



17th TechNet Conference

Panama City, Panama | October 16-19, 2023

Immunization Programmes That Leave No One Behind

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Impact of Air-travel logistics on access and availability of routine vaccines.

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Introduction.

Is there a 'faster' way to deliver vaccines and related health commodities?

- Sub-national air distribution of vaccines has been in consistent operation in one county – Turkana.
- Following Covid-19's outbreak and logistical requirements, vaccine air transportation was expanded to more regions, improving and shortening availability and access of the vaccines in these regions.
- In the wake of the Covid-19 pandemic, air transport has been expanded to cover routine vaccines and other immunization supplies in regions with reduced accessibility.

Hypothesis:



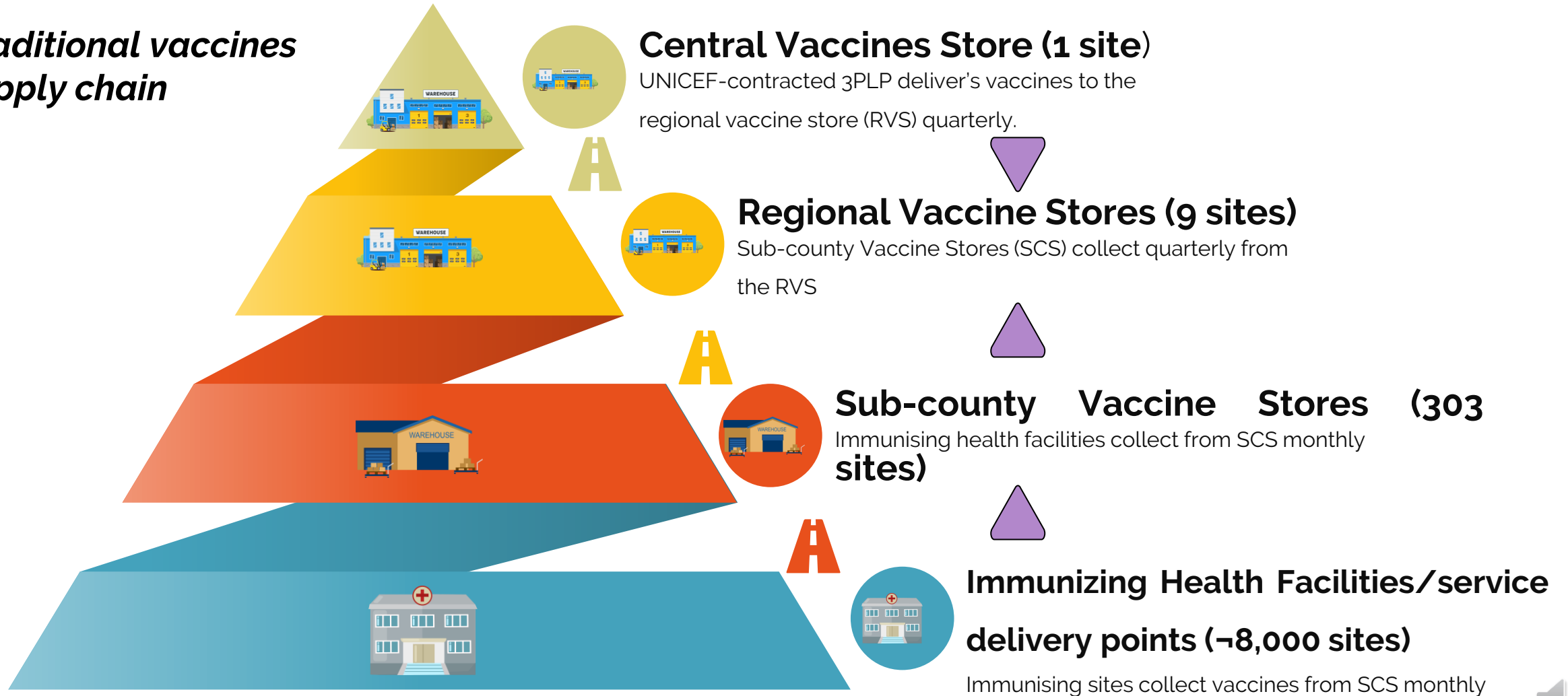
- Coordinated air travel logistics in collection and supply of vaccines and other health commodities would increase access and availability of vaccines at last mile, leading to timely delivery of immunization services.



Background.

Kenya's vaccines supply chain is a 4-tiered system, The average turnaround time for delivery between the CVS and IHFs is 14 days.

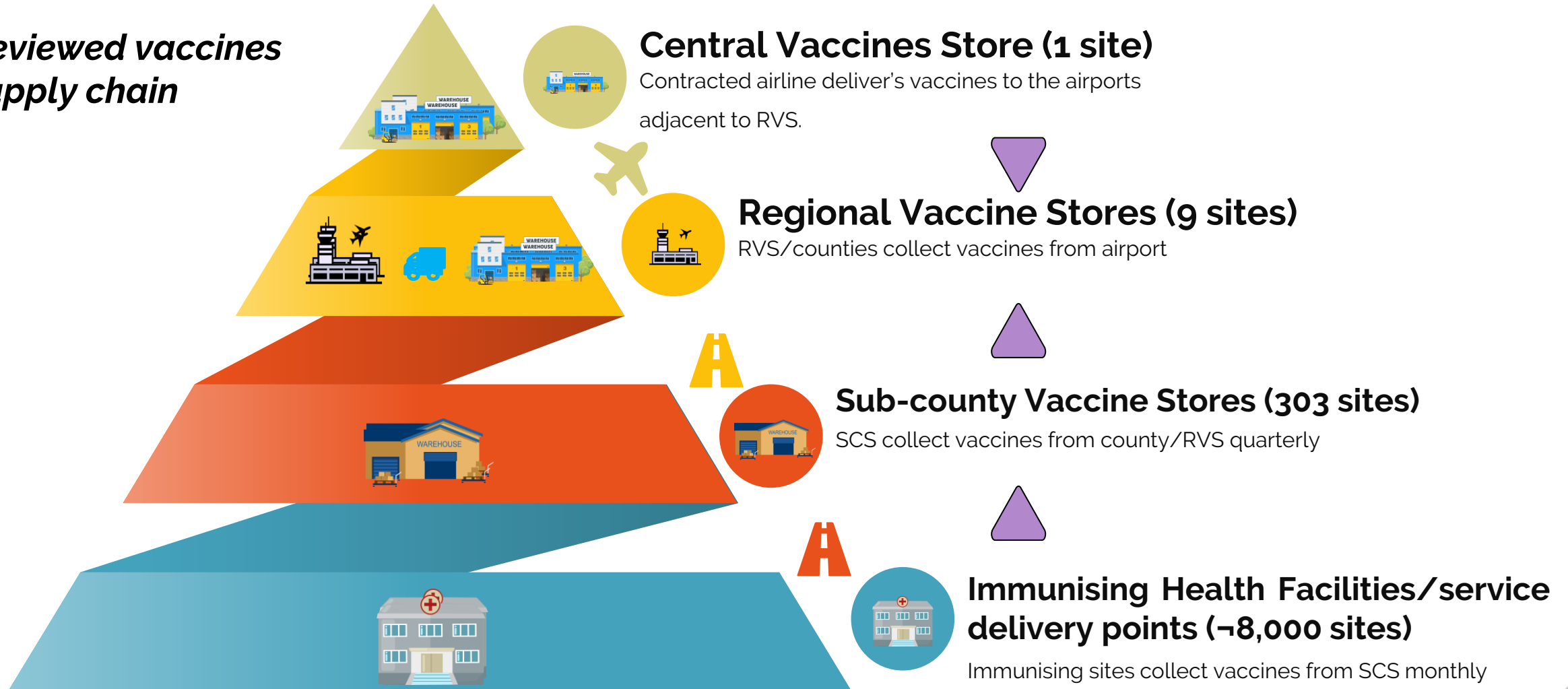
Traditional vaccines supply chain



Background.

Kenya's vaccines supply chain is a 4-tiered system, The average turnaround time for delivery between the CVS and IHFs is 14 days.

Reviewed vaccines supply chain



Methodology

Integrated distribution plan was updated to utilize air-travel for effective and efficient movement of vaccines.

- In collaboration with NVIP and other supporting stakeholders, regions and counties in urgent need of vaccines, including COVID-19, were identified. Vaccines orders were placed through Chanjo eLMIS at the sub-county or RVS level.
- Mapping was carried out based on the availability of airport/airstrips.
 - No. of regional vaccines stores (with access to air transport): 5/9
 - No. of directly impacted counties: 26/47
 - Total No. of airports and airstrips: 5
 - Review period: 2021 - 2022 (On-going)
- Sourcing for airlines was carried out based on route, timing and cost. Costing was based on volume and capacity of the aircraft in service on the route(s).
- Correct packaging was done to ensure the quality and efficacy of vaccines using conditioned ice packs. Real-time weighing and temperature-tracking devices were used to monitor potency of vaccines.
- Cold boxes were used for transporting vaccines to departure airports, and from arrival airports to county/sub-county vaccine stores, and IHFs, via ground transportation.



Results:



Air travel:

- Improved timeliness in the access and availability of vaccines and related health commodities.
- Minimised missed opportunities/defaulters by contributing to uninterrupted service delivery.
- Had direct impact of ~**50%** on 2 major supply levels ; i.e., 56% on regional vaccines stores (5/9) and 55% (26/47) for counties.
- Integration of air freight in vaccines distribution reduced distribution cost.



Challenges and feasible solutions



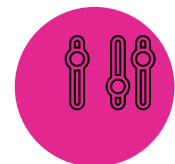
Can not carry out last mile distribution to the service delivery points.

Integrate other modes of transport available (i.e. road/ water)



Low number of airports/airstrips

Integrate other modes of transport available



Overtime/ extra working hours (pre-packing/ airport dropping/picking)

Flexible and adequate human resource; allowance; incentives such as off days.



Immediate cash payment before delivery

Quick fund acquisition/ access processes



Strict flying timings and schedules (cargo)

Advance scheduling/ distribution-planning of products



Lessons learnt and opportunities:

- Despite it being a mixed model of vaccines distribution (air and road/water where feasible); utilization of airfreight is way cheaper and faster.
- Air freight, as a mode of vaccines distribution has significant logistical advantages in emergency and/or pandemic events.
- Based on the geographical set up of a country, more than one mode of vaccines distribution can be applied.
- Coordination of key stakeholders at all supply chain levels is important to have a successful air freight mode of distribution.
- Air freight is a quick alternative in averting wastage, especially closed vial i.e. short-expiry and VVM changes, through quick re-distribution.



Recommendations

(Take home message)

Considering the economies of scale, the utilization of air freight for distributing vaccines should be contemplated with regard to:

Velocity: Air freight enables the rapid transportation of vaccines, covering vast distances in considerably shorter durations.

Efficiency: It offers a superior turnaround time, ensuring more favourable lead times for vaccine deliveries.

Economy: When compared to exclusive road transport, air freight tends to reduce overall costs, taking into account several factors, including:

- Human Resources: The need for extensive human resources is minimized in air freight operations.
- Vehicle Maintenance: Maintenance costs associated with vehicles are significantly lower in air transport.
- Security: Air freight often provides enhanced security measures, reducing the risk of vaccine pilferage or tampering.
- Mitigation of Vaccine Wastage: Quick delivery through air freight helps in averting vaccine wastage, ensuring their effectiveness and availability.



Conclusion.

The utilization of air freight is crucial in:

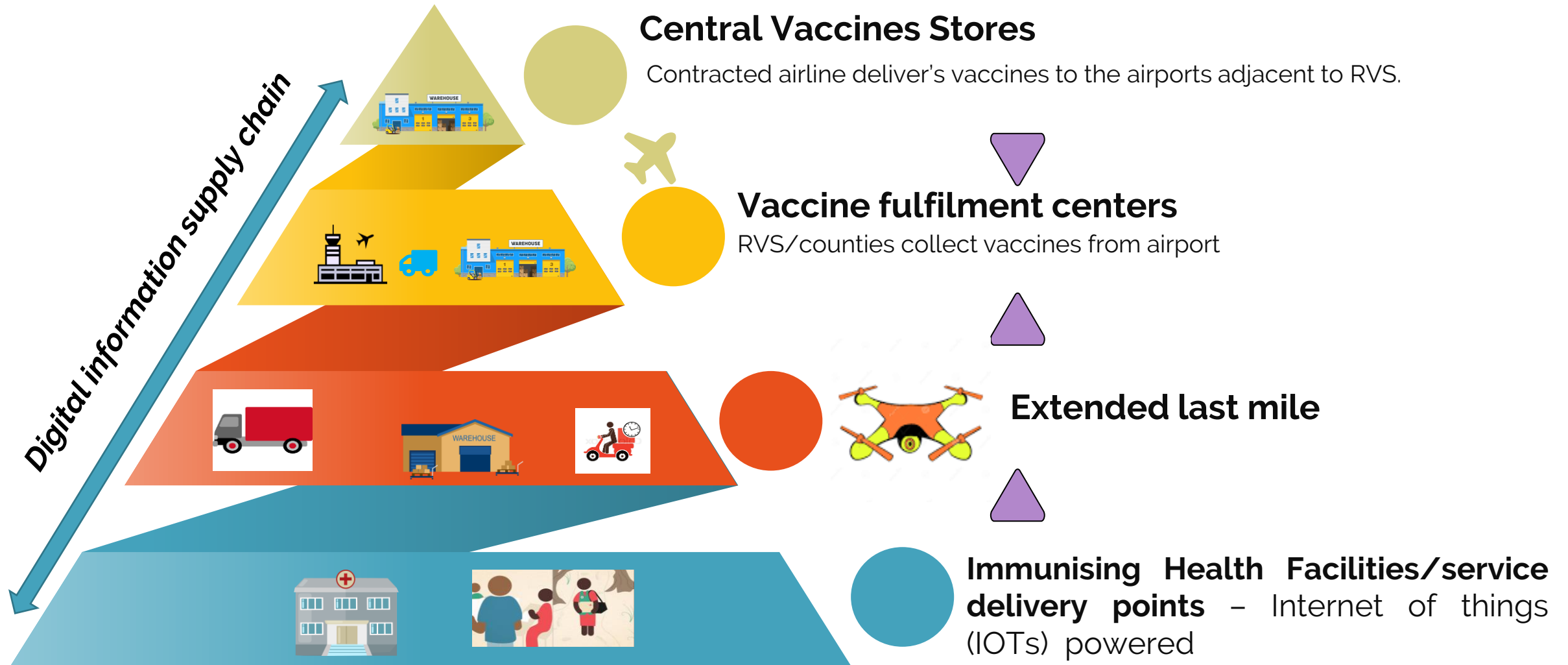
- *Streamlining the distribution of vaccines and related health products, thereby reducing turn-around and lead times.*
- *Enhancing accessibility and availability of vaccines while ensuring their potency and effectiveness.*

However, further investigation is required to study full implementation and scalability of this approach for routine vaccines distribution.



The future

Business at the speed of thought





Thank You!

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Drone logistics enables routine, emergency, and campaign immunizations for hard to reach and remote communities

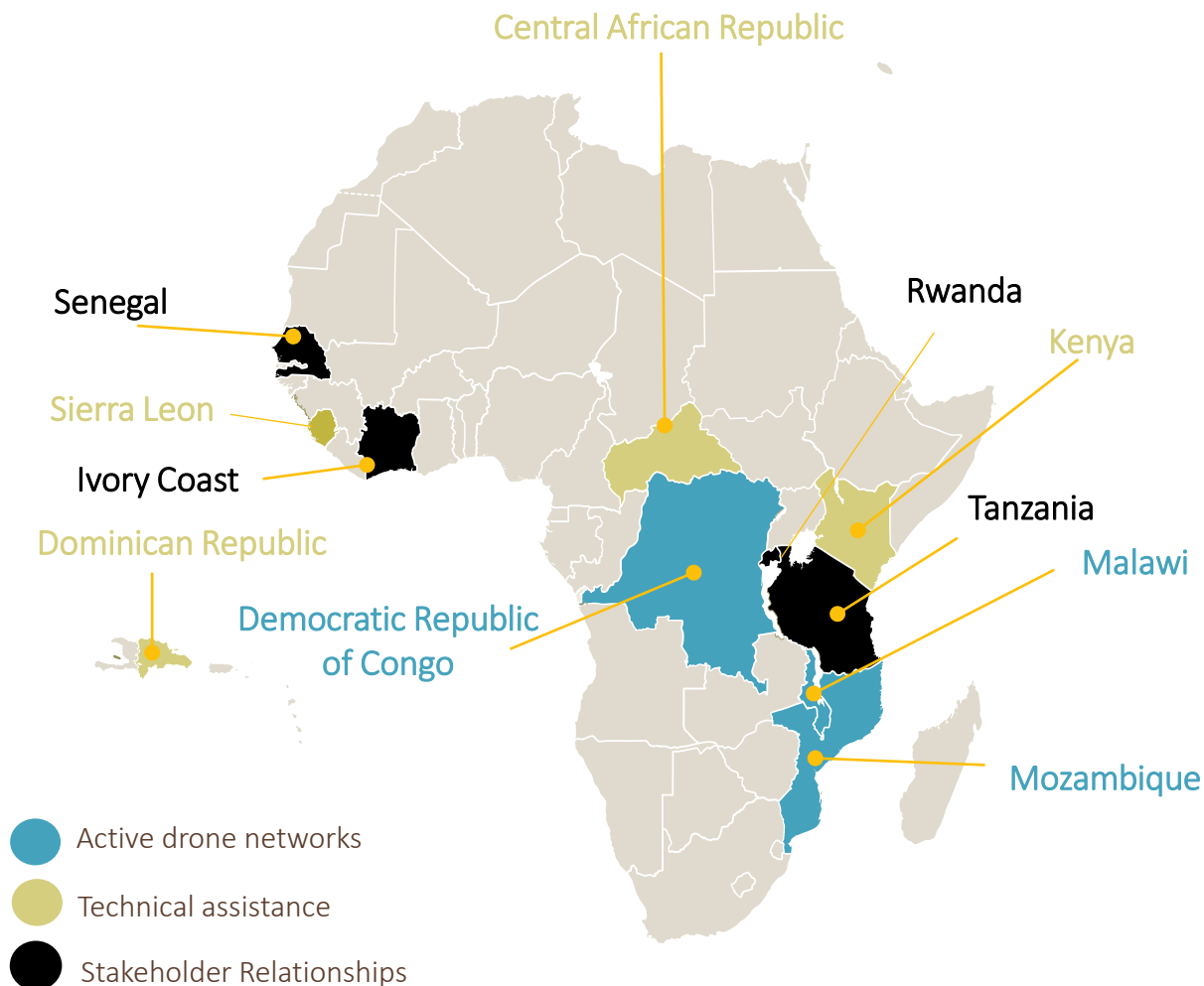
- Evidence of benefit from scaled up operations -

**Dr. Olivier Defawe,
Director, Outsourced Drone Transport Lead
VillageReach**

**Founder & Coordinator of the UAV for Payload Delivery
Working Group (UPDWG)**

October 17, 2023

VillageReach's Outsourced Drone Transport Solution since 2015



12,000+ flights, 500K+ km flown
5,000+ hours flight time



370,000+
Vaccine doses delivered



9,800+
Lab samples collected



100+
Health facilities served



260,000+
People directly served

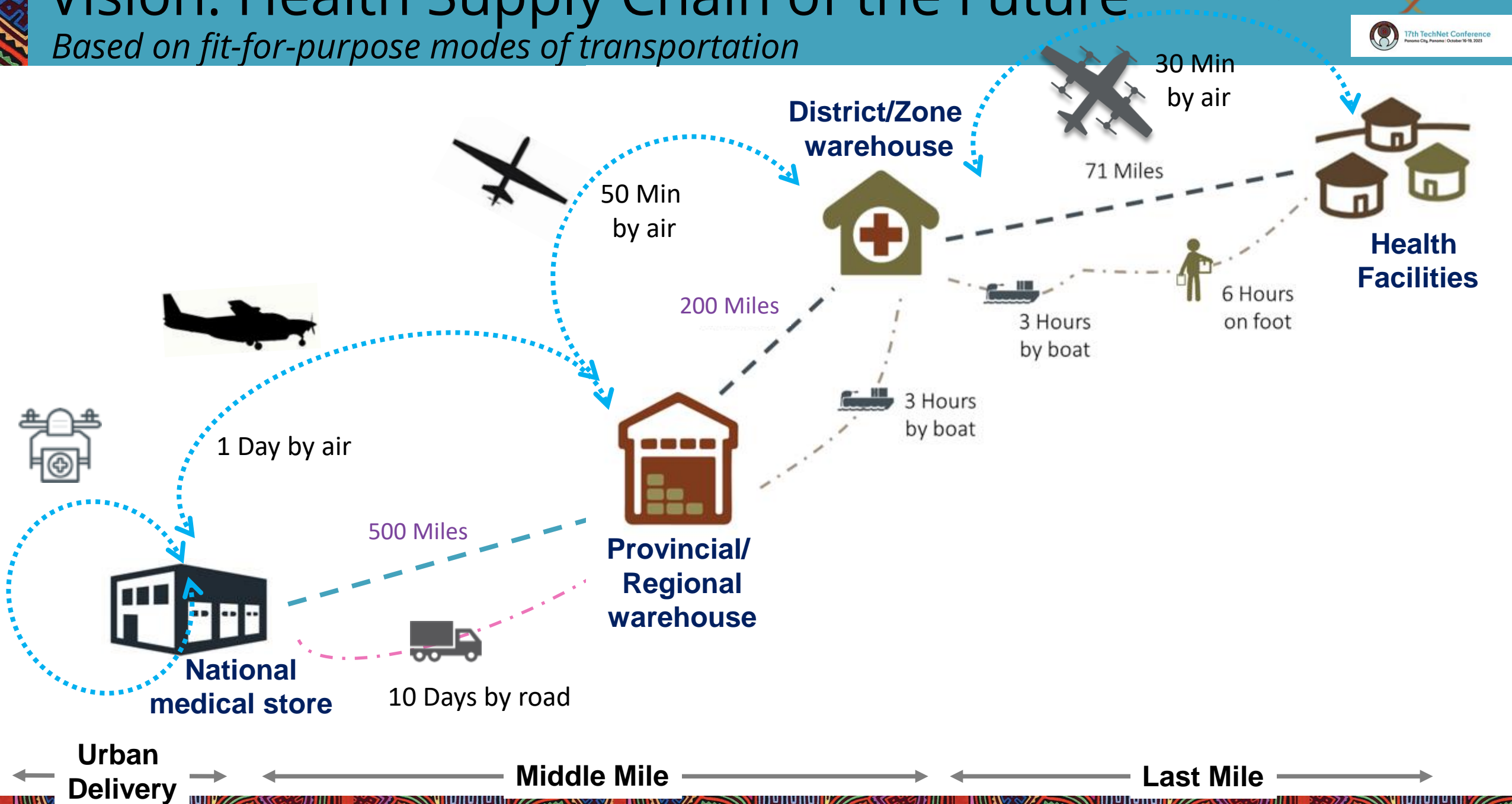


1M+
People indirectly served

As of March 2023

Vision: Health Supply Chain of the Future

Based on fit-for-purpose modes of transportation



Different Technologies for Different Uses



(DroNet, RigiTech
Swoop Aero,
Phoenix Wing)

- Short-range (<150km) drones, small to medium payload (1 – 10kg), Vertical Take-Off and Landing (VTOL)

Last mile & Urban deliveries: Sub-national storage to service delivery level OR Urban delivery



(Pyka Pelican)

- Long-range drones (>150km), medium to heavy payload (10 – 100kg), fixed wings needing take-off & landing strip

Middle mile deliveries - National storage to sub-national level



(Xwing
autonomous
Cessna Caravan)

- Long-range drones (>150km), heavy payload (100kg – 2T)

First mile - Cross boarder deliveries



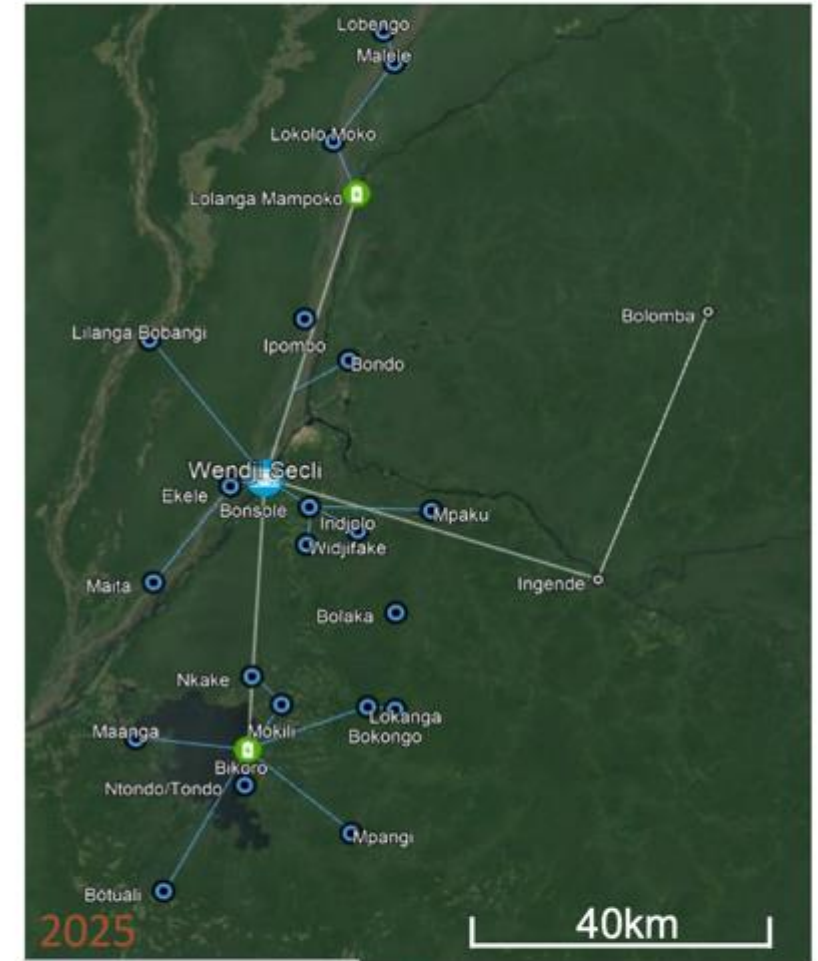
Outsourced Drone Transport in the DRC



Location: Equateur Province (103,902 km²)

Scope: Began in Dec 2020, now supplying 40 health facilities via 24 landing sites

- Bi-directional drone network is one of the largest in the world: 37,445 km²
- Drone hub ~30 min by road from provincial warehouse
- BVLOS flights of 15-60 min, landing at the remote facilities
- Drone battery change (stopover) for longer distances (> 115 km)



	2023	2024	2025
Our Expected Impact	1 province	3 provinces	5 provinces
	115 health facilities	145 health facilities	175 health facilities

DRC Routine Drone Transport

Primarily 20 Immunization Products & Lab Samples

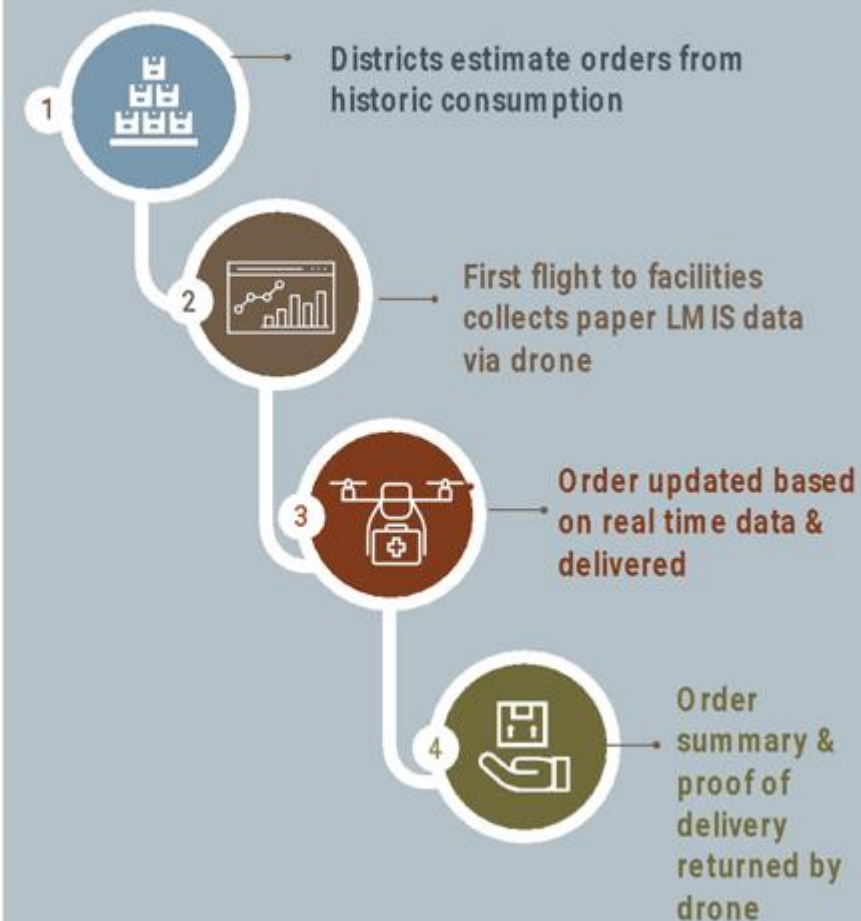
Monthly & on demand transportation for 40 communities:

1. Exclusive drone transportation for immunization products
2. Lab samples & reports
3. Emergency orders of other products

Outsourcing drone transportation to Swoop Aero:

- Bi-directional, electric, VTOL drones
- 3 kg & 5.4 L capacity
- 90-115 km/hr, 115km range
- Satellite connectivity and visual targets for areas without mobile access
- Fully local drone team

DYNAMIC RE-SUPPLY



DRC Routine Drone Transport: Accomplishments

30 Dec 2020 – 31 July 2023

5,004 flights in 413 days

1,845 product deliveries both ways

2,233 flight hours

225,031 km flown (2-6 drones)



40 health facilities

supplied with immunization products

via **24** drone-landing sites



1,862 kg (volume of 7,275 L) delivered

vaccines + lab samples, reports + medicines, PPE



131,907 people directly benefitting from products flown by drone, including:

- 76,858 children < 1 year,
- 25,911 pregnant women,
- 29,120 people of all ages,
- 18 (community) health workers



1M+ people indirectly benefitting

347,037 vaccine doses*

120,111 diluents + 185,589 syringes + 18,148 adaptors



438 lab samples

85 test results (5 positive)

311 reports + 4 product order forms
15,328 vaccination cards + 100 tally sheets



485 PPEs for COVID-19
14 blisters + 16 vials of medicines
102 collection kits + 23 other products



* Additional products moved by road

Higher availability of immunization products & faster transport after drone introduction

KEY INDICATORS	Baseline Apr – Sep 2020	Target	Endline Jan – Jun 2022	Trend
Hard-to-reach health facilities (drone landing sites)				
Vaccine availability <i>(last 3 months)</i>	65%	80%	98%	↑
% facilities with stockouts. <i>(last 3 months)</i>				
• Pentavalent	6%	0%	0%	↓
• Measles	12%	0%	4%	
• Yellow fever	18%	0%	0%	
% facilities taking 2+ days to get vaccines	65%	0%	0%	↓
% facilities stocked according to plan	32%	80%	98%	↑
% AFP (polio) samples received at provincial EPI within 2 days <i>(Drones and ground transport)</i>	35%	80%	69%	↑

Endline evaluation results are consistent with prior trends seen in the 1st and 2nd midterm evaluations (data collected over 18 months)

Health Workers & Community Perception

Higher availability of immunization products with drone transport (from 65 to 98%)



*“We are happy, before to stock up on vaccines, we took the lake route but with the drone project, our hospital no longer lacks vaccine”
(Community member from Maanga health center in Bikoro health zone)*

*“This ‘plane’ brings us the vaccines. Ingende is far from here. Before, we went to get the vaccines in Ingende, sometimes it loses coldness on the way, which was not good and today, we have the vaccines available thanks to the drone”
(Community leader from Mpakuin health center in Ingende health zone)*



Health Workers & Community Perception

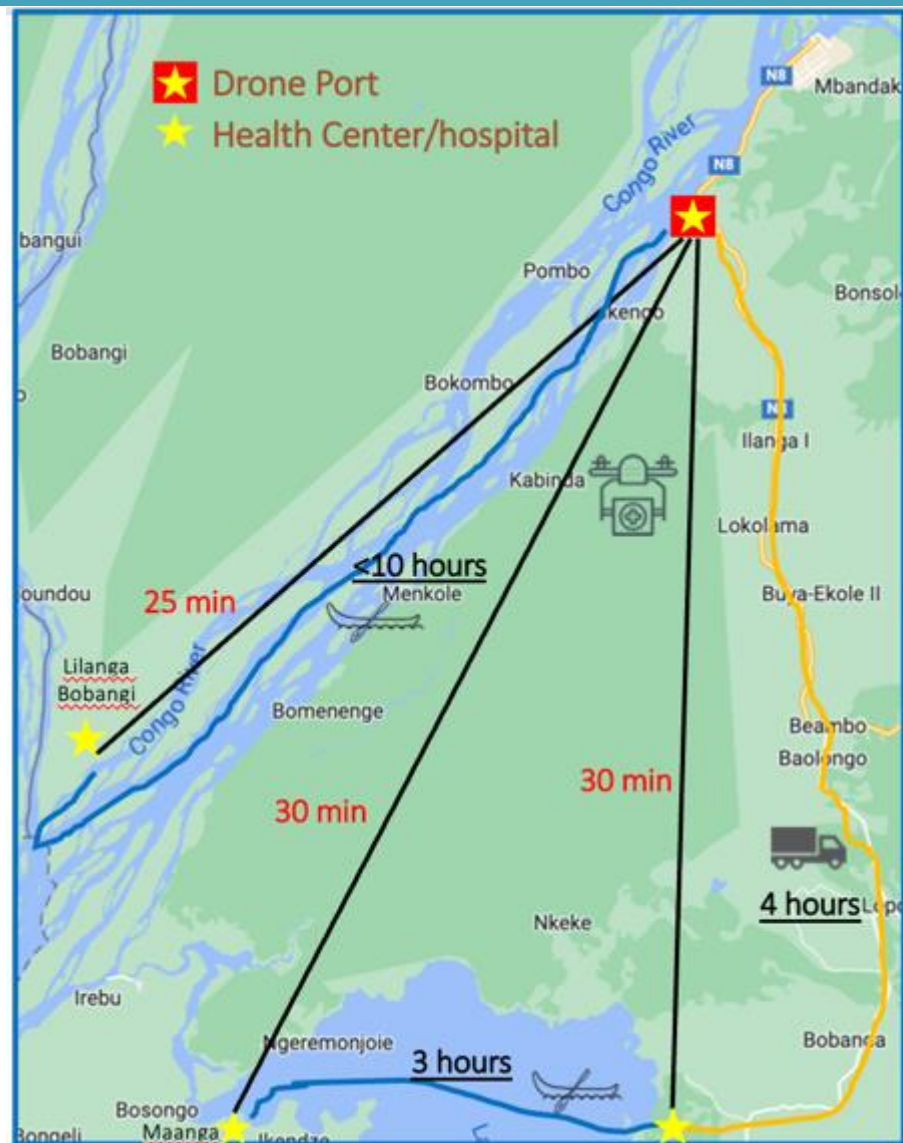
Higher % of vaccination sessions conducted according to plan (from 69 to 94%)

“The frequency has increased because we plan one session per week each time and four sessions per month. Before, it was two sessions per month because we lacked the vaccines but now there are vaccines available, every week one session”

A mother from Maanga health center said: “In the past, it was after a month that we were invited; today, it is every week that children are invited to take their vaccines”



Yellow Fever Mass Vaccination Campaign in DRC 2021



- Re-think the organization of vaccination campaign
- Optimize the cold chain equipment placement and supply network design

“The strategy of transport by drones of vaccines, biological samples and reports during the campaign against Yellow fever, improved access to vaccination for hard-to-reach populations, the inhabitants of the islets of Lake Tumba” said Dr. Guy Kalambayi, WHO, Equateur, DRC

Source: *Drones are a Hero in Yellow Fever Immunization Campaign.*
DroneLife January 09, 2022

Health Workers & Community Perception

Reduce hidden cost and burden on health care workers

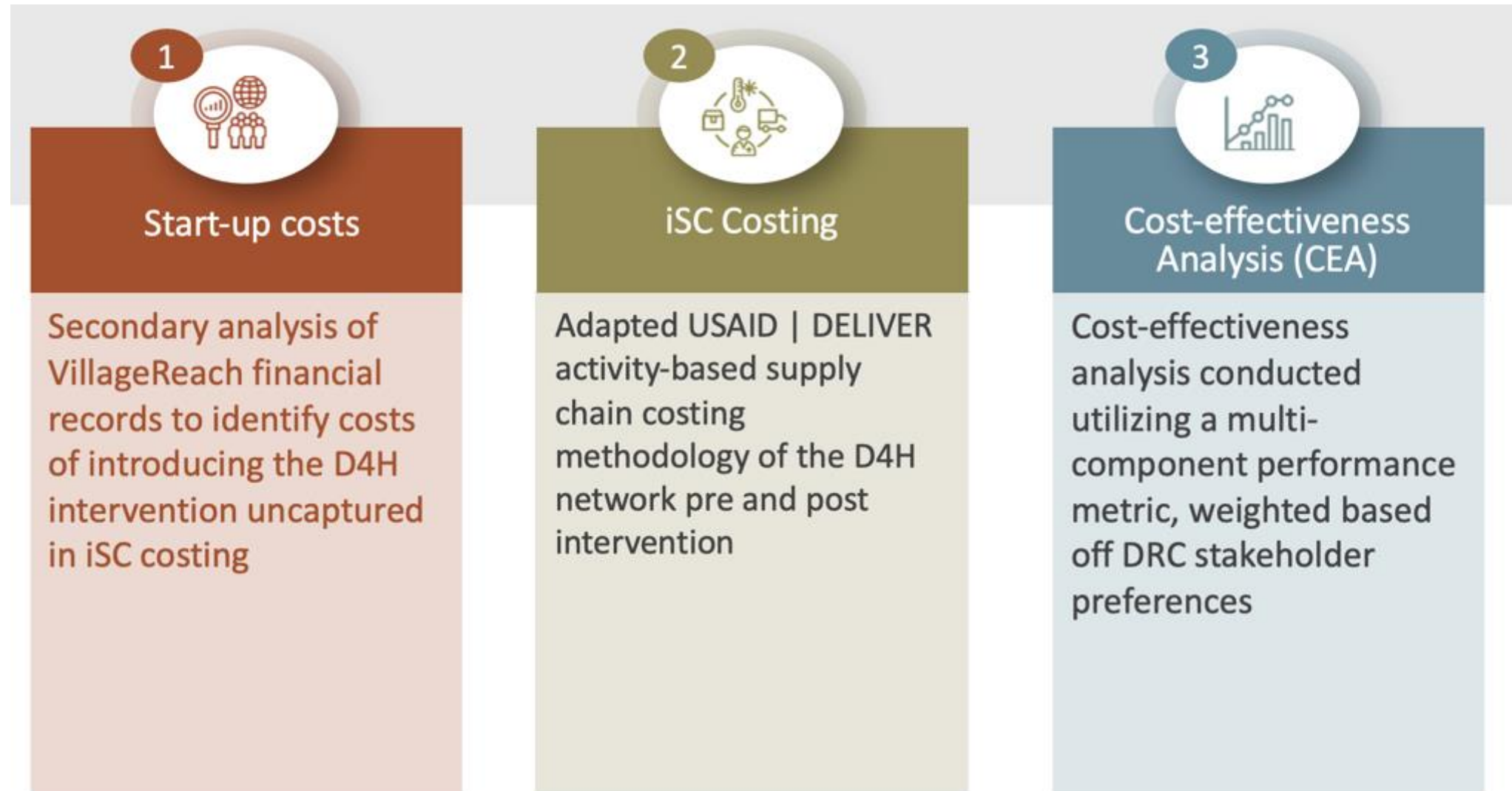


“In the past, we spent the money. Someone would have to take transportation back and forth to pick up the vaccines...it’s expensive. But today, there is no question of expenses. The drone brings the vaccines. He even transports our reports to the central office; no more question now that we pay the money. This cost is over” Nurse at Bonsole Lofosola health center in Bolenge health zone.

“There is nothing that cannot be achieved in our center regarding vaccination. If you come, you will find the vaccines. We used to lament when the nurses went to get the vaccines elsewhere. But today, the vaccine is permanent.” Focus group participant from Bonsole Lofosola health center in Bolenge health zone.



Economic evaluation methodology



The current drone iSC configuration (endline) has higher total effectiveness score but higher cost

Metrics		Baseline 2020	Endline 2022
Cost	Cost per dose	\$0.58	\$1.84
Effectiveness	Multi-metric score (%)	21%	48%
Cost-Effectiveness	Cost (\$K) per % of effectiveness	7.16	10.04


3



Cost-effectiveness Analysis (CEA)

When low asset utilization is addressed, optimized SC design shows reduction of cost, with a high potential for future cost-effectiveness

Metrics		Baseline 2020	Endline 2022	Improved Endline
Cost	Cost per dose	\$0.58	\$1.84	\$1.19
Effectiveness	Multi-metric score (%)	21%	48%	48%
Cost-Effectiveness	Cost (\$K) per % of effectiveness	7.16	10.04	6.50

3

 Cost-effectiveness Analysis (CEA)

Multi market development strategies

Levers to unlock affordable drone logistics
for the health sector in low and middle-income countries

Drone logistics are **not financially sustainable** for public health markets

Cost-competitive & sustainable pricing for the public health market

- **Public health**



- **Customers funding** start-up costs (MoH or donors)
- **Single customer** paying for all recurring costs
- **One-pricing strategy** for customers



- **Small scale** leading to high unit costs
- No economies of scale



- **Public & Private** health, agriculture, logistics, postal, maritime, disaster response, etc.



- Drone service providers **fund** start-up costs in new markets
- **Multiple customers** to spread recurring costs amongst
- **Market-driven pricing strategy** for cost-sensitive customer



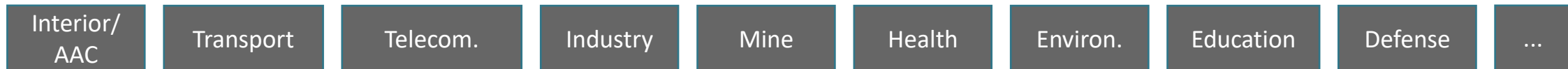
- **Large scale** leading to lower unit costs
- Economies of scale

Cross sectorial approach & market-driven pricing strategy

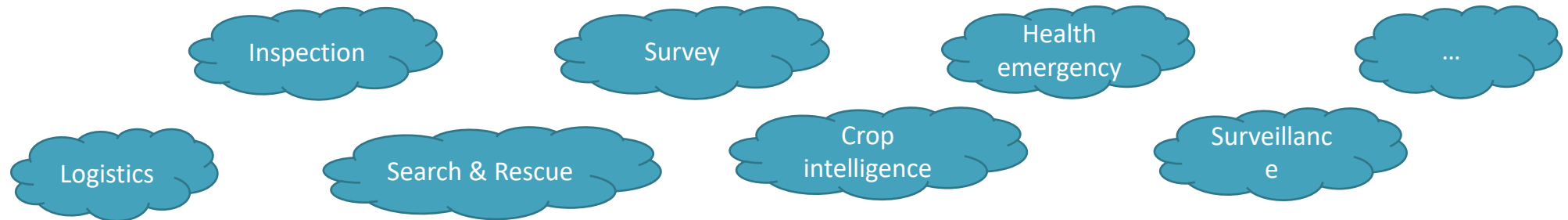
Government + Private Sector

Prime Minister

Ministries



Use Cases



Service Providers





Thank You!

Contact details:

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