

Vaccines Last Mile Delivery Project

Costing report

December 2019

Clinton Health Access Initiative

Executive Summary

The Uganda National Expanded Program on Immunization (UNEPI) in collaboration with National Medical Stores (NMS), and with funding from GAVI commissioned an 18 month pilot study in 3 districts (Nakaseke, Nakasongola and Wakiso). The pilot tested the feasibility and effect of the distribution of vaccines to the last mile through an outsourced logistics service provider (LSP). The pilot commenced in May 2018 and was implemented by UPS in partnership with Freight in Time.

Clinton Health Access Initiative (CHAI) was contracted to conduct a financial costing (i.e., monetary outlays or expenditures) of the pilot. An incremental costing approach/only additional costs of the last mile distribution process was adopted using a health sector – perspective. Costs were categorized as indirect and direct costs. Direct costs included costs for labor, vehicles, additional cold chain equipment, software and electronic reporting devices, fuel and perdiems. Indirect costs included costs for preparatory meetings, trainings and supervision visits. The costing excluded economic costs, patient expenses, vaccines and related supply costs. A costing tool was developed and updated with data from key informants and from accounting records on a monthly basis. The pilot was costed for the 18-month period.

The total cost of the pilot was valued at ~814,000USD with direct distribution costs contributing 28% of the total and indirect costs accounting for the largest proportion at 72%. This was attributed to contract management fees on warehousing and fleet management, and supplementary activities such as supportive supervisions. Labour costs accounted for the largest driver of direct distribution costs at 52% followed by capital costs at 32%. This was attributed to additional expertise to run the eLMIS, improve data quality and conduct stock counting during deliveries. The cost per kilometer was valued at 6USD. For future scale up considerations, building capacity of existing district staff to take on additional roles and exploring innovative transportation options such as solar powered active boxes could potentially lower direct distribution costs.

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List of Acronyms

3PL	Third Party Logistics
4wd	Four Wheel Drive
BCG	Bacillus Calmette Guerin
CCE	Cold Chain Equipment
CHAI	Health Access Initiative
DHT	District Health Team
DISC	Dashboards for Immunisation Supply Chains
DVS	District Vaccine Store
EPI	Expanded Programme for Immunization
FIT	Freight in Time
H/W	Health Centre
HC	Health Facility
HF	Human Papilloma Vaccine
HPV	Health worker
IPV	Inactivated Polio Vaccine
LMD	Last Mile Delivery/Distribution
LMIS	Logistics Management Information System
LSP	Logistics Service Provider
MoH	Ministry of Health
MS	Excel Microsoft Excel
NMS	National Medical Stores
OPV	Oral Polio Vaccine
PCV	Pneumococcal Conjugate Vaccine
PENTA	DPT HepB Hib (Pentavalent) Vaccine
PM	Program Manager
PMT	Project Management Team
TT/Td	Tetanus Toxoid Tetanus Diphtheria
UNEPI	Uganda National Expanded Program for Immunisation
UPS	United Postal Services
VCB	Vaccines Control Book
VVM	Vaccine Vial Monitor

1. Background

The Uganda National Expanded Program on Immunization (UNEPI) in collaboration with National Medical Stores (NMS), and with funding from GAVI commissioned an 18-month pilot study in 3 districts (Nakaseke, Nakasongola and Wakiso). The pilot tested the feasibility and effect of the distribution of vaccines to the last mile through an outsourced logistics service provider (LSP). The pilot commenced in May 2018 and was implemented by UPS in partnership with Freight in Time. Clinton Health Access Initiative (CHAI) was contracted to conduct a financial costing (i.e., monetary outlays or expenditures) of the pilot.

2. Objective of Costing

- To determine the total costs of the Last Mile distribution pilot including key cost drivers

3. Methodology

An incremental costing approach, ie only additional costs of the last mile distribution process, was adopted, using a health sector –perspective. Costs were categorized as indirect and direct costs. Direct costs included costs for labor, vehicles, additional cold chain equipment, software and electronic reporting devices, fuel and perdiems. Indirect costs included costs for preparatory meetings, trainings and supervision visits. The costing excluded economic costs, patient expenses, vaccines and related supply costs and indirect costs of the existing distribution system (eg labour, HF coldchain equipment). A costing tool was developed and updated with data from key informants and from accounting records on a monthly basis. Key informants included UNEPI representatives on the Pilot project management team, District health officers, District Cold chain technicians and EPI focal persons at district and health facility level, procurement personnel at UNICEF country office, personnel from the NMS Vaccines department and the FIT project management team.

Records reviewed included appointment letters to assess labour costs, mileage reports, perdiems payments and reports on capital purchases. Where information was unavailable, self-reporting and using market rates were applied. Data was collected on a monthly basis from May 2018.

Cost savings were determined by measuring wastage rates of the vaccines through health facility assessments at baseline and endline. For details on the assessments, refer to the LMD baseline and endline reports.

Costs were categorized into two broad categories; Direct and Indirect distribution costs. For the existing distribution system, only direct distribution costs were assessed.

Table 1: Direct distribution cost categories

Cost category	Costing elements	Data source
Transportation labour/ Personnel	job title and # of people involved: (driver, DCCT, DCCA) 8 salaried staff in Nakasongola, 3 in Wakiso and 2 in Nakaseke monthly salary # of hours dedicated to distribution of vaccines	DCCT, DHO interviews, FIT expenditure data
Maintenance	Maintenance item (vehicle or cold chain equipment) either aggregated annually/broken down. Cost based on estimates from district local government expenditure on vehicle maintenance,	DCCT, DHO interviews, FIT expenditure data
Vehicle purchase	Type of transportation and detailed description (motor cycle/double cabin) # Of vehicles-Nakasongola and Wakiso each had one car. Nakaseke had a motorcycle in addition to a car purchase price – accounting life years % of capacity apportioned to vaccines storage % of time apportioned to vaccine distribution	DCCT, DHO, UNICEF procurement interviews, FIT expenditure data
Distribution fuel	Fuel receipts mode of transportation (each district provided the total distance travelled per delivery cycle Mileage Km/l Fuel unit cost Distance (km) per route of delivery per delivery cycle # of cycles fulfilled by district per year	DCCT, DHO interviews, FIT expenditure data

Perdiems and allowances	Per-diem per delivery cycle # of people receiving per-diem per cycle # of delivery cycles per year	DCCT, DHO interviews, Excel file FIT expenditure data
Health facility pick ups¹	Summation of transportation cost for only among HFs reporting Pick up of vaccines from the DVS or from another HF	Health worker interviews, HF Baseline data collection tool
Accessories (other equipment)	Tablets, Cold boxes, eLMIS software,	FIT expenditure data

Table 2: Indirect distribution cost categories

Cost category	Costing elements	Data source
Planning and Preparation	DHT and MOH –UNEPI meetings	FIT expenditure data
	eLMIS training	
Oversight and coordination	Project Management Meetings (PMT)	PMT expenditure data
	Supportive supervision visits	

Costing assumptions

- Costing excluded health system costs such as health worker salaries, time apportioned to distribution processes and vaccine costs, or costs incurred during outreaches
- Costing period for Existing LMD –2017-2018FY
- Exchange rate: 3,700 USD
- Costing assumed only direct costs provide a true representation of actual pilot distribution costs and were compared against effectiveness data
- Costing period of the Existing distribution system was June 2017 –May 2019

¹ Applied only for the Existing distribution system, i.e. before the pilot

- Costing period of the FIT pilot distribution system was July 2018 –December 2019. This figure was annualized to compare against effectiveness data
- All Depreciation in the costing tool is calculated using straight-line depreciation². Straight-line Depreciation refers to the value of the equipment/building/vehicle for each year of life, which is calculated by dividing the purchase prices by the number of years of useful life. An asset's useful/accounting life is the period of time for which the asset will be economically feasible for use Vehicles and equipment were assigned 5 accounting lifer years

Costing limitations

- Costing of the existing last mile delivery system was largely based on interviewer recollection of events (self reporting) due to limited data sources, posing a risk of under or over valuing the existing distribution system
- Total direct distribution costs were equally apportioned to each of the 3 districts which may not be representative of actually district share of costs
- Costing savings from reduced wastage rates were not assessed due to limited data at health facility level
- The costing did not include sensitivity analyses to assess the variations in inputs

4. Results

The total cost of the existing last mile delivery system was valued at ~814,000 USD annually, with indirect distribution costs accounting for the largest proportion at 72% (~585,000USD)

Table 3: Total pilot costs broken down by direct and indirect categories

Category	Cost over 18 months	Annual cost	% share of total costs
Direct distribution by key cost drivers	\$343,473.17	\$228,982.11	28%
Indirect Distribution costs	\$866,068.01	\$585,899.06	72%
Total----->	\$1,209,541.17	\$814,881.17	

² Supply Chain Costing tool User’s Manual 2013, USAID, Deliver Project

Direct distribution costs

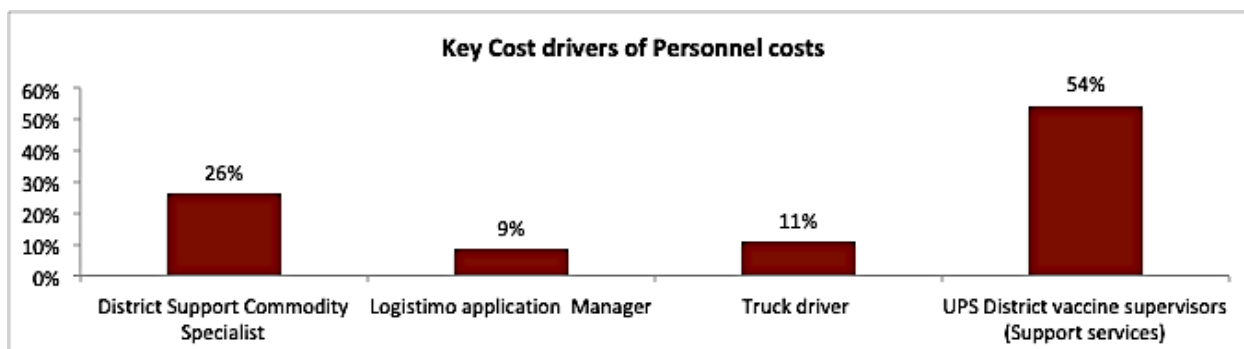
Personnel costs

Direct distribution costs accounted for an annual cost of 228,000USD, with personnel/labour costs accounting for the highest cost driver at 52%. This was attributed to the need for additional expertise to run the electronic LMIS system, improve data quality at district and health facility level through data cleaning exercises and to ensure compliance to stock management practices such as First –In –First out to avoid expiries, and monthly physical counting to avoid closed vial wastages

Labour costs included salaries of all personnel involved in the distribution process including; Refer to Annex 1 for details on a detailed description of roles

- a) District Support commodity specialists and team lead; responsible for working with the District Coldchain Technician with packing of vaccines before dispatch and managing replenishments including stock counting at facility level
- b) Distribution system planner/eLMIS application manager: responsible for running eLMIS software back-end analytics for incoming orders and processing of deliveries
- c) Truck driver: responsible for transportation and storage of vaccines in the
- d) District vaccine supervisor: Working closely with the DCCT and commodity specialist to provide oversight and ensure quality of distribution process.

Figure 1: Breakdown of personnel/labour costs by percentage of cost share



Building capacity of existing district staff including the DCCT to take on additional roles could reduce high labour/personnel costs during direct distribution.

Capital costs

Capital costs accounted for the second highest budget driver of total direct distribution costs at 32.4% (~74,000USD). These included costs of vehicle purchase, eLMIS software, tablets and cool boxes. These costs were depreciated over 5 years. The pilot was run on 3 Single Cabin Pickups (Isuzu 4x4 High Ride) with refrigerated and ambient bodies and 1 motorcycle for the 3 districts. An additional stand by pick up was used for coldchain and supervision activities.

The e-health logistics information management software (Logistimo) was customized to capture data as per the existing paper based logistics information system. Cool boxes were used to ensure temperature monitoring during motorcycle based trips and during movement of vaccines from the district store to the LSP vehicle. Tablets were used for ordering and stock management

Recurrent costs

Recurrent costs were the least cost drivers of total direct distribution costs at 15.5%. Costs included fuel, perdiems, vehicle maintenance costs and Internet connectivity costs for the ehealth LMIS software.

Table 4: Breakdown of direct distribution costs

Cost category	Direct distribution by key cost elements	Cost over 18 months	Annual cost	% Share of total cost
Personnel (52.2%)	Labour cost	\$179,209.66	\$119,473.11	52.2%
Recurrent (15.5%)	Vehicle Maintenance costs	\$6,693.03	\$4,462.02	1.9%
	Fuel costs	\$11,802.84	\$7,868.56	3.4%
	Allowances and perdiems	\$31,948.65	\$21,299.10	9.3%
	Accessories -Data for Internet connection	\$2,629.19	\$1,752.79	0.8%
Capital (32.4%)	Vehicle purchase	\$48,280.54	\$32,187.03	14.1%
	Accessories -Tablets	\$3,851.35	\$2,567.57	1.1%
	Accessories -Cool boxes	\$5,083.78	\$3,389.19	1.5%
	eLMIS software	\$53,974.11	\$35,982.74	15.7%
	Total ----->	\$343,473.17	\$228,982.11	

Indirect distribution costs

Contract management (CM) costs accounted for more than 90% (~550,000USD) of indirect distribution costs. CM costs included costs for warehousing and fleet management, office space, stationery, furniture and related utilities (water and electricity bills) and FIT/UPS project management team salaries and related benefits. Other indirect costs included costs for entry meetings with the districts to secure buy in from administrative and political leadership, training of UNEPI and district staff on the pilot operations and eLMIS software, project management team meetings and field visits for supportive supervision and mentorship. These additional activities were implemented to identify and resolve emerging pilot challenges within a timely manner. For details on the outcomes of the project management meetings and supervision visits, refer to the CHAI progress report on oversight and coordination function

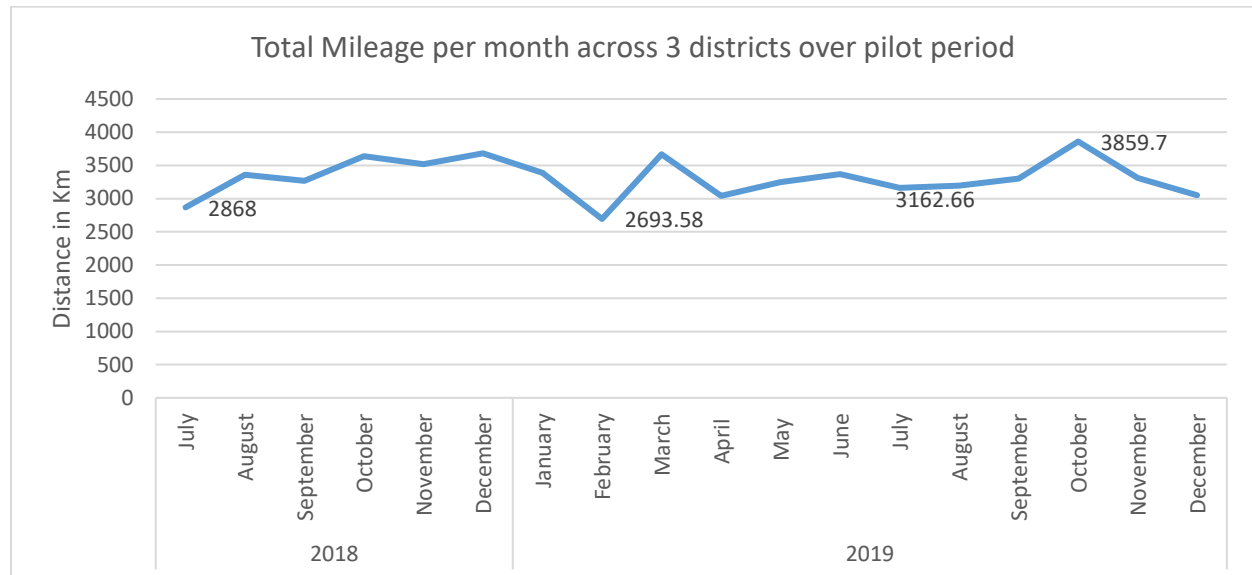
Table 5: Breakdown of indirect distribution costs

Indirect Distribution costs	Cost over 18 months	Annual cost	% share of total cost
Logistimo training	\$8,268.46	\$8,268.46	1.0%
Preparatory meeting with DHT	\$1,202.92	\$1,202.92	0.1%
Preparatory visits with District	\$2,585.90	\$2,585.90	0.3%
UNEPI training	\$13,503.89	\$13,503.89	1.6%
LMD PMT meeting	\$245.95	\$163.96	0.0%
Supportive supervision	\$6,677.15	\$4,451.43	0.8%
Contract Management	\$833,583.73	\$555,722.49	96.2%
Total ----->	\$866,068.01	\$585,899.06	

Cost per Kilometer

The total mileage of the distribution process was 58,055Km for all 3 pilot districts. The cost per kilometer was valued at ~6USD over an 18-month period. This is roughly 6 times more than the average cost per kilometer for last mile distribution of essential medicines which was estimated at 1.2USD annually as at 2019.

Figure 2: Total kilometers travelled during monthly distribution across 3 districts over 18 months



Cost savings

Cost savings resulting from reduced wastage were not ascertained due to limited data at health facilities throughout the pilot implementation period despite health worker capacity building.

Cost per capita

The cost per capital based on a target population of 124,093 surviving infants in all 3 pilot districts was valued at 1.8USD annually. Cost per capita based on a population of 2,969,900 was valued at less than a dollar (0.8USD)

Cost per child immunized

The cost of immunizing a child against Penta vaccine during the pilot was valued at ~2USD annually (ie 228982.11USD/120510)

Cost of the Existing Direct distribution system

Note: Due to limited data sources on costing the existing last mile delivery system for vaccines the data below should be interpreted with caution.

The existing Direct distribution system was valued at ~31,000USD with Recurrent costs accounting for the largest cost driver at 42%.

However, given the limited data sources to verify actual expenditures, estimates on costs were applied based on individual responses and market rates.

In addition, the baseline found that 76% of HFs picked vaccines from the district with only 1% reporting district direct deliveries to HFs.

The total value of the existing direct distribution system should be reviewed with the above context.

Recurrent costs included vehicle maintenance, allowances, fuel and costs incurred by health workers to pick up vaccines. Maintenance costs were particularly the largest cost driver of recurrent costs at 31%. This could be attributed to the decentralization of services resulting in different costs per district on fleet management. This trend shifted with the implementation of an outsourced model through the pilot. Maintenance costs accounted for 1.9% of total direct distribution costs, likely due to economies of scale from a centralized fleet management.

Table 6: Breakdown of indirect distribution costs – Existing last mile delivery system

	Cost breakdown by key cost drivers	Total costs	%
Personnel (21%)	Transportation labour	\$6,752.88	21%
Capital (36%)	Vehicle -Purchase	\$11,486.49	36%
Recurrent (42%)	Maintenance	\$9,729.73	31%
	Allowances	\$637.84	2%
	Fuel	\$2,338.39	7%
	Pick up (by Health workers)	\$717.30	2%
	<i>Total</i>	<i>\$31,662.63</i>	

To assess the ICE for the pilot, the change in cost and effectiveness data of the existing distribution system were measured against data from the pilot. The incremental cost of immunizing a child with DTP through the pilot was estimated at 23.64USD. The cost of immunizing a child was valued at 39.42USD³

³ *Costing of immunization service delivery in Uganda, 2016, WHO*

Table 7: Incremental cost effectiveness of the Piloted Last Mile Distribution system

	Annual Number of children immunised – Penta3	Annual Direct distribution cost
Existing LMD (June 2017 –May 2018)	112164	\$31,662.63
Pilot LMD (June 2018 – May 2019)	120510	\$228,982.11
	Incremental effectiveness	Incremental cost
ICE	8346	197,319
ICE ratio = (197319/8346) ICER = 23.64		

5. Key take-aways

CHAI identified the following key takeaways from the costing exercise.

- a) The pilot distribution system required high labour costs at the start, however, for future scale up considerations, building capacity of existing district staff to take on additional roles could lower direct distribution costs
- b) The pilot distribution system shifted the share of key cost drivers in the distribution process. Lower maintenance costs as a proportion of total direct distribution costs were reported with the pilot at 2% compared to the existing distribution system at (30%). This could be attributed to the economies of scale from centralized vehicle and cold chain management through the outsourced model
- c) The midline assessment showed vehicles were not used exclusively for distribution, as deliveries were completed within 1-2 weeks per monthly cycle. This presents an opportunity to serve additional sites/districts to ensure optimal efficiencies and lower distribution costs
- d) For future considerations, CHAI recommends exploring use of alternative and innovative transportation options such as solar-powered active boxes for designated routes to further lower the cost of transportation of vaccines at the last mile

Annex:

Table 8: Roles and Responsibilities of pilot distribution staff

Position:	District Commodity Support Specialist (4 staff working in all districts, deployed as work requires, at any one time at least one in a district)
Overall Objective	Support to health facilities on stock management and ordering; delivery of health commodities between District Vaccine Stores and health facilities in line with distribution schedules and quality management protocols.
Works description	<p>In order to achieve the objective above, the employee shall among others, execute the following tasks:</p> <ol style="list-style-type: none"> 1. Support HF users on and manual stock records management as well as update of stock records and orders into the LMIS. 2. Understand delivery & Proof of Delivery process as per LMIS & quality SOPs. 3. Ensure assigned vehicle(s) are maintained in good mechanical condition to deliver product. Observe all traffic regulations during deliveries. 4. Receive and execute delivery instructions on a daily basis as per delivery protocol in place; effectively communicate with health facilities before during & after delivery. 5. Manage all products received, maintaining them in proper temperature and safe, tamper proof condition up to delivery and account for product delivered and or returned to base via electronic and manual systems in place. <p>Other duties as assigned.</p>

Position:	Driver (3, 1 per car and a rider)
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Overall Objective	Safe and timely delivery of health commodities between District Vaccine Stores and health facilities in line with distribution schedules and quality management protocols.
Works description	<p>In order to achieve the objective above, the driver shall among others, execute the following tasks:</p> <ol style="list-style-type: none"> 1. Understand Delivery & Proof of Delivery process as per LMIS & quality SOPs. 2. Ensure assigned vehicle(s) are maintained in good mechanical condition to deliver products; and observe all traffic regulations during deliveries. 3. Receive and execute delivery instructions on a daily basis as per delivery protocol in place. 4. Manage all products received, maintaining them at recommended temperature and in a safe tamper proof state up to delivery. 5. Execute any other duties as may be assigned.

Position:	Distribution system planner (1 position supporting all districts) /Logistimo manager
Overall Objective	Objective: Plan, Monitor & Evaluate Optimized Health Commodities distribution at District Level; Provide Administrative support to field teams
Works description	<ol style="list-style-type: none"> 1. . Manage and Support the development &continuous review of LMIS driven pickup to delivery process between districts and Health Facilities as well as deviation protocols; Manage set project constraints e.g. temperature & timelimits. 2. Plan & continuously review delivery route plans in liaison with field teams. Monitor field team compliance with delivery protocol and planned. 3. Design and implement trainings and other corrective actions to address deviations from project plans and protocol as revealed by periodic assessments 4. Independently collect & analyze data in order to measure performance against project indicators.

	<ol style="list-style-type: none"> 5. Prepare project M&E reports, contract progress reports and accountability statements. Analyze reports from mainstream project M&E team & propose corrective action where needed. 6. Create information to support the Finance team. 7. Provide Administrative and resource management support to field teams.
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Position:	District Commodity support team leader (One position supporting all districts)
Overall Objective	Manage & Implement Optimized Health Commodities distribution at district level
Works description	<ol style="list-style-type: none"> 1. Support the development & continuous review of the Commodity pickup, delivery & POD process from district to Health Facilities. 2. Create & implement monthly delivery plans to over 200 Health Facilities in liaison with the district teams. 3. Plan Daily Trips in line with delivery route plans. Coordinate with district staff to pack Health Commodities according to distribution plan. Give support where necessary. 4. Mobilize the district human and other resources to execute delivery trips and provide accountability in a timely manner as per system for the same. 5. Manage Vehicle Maintenance schedules on a continuous basis. 6. Manage all manual and electronic proof of delivery documentation. 7. Manage product returns & accountability of stock in transit between districts Health facilities until PODs are obtained. 8. Train delivery agents and ensure compliance of Field team with established delivery protocol.

Position:	District Vaccine supervisors
Overall Objective	The District supervisor shall be responsible for ensuring that Health Facilities receive their vaccines from the district in the right form, quantity, at the right time, all the time and work to support the DCCT and DHO to ensure that all risks are identified and challenges resolved for issues affecting vaccine supply chain.
Works description	<p>Project Management</p> <p>Act as the liaison person between FIT and BLL on all matters to do with the flow of vaccines from NMS to the Districts</p> <ol style="list-style-type: none"> 1) Closely work with partners, districts to ensure that health facilities consistently receive vaccines in line with the distribution schedule and on time 2) Update the Project Manager about the district activities and emerging issues immediately 3) Participate in project implementation review meetings by providing insights on key challenges and workable recommendations for their resolution 4) Undertake regular visits to the district and selected health facilities to appraise the distribution process and pick up issues that need attention to ensure smooth receipt of vaccines 5) Establish a good working relationship with the District Cold Chain Technician (DCCT) so that he commits to his role in order to increase the likelihood of success during implementation 6) Familiarize yourself with the district vaccines management standard operating procedures (SOPs) including key documentation required to ensure accountability for all vaccine stock <p>Reporting</p> <ol style="list-style-type: none"> 7) Develop and share weekly and monthly reports based on the project key deliverables and circulate them on a timely basis

8) Participate in the collection of data on the execution and performance of the project on a timely basis as and when required

Financial

9) Demonstrate integrity in the course of your work and provide accountability for funds/resources used to support the implementation of project activities in line with FIT procedures