, to support their TSS pilot activities in the province. The collaborative framework between PLM and Village Reach is included in this report.

Finding potential 3PL distribution partners to provide a distribution service to facilities across the country has been difficult. The information, ways of working and potential costs provided have not always been reliable and clearly understood by third parties. The approach taken to implement third-party distribution should be determined and implemented for each Intermediary Warehouse as they are established. Elements to be included in a Supplier Evaluation Framework have been listed in this report.

Templates have been provided for an outsourced distribution contract as well for Service-Level-Agreements including performance management indicators as used in the private sector. In addition, elements relating to basic human rights and conditions of employment that service providers typically have to adhere to have been listed.

The PLM team worked with J Durao to support the design and set-up for the first Intermediary Warehouse (IW) in Vilankulo, Inhambane province. After a visit by the Coca-Cola team to the Maputo provincial warehouse and the Zimpeto warehouse,

feedback on the proposed functions and supporting organization structure and resources for the Vilankulo warehouse was submitted and is included in this report. Job profiles and job descriptions were reviewed and found to be very complete. Elements relating to managing outsourced distribution and optimization were added. Selected Standard operating procedures (SOPs) for the IW were submitted.

Recommended psychometric assessments for all Warehouse roles are included as well Performance Management objectives, targets and high level review process for logistics management roles at the Intermediary Warehouse level. Warehouse competencies (knowledge and skills) that warehouse staff need to perform their jobs optimally have been defined including the different levels of competence required. This also shows how a curriculum is built to meet each level of competence required.

To limit the size of this report, a list is provided of documents, templates and workings which also form part of this report but have been circulated separately in a USB drive.

1.2 Project Overview

The original contract between the Ministry of Health and GETF was dated 20 June 2016 with a timeline for delivery from that date to 19 June 2017. With delays in signing of the contract, it was only during the week of 26 September 2016 that the project did kick-off. Effective 23 March 2017 the contract was updated per Change Order No. 1 with respect to the Program Timeline to read 26 September 2016 through to 25 September 2017. The Program Deliverables and Target Outcomes were updated and replaced.

Work in the first several weeks of the project was focused on clearly defining scope, aligning with partners and stakeholders on proposed workstreams and deliverables, and in developing key and realistic plans for the relatively short timeframe of the project. The project team made a visit in November 2016 to Tete province and in January 2017 to Inhambane province to meet the local health authorities, visit the provincial and district hospitals and also to witness and assess the distributions by implementing partners to several Health Centres (HCs) in those provinces.

A Steering Committee was established in November 2016, and the detailed workplan with activities, timelines and Governance elements was approved on 17 January 2017. The Steering Committee met on the following dates:

17 January 2017
28 February 2017
28 March 2017
3 May 2017
15 June 2017 – Steering Committee and Project Review meeting
3 August 2017
28 September 2017 – Steering Committee and closing Phase 1 Project Review meeting.

The current project phase review and closing Steering Committee meeting took place on 28 September 2017 at CMAM in Maputo. This final report has been updated to include outcomes from the meeting and key aligned messages for the National Conference from 18 – 20 October.

The status and evidence of delivery against the contract is detailed in this report by workstream with further supporting documents included in the annexures. The summary of delivery against all elements of the revised contract as per Change Order #1 is included in the table hereunder.

Colour coding has been applied as follows throughout this report to indicate the status for each step in the workstreams:

Completed
In progress
Behind schedule but on track for delivery
At Risk
Not started

Workstream	Deliverables	Estimated Completion D	Status
Project Management	Workplan developed, Governance Structure Agreed including composition and role of the Steering Committee; Project Deliverables and measure of success agreed.		Approved at SteerCom meeting on 17 January 2017
	Final Report	September 2017	SteerCom report issued on 25 September 2017 with final report (post 28 September meeting) submitted on 6 October 2017.
Network/Routing Optimization	Warehouse location assessment	June 2017	Completed - 30 June 2017
	Improved route-to-market mapping and plan	June 2017	Completed for Gaza with report issued 5 May 2017. Completed for Tete with report issued 16 Jun 2017 and Inhambane report issued 30 Jun 2017. For all other provinces, the simulated study results included in the Final Report of 25 September 2017.
	Route-to-market business case (cost, benefit, targets, requirements)	June 2017	Completed for Gaza with preliminary report issued 5 May 2017. Completed for Tete with report issued 16 Jun 2017 and Inhambane report issued 30 Jun 2017. For all other provinces, the simulated study results included in Final Report 25 September 2017.
	Pilot design and scope	March 2017	Completed for Gaza (10 Feb 2017), Tete (31 March 2017) and Inhambane (5 May 2017) .
	Pilot evaluation report	September 2017	Completed for Gaza with preliminary report issued 5 May 2017. Completed for Tete with report issued 16 Jun 2017 and Inhambane report issued 30 Jun 2017.
Outsourced Distribution	List of potential suppliers and supplier evaluation framework	June 2017	Included in Final Report - 25 September 2017
	Benchmark cost data and estimated cost for the proposed RTM model(s), including key targets/ metrics based on Sabco experience	September 2017	Provisionally for Tete on 16 June and Inhambane on 30 June. For all country on simulated basis included in the final report of 25 September 2017.
	Supplier performance and contract management process document (including any tools developed for CMAM or its suppliers)	June 2017	Included in Final Report - 25 September 2017
Logistics Management Capability Development (Intermediary Warehouses)	Role profiles and job descriptions for the key logistics management roles at Intermediary Warehouse level	June 2017	Reviewed and submitted to J Durão on 11 August 2017. Recommended Psychometric Assessments for recruiting each of these roles submitted to J Durão on 17 August 2017.
	Performance management objectives, targets and high level review process for logistics management roles at Intermediary Warehouse level	June 2017	Warehouse KPIs and quality requirements for key activities at IW level submitted to J Durão on 18 August 2017. Standard Operating Procedures applicable to IWs submitted to J Durão on 18 August 2017.
	Relevant Training materials developed	June 2017	Warehouse role competencies and level defined with curriculum development elements.

Regular project status and review reports have been prepared for CMAM and the Steering Committee and they have been submitted as follows:

Report	English	Portuguese
Report 1	24 February 2017	7 March 2017
Report 2	25 March 2017	10 April 2017
Report 3	27 April 2017	15 May 2017
Report 4	12 June 2017	14 June 2017
Report 5	02 August 2017	13 August 2017
Report 6	25 September 2017	
Report 7	06 October 2017	In translation

Section 2 Network (Route) Optimisation

2.1 Overview and Objectives

2.1.1 Overview

This section focuses specifically on the methodology, processes and recommendations for the Route Optimisation workstream and related elements of the Outsourced Distribution workstream.

A full Route Optimisation study was conducted on the current model and proposed intermediary warehouse (IW) model to determine resources required and distribution costs on an optimized basis. The PLM team started this process by conducting pilot studies in three select provinces to gain an insight into the challenges, costs and resources required to effectively implement and run both models. These learnings were then validated, mapped and applied in a simulated study for the rest of the country, providing a comprehensive and holistic understanding of what both the current and proposed IW model would look like on a national level.

SpatialXL was used for the mapping and verification checks of all health facilities and RouteXL was used to run Route Optimisation across all 11 provinces.

2.1.2 Route Optimisation Objectives and Target Outcomes

The Route Optimisation objectives can be summarized as follows:

1. Delivery of an optimised Route to Market plan for the proposed Intermediary Warehouse model (PELF).
2. Optimized routing recommendations by province based on learnings from the pilot provinces
3. Resources and cost data including comparatives between both the current DDM and proposed IW model
4. Outsourced vs direct distribution modeling and recommendations.
5. Warehouse size recommendations and estimated costing for both models.

2.2 Project methodology and Process Followed

In order for the Route Optimisation study to be effective, a specific process must be followed to ensure the best possible outputs. This section focuses on the key considerations and process followed throughout the study.

2.2.1 Pilot study methodology and key outcomes

A Time and Motion study was conducted to record vital logistical information in order to better understand the realities of distribution on the ground in the three pilot provinces of Gaza, Tete and Inhambane. This was achieved by physically driving all routes currently being utilised for distribution and recording key information and insights while on route. At the same time, extensive work was done to verify the locations of all health facilities using CMAMs latest database. This was achieved using GPS tracking technology designed specifically for verification and tracking purposes.

Coca-Cola SABCO provided the PLM team with a driver and a 1ton 4X4 pickup truck which was used in the time and motion study. Using a Samsung tablet with fit for purpose software specifically designed for this kind of study, the driver's progress was tracked on a daily basis and data on his movements was submitted to the PLM team at the end of each day. The driver also teamed up with a representative from DPS who provided navigation and local insights on the routes being traveled. Below is a summary of the health facilities that were located and verified across the 3 pilot provinces:

Province	Number of HFs	Located HFs	% Complete	Month
Gaza	135	101	75%	Feb 17
Tete	127	106	83%	April 17
Inhambane	126	119	94%	May 17
Total	**388**	**326**	**84%**	-

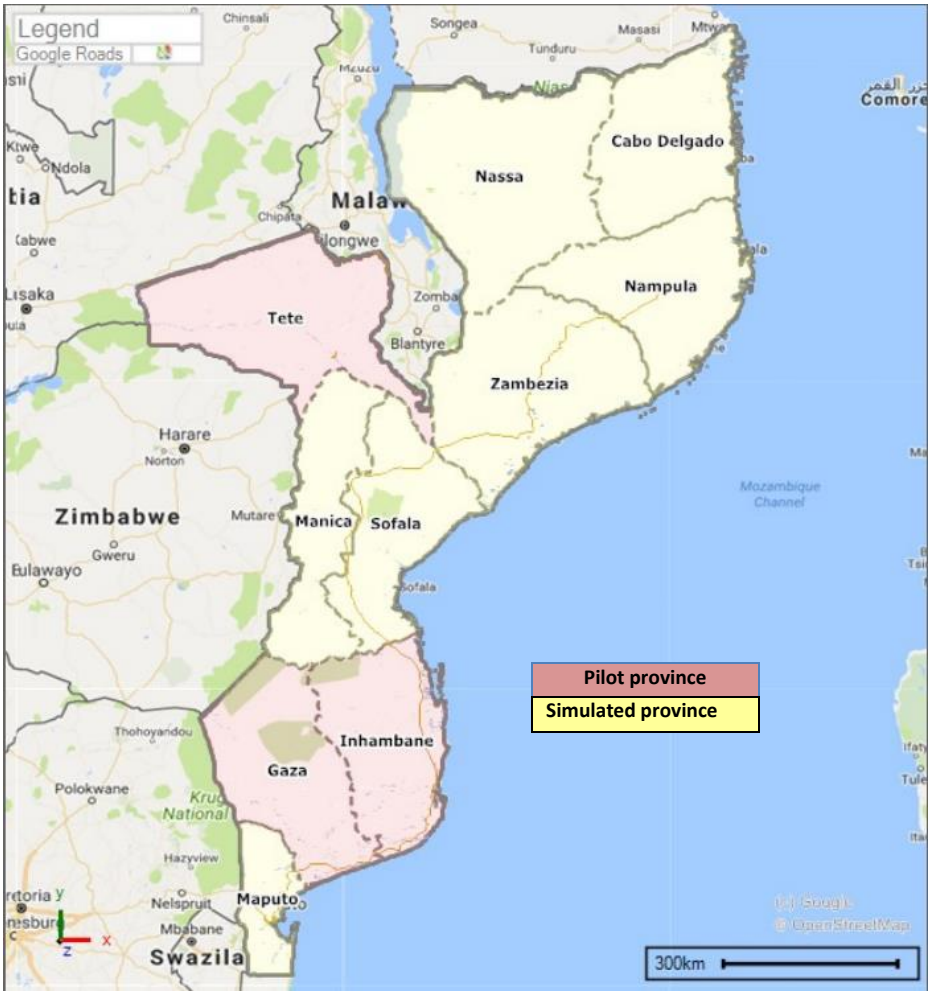


Figure 1: Total Health Facilities located across the 3 pilot provinces and the map highlighting pilot versus simulated provinces.

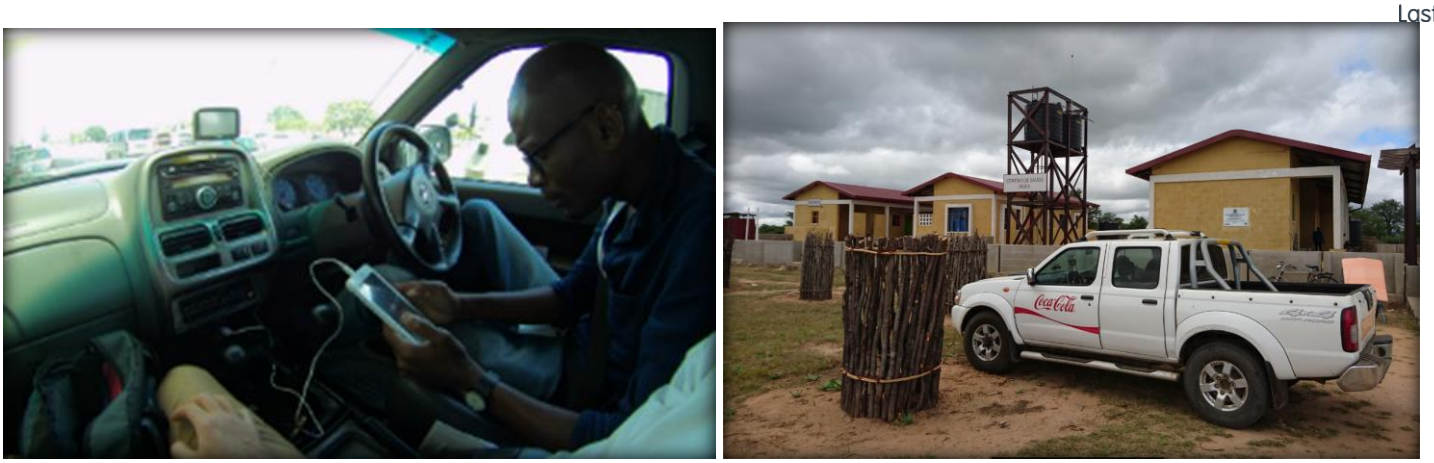


Figure 2: Coca-Cola Driver and vehicle during the Tete pilot, April 2017.

As a part of the quality control process and analysis the following information was mapped and analyzed upon completion of the pilots:

a) Health facility GPS coordinates supplied by PSM.
b) Health facility GPS coordinates recorded during the pilots
c) GPS tracking information showing where the driver travelled and the profile of the roads.
d) The route details and insights recorded during the surveys.

GPS locations recorded during the pilots were overlaid with the existing GPS coordinates to measure the level of accuracy. Any discrepancies were then checked and corrected. Overall, the results were very positive and the majority of the GPS coordinates recorded were accurate. Each district was mapped and validated individually, ensuring the highest possible accuracy throughout the pilot study.

Some of the key outputs from the pilot studies included:

- GPS bread crumb trail
- Average speeds and a delay time factor
- Average KMs travelled per day
- Health facility visit rate per day
- STEM time (start to finish from point A to point B)
- Stop time at each health facility
- Road conditions
- Risks and dangers

These were all important factors considered when calculating and running the route optimisation solutions for the pilot provinces and the simulated study for the rest of the country.

Below are the mapped results from the 3 pilot studies in Gaza, Tete and Inhambane. This highlights the average speeds across each province and shows which districts are difficult to access due to poor road conditions. These are highlighted in red and orange as per the legend. Larger versions of these maps can be made available.

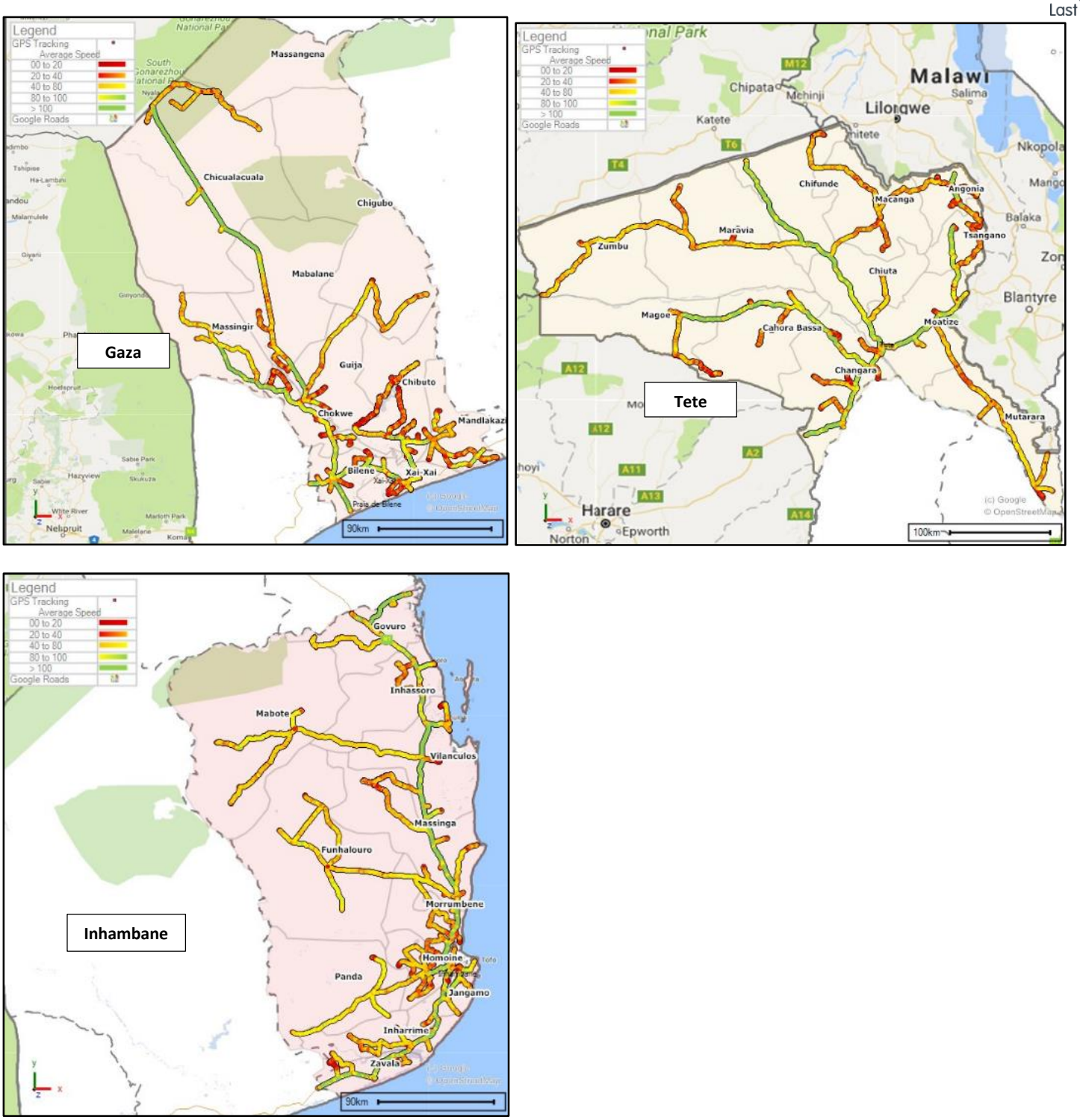


Figure 3: Results from the Time and Motion study in all 3 provinces. This highlights the drive time analysis of average speed and road conditions.

2.2.2 Mapping all Warehouses and Health Facilities for Analysis

Once all 3 pilot studies were complete, the PLM team went about consolidating, updating and verifying the existing health facility master file with the findings. Any discrepancies were checked and updated before proceeding. Strict version control and saving protocol was also followed to ensure the highest data quality standards. This was a major exercise as each district across all 11 provinces was mapped and checked individually to ensure accurate data for the Route Optimisation process. The table and chart to follow highlight the total health facilities per province that were used for this study:

Province	Number of HFs	% of total units
Cabo Delgado	119	8%
Gaza	136	9%
Inhambane	127	8%
Manica	113	7%
CD Maputo	28	2%
Maputo Provincia	108	7%
Nampula	210	14%
Niassa	171	11%
Sofala	147	10%
Tete	122	8%
Zambezia	240	16%
Grand Total	**1521**	**100%**

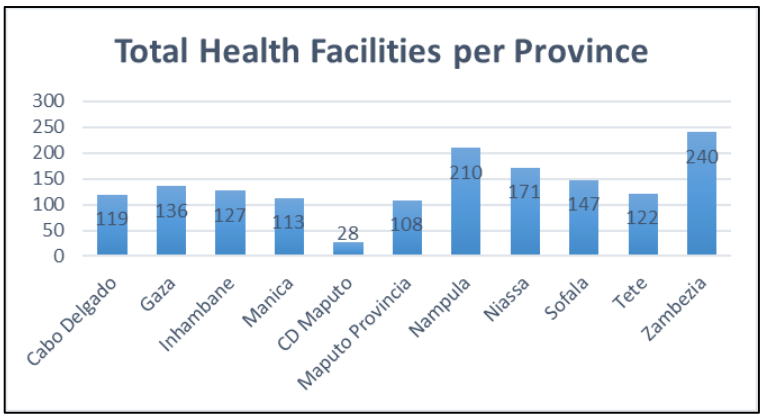


Figure 4: The total Health Facilities per province

The map below illustrates how these verification checks were executed down to a district level for all 11 provinces. This was done using SpatialXL which allows you to map, display and analyse data is a variety of ways in Microsoft Excel.

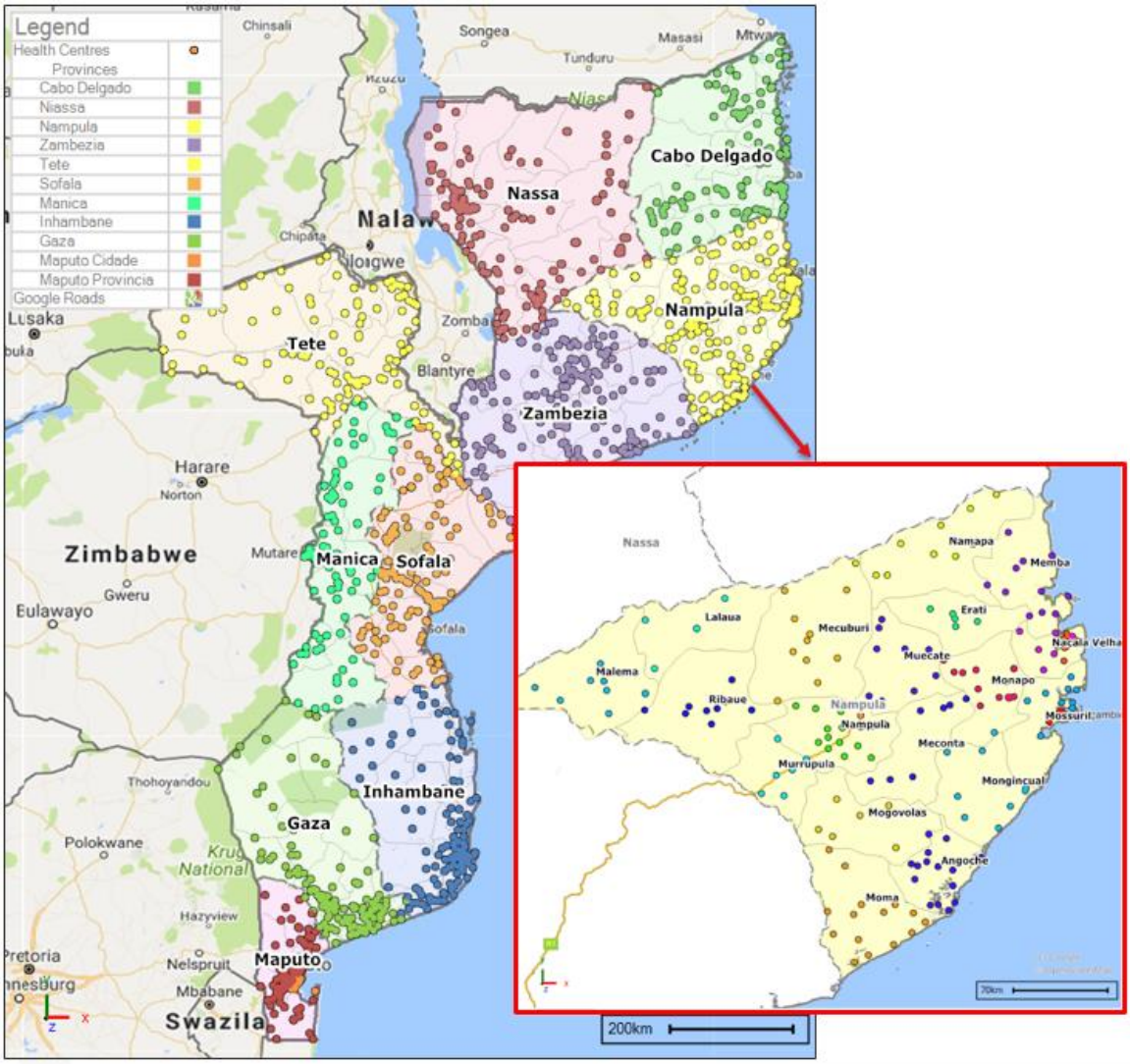


Figure 5: Distribution of health facilities on a provincial and district level.

Once the Masterfile was signed off and all health facilities were mapped, the concertation of health facilities across all 11 provinces was assessed in more detail. The heat map below illustrates areas of high health facility density as highlighted in red.

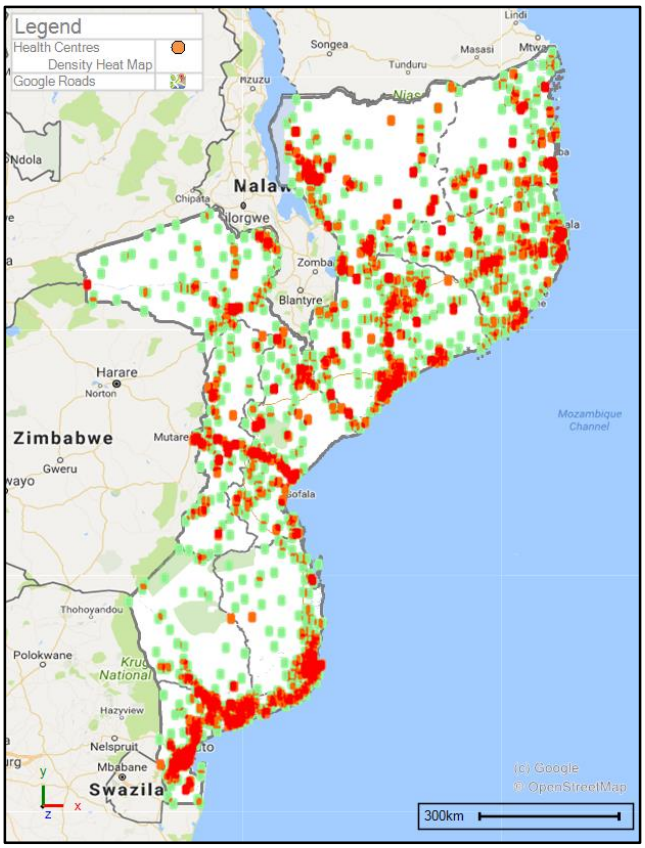


Figure 6: Heat map showing the high density of health facilities in all 11 provinces.

Storage locations for both the current and proposed RTM models were also mapped and verified for all 11 provinces. The proposed IW locations were plotted based on existing warehouse locations (DPM or DDM) within the proposed city, town or location. The figure below shows the provincial warehouse (DPM) and district warehouse (DDM) locations per province for the current distribution model. This is followed by the IW locations per province for the proposed IW model.

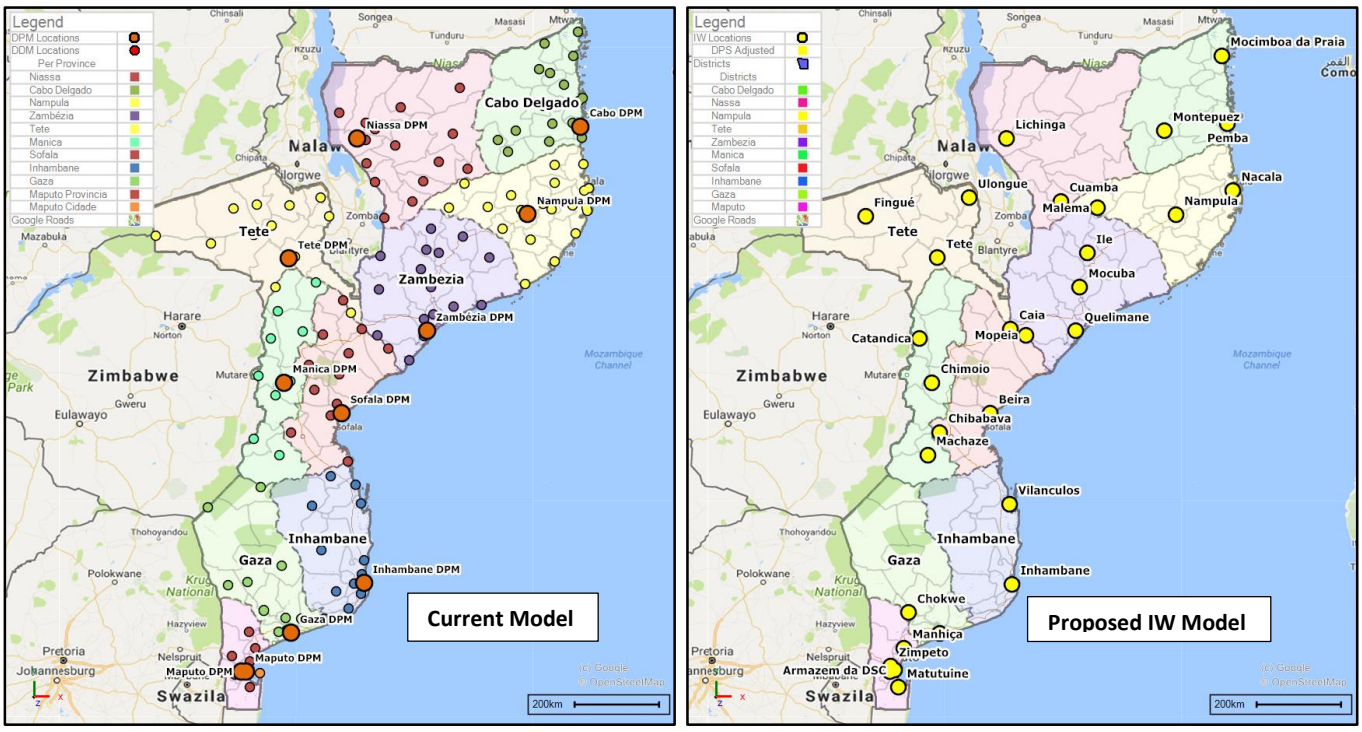


Figure 7: Locations of DPM, DDM for the current distribution model and IW locations for the proposed IW model

2.2.3 Projected Volume Estimates and Analysis

Another key input for the Route Optimisation process is the calculation of estimated demand in cubic meters (m3). To meet the objectives of this study this was done for every health facility across all 11 provinces. To calculate these volume estimates the following three data sources were used:

- 2014 population census data
- 2023 BASELINE volume estimates from the CMAM Warehouse Network Design Study (June 2014)
- Actual volume data supplied by CMAM and PSM from the pilot provinces

Using the same methodology as used for the three pilot provinces, the PLM team looked at the percentage of the total population per district in each province and applied this to the 2023 Baseline volume estimates. Using the same population statistics per district, the volume estimates were then broken down further to a health facility level based on the estimated number of people serviced by each health facility in the immediate area. This was sense checked using CMAM's actual volume data from the pilot provinces. Unfortunately, the full database of actual volume data wasn't available at the time of this study.

A factor of 30% was applied to these volume estimates to compensate for the supply chains that were not included in the original CMAM Warehouse Network Design Study in July 2014. It is also important to note that the CMAM Warehouse Network Design Study in June 2014 was conducted on about 1300 health facilities. The volume estimates for this study are based on a panel of 1521 Health facilities. These volume estimates displayed are per province in the table below:

Provinces	Number of HFs	Volume (m3) per Month	Volume (m3) per Annum	% of National Demand
Cabo Delgado	119	558	6,694	7%
Gaza	136	497	5,962	7%
Inhambane	127	628	7,540	8%
Manica	113	530	6,361	7%
CD Maputo	28	659	7,908	9%
Maputo Provincia	108	379	4,548	5%
Nampula	210	1,350	16,199	18%
Niassa	171	505	6,061	7%
Sofala	147	524	6,288	7%
Tete	122	668	8,011	9%
Zambezia	240	1,221	14,651	16%
Grand Total	**1,521**	**7,519**	**90,222**	**100%**

*Figure 8: Monthly and annual demand in m3 per province. *Excludes Central and General Hospitals*

As done for the GPS verification checks, the volume estimates were mapped and checked in each province using SpatialXL. This was done in such a way as to understand the localised demand down to a district level. In the themed map below, the concentration of health facilities and their demand in cubic meters (m3) is illustrated across all 11 provinces.

In map 1 the health facilities are displayed to show individual health centres with high volumes. In map 2 a heat map illustrates areas of high volume using the total volume for all health facilities.

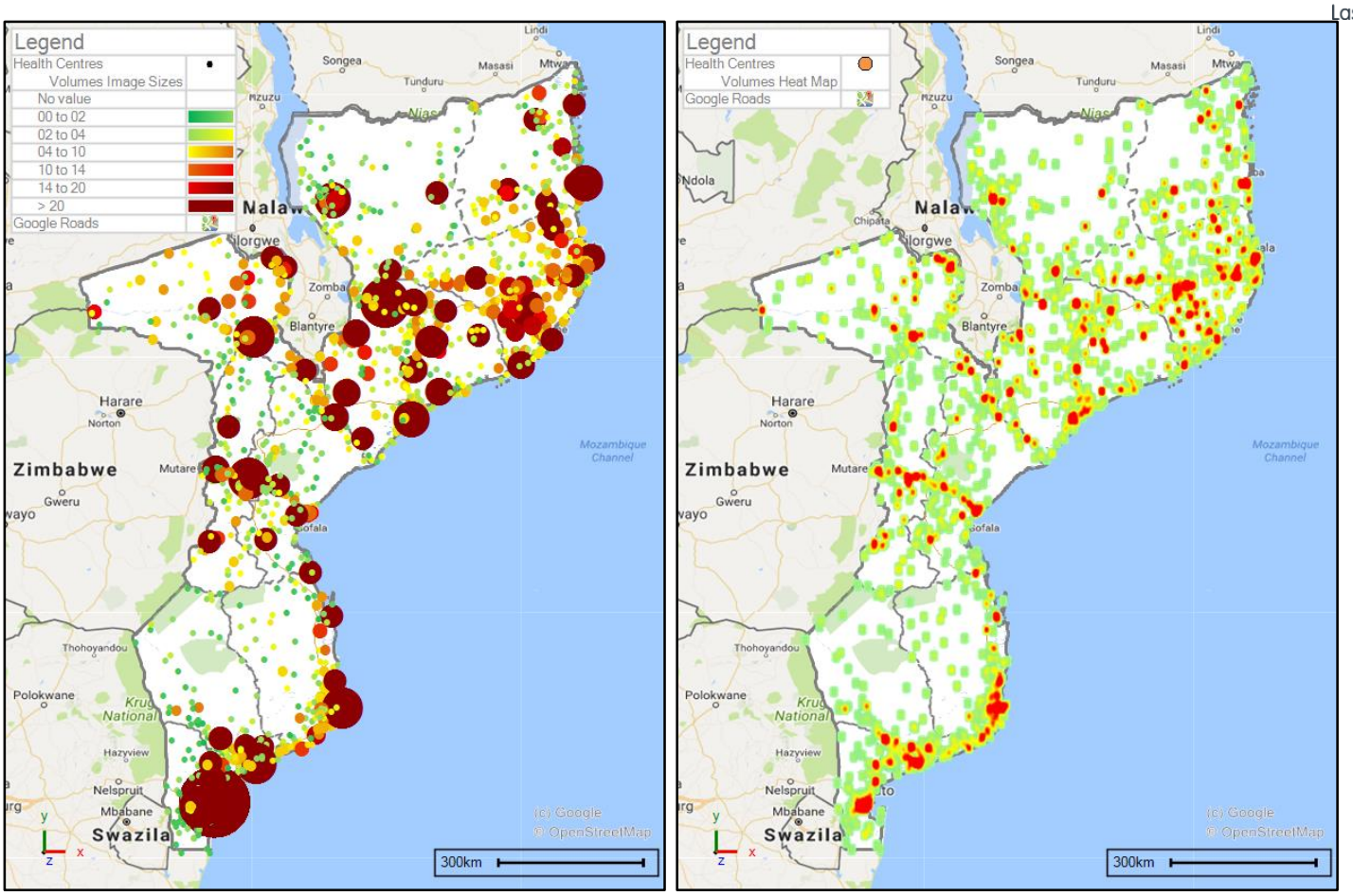


Figure 9: Maps illustrating demand across all 11 provinces

2.2.4 Current RTM model versus the proposed RTM model

Next the PLM team set about understanding the key differences between the current distrubution model and the proposed IW model before proceeding with Route Optimisation. This meant breaking down the respective models to understand the flow of goods from the different levels of storage locations to service points. The two figures below illustrate what the implimentation of the proposed IW model would look like in terms of the following:

- Distribution from IWs instead of DPM and DDM
- Number of storage locations at each level
- Number of service delivery points at each level

The current model is illustrated in figure 9 below. Here the number of storage locations and service delivery points are highlighted at a central, provincial, district, primary and community level. In comparison, figure 10 highlights the number of storage locations and service delivery points at a central, Intermediary, primary and community level. The significant change that comes with the implimentation of the proposed IW model is the introduction of the IWs to replace DPMs and DDMs.

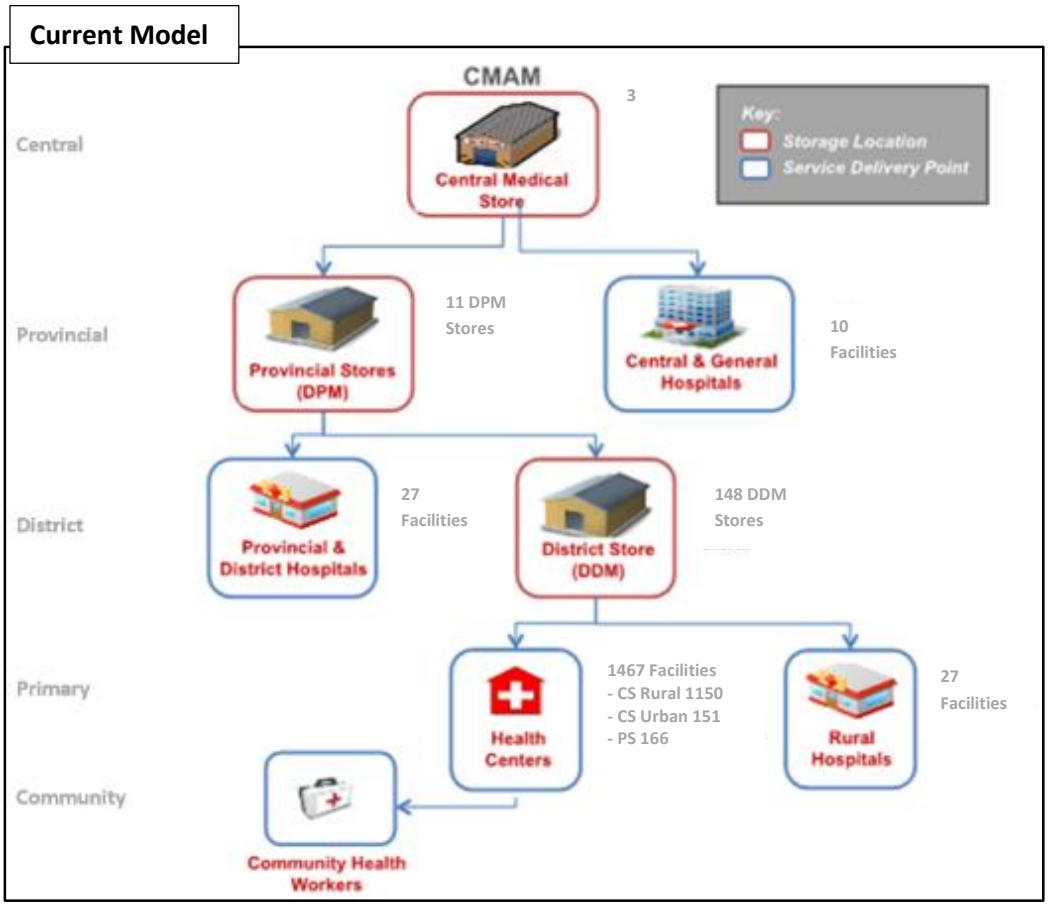


Figure 10: Current distribution model highlighting number of storage locations and service delivery points.

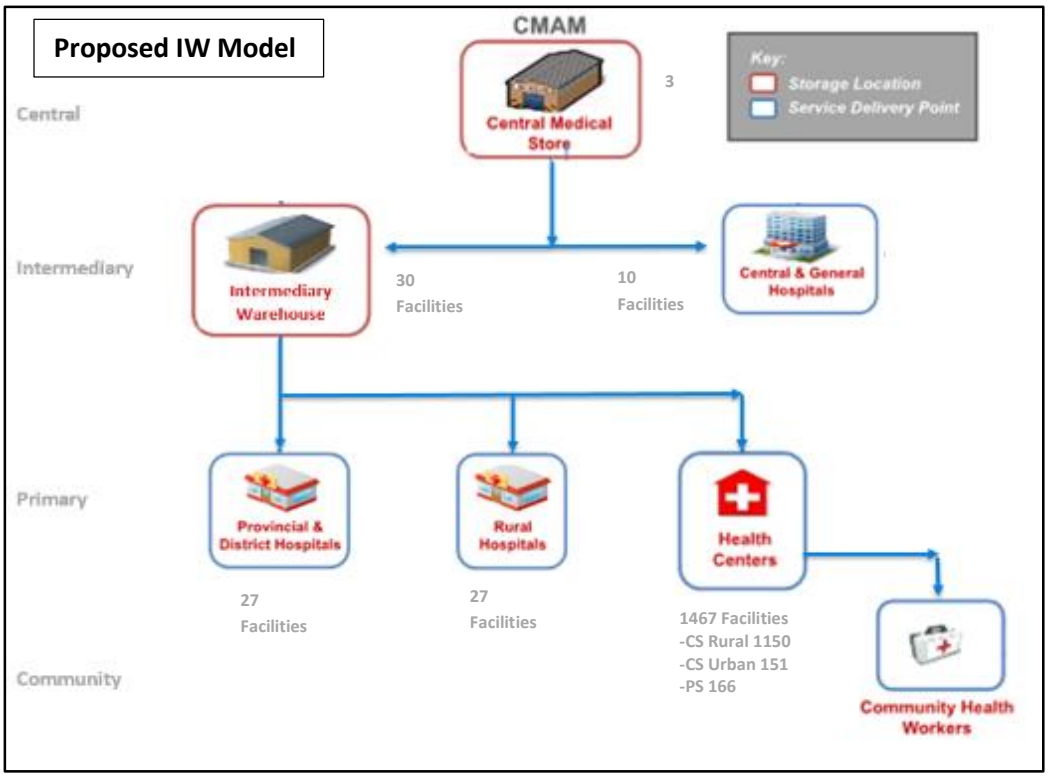


Figure 11: IW distribution model highlighting number of storage locations and service delivery points.

When comparing both models, there is a difference in the total volume and the number of health facolities. This is broken down per health facility clasification in the tables below.

1. Current model – District warehouses (DDM) to rural hospitals and health facilities

Service Delivery Points	Total Units	Volume per Month (m3)
Hospital Rural	27	592m3
Centro de Saúde Urbano	151	1,318m3
Centro de Saúde Rural	1,150	4,219m3
Posto de Saúde	166	558m3
Grand Total	**1,494**	**6,479m3**

2. Proposed IW model – Distribution from intermediary warehouse (IW) to health facilities and provincial, district and rural Hospitals.

Service Delivery Points	Total Units	Volume per Month (m3)
Hospital Provincial	8	318m3
Hospital Distrital	19	514m3
Hospital Rural	27	592m3
Centro de Saúde Urbano	151	1,318m3
Centro de Saúde Rural	1,150	4,219m3
Posto de Saúde	166	558m3
Grand Total	**1,521**	**7,519m3**

Now that the key differences between the two models have been highlighted, the definition of routing specifications per model can take place in the Route Optimisation setup.

2.2.5 Network (Route) Optimisation Setup

With an understanding of the fundamental differences between the two models in terms of the flow of goods and the number of storage locations versus service delivery points, it is necessary to define the routing specifications for both models. In other words, what needs to be considered when running routing solutions from district warehouses (current model) and intermediary warehouses (IW model). By defining this information up front there is assurance of consistency and accuracy when generating the routes.

These specifications are a result of the learnings and recommendations from the 3 pilot studies and day to day routing requirements as specified by CMAM and PSM. These were applied to the other provinces in a simulated study, providing accurate and consistent results in the outputs for both models.

These can be defined for both models as follows:

1. **Number of vehicles**

   a. Current model (DDM) – for the purpose of this study, it is assumed that every DDM has its own vehicle to service its district.
   b. IW model (PELF) – these results are generated and the recommendations are based on the route optimisation solution and analysis conducted for each IW.

2. **Types of vehicles to be used**

   a. Current model (DDM) - 2ton vehicles with carrying capacity of 8m3 were used at this level. This is based on learnings from the pilot study and feedback on vehicles currently being utilised at this level.
   b. IW model (PELF) – 4ton vehicles with a carrying capacity of 14m3. This is based on the learnings from the pilot study and the drive time analysis conducted in each province during the route optimisation process using Route XL.

3. **Cross-border distribution**

   a. Current model (DDM) – Route optimisation for district warehouses is conducted within district boundaries only. No cross-district border distribution is considered unless there is no DDM within the district boundary.
   b. IW model (PELF) – A comparison of both distribution across provincial boundaries and distribution within provincial boundaries is conducted. This is run as two separated route optimisation studies for comparison.

4. **Number days for distribution each month**

   For both models, it is agreed that distribution must be complete within ten working days every month. The route optimisation solution for both models is setup to account for this important consideration. The results and recommendations on cost and resources are therefore calculated based on this timeframe.

5. **Start and End points**

   For both the current and proposed RTM models, the route optimisation calculation uses the warehouse (DDM or IW) as the start and end point for every route. Some routes require multi day (MD) trips before completion. This was kept to a bare minimum for safety and security reasons. As a result, on average there are about 3 – 4 health facilities per route, depending on distance and demand.

2.2.6 Calculating Cost per KM

In order to better understand the potential costs, resources and infrastructure required to implement and run the proposed IW model versus the current model, PLM worked closely with the team from Coca-Cola Sabco to calculate cost per KM for all 11 provinces and 30 IWs. Using Coca-Cola's local expertise and experience, the objective was to gain insights onto the following:

1. The cost implications of using outsourced distribution versus direct distribution for both RTM models.
2. Identifying and evaluating potential third-party distribution suppliers.

Coca-Cola's costing model that is used to calculate cost per KM for both direct distribution and outsourced distribution was adapted based on PLM specifications and requirements. This template is designed to factor in fixed and variable costs specifically for vehicle and labour. This was done for both direct and outsourced distribution and provided a benchmark base. These costs are made up as follows:

1. **Description of Fixed costs**
   - Cost of capital
   - Cost of labour
   - Insurance
   - Licensing

2. **Description of Variable costs**
   - Fuel and lubricants
   - Tires
   - Cost subsidies
   - Maintenance
   - Other licenses and tolls
   - Other costs – contingencies

3. **Profit margin (3PLs only)**

In addition to this, Coca-Cola shared the average cost per KM for their fleets for all 11 provinces. This provided insights into the cost of operations by province. Using this feedback and our learnings from the three pilot studies, different maintenance costs were factored into the overall cost per KM workings per province. Labour cost per KM was calculated using both the driver and assistant's annual salary based on calculated resource requirements for each province. Per diem was also factored into the labour cost based on the required resources per province. The number daily and multiday routes per month and per annum were also used to establish per diems per driver and assistant.

Important note: Cost per KM was worked out per warehouse for both the current model and the proposed IW models. This was built up to a provincial level and then a national level. A digital copy of this easy to use template (with formulas) is made available with the annexures to calculate resources and costs going forward.

Following this, in order to fully understand the cost implications of using outsourced distribution versus direct distribution, the Coca-Cola team assisted by identifying and evaluating potential third-party distribution suppliers across all 11 provinces. To do this the PLM team ran the full Route Optimisation process for each province individually. The results and recommendations were consolidated into 4 page summaries for each province. These contain details on the number of warehouses, type of vehicle and requirements, number of vehicles, total KMs for each warehouse, estimated volume and the number of routes and the required number of delivery days per month. These were distributed to potential third-party distribution suppliers across the country and a technical and financial proposal was requested from interested suppliers.

The cost per KM results and resource recommendations are reviewed in more detail in the sections to follow.

2.3 Route Optimisation – Current RTM Model (DDM)

In this section the route optimisation results and associated costs at a DDM level specifically are analyzed to fully understand the costs, benefits and comparative implications of a move to the proposed IW model. The current DDM locations and the coverage the current model provides in proximity to all health facilities are shown here.

2.3.1 Route Optimisation Process

The route optimisation process follows 3 steps:

Step 1: Allocation of Health Facilities to District Warehouses

For the purposes of this study, as was decided in the Steering committee meeting on 15 June 2017, all route optimisation for the current model must remain within district boundaries. This means that all health facilities must be allocated to and serviced by the DDM within the district boundary they fall within. In a situation where a district does not have a DDM within the district boundaries, then health facilities are allocated to the nearest DDM based on shortest drive time analysis. It is also important to note that there is no cross provincial boundary distribution for the district warehouse routes.

Below is a breakdown of the Route Optimisation results for all 11 provinces for the current model:

Province	Total DDMs	Total Health Facilities per Province	% of Total Health Facilities	Est. Volume (m3) p/m
Cabo Delgado	17	117	8%	507
Gaza	12	135	9%	453
Inhambane	14	125	8%	555
Manica	10	108	7%	392
Maputo Cidade	7	27	2%	423
Maputo Provincia	8	106	7%	313
Nampula	21	208	14%	1,282
Niassa	16	169	11%	443
Sofala	13	146	10%	498
Tete	13	120	8%	615
Zambezia	17	233	16%	999
Grand Total	**148**	**1494**	**100%**	**6,479**

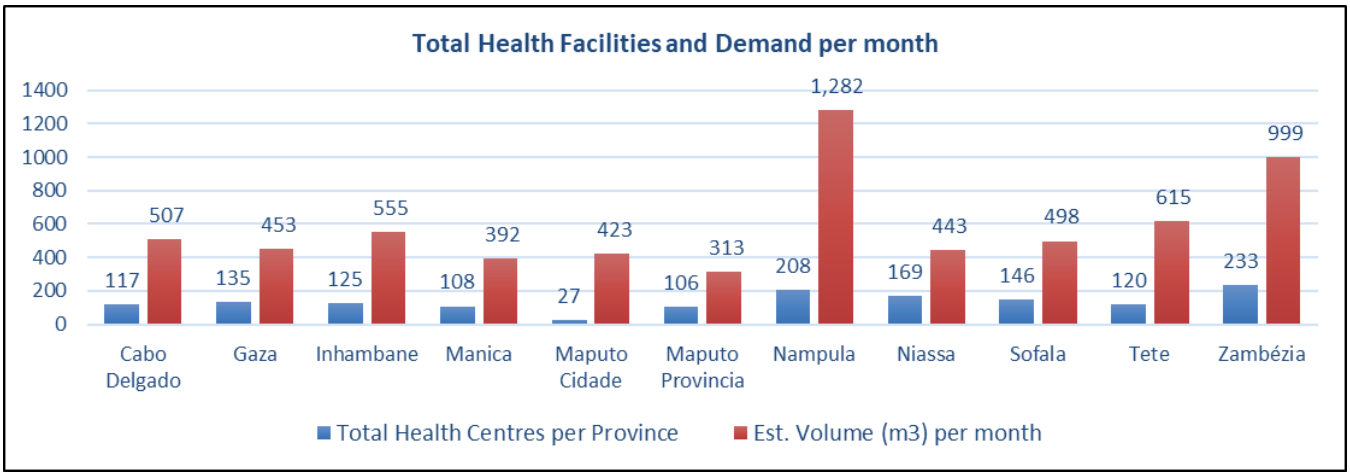


Figure 12: Current allocation of HCs to DWs with monthly volumes.

Step 2: Establish and Map Delivery Areas

Once all Health Facilities have been allocated to a DDM, delivery areas are then established and mapped. Delivery areas will remain within existing district boundaries for the current model. Depending on distance, demand and carrying capacity, several routes can be covered in one day in some cases. Below is an example of the delivery areas based on the existing district warehouse allocations for Nampula province. These have been themed in different colours and mapped along with the district warehouse locations. Now it can be visualized how distribution will take place in each district across the province.

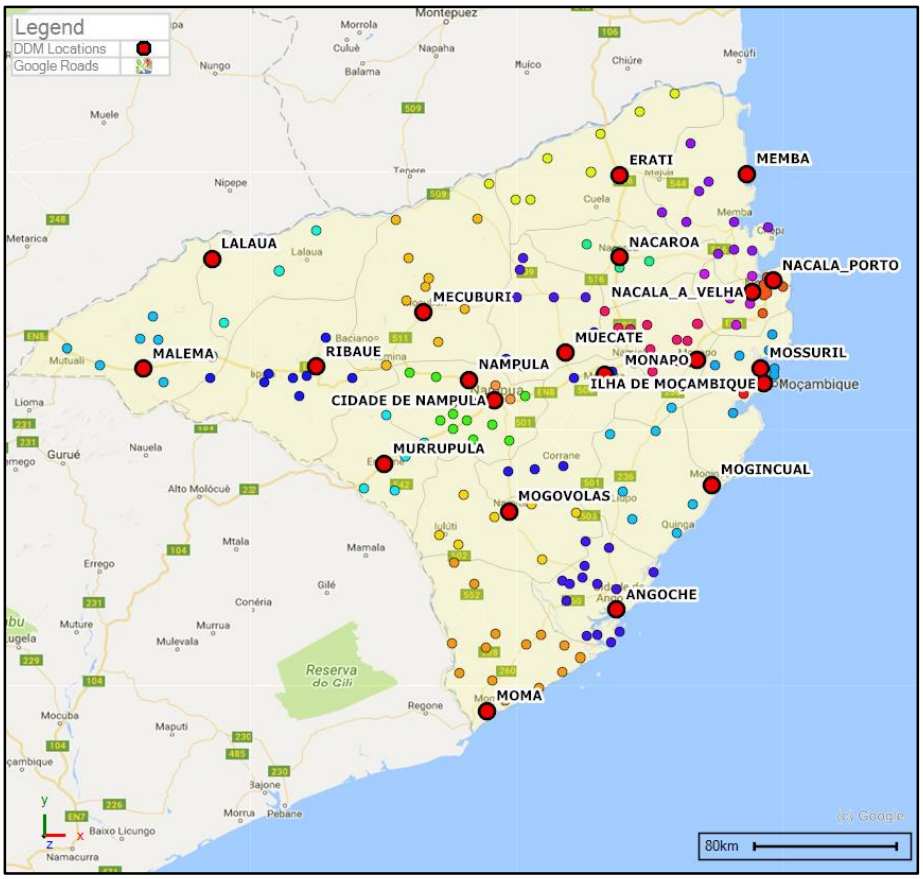


Figure 13: Delivery areas per DDM within district boundaries – Nampula Province

This step was complete for every district for all 11 provinces.

Step 3: Optimise Delivery Areas and Develop Routes

Once the Delivery Areas have been checked and signed off, route optimisation using RouteXL could commence. The tool used for this exercise, QVR (Quantitative Vehicle Routing), is a dynamic system that makes it possible to customize the route optimisation calculation to fit specific needs. Using QVR, the following were factored in during the route optimisation for each Delivery Area:

- Minimum of one delivery per month
- 10-day delivery period
- Delivery time of 60 minutes per HF
- Start and end location (DDM)
- Overall shift time
- Start time/ end time
- Capacity of the vehicle
- Average speeds
- Delay time factor due to poor roads

The same type of vehicle currently being utilised for distribution in Inhambane and Tete was used for route optimisation for the rest of the country. These are 2ton vehicles with a carrying capacity of 8m3. Based on the shorter average distances and demand within district boundaries, 2ton vehicles are well suited for distribution for this model. When the distances and demand increased for intermediary warehouses, alternative vehicles were assessed.

2.3.2 Results and Findings – Current Model

In the figure below, each DDM is mapped with a 50km buffer zone around it to highlight the level of coverage across all 11 provinces. This exercise revealed that 93% of the current 1521 health facilities lie within 50km from a DDM.

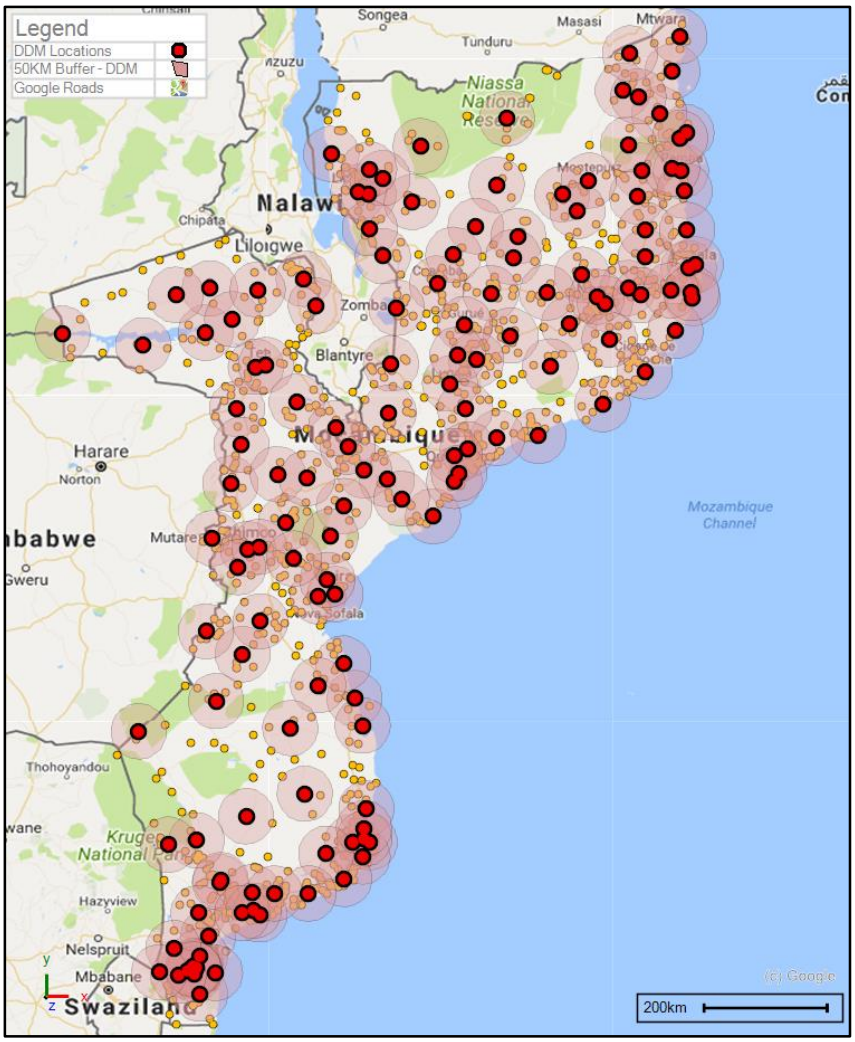


Figure 14: DDMs mapped with 50km buffer zones showing overall coverage of the country.

The table below shows what this coverage looks like at a provincial level. Note that provincial and district hospitals have been included in the figures below even though they are not delivered to by DDMs. This is just to illustrate the high level of coverage for all service delivery points with the current RTM model.

Province	Total DDMs per province	HFs Within 50KM of DDM	% HFs Within 50KM of DDM	HFs Outside 50KM of IW	Grand Total
Cabo Delgado	17	117	98%	2	119
Gaza	12	123	90%	13	136
Inhambane	14	114	90%	13	127
Manica	10	109	96%	4	113
CD Maputo	7	28	100%	0	28
Maputo Provincia	8	104	96%	4	108
Nampula	21	200	95%	10	210
Niassa	16	153	89%	18	171
Sofala	13	140	95%	7	147
Tete	13	101	83%	21	122
Zambezia	17	219	91%	21	240
Grand Total	**148**	**1408**	**93%**	**113**	**1521**

Figure 15: Results from the DDMs map with 50km buffer zones showing overall coverage per province

Once the Route Optimisation results had been generated for each DDM across all 11 provinces, this was checked and consolidated into the Masterfile for analysis. The table below is a summary the key results and findings per province. This is based on a 10-day delivery period each month.

Province	Total District Warehouse	Total Health Centres per Province	Total KMs per province	Est. Volume per month (m3)	Average no. shifts/ days per DDM
Cabo Delgado	17	117	5,922	507	3
Gaza	12	135	7,508	453	4
Inhambane	14	125	6,934	555	3
Manica	10	108	5,520	392	4
Maputo Cidade	7	27	206	423	2
Maputo Provincia	8	106	3,719	313	5
Nampula	21	208	9,355	1,282	3
Niassa	16	169	9,107	443	4
Sofala	13	146	8,416	498	4
Tete	13	120	8,676	615	4
Zambezia	17	233	12,065	999	5
Grand Total	**148**	**1,494**	**77,428**	**6,479**	**4**

**Excludes Central, General, Provincial and District Hospitals* **Study assumes each DDM has its own vehicle*

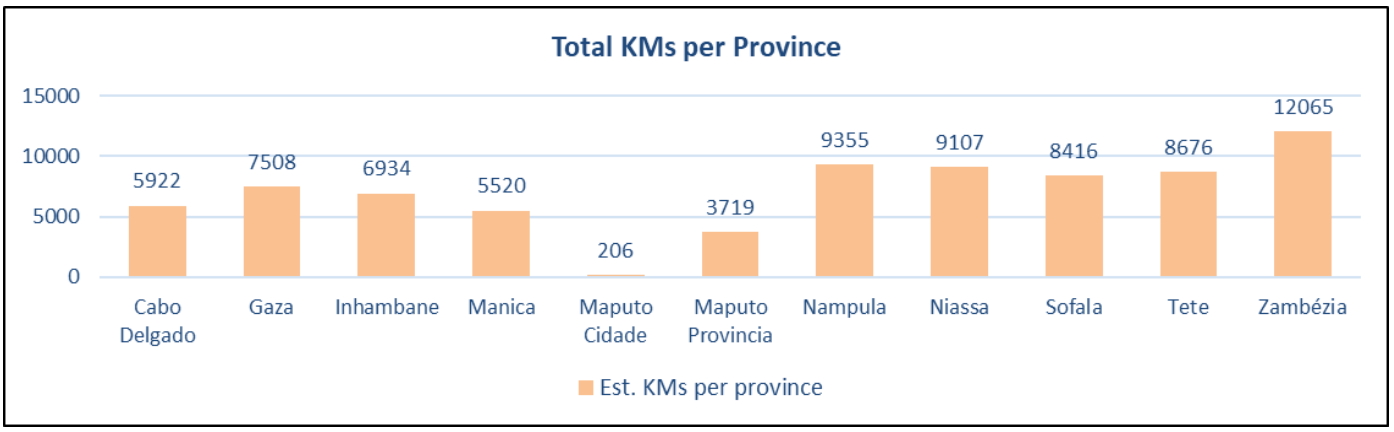


Figure 16: Current allocation of HCs to DWs with monthly volumes.

On the basis that every district has its own vehicle, driver and assistant (148 vehicles), the biggest opportunity with the current model is the average number of days required to successfully service all health facilities within each district. This means a national average of 3.8 days out of the targeted 10 delivery days. The conclusion is that the teams are working at less than half capacity.

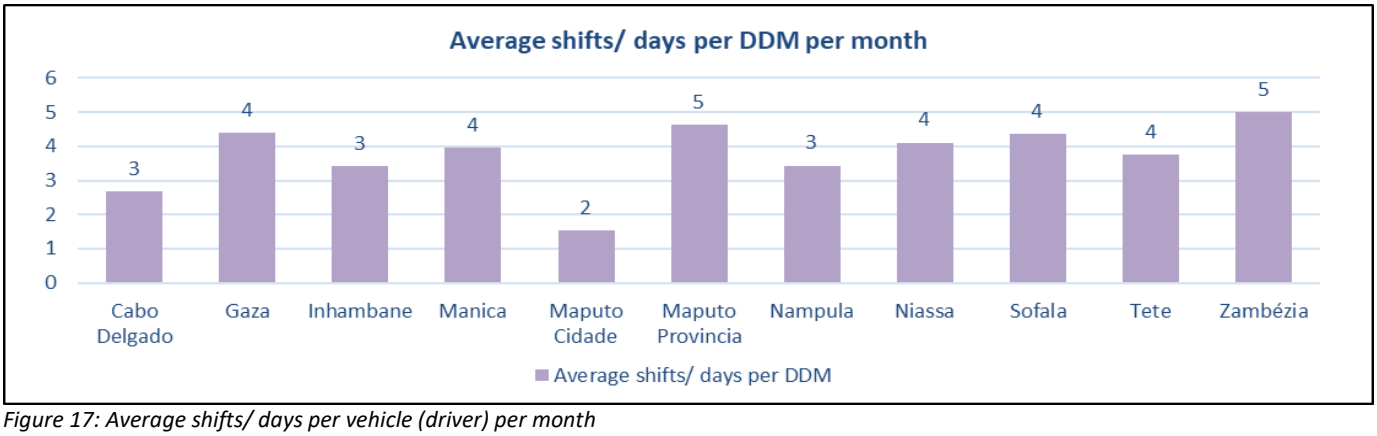


Figure 17: Average shifts/ days per vehicle (driver) per month

2.3.3 Cost per KM – Current Model (DDM)

National Summary

Yearly Cost	MZN	101,048,997	$	1,684,149
Yearly KM		929,130KM		929,130KM
Cost per KM	MZN	108.76	$	1.81

Provincial Cost per KM

Province	Total DDMs	Total KM per month	Average Cost per KM per vehicle (MT)	Average Cost per KM for labour (MT)	Average Total Cost per KM (MT)
Cabo Delgado	17	5,922	37.35	179.68	217.03
Gaza	12	7,508	33.96	106.53	140.49
Inhambane	14	6,934	33.96	97.70	131.66
Manica	10	5,520	33.96	80.01	113.97
Maputo Cidade	7	206	33.96	1,850.30	1,884.25
Maputo Provincia	8	3,719	33.96	101.15	135.11
Nampula	21	9,355	36.33	106.86	143.19
Niassa	16	9,107	36.67	87.66	124.33
Sofala	13	8,416	33.96	78.88	112.84
Tete	13	8,676	37.01	194.73	231.74
Zambezia	17	12,065	35.99	67.51	103.51
Grand Total	**148**	**77,428**	**35.48**	**193.33**	**228.81**

Figure 18: Cost per KM breakdown per province for distribution from DDM

Provincial total cost per month and per year.

Province	Total DDMs	Total KM per Year	Total Cost per Month (MT)	Total Cost per Year (MT)	Total Cost per Month (USD)	Total Cost per Year (USD)
Cabo Delgado	17	71,064	872,871	10,474,461	14,547	174,574
Gaza	12	90,096	714,952	8,579,429	11,915	142,990
Inhambane	14	83,204	772,117	9,265,413	12,868	154,423
Manica	10	66,241	570,781	6,849,374	9,513	114,156
Maputo Cidade	7	2,474	275,336	3,304,038	4,588	55,067
Maputo Provincia	8	44,628	432,955	5,195,464	7,215	86,591
Nampula	21	112,256	1,144,895	13,738,747	19,081	228,979
Niassa	16	109,287	947,333	11,368,004	15,788	189,466
Sofala	13	100,986	784,102	9,409,228	13,068	156,820
Tete	13	104,113	819,466	9,833,599	13,657	163,893
Zambezia	17	144,777	1,085,936	13,031,234	18,098	217,187
Grand Total	**148**	**929,130**	**8,420,749**	**101,048,997**	**140,345**	**1,684,149**

Figure 19: Cost per KM per province per month and per year for distribution from DDM

2.3.4 Cost per KM for transport from DPM to DDM – Current Model (DPM)

National Summary

Yearly Cost	MZN	27,727,708	$	462,128
Yearly KM		549,556 KM		549,556 KM
Cost per KM	MZN	50.45	$	0.84

Costs for distribution from DPM to DDM were calculated using current distribution costs for select provinces. These were adjusted according to the forecasted volumes discussed in section 2.2.3. The total distances were also calculated using Route XL. These calculated using a 30% delay factor for poor roads, a 2-hour delivery time per DDM and the assumption that every delivery requires a return trip to the DPM. In the tables below, the cost per KM and total cost are broken down per province.

Provincial Cost per KM

Province	Total DDMs	Total KM per Month	Estimated Volume (m3) per Month	Total Cost per KM (MT)
Cabo Delgado	17	5,744	507	40.98
Gaza	12	3,715	453	44.14
Inhambane	14	4,250	555	45.85
Manica	10	3,093	392	57.74
Maputo Cidade	7	149	423	578.55
Maputo Provincia	8	905	313	163.03
Nampula	21	5,784	1,282	54.72
Niassa	16	6,282	443	40.81
Sofala	13	5,052	498	36.32
Tete	13	4,707	615	54.94
Zambezia	17	6,115	999	47.27
Grand Total	**148**	**45,796**	**6,480**	**50.45**

Figure 20: Cost per KM breakdown per province for distribution from DPM to DDM

Provincial total cost per month and per year

Province	Total DDMs	Total KM per year	Cost per Month (MT)	Cost per Year (MT)	Cost per Month (USD)	Cost per Year (USD)
Cabo Delgado	17	68,930	235,400	2,824,800	3,923	47,080
Gaza	12	44,581	164,000	1,968,000	2,733	32,800
Inhambane	14	51,000	194,875	2,338,500	3,247	38,975
Manica	10	37,113	178,569	2,142,827	2,976	35,714
Maputo Cidade	7	1,787	86,134	1,033,608	1,435	17,227
Maputo Provincia	8	10,862	147,574	1,770,893	2,459	29,515
Nampula	21	69,413	316,540	3,798,480	5,275	63,308
Niassa	16	75,384	256,400	3,076,800	4,273	51,280
Sofala	13	60,623	183,500	2,202,000	3,058	36,700
Tete	13	56,480	258,600	3,103,200	4,310	51,720
Zambezia	17	73,384	289,050	3,468,600	4,818	57,810
Grand Total	**148**	**549,556**	**2,310,642**	**27,727,708**	**38,511**	**462,128**

Figure 21: Cost per KM per province per month and per year for distribution from DPM to DDM

2.4 Route Optimisation – Proposed Model (IW)

With the optimised solution for the current model and an understanding of the required resources and associated costs, the proposed IW RTM model can now be analyzed. In this section the route optimisation process is examined, and the differences compared in applying the model across provincial boundaries versus remaining within provincial boundaries. In addition, cost per KM for direct distribution versus outsourced distribution is compared. Finally, the optimised resources and overall investment cost for this model are calculated.

2.4.1 Route Optimisation Process

Using the same learnings from the pilot study, volume estimates and verified GPS locations, the same process was followed when assessing and optimising the routes for all 30 Intermediary Warehouses across the 11 provinces. As was done for the Inhambane, Tete and Gaza study, the same recommended locations for the 30 Intermediary Warehouses were used as supplied by PSM and CMAM. The route optimisation process follows 3 steps:

Step 1
Allocation of Health Centres to Warehouses.

Step 2
Establish and Map Delivery Areas

Step 3
Optimise Delivery Areas and Develop Routes.

Step 1: Allocation of Health Centres to Intermediary Warehouses

Health facilities across all 11 provinces are allocated to an intermediary warehouses based on a drive time analysis using the Set-to-Set routing tool in RouteXL. This utilises TomTom Africa databases to calculate these allocations based on shortest drive time. The whole country is analysed at once and the results are added into the Masterfile for analysis. The results for all 11 provinces are in the figure below:

Province	Total IWs	Total HF per IW	% of the total health Facilities	Est. Volume (m3) per month
Cabo Delgado	3	141	9%	558
Gaza	2	136	9%	497
Inhambane	2	120	8%	628
Manica	3	114	7%	530
Maputo Cidade	2	54	4%	659
Maputo Provincia	3	79	5%	379
Nampula	3	223	15%	1,350
Niassa	2	150	10%	505
Sofala	3	173	11%	524
Tete	3	112	7%	668
Zambezia	4	219	14%	1,221
Grand Total	**30**	**1,521**	**100%**	**7,519**

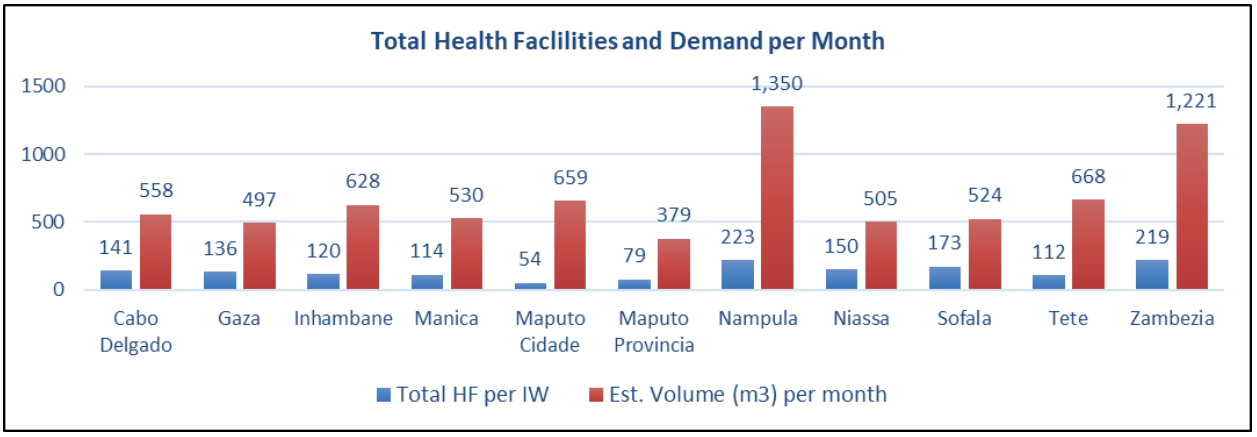


Figure 22: Allocation of HCs to IW with monthly volumes.

Step 2: Establishing and Mapping Delivery Areas for Intermediary Warehouses

Once the Set-to-Set allocations have been checked, the delivery areas for each IW can be established and mapped. As was done for the DDM model, each IW will have a unique delivery area with multiple routes within it. Each delivery area is checked and assessed in Spatial XL to ensure that all health facility allocations make logical sense.

In the map below, all 30 IWs and their allocated delivery areas have been highlighted. Also shown, is the extent to which cross provincial boarder distribution takes place when optimising the routes based on shorted drive time from the proposed IW locations.

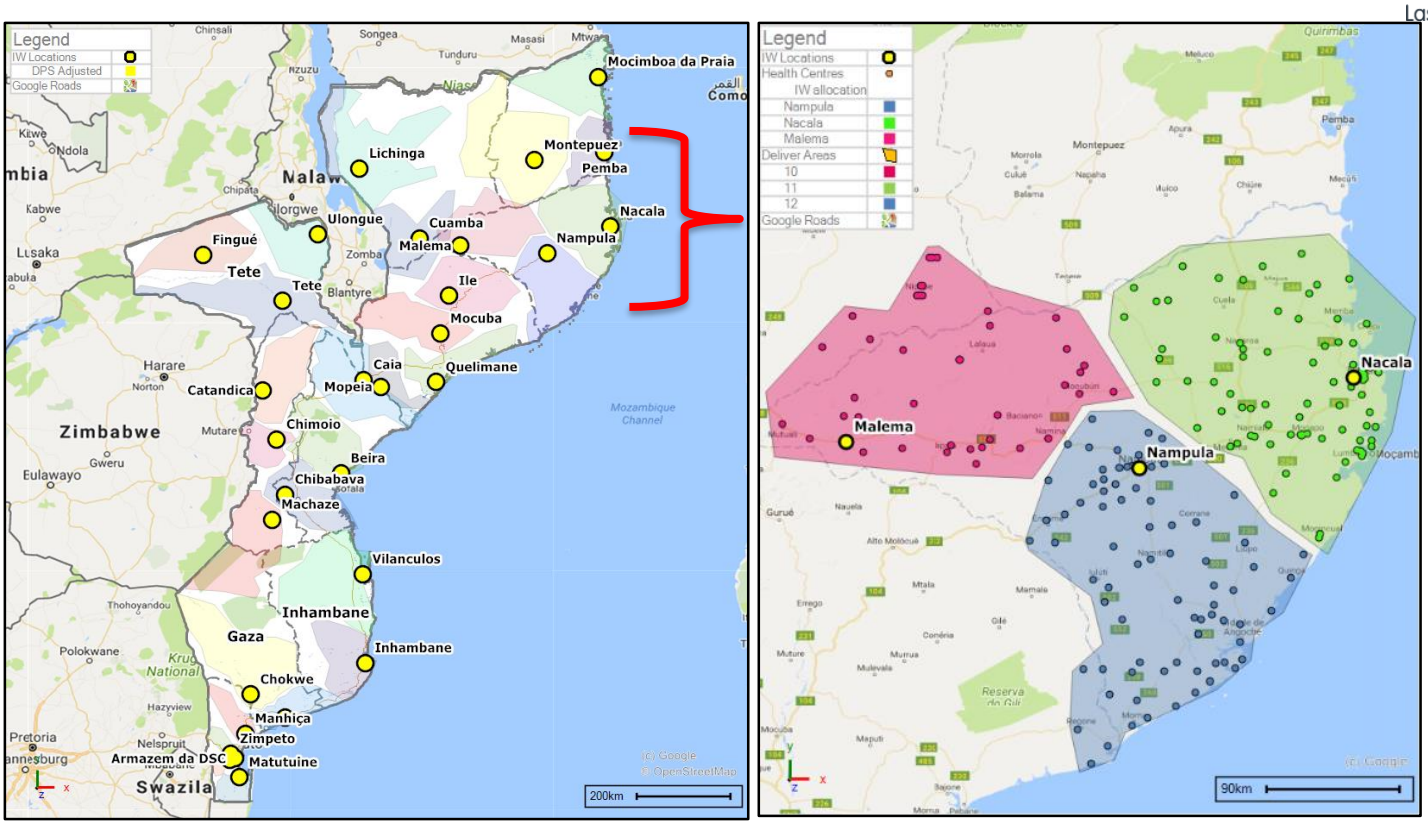


Figure 23: Set to Set allocation of health facilities with delivery areas for each IW.

Step 3: Optimise delivery areas and develop routes

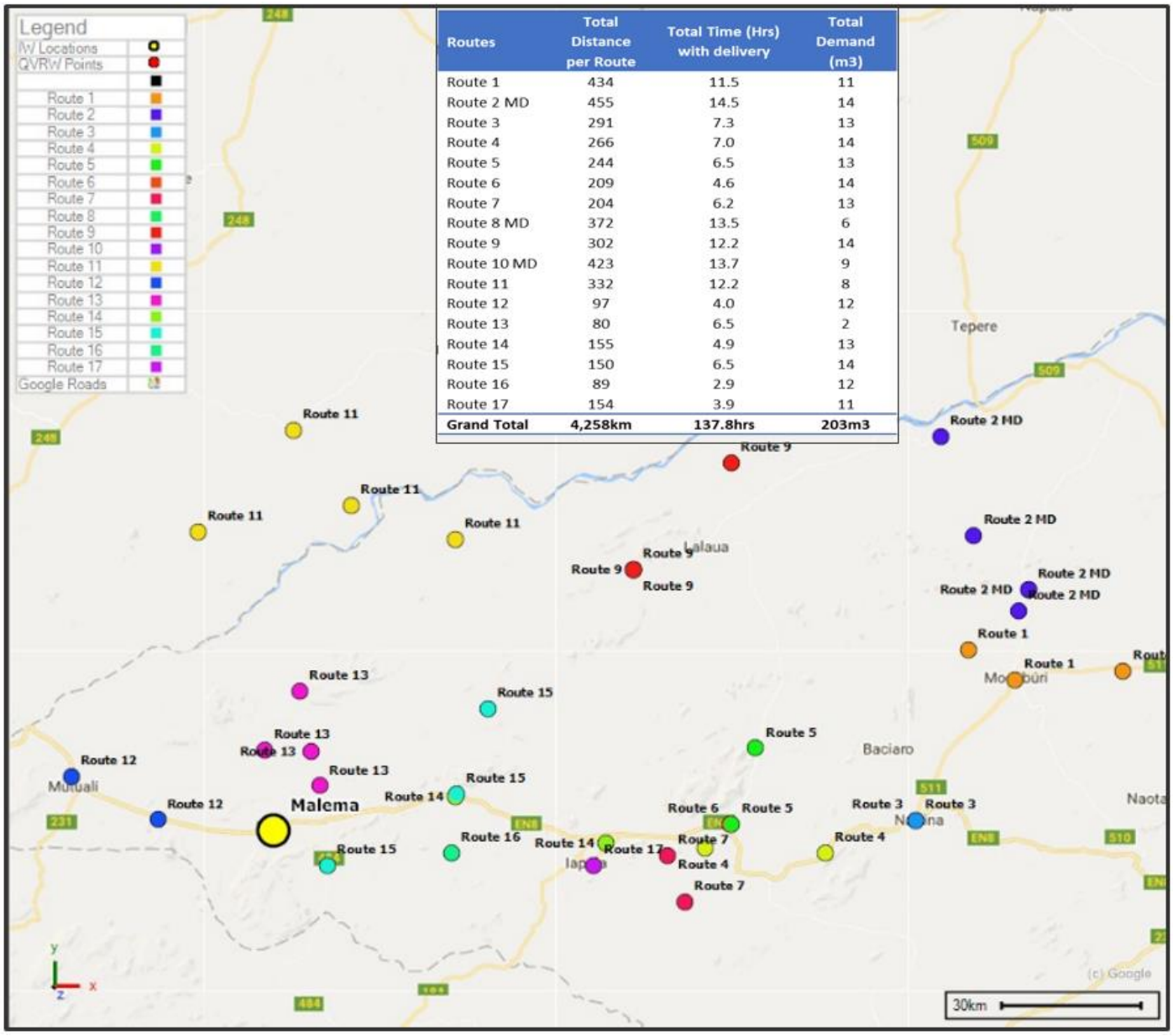
Once all health facilities have been allocated and delivery areas have been established and mapped, route optimisation can be run. Using the QVR tool, the following was factored in when optimising the delivery areas and developing routes for each Intermediary Warehouse:

- Minimum of one delivery per month
- A 10-day delivery period
- Delivery time of 60 minutes per HF
- Start and End location (IW)
- Overall Shift time
- Capacity of the vehicle
- Average speed
- Start time/ End time
- Delay time factor for poor road conditions

Based on learnings from the 3 pilot provinces, the estimated demand and the larger delivery areas per IW, it was concluded that 4ton vehicles (with 14m3 carrying capacity) are best suited for distribution at an IW level. Larger vehicles would likely struggle when the routes go off the national roads.

An example of the route results can be found in the diagram below. This is for Malema IW in Nampula province. This shows the route name, distance per route, total time (with delivery) per route and estimated volume per route. Any health facilities with a greater demand than the vehicle's 14m3 carrying capacity are revisited during a second delivery route at a later stage.

Malema IW optimised routes, Nampula province.



Routes	Total Distance per Route	Total Time (Hrs) with delivery	Total Demand (m3)
Route 1	434	11.5	11
Route 2 MD	455	14.5	14
Route 3	291	7.3	13
Route 4	266	7.0	14
Route 5	244	6.5	13
Route 6	209	4.6	14
Route 7	204	6.2	13
Route 8 MD	372	13.5	6
Route 9	302	12.2	14
Route 10 MD	423	13.7	9
Route 11	332	12.2	8
Route 12	97	4.0	12
Route 13	80	6.5	2
Route 14	155	4.9	13
Route 15	150	6.5	14
Route 16	89	2.9	12
Route 17	154	3.9	11
Grand Total	4,258km	137.8hrs	203m3

Figure 24: Set to Set allocation of health facilities with delivery areas for each IW.

Note that all optimised route results for all 30 IWs are included in the annexure.

2.4.2 Route Results and Findings – Proposed IW Model

In the figure below, each IW is mapped with a 100km buffer zone around it. This exercise revealed that 81% of the current 1521 health facilities lie within 100km from an IW. A 100km buffer zone was used for this exercise as the average distance traveled each day per vehicle for all 11 provinces is about 210km. This takes into consideration the return trip for each route.

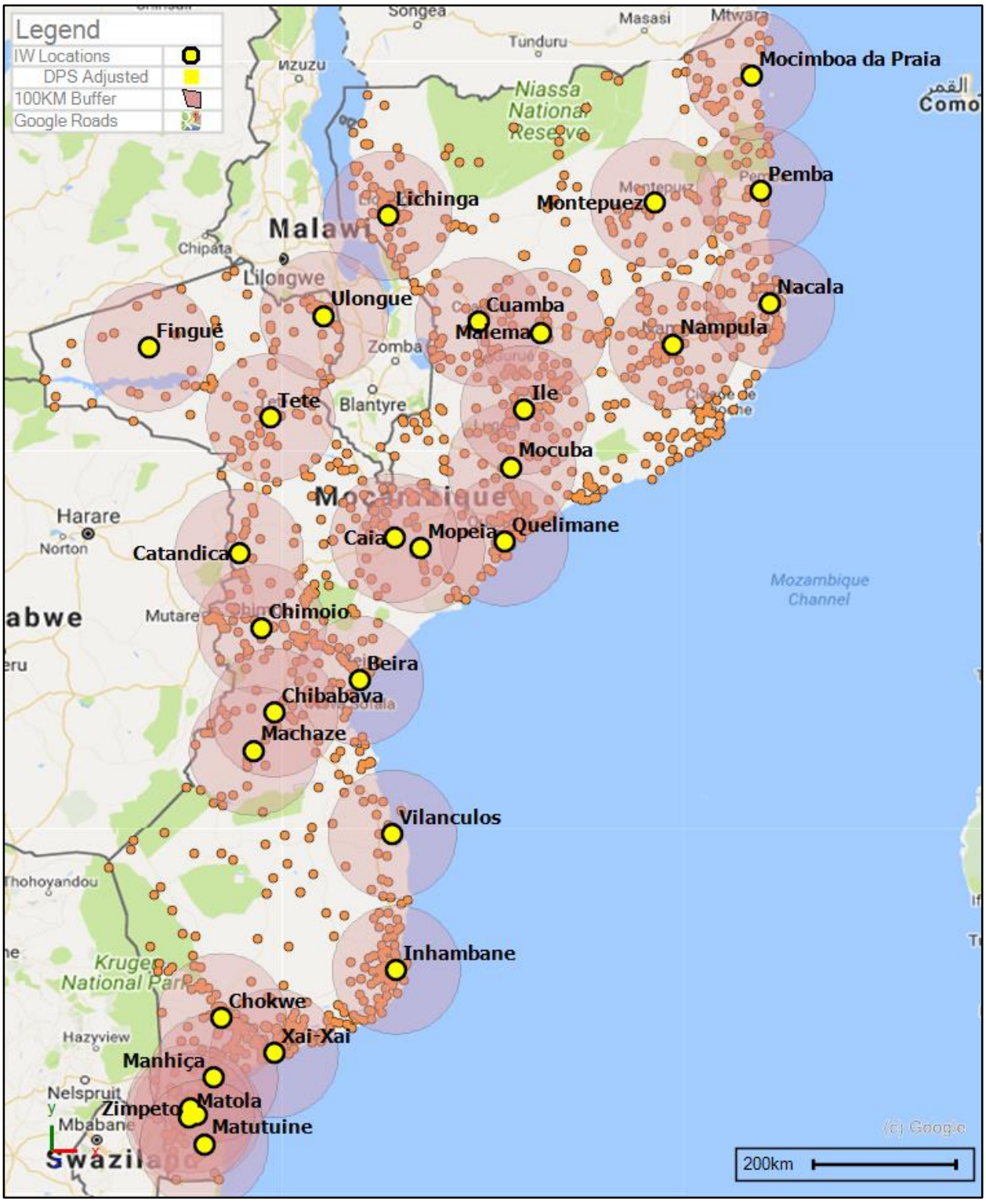


Figure 25: IWs mapped with 100km buffer zone showing overall coverage across all 11 provinces.

The table below shows what this coverage looks like at a provincial level. Niassa, Tete, Nampula, Inhambane and Zambezia provinces have less than 80% of their health centres within a 100km buffer zone. This is reflected in the high number of delivery KMs expected each month.

Province	Total of IWs	Within 100KM of IW	% Within 100KM of IW	Outside 100KM of IW	Grand Total
Cabo Delgado	3	113	95%	6	119
Gaza	2	111	82%	25	136
Inhambane	2	98	77%	29	127
Manica	3	102	90%	11	113
Maputo CD	2	28	100%	0	28
Maputo Provincia	3	108	100%	0	108
Nampula	3	157	75%	53	210
Niassa	2	110	64%	61	171
Sofala	3	126	86%	21	147
Tete	3	90	74%	32	122
Zambezia	4	189	79%	51	240
Grand Total	**30**	**1232**	**81%**	**289**	**1521**

Figure 26: IWs 100km buffer zone showing overall coverage across all 11

Below is a summary of the monthly route optimisation results for all 30 IWs across all 11 provinces. Included in these results are the total distances, estimated volumes, required number of vehicles and visit rate per day per vehicle. KMs per month have been highlighted in colour below.

Province	Total Intermediary Warehouses	Total HF per Province	KMs per Month	Total Vehicles Required	Est. Volume (m3) per month
Cabo Delgado	3	141	10,621	5	558
Gaza	2	136	7,084	4	497
Inhambane	2	120	7,615	5	628
Manica	3	114	6,725	4	530
Maputo Cidade	2	54	897	2	659
Maputo Provincia	3	79	2,784	3	379
Nampula	3	223	21,122	9	1,350
Niassa	2	150	6,790	4	505
Sofala	3	173	12,352	5	524
Tete	3	112	15,793	5	668
Zambezia	4	219	17,875	7	1,221
Grand Total	**30**	**1,521**	**109,658**	**53**	**7,519**

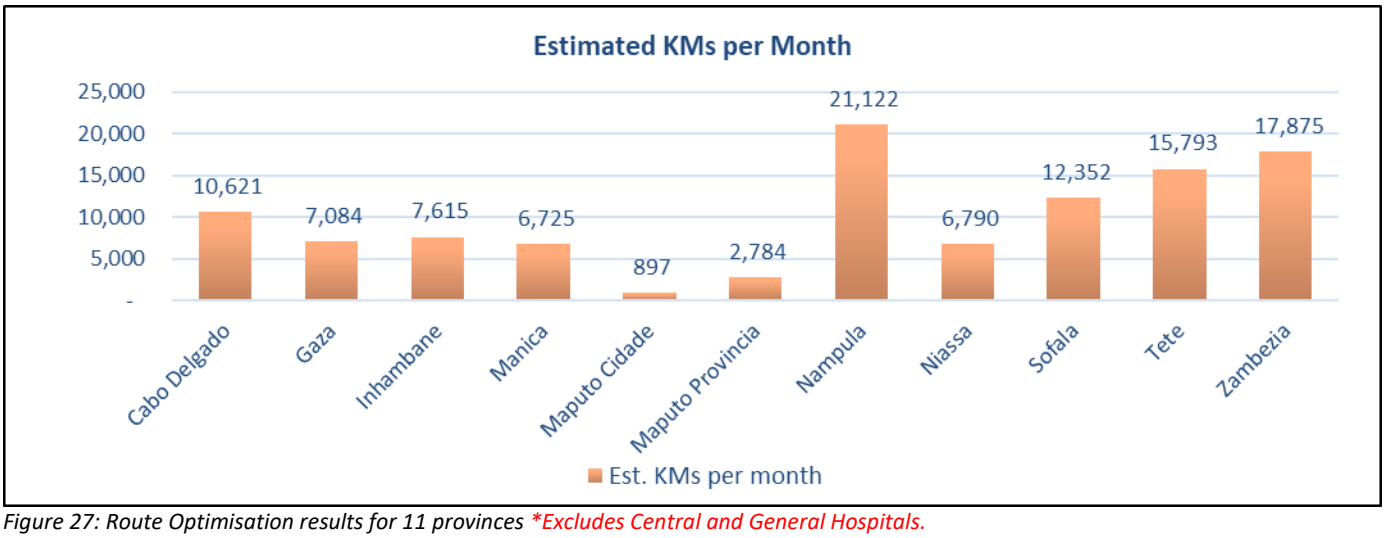


*Figure 27: Route Optimisation results for 11 provinces *Excludes Central and General Hospitals.*

These results can be further examined on a IW level in the table below. This takes into account cross provincial distribution.

Province	Intermediary Warehouse	Total HF per IW	KMs per IW per month	No. Vehicles Required	Est. Volume (m3) per month	No visits per day per Vehicle
Cabo Delgado	Mocimboa da Praia	41	2,401	1	159	3
Cabo Delgado	Montepuez	53	4,293	2	211	3
Cabo Delgado	Pemba	47	3,928	2	284	3
Gaza	Chokwe	63	3,561	2	176	3
Gaza	Xai-Xai	73	3,523	2	347	3
Inhambane	Inhambane	76	4,352	3	390	3
Inhambane	Vilanculos	44	3,262	2	199	3
Manica	Catandica	33	1,820	1	92	4
Manica	Chimoio	52	2,213	1	308	4
Manica	Machaze	29	2,692	2	114	1
Maputo Cidade	Armazem da DSC (10ton)	31	380	1	682	6
Maputo Cidade	Zimpeto	23	517	1	60	4
Maputo Provincia	Manhiça	28	1,479	1	96	3
Maputo Provincia	Matola	33	525	1	165	5
Maputo Provincia	Matutuine	18	780	1	25	4
Nampula	Malema	47	4,258	2	203	3
Nampula	Nacala	91	7,197	3	528	3
Nampula	Nampula	85	9,667	4	623	2
Niassa	Cuamba	63	2,881	2	276	3
Niassa	Lichinga	87	3,910	2	248	4
Sofala	Beira	74	4,465	2	292	3
Sofala	Caia	65	5,764	2	264	3
Sofala	Chibabava	34	2,123	1	107	3
Tete	Fingue	17	6,040	1	78	1
Tete	Tete	62	5,057	2	285	3
Tete	Ulongue	33	4,695	2	218	4
Zambezia	Ile	63	5,612	2	391	3
Zambezia	Mocuba	52	6,007	2	268	3
Zambezia	Mopeia	26	1,602	1	98	3
Zambezia	Quelimane	78	4,654	2	334	3
Total		**1,521**	**109,658**	**53**	**7,519**	**3**

Figure 28: Route Optimisation results for 30 IWs **Excludes Central and General Hospitals *Armazem da DSC (Maputo Cidade) is calculated with a 10Ton vehicle*

These results are broken down into daily targets for each vehicle showing what a typical day in the life of a driver will look like. The average health facility visited per day, average KMs traveled per vehicle per day and average volume delivered per vehicle per day can be compared province by province in the table below. Note that this is calculated over 10 working days per month.

Province	Total IWs	Total Vehicles Required	Ave. HF visits per day per Vehicle	Ave. KMs per day per Vehicle	Ave. m3 Volume per day per Vehicle
Cabo Delgado	3	5	3	212 km	11
Gaza	2	4	3	177 km	12
Inhambane	2	5	3	190 km	16
Manica	3	4	3	168 km	13
Maputo Cidade (10ton)	2	2	3	45 km	33
Maputo Provincia	3	2	4	139 km	19
Nampula	3	8	3	264 km	17
Niassa	2	4	4	170 km	13
Sofala	3	6	3	206 km	9
Tete	3	5	2	316 km	13
Zambezia	4	7	3	255 km	17
Grand Total	**30**	**53**	**3**	**211** km	**14**

Figure 29: Daily averages per vehicle/ driver per province **Excludes Central and General Hospitals *Armazem da DSC (Maputo Cidade) is calculated with a 10Ton vehicle*

2.4.3 Routes, Results and Findings for Scenario B – Proposed IW Model

The previous section shows an optimised break down of the routes for the IW model for all 11 provinces. Here the routes results are calculated using the learnings from the 3 pilots and specifications shared by CMAM and PSM. This includes a delay time based on road conditions and a 1-hour delivery time as specified in section 2.4.1 Step 3 of the route optimisation process.

In this section, we will factor in an additional delay time factor for poor road conditions and additional delivery time for all health facilities. This will give us a better understanding of what a more realistic scenario would look like and the resulting impact on resources for distribution. The additional delay time factor and delivery time will vary depending on province and volumes for each health facility.

As per feedback from Coca-Cola Sabco, the northern provinces are more challenging to distribute in so the delay time factor for road conditions will be 10-15% higher. Provinces in the south will have an additional 5-10% delay time factor added. Additional delivery time of 30min – 1hr was added the existing delivery time for all health centres. All delivery times now range from 1.5hrs – 2hrs, depending on volume.

An additional 4 vehicles have also been added in case of breakdowns, accidents or other incidents.

Cabo Delgado	Total Intermediary Warehouses	Total Health Centres per Province	Est. KMs per Province	Total Vehicles	Sum of Est. Volumes in m3 (2023)
Cabo Delgado	3	141	10,621	6	653
Gaza	2	136	7,084	5	523
Inhambane	2	120	7,615	5	589
Manica	3	114	6,725	5	514
Maputo Cidade	2	54	897	2	742
Maputo Provincia	3	79	2,784	3	286
Nampula	3	223	21,122	11	1,354
Niassa	2	150	6,790	5	524
Sofala	3	173	12,352	7	663
Tete	3	112	15,793	6	581
Zambezia	4	219	17,875	9	1,090
Grand Total	**30**	**1521**	**109,658**	**66**	**7,519**

*Figure 30: Scenario B Route Optimisation results for the 11 provinces with additional delay and delivery time factored in. *Excludes Central and General Hospitals *Armazem da DSC (Maputo Cidade) is calculated with a 10Ton vehicle*

2.4.4 Distribution within versus crossing provincial boundaries

In this section distribution within provincial boundaries versus cross-provincial boundaries is compared for all 11 provinces. Both were calculated separately in order to compare results. Cross-provincial calculations were generated using drive time analysis on a national level where provincial boundaries were ignored and within provincial boundary distribution was calculated using a drive time analysis within provincial boundaries.

Overall there is only a difference of 685 KMs per month and the required number of vehicles varies by 2 units. If the decision is made to remain within provincial boundaries, then the overall KMs travelled can be reduced if select IWs are targeted for cross distribution only. These will be highlighted in the table, chart and maps below.

The table and chart below illustrate the variance between the two scenarios when distributing from the same IW locations.

Province	Number of IWs	Total HF per IW	Total HF per IW	Total KMs per month (Cross)	Total KMs per month (Within)
Cabo Delgado	3	141	119	10,621	8,574
Gaza	2	136	136	7,084	7,896
Inhambane	2	120	127	7,615	8,031
Manica	3	114	113	6,725	6,275
Maputo Cidade	2	54	54	897	897
Maputo Provincia	3	79	81	2,784	2,949
Nampula	3	223	210	21,122	19,917
Niassa	2	150	171	6,790	8,004
Sofala	3	173	148	12,352	10,715
Tete	3	112	121	15,793	17,083
Zambezia	4	219	241	17,875	20,002
Grand Total	**30**	**1,521**	**1,521**	**109,658**	**110,343**
Provincial boundary status		***Cross***	***Within***	***Cross***	***Within***

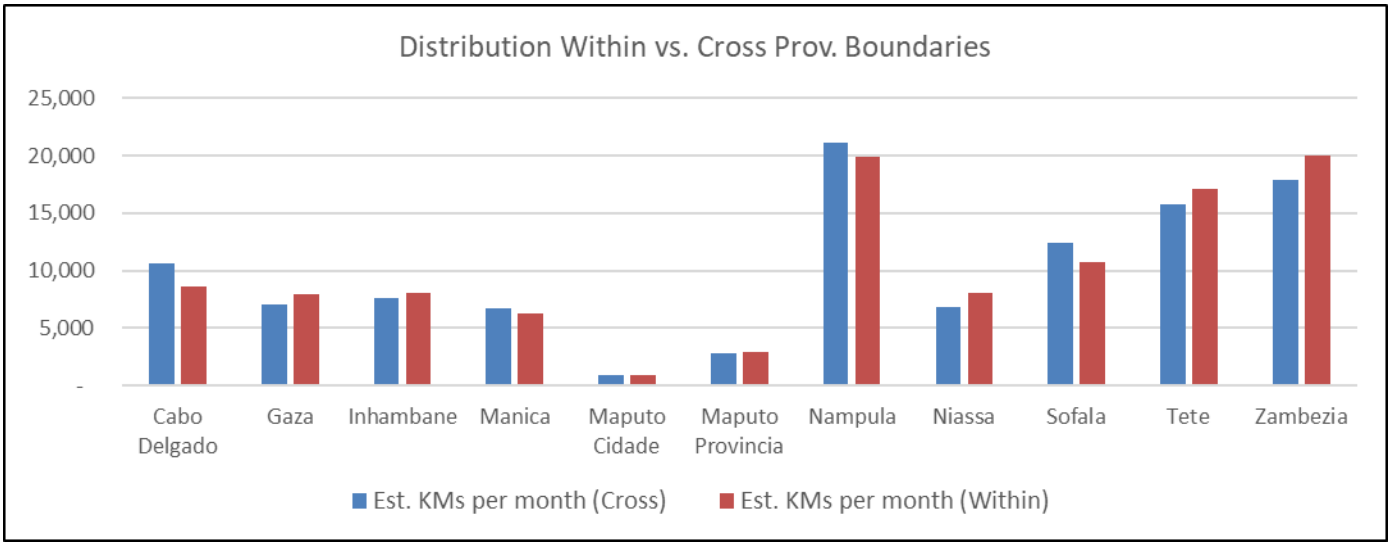


Figure 31: Cross versus within provincial boundary distribution per province

The variance in KMs between cross and within provincial boundary distribution is highlighted at a IW level in the table below. The IWs with the biggest variance are highlighted in orange. These are instances where cross provincial distribution should be considered. By targeting these IWs for cross provincial distribution, the total KMs will be reduced along with the associated costs.

Province	Intermediary Warehouse	HFs per IW (Cross)	HFs per IW (Within)	KMs per month (Cross)	KMs per month (Within)	KMs variance
Cabo Delgado	Mocimboa da Praia	41	41	2,401	2,401	-
Cabo Delgado	Montepuez	53	34	4,293	2,496	(1,796)
Cabo Delgado	Pemba	47	44	3,928	3,677	(251)
Gaza	Chokwe	63	71	3,561	4,582	1,022
Gaza	Xai-Xai	73	65	3,523	3,313	(210)
Inhambane	Inhambane	76	84	4,352	4,810	458
Inhambane	Vilanculos	44	43	3,262	3,221	(42)
Manica	Catandica	33	35	1,820	1,930	110
Manica	Chimoio	52	56	2,213	2,383	170
Manica	Machaze	29	22	2,692	1,961	(730)
Maputo Cidade	Armazem da DSC	31	31	380	380	-
Maputo Cidade	Zimpeto	23	23	517	517	-
Maputo Provincia	Manhiça	28	30	1,479	1,585	106
Maputo Provincia	Matola	33	34	525	541	16
Maputo Provincia	Matutuine	18	17	780	823	43
Nampula	Malema	47	36	4,258	3,261	(996)
Nampula	Nacala	91	94	7,197	7,557	360
Nampula	Nampula	85	80	9,667	9,099	(569)
Niassa	Cuamba	63	75	2,881	3,313	432
Niassa	Lichinga	87	96	3,910	4,691	782
Sofala	Beira	74	64	4,465	3,862	(603)
Sofala	Caia	65	44	5,764	4,306	(1,459)
Sofala	Chibabava	34	40	2,123	2,547	425
Tete	Fingue	17	17	6,040	6,040	-
Tete	Tete	62	71	5,057	6,348	1,290
Tete	Ulongue	33	33	4,695	4,695	-
Zambezia	Ile	63	73	5,612	6,453	842
Zambezia	Mocuba	52	42	6,007	5,032	(975)
Zambezia	Mopeia	26	46	1,602	3,138	1,536
Zambezia	Quelimane	78	80	4,654	5,378	724
Total		**1,521**	**1,521**	**109,658**	**110,343**	**685**
Provincial boundary		***Cross***	***Within***	***Cross***	***Within***	

Figure 32: Cross versus within provincial boundary distribution variance per IW

In the diagram below, Niassa and Cabo Delgado are compared. The variance in total KMs for Montepuez, Lichinga and Cuamba IWs highlighted below. The red blocks highlight how cross provincial distribution would reduce the total KMS travelled in this region.

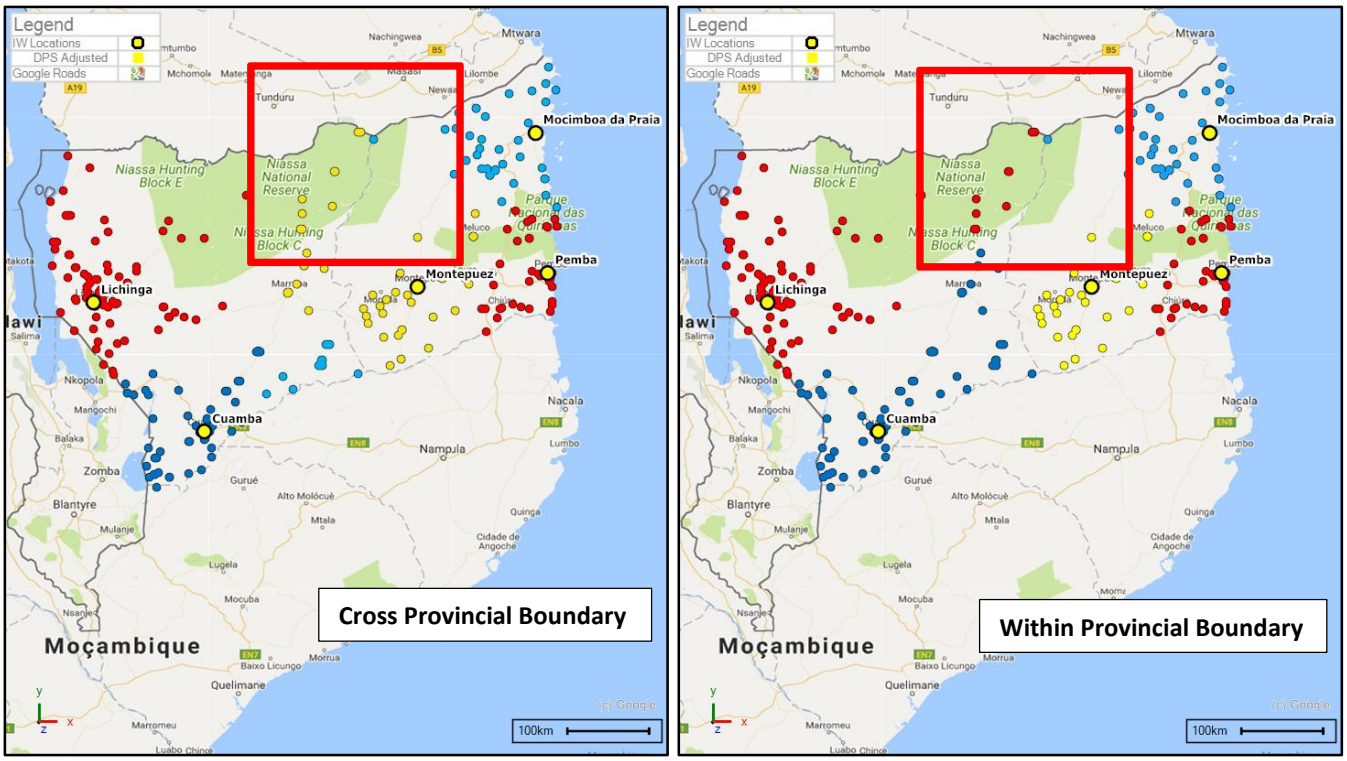


Figure 33: Within versus Cross provincial distribution in Niassa and Cabo Delgado.

In the diagram below, Tete, Sofala and Zambezia are compared. The variance in total KMs for Tete, Caia and Mopeia IWs are highlighted here. The red blocks highlight how cross provincial distribution would reduce the total KMS travelled in this region.

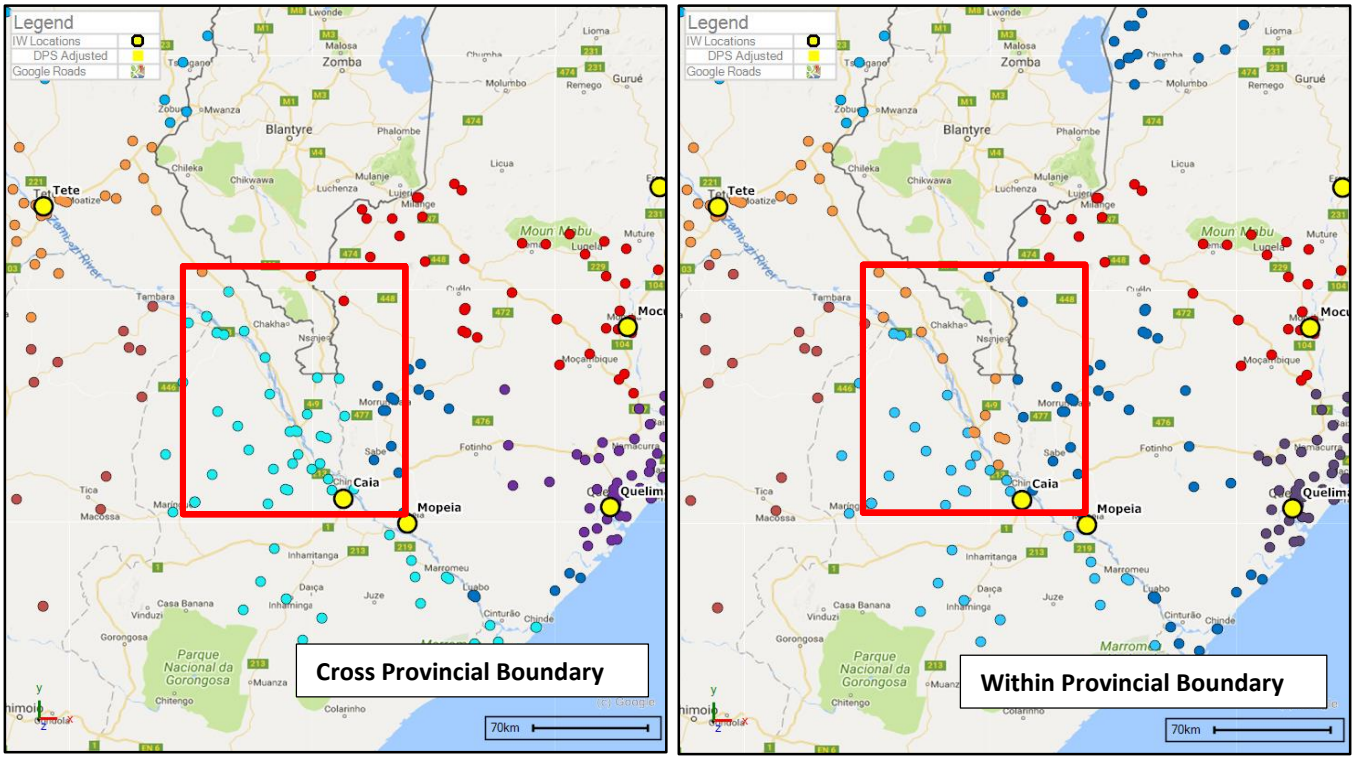


Figure 34: Within versus Cross provincial distribution in Tete, Sofala and Zambezia.

2.4.5 Cost per KM – Direct versus Outsourced Distribution

In this section we examine the cost per KM for direct versus outsourced distribution. The cross provincial distribution results will be examined in this section to show the variance between direct and outsourced costs. These are made up of vehicle and labour costs as detailed in section 2.2.6.

Important note: All costs are worked out at an IW level and worked up to a provincial and national level. Cost per KM workings at a IW level are available in the Annexure. Both tables below show the average cost per KM for each IW per province.

Average Cost per KM per province – Direct Distribution (MT)

Province	Total IWs	Total KM per Month	Number of vehicles	Average of Cost per KM per Vehicle (MT)	Average of Cost per KM for Labour (MT)	Average of Total Cost per KM per Month (MT)
Cabo Delgado	3	10,621	5	63.97	17.78	81.76
Gaza	2	7,084	4	69.79	21.65	91.44
Inhambane	2	7,615	5	87.24	24.96	112.20
Manica	3	6,725	4	46.53	22.29	68.81
Maputo Cidade	2	897	2	52.10	87.49	139.59
Maputo Provincia	3	2,784	3	34.90	49.36	84.25
Nampula	3	21,122	9	110.97	16.62	127.58
Niassa	2	6,790	4	75.37	23.11	98.48
Sofala	3	12,352	5	58.16	16.18	74.33
Tete	3	15,793	5	61.07	12.61	73.68
Zambezia	4	17,875	7	63.51	16.71	80.22
Grand Total	**30**	**109,658**	**53**	**64.99**	**26.19**	**95.04**

Figure 35: Average cost per KM with breakdown per province – Direct distribution

Average Cost per KM per province – Outsourced Distribution (MT)

Province	Count of Intermediary Warehouse	Sum of KM per IW per Month	Sum of Number of vehicles	Average of Cost per KM (Vehicle)	Average of Cost per KM (labour)	Average of Total Cost per KM per month
Cabo Delgado	3	10,621	5	72.93	20.27	93.20
Gaza	2	7,084	4	75.38	24.68	100.06
Inhambane	2	7,615	5	94.22	28.45	122.67
Manica	3	6,725	4	50.25	25.41	75.66
Maputo Cidade	2	897	2	56.27	99.74	156.01
Maputo Provincia	3	2,784	3	37.68	56.27	93.95
Nampula	3	21,122	9	126.50	18.94	145.45
Niassa	2	6,790	4	85.93	26.34	112.27
Sofala	3	12,352	5	62.81	18.44	81.25
Tete	3	15,793	5	69.62	14.37	83.99
Zambezia	4	17,875	7	72.40	19.05	91.45
Grand Total	**30**	**109,658**	**53**	**74.39**	**29.86**	**104.25**

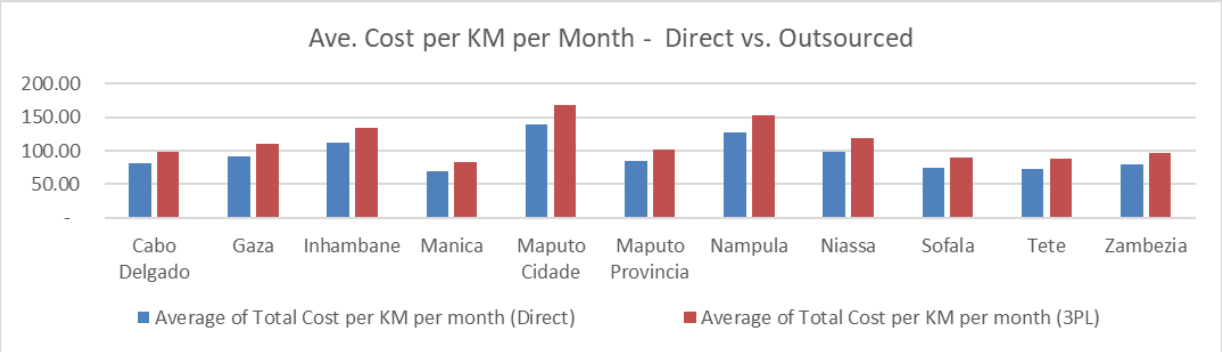


Figure 36: Average cost per KM with breakdown per province – Outsourced distribution

2.4.6 Optimized Resources, Investment and Distribution Cost

In this section the total investment and distribution costs per month and per annum are examined. The total costs for direct versus outsourced distribution are also compared here. These are made up of vehicle and labour costs as detailed in section 2.2.6.

Important note: All costs are worked out at an IW level and worked up to a provincial and national level. Total costs are available at an IW level and are available in the Annexure. Both tables below show the total monthly and annual cost per province.

Total Cost per month and per year using direct distribution

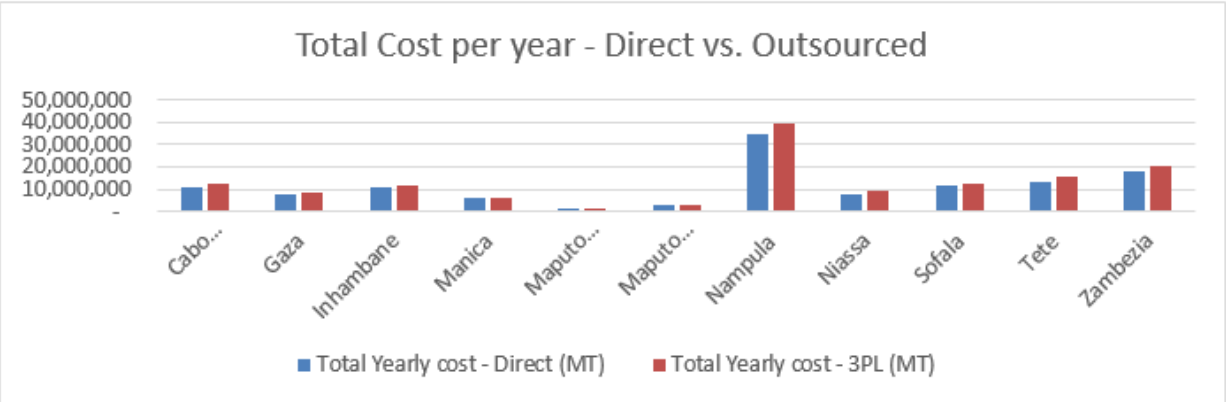
Province	Total IWs	Total Yearly KM	Total Cost per Month (MT)	Total Cost per Year (MT)	Total Cost Per Month (USD)	Total Cost per Year (USD)
Cabo Delgado	3	127,452	914,881	10,978,573	15,248	182,976
Gaza	2	85,006	647,717	7,772,599	10,795	129,543
Inhambane	2	91,374	874,961	10,499,535	14,583	174,992
Manica	3	80,700	481,934	5,783,207	8,032	96,387
Maputo Cidade	2	10,768	121,057	1,452,679	2,018	24,211
Maputo Provincia	3	33,407	212,146	2,545,749	3,536	42,429
Nampula	3	253,464	2,888,943	34,667,313	48,149	577,789
Niassa	2	81,485	665,148	7,981,781	11,086	133,030
Sofala	3	148,229	979,673	11,756,079	16,328	195,935
Tete	3	189,513	1,127,652	13,531,822	18,794	225,530
Zambezia	4	214,494	1,507,576	18,090,907	25,126	301,515
Grand Total	**30**	**1,315,893**	**10,421,687**	**125,060,243**	**173,695**	**2,084,337**

Figure 37: Total cost per province – Direct distribution

Total Cost per month and per year using outsourced distribution

Province	Total IWs	Total Yearly KM	Total Cost per Month (MT)	Total Cost per Year (MT)	Total Cost Per Month (USD)	Total Cost per Year (USD)
Cabo Delgado	3	127,452	1,042,964	12,515,570	17,383	208,593
Gaza	2	85,006	699,534	8,394,408	11,659	139,907
Inhambane	2	91,374	944,959	11,339,503	15,749	188,992
Manica	3	80,700	520,489	6,245,867	8,675	104,098
Maputo Cidade	2	10,768	130,741	1,568,894	2,179	26,148
Maputo Provincia	3	33,407	229,118	2,749,410	3,819	45,824
Nampula	3	253,464	3,293,394	39,520,733	54,890	658,679
Niassa	2	81,485	758,269	9,099,229	12,638	151,654
Sofala	3	148,229	1,058,047	12,696,566	17,634	211,609
Tete	3	189,513	1,285,523	15,426,275	21,425	257,105
Zambezia	4	214,494	1,718,636	20,623,637	28,644	343,727
Grand Total	**30**	**1,315,893**	**11,681,674**	**140,180,093**	**194,695**	**2,336,335**

Figure 38: Total cost per province – Outsourced distribution



The cost of capital for set up for direct distribution by CMAM has also been calculated by province. The total cost for distribution by year excluding the capital cost is also shown in this table by province. These are made up of vehicle and labour costs as detailed in section 2.2.6 above.

Province	Total IWs	Number of vehicles	Cost of capital - Year 1 (MT)	Cost of capital - Year 1 (USD)	Total Running Cost per Year (MT)	Total Running Cost per Year (USD)
Cabo Delgado	3	5	13,077,750	217,963	8,030,423	133,840
Gaza	2	4	10,462,200	174,370	5,757,268	95,954
Inhambane	2	5	13,077,750	217,963	7,714,116	128,569
Manica	3	4	10,462,200	174,370	4,443,682	74,061
Maputo Cidade	2	2	7,160,450	119,341	1,297,137	21,619
Maputo Provincia	3	3	7,846,650	130,778	2,149,739	35,829
Nampula	3	9	23,539,950	392,333	24,297,048	404,951
Niassa	2	4	10,462,200	174,370	5,895,390	98,257
Sofala	3	5	13,077,750	217,963	8,543,806	142,397
Tete	3	5	13,077,750	217,963	9,716,321	161,939
Zambezia	4	7	18,308,850	305,148	13,039,193	217,320
Grand Total	**30**	**53**	**140,553,500**	**2,342,558**	**90,884,124**	**1,514,735**

Figure 39: Cost of capital and annual distribution costs for Direct Distribution.

The estimated cost of capital and running costs at a IW level are included in the annexure.

Finally, a summary table of the total annual distribution cost, annual KMs and overall cost per KM for distribution highlights the key differences for these two RTM models – IW model and Current DDM model. Important consideration is that the current model includes distribution costs from DPM to DDM, making it a costlier option with the projected volumes used in this study.

	IW model - Direct Distribution			Current model - Direct Distribution		
Total Cost per Year	**MZN**	**125,060,242**	**$2,084,337**	**MZN**	**128,776,705**	**$2,146,277**
KMs per Year	**1,315,893KM**			**1,478,686KM**		
Cost Per KM	**MZN**	**95.04**	**$1.58**	**MZN**	**87.08**	**$ 1.45**

A summary table is also included for Direct and Outsourced distribution. This is calculated using total vehicle and labour costs throughout the vehicle life period in KMs and highlights the key differences in cost.

	IW model - Direct Distribution			IW model - Outsourced Distribution		
Total Cost per Year	**MZN**	**125,060,242**	**$2,084,337**	**MZN**	**140,180,093**	**$2,336,335**
KMs per Year	**1,315,893KM**			**1,315,893KM**		
Cost Per KM	**MZN**	**95.04**	**$1.58**	**MZN**	**106.53**	**$1.77**

The above factors only direct costs and capital investment when comparing direct versus outsourced distribution. Refer to Section 3 below on Outsourced Distribution with reference to other factors to be considered in addition to the direct cost factors when evaluating direct versus outsourced distribution.

2.5 Intermediary Warehouse Size Recommendations and Costs

2.5.1 Intermediary Warehouse Size Recommendations

In this section we will take a look at the monthly volumes (m3) per IW and assess the storage capacity requirements of each based on the need that IWs must have the capacity to hold 2 month's supply of its expected monthly volumes. This may vary depending on distance and frequency of delivery from the Central Warehouse, however for the purposes of this exercise each IW must be able to handle 2 months' worth of its expected volume.

Per agreement with PSM, the standard IW specifications are as follows:

IW Size	Carrying Capacity (m3)
Small	0 - 300m3
Medium	300 - 600m3
Large	600 - 900m3

Both cross provincial and within provincial distribution volumes were assessed at an IW level for this exercise. In the table, we can compare both the number of health facilities and volumes per IW for both scenarios. Note that the allocation of health facilities to IWs is different for both these scenarios.
The IW size recommendations below are based on estimated demand per IW. It is for this reason that both cross and within provincial boundary scenarios are considered when defining the size requirements for each IW. Recommendations are as follows:

	Cross Provincial		Within Provincial		
Intermediary Warehouse	Total HF per IW (Cross)	Volume (m3) per month (Cross)	Total HF per IW (Within)	Volume (m3) per month (Within)	IW Size
Mocimboa da Praia (Cabo Delgado)	41	159	41	159	**Small**
Montepuez (Cabo Delgado)	53	211	34	150	**Medium**
Pemba (Cabo Delgado)	47	284	44	249	**Medium**
Chokwe (Gaza)	63	176	71	192	**Medium**
Xai-Xai (Gaza)	73	347	65	305	**Large**
Inhambane (Inhambane)	76	390	84	432	**Large**
Vilanculos (Inhambane)	44	199	43	196	**Medium**
Catandica (Manica)	33	92	36	100	**Small**
Chimoio (Manica)	52	308	56	324	**Medium**
Machaze (Manica)	29	114	22	110	**Small**
Armazem da DSC (Maputo Cidade)	31	682	31	682	**Large**
Zimpeto (Maputo Cidade)	23	60	23	60	**Small**
Manhiça (Maputo Provincia)	28	96	29	95	**Small**
Matola (Maputo Provincia)	33	165	36	177	**Medium**
Matutuine (Maputo Provincia)	18	25	17	24	**Small**
Malema (Nampula)	47	203	36	186	**Medium**
Nacala (Nampula)	91	528	93	562	**Large**
Nampula (Nampula)	85	623	81	602	**Large**
Cuamba (Niassa)	63	276	75	240	**Medium**
Lichinga (Niassa)	87	248	95	262	**Medium**
Beira (Sofala)	74	292	65	245	**Medium**
Caia (Sofala)	65	264	41	141	**Medium**
Chibabava (Sofala)	34	107	40	134	**Small**
Fingue (Tete)	17	78	17	78	**Small**
Tete (Tete)	62	285	72	372	**Medium**
Ulongue (Tete)	33	218	33	218	**Medium**
Ile (Zambezia)	63	391	73	487	**Large**
Mocuba (Zambezia)	52	268	41	217	**Medium**
Mopeia (Zambezia)	26	98	47	174	**Small**
Quelimane(Zambezia)	78	334	80	347	**Medium**
Total	**1,521**	**7,519**	**1,521**	**7,519**	

Figure 40: IW size recommendations based on estimated monthly demand in m3

2.5.2 Intermediary Warehouse costs

Another important cost consideration when comparing the current and proposed IW model is the cost of warehouses. As highlighted in section 2.2.4, the implementation of the proposed IW model will mean replacing 11 DPMs and 148 DDMs with 30 IWs. This will have significant implications from an operational and equipment cost point of view.

PSM, supplied the PLM team with estimated warehouse costs for both the proposed IW model and the current model (DPM only). These costs were adapted for the current model for both DPM and DDM based on the forecasted volumes. In the following tables the warehouse operational costs are broken down for IW, DPM and DDM. This is summarized on a provincial level for DPM and DDM.

Proposed IW Model Warehouse costs – Year 1 (USD)

Province	Intermediary Warehouse	Total Health Centres per IW	Est. Volumes in m3 (2023)	Size of IW	Monthly Operational cost (USD)	Yearly Operational cost (USD))
Cabo Delgado	Mocimboa da Praia	41	159	Small	3,079	36,951
Cabo Delgado	Montepuez	53	211	Medium	6,160	73,916
Cabo Delgado	Pemba	47	284	Medium	6,160	73,916
Gaza	Chokwe	63	176	Medium	6,160	73,916
Gaza	Xai-Xai	73	347	Large	12,319	147,832
Inhambane	Inhambane	76	390	Large	12,319	147,832
Inhambane	Vilanculos	44	199	Medium	6,160	73,916
Manica	Catandica	33	92	Small	3,079	36,951
Manica	Chimoio	52	308	Medium	6,160	73,916
Manica	Machaze	29	114	Small	3,079	36,951
Maputo Cidade	Armazem da DSC	31	682	Large	12,319	147,832
Maputo Cidade	Zimpeto	23	60	Small	3,079	36,951
Maputo Provincia	Manhiça	28	96	Small	3,079	36,951
Maputo Provincia	Matola	33	165	Medium	6,160	73,916
Maputo Provincia	Matutuine	18	25	Small	3,079	36,951
Nampula	Malema	47	203	Medium	6,160	73,916
Nampula	Nacala	91	528	Large	12,319	147,832
Nampula	Nampula	85	623	Large	12,319	147,832
Niassa	Cuamba	63	276	Medium	6,160	73,916
Niassa	Lichinga	87	248	Medium	6,160	73,916
Sofala	Beira	74	292	Medium	6,160	73,916
Sofala	Caia	65	264	Medium	6,160	73,916
Sofala	Chibabava	34	107	Small	3,079	36,951
Tete	Fingue	17	78	Small	3,079	36,951
Tete	Tete	62	285	Medium	6,160	73,916
Tete	Ulongue	33	218	Medium	6,160	73,916
Zambezia	Ile	63	391	Large	12,319	147,832
Zambezia	Mocuba	52	268	Medium	6,160	73,916
Zambezia	Mopeia	26	98	Small	3,079	36,951
Zambezia	Quelimane	78	334	Medium	6,160	73,916
Total		**1,521**	**7,519**		**194,024**	**2,328,286**

Figure 41: Proposed IW Model Warehouse costs – Year 1 (USD)

Current Model DPM Warehouse costs – Year 1 (USD)

Province	Total DPM	Est. Volumes in m3 (2023)	Size of DPM	Monthly Operational Cost (USD)	Yearly Operational Cost (USD)
Cabo Delgado	1	507	Large	12,315	147,783
Gaza	1	453	Large	11,237	134,846
Inhambane	1	555	Large	10,374	124,490
Manica	1	392	Large	9,203	110,431
Maputo Cidade	1	423	Large	10,751	129,014
Maputo Provincia	1	313	Large	10,427	125,126
Nampula	1	1,282	Large	16,451	197,415
Niassa	1	443	Large	10,049	120,593
Sofala	1	498	Large	10,149	121,793
Tete	1	615	Large	14,528	174,338
Zambezia	1	999	Large	10,149	121,793
Grand Total	**11**	**6,479**		**125,635**	**1,507,623**

Figure 42: Current Model DPM Warehouse costs – Year 1 (USD)

Current Model DDM Warehouse costs – Year 1 (USD)

Province	Total DDM	Est. Volumes in m3 (2023)	Monthly Operational Cost (USD)	Yearly Operational Cost (USD)
Cabo Delgado	17	507	7,698	92,377
CD Maputo	12	423	8,622	103,462
Gaza	14	453	5,235	62,817
Inhambane	10	555	7,236	86,835
Manica	7	392	4,773	57,274
Maputo Provincia	8	313	5,697	68,360
Nampula	21	1,282	18,629	223,553
Niassa	16	443	6,928	83,139
Sofala	13	498	6,312	75,750
Tete	13	615	11,701	140,413
Zambezia	17	999	14,165	169,974
Grand Total	**148**	**6,479**	**96,996**	**1,163,953**

Figure 42: Current Model DDM Warehouse costs – Year 1 (USD). DDM operational costs are estimated.

These estimated warehouse costs for both models are summarized in the table below:

	IW model – Warehouse costs	Current model – Warehouse costs (DPM and DDM)
Total Cost – Year 1	**USD 2,328,286**	**USD 2,671,576**

2.6 Final Recommendations for Route Optimisation

1. Vehicle type

Given the average distances and demand per day for the IW RTM model, a 4ton vehicle with a 14m3 carrying capacity is the best suited vehicle for this model. It is also important to take a look at the high risk areas for accessibility when deciding on the type of vehicle. In most cases the 4ton vehicle will be able to access the same areas as the 2ton truck, however there will be areas that the larger truck will struggle on poor roads when conditions deteriorate. Strategically posting 2ton vehicles with good 4x4 capability at IWs that have areas of high risk is highly recommended for additional support. This would mean redeploying vehicles currently being used for DDM distribution at an IW level when the transition is eventually made. Targeting different terrains with different vehicles can be done once a full pilot study has been conducted for the other provinces.

2. **Cross provincial distribution for the IW model**
   Cross provincial distribution is the recommended solution as it requires 2 less vehicles (and delivery teams) and about 8,220 less KM travel per annum. If a decision is taken to only distribute within provincial boundaries, then targeting a select few IWs for cross-distribution will reduce the number of KMs and hours required to sufficiently service all HCs within the expected 10 day delivery period each month. Niassa/ Cabo Delgado, Zambezia/ south of Tete, south of Manica/ Gaza and Gaza/Inhambane are target areas for this.

3. **Intermediary Locations**
   The proposed IW model provides good coverage with 81% of all health facilities falling within a 100km radius of the proposed IW locations. One area of concern is the south of Nampula Province in Moma, Angoche and Mogovolas districts. There are a number of health facilities with relatively high volumes in this region. Distribution costs in Nampula province would be reduced significantly if a IW was positioned closer to this region. In contrast, there are duplication concerns with the proposed Mopeia IW location. For the proposed IW model (Cross-provincial) 80% of the Mopeia health facilities are within 100km of the Caia IW. The positioning of the Inhambane IW is also worth highlighting. As discussed in the Inhambane report, 83% of the health facilities allocated to this IW are on the opposite side of the Inhambane bay/lagoon. Monthly distribution costs could be reduced significantly by repositioning this on the other side of the bay, for example in Maxixe.

4. **Direct versus Outsourced distribution**
   When looking at quantifiable factors only, outsourced distribution is about 10-15% more expensive than direct distribution when factoring in direct costs, variable costs and 3PL profit margin. This will vary province by province with the northern provinces being more expensive due to a poor infrastructure and difficult conditions. In Section 3.2 below, other non-quantifiable factors are listed which must be considered when evaluating direct versus outsourced distribution. The non-quantifiable factors are likely to far outweigh the marginal theoretical cost benefit calculated here. It is recommended that CMAM continue to pursue outsourced distribution as the preferred method for last-mile distribution.

Section 3: Outsourced Distribution

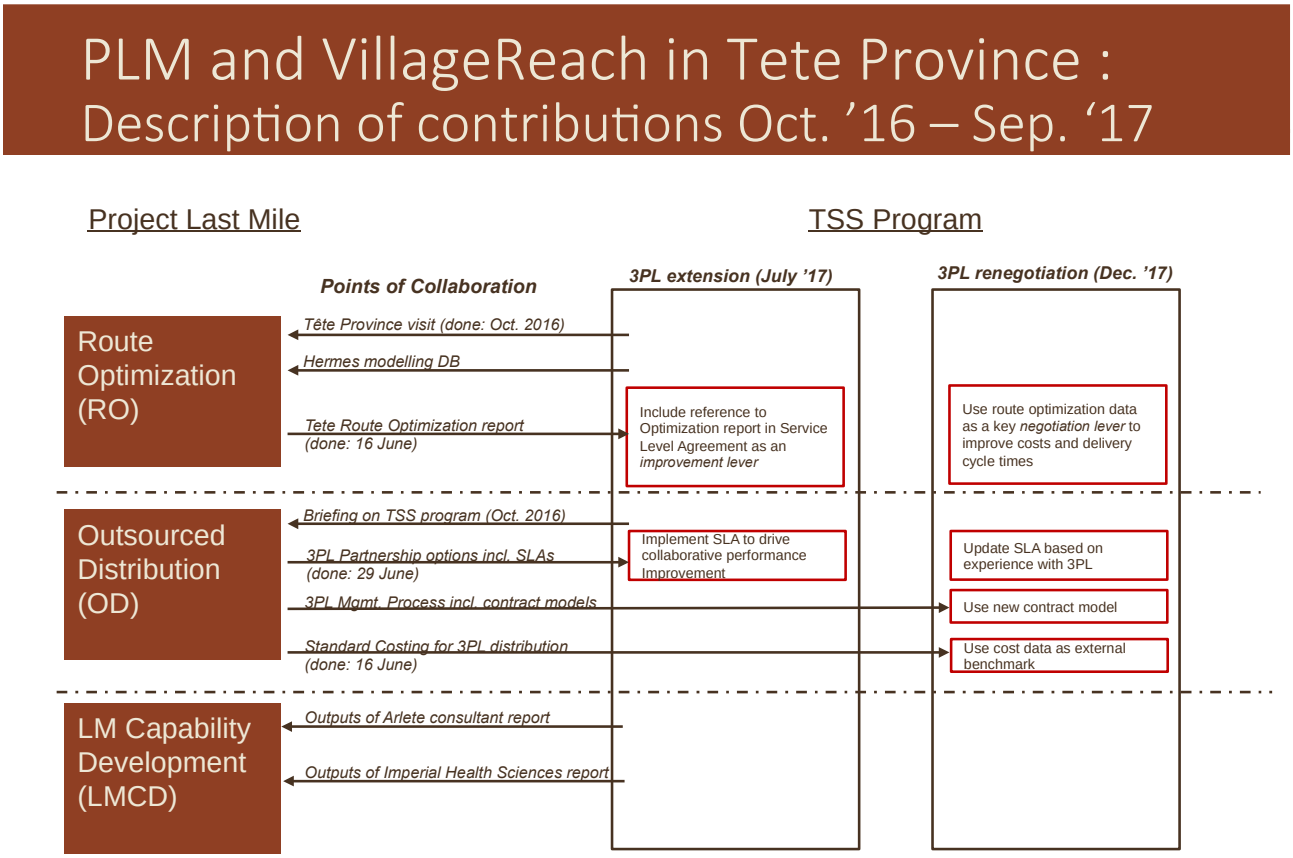
3.1 Outsourced Distribution Deliverables

The Outsourced Distribution deliverables per the revised contract are as follows:

1. List of potential suppliers and supplier evaluation framework;
2. Benchmark cost data and estimated cost for the proposed RTM model(s), including key targets/ metrics based on Sabco experience;
3. Supplier performance and contract management process document (including any tools developed for CMAM or its suppliers.

PLM was engaged directly with Outsourced Distribution only in Tete province and in conjunction with Village Reach to support their TSS pilot activities in the province. Village Reach has negotiated various extensions of the original contract (to December 2016) with the service provider - Confiança Absoluta. PLM and Coca-Cola provided support for the renegotiations in terms of contracting mechanisms and templates for Service-Level-Agreement. The data and costing information gathered from the routing optimization work done in Tete province also served as an input into the negotiations. Available metrics in terms of Delivery Intervals and also stock-out rates for ARV's and vaccines were tracked in the last two quarters though PLM's impact on those metrics is hard to fathom at this stage. PLM has shared various tools with Village Reach and with CMAM in this report and annexures relating to working with third-party distribution partners. Despite all the advances, Village Reach has recently suspended their collaboration with Confiança Absoluta. It is expected that Village Reach will be undertaking a new outsourced distribution process in Tete province effective from January 2018 and if so, PLM will provide the needed support in the initial tendering, selection and contracting stages during the Bridging Phase from October to December 2017.

The following diagram illustrates the collaboration between PLM and Village Reach to this point.



3.1.1 List of Potential Suppliers and Supplier Evaluation Framework

In line with the strategic direction of the PELF and the aim to effectively identify suitable and appropriate third-party logistics (3PL) providers, it is essential that the selection process for a 3PL provider is structured and considers multiple criteria to ensure there is a fit with CMAM's requirements.

The use of 3PL providers can yield important benefits such as reduced distribution cost, the application of less capital investment, improved order fill rates and shortened order-to-delivery cycle lengths.

The following elements should be included in a supplier evaluation framework and addressed before entering into a contract:

- Agreement on and signature of the Standard Terms & Conditions (if applicable)
- Vendor has submitted a Vendor Maintenance form that includes all relevant and needed details
- A copy of the Vendor's Operating License has been submitted
- A Finance Declaration has been submitted
- Copy of Declaration by the Ministry of Finance has been submitted
- Proof of registration for INSS has been submitted
- Declaration from Vendor bankers confirming NIB number and bank account details
- Proof of internal procedures has been provided that includes aspects such as medical aid, disciplinary procedure and protection against accidents
- Vendor facility names and respective contact details have been supplied
- The Vendor has provided a verifiable physical address from where they operate.
- References from other clients that speak to the character and culture of the provider. Companies should be delivering a higher value proposition than simple efficiency or the lowest cost.

The following suppliers have expressed an interest in working with CMAM for distributions from future IW's to Health Centres and some of their proposals have been included in the Routing Optimization calculations and recommendations above.
It should be noted that finding potential 3PL distribution partners who can be counted on to provide a distribution service to health facilities across the country or province-by-province has been difficult. The information, ways of working and potential costs provided have not always been reliable and clearly understood. The approach taken to implement third-party distribution should be determined and implemented for each intermediary warehouse as they are established.

National – across all provinces

Acutrex AS, Lda
Address: Av. Romão Fernandes Farinha Nº 627 – Cidade de Maputo
Name of contact person: Sr. Adelino Tanasse
Cel.: +258 84 1139110;
Email: adelinotanasse@gmail.com / acutrex.enquiry@gmail.com

Freight Alliance
Name of contact person: Neil Raven
Telephone number: +258 – 87 237 8900
Email: neil@freightalliance.co.mz

Tete Province

Confiança Absoluta
Address: Ave. Eduardo Mondlane, Tete
Name of contact person: Sr. Tamimo / Sr. Zulficar
Telephone number: +258 84 7638 454 / 84 1412 390 / 82 5930 230
Email: confiancaabsoluta@gmail.com

Sergio Transporte
Address: Chimoio Ave. 25/09
Name of contact person: Sergio Abilio
Telephone number: +258 - 843888740
Email: sergiolia1979@gmail.com

Elso Transportes
Address: Matola Ave. 700, Maputo
Name of contact person: Abdul Mussa
Telephone number: 849159321
Email: elsotransporte@gmail.com

Inhambane Province

Sergio Transporte
Address: Massinga/EN1
Name of contact person: Sergio Lia
Cel.: 843888740
Email: sergiolia1979@gmail.com

Mircosegur
Address: Rua de MoMA, Bairro da Liberdade, 847
Name of contact person: Alicidio Cintura
Cel.: +258 - 847400140
Email: acintura@yahoo.com

3.1.2 Benchmark cost data and estimated cost for the proposed RTM model(s), including key targets/ metrics based on Sabco experience

The benchmarking of cost data for third-party service providers and comparison to cost data for own distribution has been included in the Routing Optimization workings and recommendations above.

KPI's to measure the effectiveness of a 3PL should be included in the Service-Level-Agreement as explained in section 3 below. KPI's can include the following:

- Vehicle availability
- Turn-around time from vehicle order to availability
- Travel-time adherence
- Safety incidents and accidents
- Load plan adherence
- Number of missed shipments to Health Centres
- Shortages in shipments to Health Centres

3.1.3 Supplier Performance and Contract Management Process Document

This is including any tools developed for CMAM or its suppliers. The contract for distribution entered into with any 3PL service provider that should contain at least the following elements:

- Provider responsibilities (including fleet condition, cleanliness, image
- Responsibilities of both the 3PL and the contractor (CMAM)
- Duration of the Agreement
- Warranties
- Risks
- Limitations of liability and indemnity
- Time for performance
- Load requirements
- Contract pricing, terms and invoicing
- Early termination
- Occupational Health and Safety
- Confidentiality of information
- Claims and liens
- Performance Management
- Terms and conditions
- Breach
- Force Majeure
- Consequences of Termination
- Dispute resolution – Mediation or Arbitration
- Domicilia

Refer to Document "OutsDist Doc 1 Distribution Contract Eng.doc" in Annexure xx for a standard Distribution contract template.

In addition to the contract itself it is recommended that a Service-Level-Agreement (SLA) be entered into between the service provider and CMAM. A properly thought-out and executed SLA specifies in measurable terms what services the provider will furnish, improves outcomes for both parties and helps foster long-term relationships. It is beneficial to work in genuine collaboration within a clearly defined framework. A typical distribution SLA will include the following elements:

- Description of the service provided
- Quality assurance provisions
- Staffing/recruitment and training of by provider
- Maintenance of vehicles
- Monitoring and tracking of vehicles

- Reporting and governance requirements
- Ordering process
- Availability of vehicles
- Loading and quantities
- Customer (CMAM) obligations
- Product loss claim procedure
- Roles & responsibilities
- Service levels for performance management
- Defined territory, routing master data
- Travel time adherence
- Load plan adherence
- Change control procedure

Refer to Document "OutsDist Doc 2 SLA Tpt Coca-Cola Eng.doc" in Annexure 2.3 for a standard SLA template.
Refer to Document "OutsDist Doc 3 SLA TeteVReach Port.doc" in Annexure 2.4 for the SLA set up between Village Reach, Confianca Absoluta and DPS-Tete.

It is recommended that agreement also be reached with service providers in terms requirements for storage and principally distribution of CMAM products. These requirements may be included in the SLA if not contained in a separate document.

Guidelines to be included are as follows:

- Storage areas at supplier's warehouse must be secure with no unauthorized personnel allowed
- Storage areas must ensure integrity of product/package/material and avoid exposure to the environment, excessive heat, sunlight water, fumes, and cross contamination from other materials.
- Pallets must be of a suitable material and must be clean dry and free from contaminants such as insecticides, fungicides, pesticides or other chemicals.
- Distribution trucks must prevent direct exposure to the environment: excessive heat, sunlight, water and fumes.
- Closed trucks and those with lockable side curtains are recommended.
- If pallets are used they must be secured in the truck in such a way as to avoid damage to the products on the pallet.
- Suppliers must assess that adequate ventilation is in place on trucks to avoid excessive heat.
- Tarpaulins may be used if they are in good condition and stored correctly on the truck so as to avoid cross contamination of the materials being shipped.
- Distribution trucks must be maintained in a good road worthy condition.
- Distribution trucks must be kept clean and cleaning schedules made available on request.
- It is preferred that Distribution trucks must be dedicated to the transportation of medical goods.
- Where Distribution trucks are being used for multi loads, the trucks must be cleaned before transportation of medical goods.
- All legal requirements should be adhered regarding load identification and hazardous materials.

It is advisable that suppliers understand and sign up to the core values and principles of the MoH in Mozambique and CMAM. In addition to standard international Human Rights principles, service providers are typically expected to meet and be able to demonstrate compliance with minimum standards with respect to:

- Laws and Regulations of the country
- Forced labour
- Child labour
- Abuse of labour
- Freedom of association and collective bargaining
- Discrimination
- Wages and benefits
- Work hours and overtime
- Health and safety
- Environment
- Business integrity.

3.2 Other factors when evaluating Direct vs Outsourced Distribution

In addition to the cost factors evaluated in Section 2.4.5 and 2.4.6 above, it is important to consider other non-quantifiable factors when deciding between direct and outsourced distribution. Global trends including for distribution to the last mile, indicate that distribution activities that are transactional, operational and repetitive are most frequently outsourced. In a 2016 study*, 93% of 3PL users and 94% of 3PL service providers reported that their relationships are successful and yielding positive results.

The same study showed that:

- 70% of those who use 3PL logistics services (Distributors) and 85% of 3PL service providers said the use of 3PL services has contributed to overall logistics cost reductions;
- 83% of distributors and 94% of 3PL service providers said the use of 3PLs has contributed to improved customer service;
- 75% of distributors and 88% of 3PL providers—said 3PLs offer new and innovative ways to improve logistics effectiveness.

Specifically for CMAM the following factors need to be factored in and evaluated (in addition to the direct cost) when considering the use of outsourced distribution:

- Flexibility and scale-up – Ability and reaction time to manage demand volatility both in terms of increased and decreased volumes.
- Predictability in costs - Less volatility in cost including fuel, maintenance and incident management.
- Access to the latest supply chain knowledge, access to skills and talent as well as the latest in related IT systems and technology.
- Increased ability to find new and innovative ways to improve logistics effectiveness.
- Incident management and ability to respond – particularly in rural areas where support infrastructure for breakdowns is absent.
- Easier entry and improved knowledge in the future for possible access to outsourced warehousing.
- Improved ability to implement green and environment-friendly supply chain initiatives.

* The Capgemini 20th Annual Third Party Logistics Study – 2016.

It is recommended that notwithstanding the difficulties encountered by PLM at this simulated stage to source outsourced distribution partners, that CMAM continue to pursue outsourced distribution as the preferred method for last-mile distribution. The non-quantifiable factors above, even if not all applicable, far outweigh the marginal theoretical cost benefit calculated in Section 2 above. A well structured and tested outsourced distribution model implemented and scaled-up over time will ultimately deliver cost and efficiency benefits to CMAM and improved availability of medicines and health-care products to those in need.

Section 4: Capability Development

4.1 Capability Development Deliverables

4.1.1 Role Profiles and Job Descriptions for the Key Logistics Management Roles at Intermediary Warehouse Level

Warehouse Structure and Resources

The Coca-Cola Sabco Mozambique Logistics Team reviewed the below Village Reach recommended IW roles, job profiles & job descriptions for the three different sizes of warehouse.

Warehouse Role	Required resources for Small IW	Required resources for Medium IW	Required resources for Large IW
1. Warehouse Manager	1	1	1
2. Administrator	1	1	1
3. Inventory Control Manager	1	1	1
4. Inbound & Outbound Manager	1	1	1
5. Inbound Officer / Data Clerk	1	1	1
6. Outbound Officer / Data Clerk	1	1	1
5. Forklift Driver	2	2	2
6. Put away Picker	2	3	4
7. General Maintenance Technician	0	1	1
8. Truck Driver	1	1	2
9. Cleaner	1	1	1
Total Required Resources per IW size	**12**	**14**	**16**

To get a deeper understanding of the operations and therefore make relevant recommendations, on the 17th and 19th of July 2017, Coca-Cola Sabco Mozambique visited warehouses in Maputo together with Joaquim Durao and PSM representatives. These were the Maputo provincial warehouse in Matola and CMAM's Zimpeto Warehouse.

Based on this visit the Coca-Cola Sabco team made the following recommendations:

1. Combine the Inventory Control Manager and the Inbound & Outbound Manager roles for at least the small (300 pallet) warehouse and possibly for the medium (600 pallets as well).
2. Combine the Inbound Officer & the Outbound Officer roles across all sizes of warehouse.
3. Review the role of security:
    a. Security should be more involved in controls, participating in the stock count and in the checking of stock moving in and out at the gates;
    b. Security should sign the control documents and share in accountability for losses.
4. The warehouse could be divided into sections. A system of cycle counts could be introduced with each section to be counted within a month to ensure that every stock item is counted on a rotational basis at least once in a month.
5. At the start-up phase it is recommended to start with fewer positions and only if the workload justifies it should more people be added. This should apply to the Stock handling / forklift operator positions

Below are the roles recommended for the Vilanculos warehouse specifically:

Warehouse Role	Required resources Vilanculos IW
Warehouse Manager	1
Administrative Technician	1
Inbound/Outbound & Inventory Control Manager	1
Inbound/Outbound Officer / Data Clerk	1
Technician for PAV	1
Technician for MMC	1
Laboratory Technician	1
Stock handlers / forklift operators	5
Truck driver	1
Cleaner	1
Total Staff	**14**

Job Profiles

In addition, each of the proposed job profile were reviewed. The team found the job profiles to be complete and comprehensive. No amendments were made on the job profiles except for the Warehouse Manager role profile. To this role were added the responsibilities related to Route Optimization and 3PL Management.

Refer to annexure 2.1 for the job profiles and job descriptions that were reviewed and edited for the following roles:

- Warehouse Manager
- Administrator
- Inventory Control Manager
- Inbound-Outbound Manager
- Inbound Officer/Data Clerk
- Outbound Officer/Data Clerk
- Put away Picker
- General Maintenance
- Technician
- Truck Driver
- Cleaner

Psychometric Assessments

Psychometric assessments are often used as part of the recruitment and selection process. They are a way for employers to assess an applicant's intelligence, skills and personality. They are structured to accurately evaluate an applicant's capacity to work with others, process information and cope with the stresses of the job. Employers use the results from these tests to determine whether the applicant would be a suitable match for the company to which you are applying.

In the figure below are the recommended psychometric assessments for all Warehouse roles:

Assessment Name	Target Audience	What the assessment measures	How the assessment is conducted	Available in Portuguese	Service Provider & Assessment Cost
Situational Judgement Test (SJT)	Warehouse Manager	The SJT Consists of attitudinal, behavioral and situational questions aimed at assessing the candidate's ability to problem solve and use appropriate judgment while performing the manager function. The test provides an opportunity to objectively assess the management skills of job candidates. It was developed to identify those applicants best able to handle the daily challenges encountered by most managers and supervisors.	Online Assessment	No	BIOSS SA - R500
Elite intellect Profile	Warehouse Manager, Warehouse Administrator, Technicians, Picker, Truck Driver, Forklift Driver	The Elite Intellect Profile helps employers accurately test a candidate's level of general cognitive ability. More specifically, the assessment measures the individual's potential to be trained, to effectively and efficiently solve problems, to communicate clearly and to comprehend complex relationships	Online Assessment	No	BIOSS SA - R500
IRIS (Capability Assessment)	Warehouse Manager, Warehouse Administrator, Technicians, Picker, Truck Driver, Forklift Driver	The IRIS is a semi-structured interview which explores the theme of work in which individuals feel most comfortable. It is ultimately used to match the individual to their work in such a way that they do not feel bored or frustrated in their job. It evaluates the types of decisions with that they are currently comfortable making, as well as how they are likely to grow and develop over the next five to fifteen years.	Face to Face or Telephonic	Yes	BIOSS SA – R1900. However, an internal candidate can be trained to conduct this assessment.

Personality Development Analysis	Warehouse Manager, Warehouse Administrator, Technicians, Picker, Truck Driver, Forklift Driver	This assessment is a reliable and scientifically validated tool. It is an accurate description of the way an individual generally responds to different situations, challenges and commitments that the individual is faced with on a daily basis. It was specifically developed to identify and predict the behaviour of individuals in organizations.	Online Assessment	Yes	BIOSS SA – R1100
Elite Staffing Profile	Warehouse Administrator, Lab Technician	The Elite Staffing Profile is a general indicator of the individual's ability to perform basic skills required of most entry-level through supervisory jobs along with the ability to be hard working, responsible and trustworthy.	Online Assessment	No	BIOSS SA - R500
Elite Transportation Profile	Picker, Truck Driver, Forklift Driver	The Elite Transportation Profile is a general indicator of the individual's ability to behave responsibly, be safety conscious and follow rules and procedures. This profile is ideal for drivers and warehouse packers and shippers.	Online Assessment	No	BIOSS SA - R500

Refer to annexure 2.2 for all psychometric assessments.

4.1.2 Performance management objectives, targets and high level review process for logistics management roles at Intermediary Warehouse level

a) Key Warehouse Processes & Standard Operating Procedures

The Coca-Cola Beverages Africa Logistics Team, shared the below list of key Warehouse processes needed to manage the receiving, storing, controlling and dispatching of goods in a Warehouse and to support the running and success of a Warehouse.

RECEIVING	STORING	STOCK CONTROL	DISPATCHING
Unloading inbound goods	Warehouse Layout	Stock/Cycle Count	Order Picking
Receiving & checking Inbound goods	Warehouse Utilization	Stock Replenishment	Order Make Up
Putaway & stacking	Storage standards (temperature)	Stock write off	Staging
Stock update on system	Traceability & Batch Management	Stock destruction	Load vehicle
KPI Management	KPI Management	KPI Management	KPI Management
People Management	People Management	People Management	People Management

SHEQ	SHEQ	SHEQ	SHEQ
House Keeping	House Keeping	House Keeping	House Keeping
Manpower Resources	Manpower Resources	Manpower Resources	Manpower Resources
Equipment Resources	Equipment Resources	Equipment Resources	Equipment Resources

The General Warehouse Standard Operating Procedure document focuses on the following:

- Warehouse key rules and regulations
- Inbound stock movements process
- Storage process
- Stock taking process
- Outbound stock movements
- Safety and security procedure

Refer to annexure 2.3 for these Standard Operating Procedures.

The following examples of Standard Operating Procedures are included in the Annexures:

- Stock count
- Housekeeping standards
- Incoming Primary Distribution
- Outgoing Distribution
- Route Settlement
- Breakages management
- CCTV monitoring

Refer to annexure 2.5 for these Standard Operating Procedures.

b) Warehouse KPI'S

The key outputs with respect to relevant Warehouse KPI's are included for the following:

- Managed Inventory
- Managed Warehouse Cost
- Optimized Warehouse Layout
- Enforced SHEQ and GMP compliance
- Human Resource Management

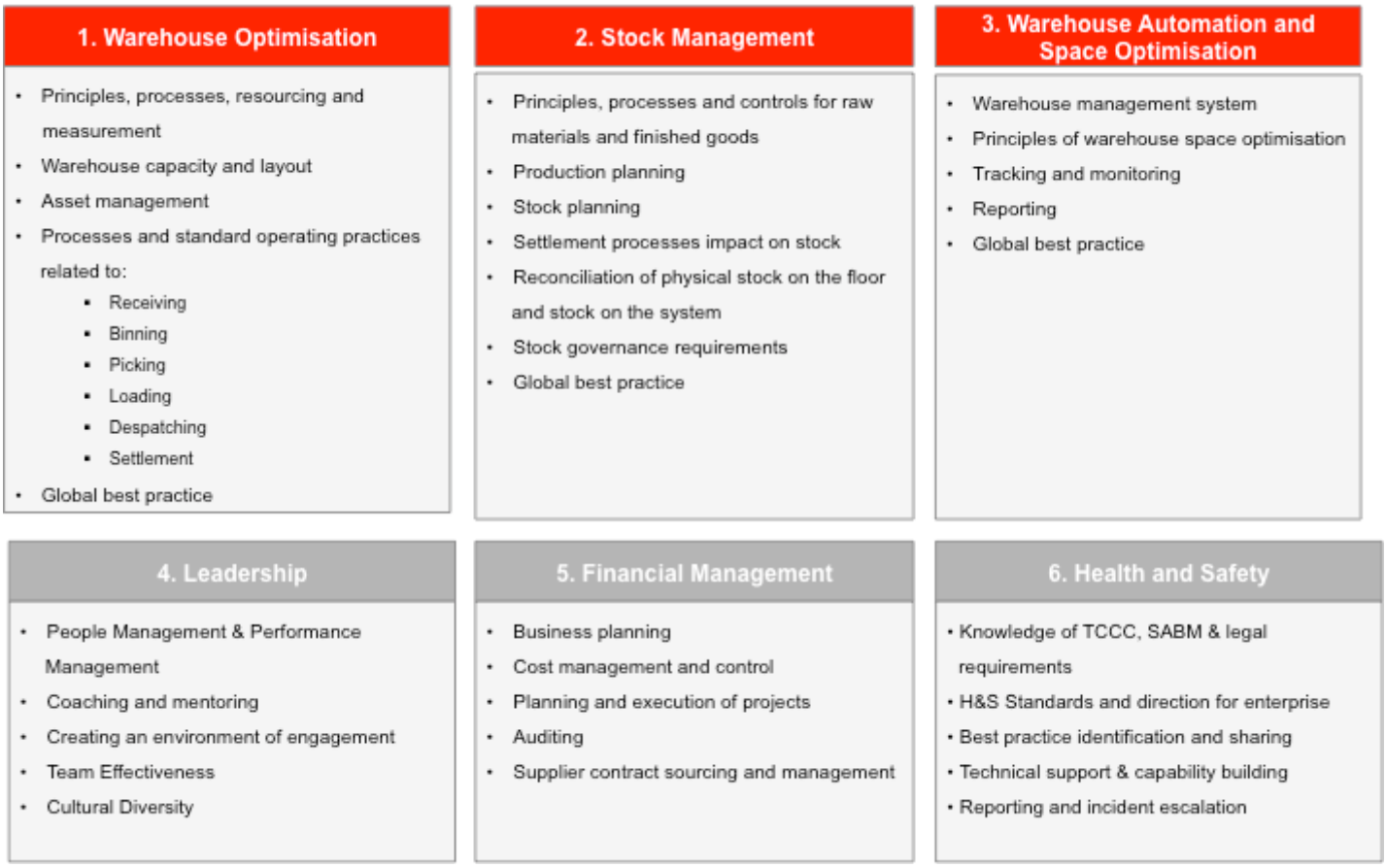
With definitions in respect to:

- Key warehouse outputs
- Key tasks and activities to be executed to achieve these outputs and
- The quality requirement to be achieved to ensure maximum achievement of the output.

Refer to annexure 3.5.1 for the Warehouse KPI document.

4.1.3 Relevant Training materials developed

From a private-sector perspective, the warehouse competencies (knowledge and skills) that warehouse staff need to perform their jobs optimally are as follows:



The core warehouse competencies are:

- **Warehouse Optimisation**
  - Planning, implementing, and controlling the efficient, effective forward and reverse flow and storage of product and information between the point of origin and the point of consumption in order to meet customers' requirements.
- **Stock Management**
  - Monitoring, managing and controlling product so that the correct stock quantities are available just in time to meet the customer requirements and protect company assets.
- **Warehouse Automation and Space Optimisation**
  - Direct control of handling devices and systems that produce the storage and movement of products in a manner that increases productivity, warehouse space utilisation and accuracy.

The set of competencies needed in each function in terms of “levels of competence” are as follows. Note that as the levels progress they become more stretching. This helps differentiate the best performers not just by how often they demonstrate a competency, but by understanding the level of sophistication with which they demonstrate it as shown on the below table.

Level	Definition	Understanding	Application
Level: Awareness	Limited understanding or experience	Limited	Limited: • Minimal use • Can apply without assistance but needs frequent supervision
Level: Fundamental	Understanding with some experience and application	Some	Some: • Working/functional proficiency
Level: Developed	Full understanding of the concepts and their application to the Business	Full	Regular: • Assist/consult • Lead others
Level: Advanced	Mastery at the highest level of understanding and consistent application	Mastery	Habitual: • Broad • Recognised as an authority or master performer in exercising the competency

Refer to annexure 2.6.1 for an example on how these levels of competence are related to the core competencies of:

- Warehouse Optimization
- Stock Management
- Warehouse Automation and Space Optimisation

Below is a private-sector example of how these warehouse competencies are matched to roles:

	Warehouse Optimisation	Stock Management	Warehouse Automation	Leadership	Financial Management	Health and Safety
Logistics Services Manager	Advanced	Advanced	Advanced	Advanced	Advanced	Advanced
Regional Supply Chain Manager	Developed	Developed	Developed	Advanced	Advanced	Advanced
Logistics Manager	Developed	Developed	Developed	Advanced	Advanced	Developed
Stock Manager	Developed	Developed	Developed	Developed	Developed	Developed
Supply Manager	Developed	Developed	Developed	Developed	Developed	Developed
Stock Team Leader	Awareness	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Warehouse Team Leader	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Supply Team Leader	Awareness	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Warehouse Operator	Awareness	Awareness	Awareness	Awareness	Awareness	Fundamental

The table below shows how a Warehouse Curriculum is built to meet each of the levels of competence:

Level	Warehouse Optimisation	Stock Management	Warehouse Automation
Awareness	• Warehouse Standard Operating Practices and Work Instructions • Warehouse Optimisation Competency Framework	• Stock Management Standard Operating Practices • Stock Management Competency Framework	• FLT License and PPT License Certification • ORTEC Warehouse Management Training • Warehouse Automation and Space Optimisation Competency Framework
Fundamental	• Warehouse Standard Operating Practices • Warehouse Optimisation Competency Framework	• Stock Management Standard Operating Practices • Stock Management Competency Framework • Stock Academy for Stock	• FLT and PPT Standard Operating Procedures • Warehouse Automation and Space Optimisation Competency Framework • Sherq Training
Developed	• Warehouse Standard Operating Practices • Warehouse Optimisation Competency Framework • Benchmarking visits • Global Best Practice Solutions • Research and Case Studies	• Stock Management Standard Operating Practices • Stock Management Competency Framework • Benchmarking visits • Global Best Practice Solutions • Research and Case Studies	• ORTEC Standard Operating Practices • Warehouse Automation and Space Optimisation Competency Framework
Advanced	• Warehouse Optimisation Competency Framework • Benchmarking visits • Global Best Practice Solutions • Research and Case Studies	• Stock Management Competency Framework • Benchmarking visits • Global Best Practice Solutions • Research and Case Studies	• Warehouse Automation and Space Optimisation Competency Framework • Benchmarking visits • Global Best Practice Solutions • Research and Case Studies

Refer to annexure 2.6.2 for an example of Coca-Cola Stock Academy Framework and a Warehouse Team Leader Academy Framework.

Owing to ownership and regulatory changes affecting Coca-Cola Beverages Africa (CCBA), permission to release Learning Pathways that can be applicable to key roles at the IW in Vilankulo is expected to be received at a later. Once received the Learning Pathways will be released to CMAM.

Section 5: Monitoring and Evaluation

The Yale Global Health Leadership Institute (GHLI), a key implementing partner of PLM, conducts monitoring and evaluation of PLM activities. GHLI has been working with the PLM Mozambique team to tailor an M&E framework. The framework measures PLM impact over time by tracking quantitative metrics (inputs, outputs, outcomes, and impact) and will include conducting qualitative interviews and observations towards the end of the project.

PLM has tracked inputs (i.e. funding, in-kind contributions from The Coca-Cola System, etc.); outputs (i.e. deliverables produced as a result of inputs); outcomes and impacts. Outcome indicators are provided below. PLM worked with CMAM, USAID, PSM and Village Reach to identify and integrate metrics to capture PLM's contributions to health and health systems impact.

The Yale team is in Mozambique for the week of 25 September 2017 for qualitative interviews with stakeholders and to capture and understand PLM project successes, challenges, and lessons learned. The aim is to strengthen PLM's contributions to future supply chain improvement activities in Mozambique and demonstrate program value to donors and partners.

The Yale researchers will meet with project partners for one-on-one interviews. Partners include representatives from the Ministry of Health, CMAM, Coca-Cola Sabco, the Global Fund, USAID, PSM, Village Reach, Frontline Market Research and the PLM team itself.

The researchers ask open-ended questions about project implementation, with topics including a description of the partnership as well as progress, successes, and challenges to date. Any identifying information is kept confidential and will be anonymous in future reports.

Workstream	Deliverables	Definition	Baseline Value	Outcome Value
Network/Routing Optimization	Percentage of facilities reached in pilot region	(# facilities reached in pilot region / # facilities in pilot region) x 100	Gaza - 135 Tete - 124 Inhambane - 130	Gaza - 101; 75% Tete - 106; 85% Inh'bane - 119; 94%
	Cost Efficiency - Last mile distribution	Distribution US$ Cost/km - Vehicle cost; Vehicle maintenance; Fuel; Driver wage; Driver Per Diem; Accommodation / Km's to all HC's	Village Reach Zero-based: $0.62/km CHAI: Inhambane & Gaza $1.35/km Tete: $0.55/km	Cost/km (Provisional) Based on Inh'bane - 107.41MT/km (10 day dist. cycle). Refer 25 September 2017 report for detailed cost analysis.
Outsourced Distribution	Stockout Rates for ARV's, Vaccines & Syringes	The stock out rate is monthly average calculated based on the number of facilities that have zero-stock availability at the time of a visit over the number of facilities visited on that given month.	TETE Province ARV's - 10% Vaccines/Syringes - 6%	Technical delays with data from MSF/VR so results for Tete not available.
	Delivery Intervals	% of HC's visited within 40 days of last distribution	Tete by 3PL in 2016: 81% Jan-Apr 2017: 46%	Tete province: May 66%; Jun 70%; Jul 59%.
	Distribution cost - Per km	Monthly cost payable to 3PL/# of HC's	Village Reach 3PL $1.90/km	Contract revision from Sep 2017 - $1.54
Logistics Management Capability Development (Intermediary Warehouses)	Number of IW Job Profiles and Job Descriptions reviewed and updated	# of JD's available / # of Logistics / Warehouse posiitons at IW	11 Reviewed and WH Mgr updated	
	Percentage of IW SOP's reveiewed and updated	# of SOP's reviewed and updated / # of IW SOP's x 100	9 SOPs for IWs submitted	
	% of IW roles for which Perf. Mgt objectives are set	# of roles with objectives & targets / # of IW roles x 100	5 Warehouse Outputs with KPIs & Quality requirements	
	% of IW roles for which Learning pathways developed	# of roles with Learning pathways / # of IW roles x 100	Learning pathways for at least 6 key roles at IW level to be submitted.	

Section 6: Governance

Element	Frequency	Notes
Steering Committee	+- Monthly meeting/teleconference	A report is submitted to the Steering Committee ahead of each meeting.
Project Delivery Oversight	One-pager report issued monthly (between the Steercom meetings). The PLM core team and delivery team have teleconference to discuss.	The report includes progress against workplan, budget status and risks & Issues.
Strategic Review Sessions	Mid-term and at close	The mid-term review in-country took place on 15 June 2017 in Maputo. A closing phase review meeting took place on 28 September 2017.

The composition of the Steering Committee was as follows.

- Dr Antonio Assane – Director of CMAM (from 15 June 2017)
- Dr Brana Santos - CMAM
- Dr Sergio Seny – CMAM
- Dr Carla Matos – MISAU (GF unit)
- Leah Hassleback – USAID
- Ana Fernandes – Coca-Cola Mozambique
- Adrian Ristow – PLM

Section 7: Bridging Phase and Phase 2 Proposal

A request was made by USAID and supported by CMAM to undertake a complete routing optimization exercise in Zambezia province as was done in Gaza, Tete and Inhambane during the pilot phase of the PLM project. A proposal for a Bridging Phase for the period of 3 months from October to December 2017 was made to CMAM on 30 June 2017. The Bridging Phase will also allow PLM to build momentum on Outsourced Distribution and be well positioned for at least one complete end-to-end implementation of outsourced distribution from early in 2018 – either in Tete, Zambezia province or from the Vilankulo IW.

The Bridging Phase will be funded from savings derived from the current phase of the PLM project in Mozambique and so no additional requests for funding having been made. The following plan shows the timelines and key steps for the Bridging Phase:

			02-Oct	09-Oct	16-Oct	23-Oct	30-Oct	06-Nov	13-Nov	20-Nov	27-Nov	04-Dec	11-Dec	18-Dec
Phases & Activities														
1,0 Initiation & Mobilization														
1,1	Alignment and Workplan													
	1.1.1	CMAM	■											
	1.1.2	Frontline/PLM	■											
	1.1.3	Work plan, Governance and Deliverables agreed	28-Sep											
2,0 Deliverables														
2,1	Routing Optimizatioin - Zambezia Province													
	2.1.1	Consolidate and check the the Zambezia database	■											
	2.1.2	Setup hardware and software in preparation for the pilot	■											
	2.1.3	Setup project package and equipment testing	■											
	2.1.4	Map all HC and routes for time and motion study. (With & w/out Prov.	■											
	2.1.5	Driver preparation and training for time and motion study.		■										
	2.1.6	Driver time and motion study with survey			■	■	■	■	■	■				
	2.1.7	Data from time and motion study to be checked/ scrubbed/ consolidated.				■	■	■	■	■	■			
	2.1.8	New data to me mapped for comparison.									■			
	2.1.9	Optimisation of routes using Route XL Scheduling tool									■	■		
	2.1.10	Revise costing & resources for direct vs. outsourced distribution										■		
	2.1.11	Deliver recommendation and findings to CMAM for Zambezia Province											■	■
2,2	Outsourced Distribution													
	2.2.1	Track performance of current 3PL (CA) in Tete province in line with SLA	■	■	■	■	■	■	■	■	■	■	■	
	2.2.2	Assist Village Reach with tender and selection of 3PL for 2018 contract					■	■	■	■	■	■	■	
	2.2.3	Identify and engage potential 3PL's in Zambezia and Vilankulo for 2018							■	■	■	■	■	
2,3	Logistics & Warehouse Capability Development													
	2.3.1	Assist with preparation for Delivery and Supply Chain conference	■	■	■	■								
	2.3.2	Review and support SOP development with J Durao for Vilankulo IW	■	■	■	■	■	■	■	■	■	■	■	■
Governance														
Steering Committee Meetings														■
Project Delivery Oversight - Status Update One-pager							■				■			

A full and comprehensive proposal was made to CMAM on 31 July 2017 for a second phase of a two-year period from January 2018 that would support CMAM as it moves to the actual implementation phase of the strategic PELF initiatives.

Given the short timeframe of the initial phase, the proposal remained focused on building on the three priority workstreams of Routing Optimization, Outsourced Distribution and Logistics Capability Development. In addition to the three workstreams building on the foundation work of the first phase, PLM will be well positioned to support CMAM more broadly in the establishment of a supply chain Visibility and Analytics Network (VAN) especially given CMAM's planned greater autonomy and centralized control.

The timelines by quarter for the key activities by workstream are set out below:

			2018				2019			
			Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Phases & Activities										
1,0		**Routing Optimisation**								
	1,1	Route Optimisation surveys - Remaining 7 provinces	■	■	■	■	■			
	1,2	Optimisation reporting & recommendations		■	■	■	■	■		
	1,3	Capability Development - Routing Manager			■	■	■	■		
	1,4	Implimentation of data mgt processes and systems			■	■	■	■	■	■
2,0		**Outsourced Distribution**								
	2,1	Tete province TSS with Village Reach	■	■	■	■	■	■		
	2,2	Vilankulo IW 3PL pilot			■	■	■	■	■	■
	2,3	Direct OD process and contract with 3PL and CMAM					■	■	■	■
	2,4	Documented end-to-end OD Process							■	■
	2,5	Regional OD workshops facilitation			■					
3,0		**Logistics Capability Development**								
	3,1	Support Vilankulo IW organizational capability build	■	■						
	3,2	Training and developement re 3PL and Optimization			■	■	■	■		
	3,3	Demand planning & Forecasting incl. HC processes				■	■	■	■	■
	3,4	Review and PSE input into Logistics SOPs	■	■	■	■	■	■	■	■
4,0		**Visibility & Analytics Network (VAN)**								
	4,1	Supply chain review and prioritization workshop	■							
	4,2	Support Policy and Governance development	■	■	■	■				
	4,3	Design Organization structure, roles and RACI			■	■	■	■		
	4,4	Define process maps, frequency and KPIs					■	■	■	■

Section 8: Conclusion

The PLM team is now engaged with setting up and preparing for the full route optimization study in Zambezia province. The report with recommendations will be issue to CMAM by 22 December 2017.

PLM thanks MISAU and CMAM for the opportunity to work on this meaningful and value-adding project in Mozambique in support of the PELF implementation. PLM also thanks all members of the Steering Committee including USAID for the continued guidance and support. Thanks also to PSM, Village Reach and CC Saude for the collaboration and Coca-Cola in Mozambique for giving so much of their time and sharing of private-sector expertise and intellectual property.

Glossary

IW – Intermediary Warehouse
DDM – District Warehouse
DPM – Provincial Warehouse
RTM – Route to Market
HF – Health Facilities
HC – Health Center
PELF - Strategic Plan for Pharmaceutical Logistics
SOPs - Standard operating procedures SOPs
CCS – Coca-Cola SABCO
3PL – Third party supplier
M3 – cubic meters

Annexures

Route Optimisation

1.1 Cost per KM model – live resource calculator template.
1.2 Optimised routes and results report for all 11 provinces - proposed IW Model

Outsourced Distribution

2.1 Outsourced Distribution Contract (English)
2.2 Outsourced Distribution Service Level Agreement – Coca-Cola (English)
2.3 Outsourced Distribution Service Level Agreement – Tete (Village Reach)

Capability Development

3.1 Job profiles and job descriptions for the IW roles
- 3.1.1 Warehouse Manager
- 3.1.2 Administrator
- 3.1.3 Inventory Control Manager
- 3.1.4 Inbound-Outbound Manager
- 3.1.5 Inbound Officer/Data Clerk
- 3.1.6 Outbound Officer/Data Clerk
- 3.1.7 Putaway Picker
- 3.1.8 General Maintenance
- 3.1.9 Technician
- 3.1.10 Truck Driver
- 3.1.11 Cleaner

3.2 Psychometric Assessments for the IW roles
- 3.2.1 Situational Judgment Test
- 3.2.2 Elite intellect Profile
- 3.2.3 IRIS
- 3.2.4 Personality Development Analysis
- 3.2.5 Elite Staffing Profile
- 3.2.6 Elite Transportation Profile

3.3 General Warehouse Standard Operating Procedure document
3.4 Standard Operating Procedures
- 3.4.1 Stock count procedure
- 3.4.2 Housekeeping standards
- 3.4.3 Incoming Primary Distribution procedure
- 3.4.4 Outgoing Distribution procedure
- 3.4.5 Route Settlement procedure
- 3.4.6 Breakages management
- 3.4.7 CCTV monitoring

3.5 Warehouse KPI
- 3.5.1 Warehouse KPI document

3.6 Warehouse Training Programs
- 3.6.1 Warehouse Competency Framework
  - 3.6.1.1 Levels of competence
  - 3.6.1.2 Examples of academies