Drone delivery to accelerate the results for children

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The need

1 billion people

live further than

2 km away

from an all-season road

The need

29 % of population
in Sub-Saharan Africa lives more than

2-hour travel
from the nearest public hospital

The need

10.6 million children

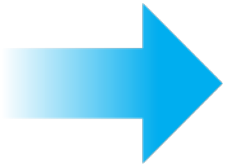
do not receive the first dose of basic vaccines

most of them living in

remote locations

The need

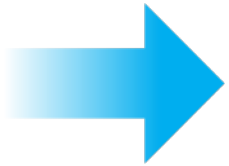
The bigger the distance to a health facility



Lower health service utilization and higher neonatal mortality

The need

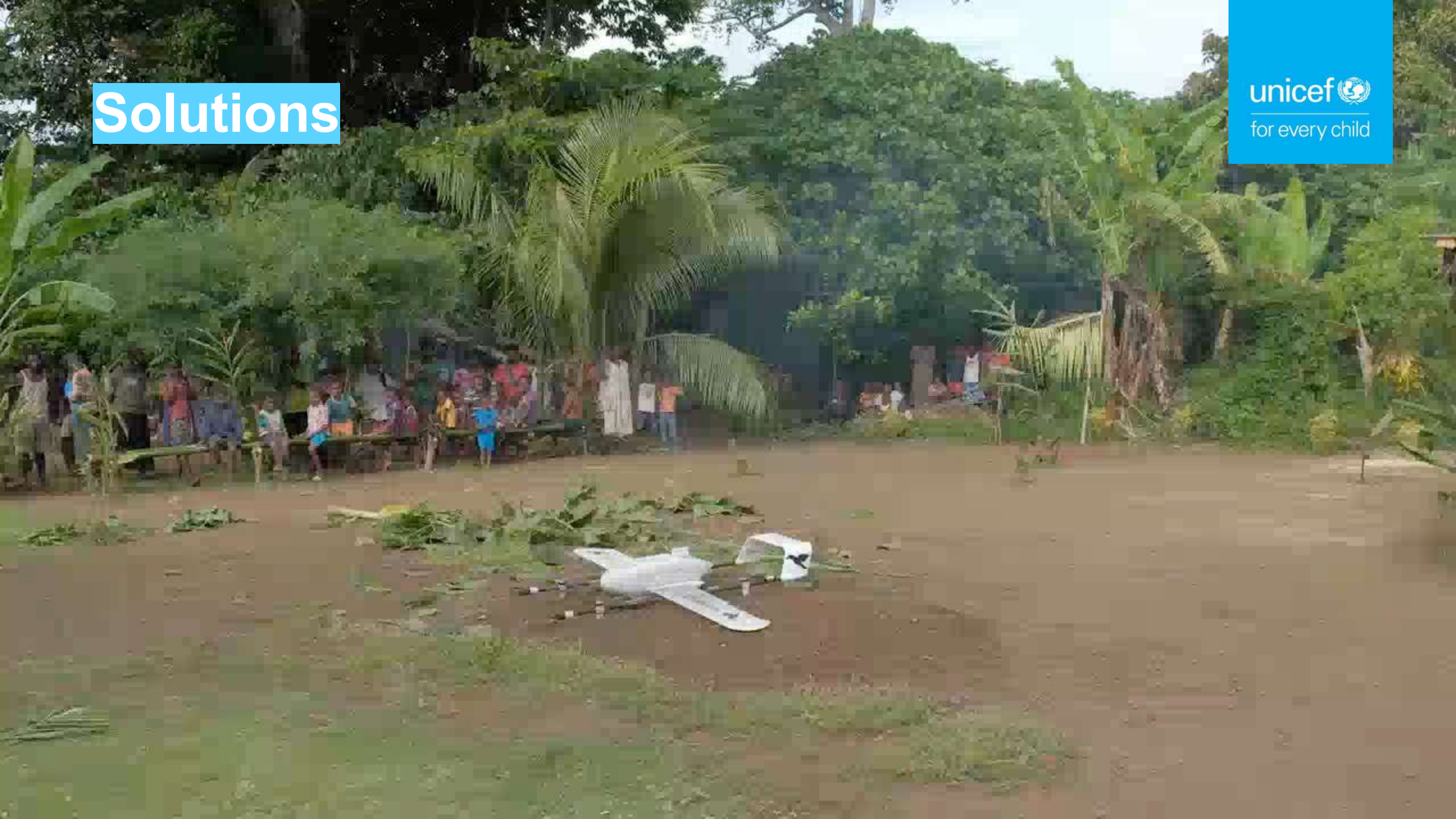
Lack of accessibility and poor transportation



Lack of equitable access to health and other essential services

The need

The need


Solutions
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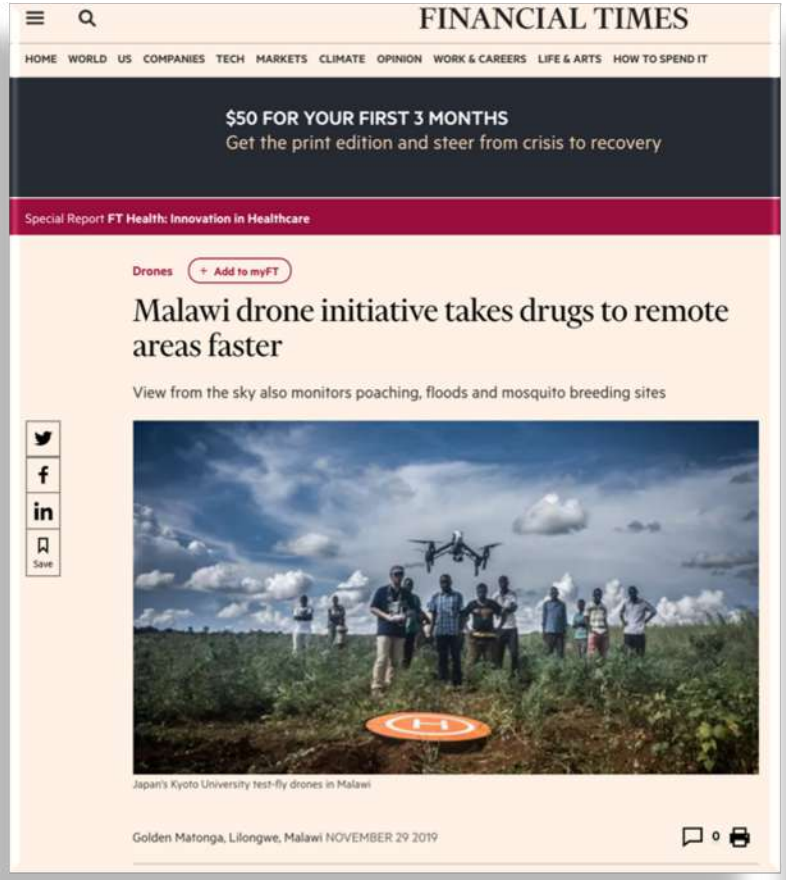
The benefits of using drones for health supply chains

UNICEF's leadership and achievements to-date



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Malawi drone initiative takes drugs to remote areas faster

View from the sky also monitors poaching, floods and mosquito breeding sites

Japan's Kyoto University test-fly drones in Malawi

Golden Matonga, Lilongwe, Malawi NOVEMBER 29 2019

The New York Times

An Island Nation's Health Experiment: Vaccines Delivered by Drone

In Vanuatu, 20 percent of children miss their shots because villages are so hard to reach. It has hired an Australian company to fly them in.

Forbes

Long-Range Drones Deliver Medical Supplies To Remote Areas Of Malawi

Lauren Davitt Brand Contributor
UNICEF USA BRANDVOICE | Paid Program
Leadership

The UNICEF Humanitarian Drone Corridor in Malawi is a testing ground for innovative drone projects that can help save lives.

A UNICEF-supported medical supply delivery drone takes off from the Kasungu airstrip in central Malawi in June 2019. © UNICEF MALAWI/2019/LAMECK LUHANGA

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Projects in Malawi, Vanuatu and elsewhere have demonstrated the value

- Use of drones can lead to **65 % reduction in turnaround times** of diagnostic samples (samples delivered on time, not expiring, effective diagnostics), and up to **130 % increase in diagnostic sample collection**, that leads to more patients being effectively treated *(in Malawi)*
- **Reduction of delivery time** from 1-2 days to 30-60 minutes. *(in Vanuatu)*
- **Improved compliance/adherence** with immunization and treatment schedules/campaigns, **introducing services** that wouldn't be available otherwise *(in Vanuatu)*
- Drone delivery can help **minimize the vaccine** (and other health commodity) **stock-out levels** and **increase general availability of health commodities** at the health-facility level. *(in Vanuatu and Malawi)*
- **Reducing the health facility dependency** on storage capacity and storage equipment *(in Vanuatu)*
- Other benefits observed by UNICEF partners included:
  - Drone delivery bundled with other innovative interventions **can offer a cost-effective solution** for disease (TB) control (based on WHO CEA methodologies)
  - Drone delivery could **decrease transport costs** if the drones are used frequently enough to overcome the capital costs of installing and maintaining the system.

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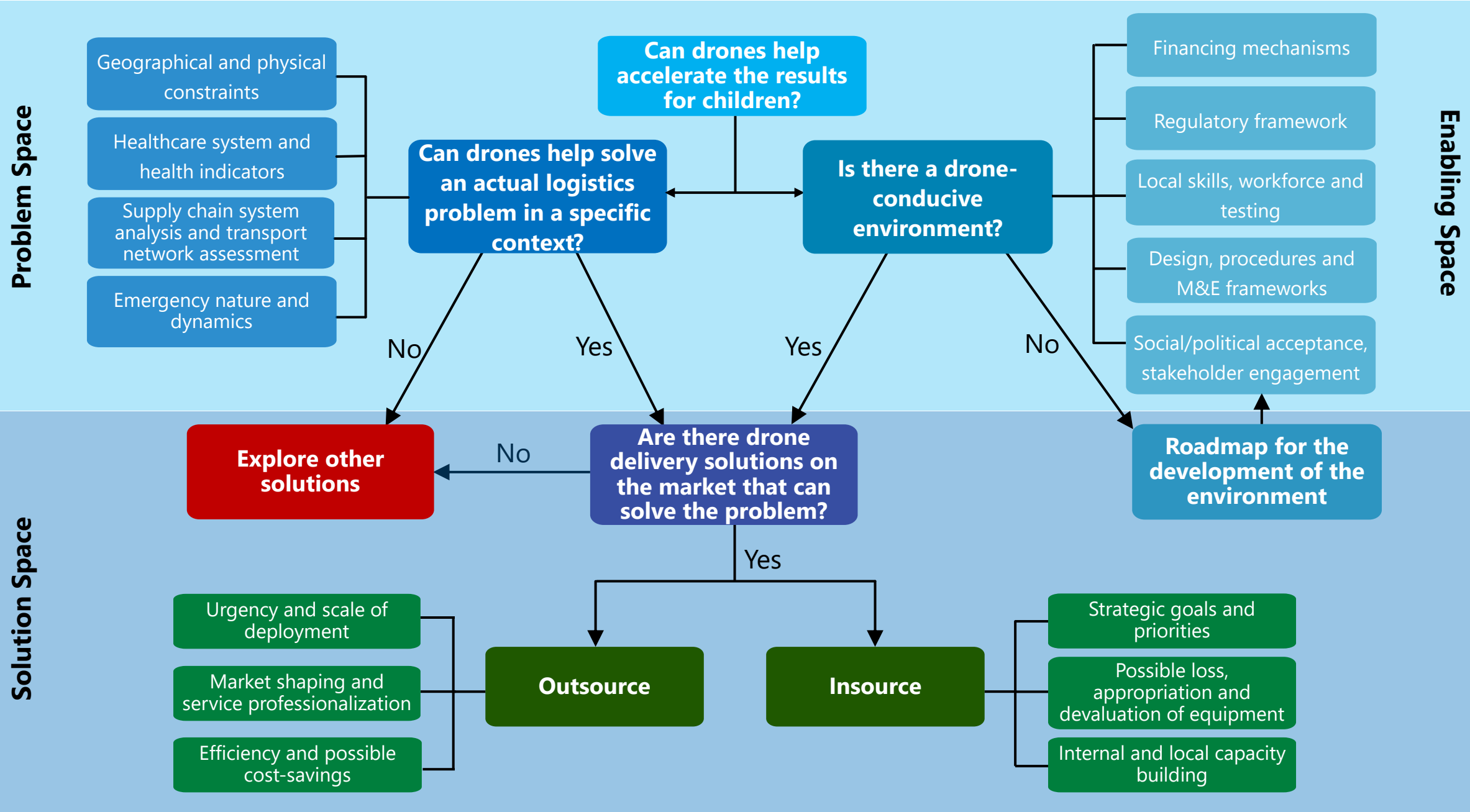
How to make it work?
Scaling innovations

Our approach to drone delivery



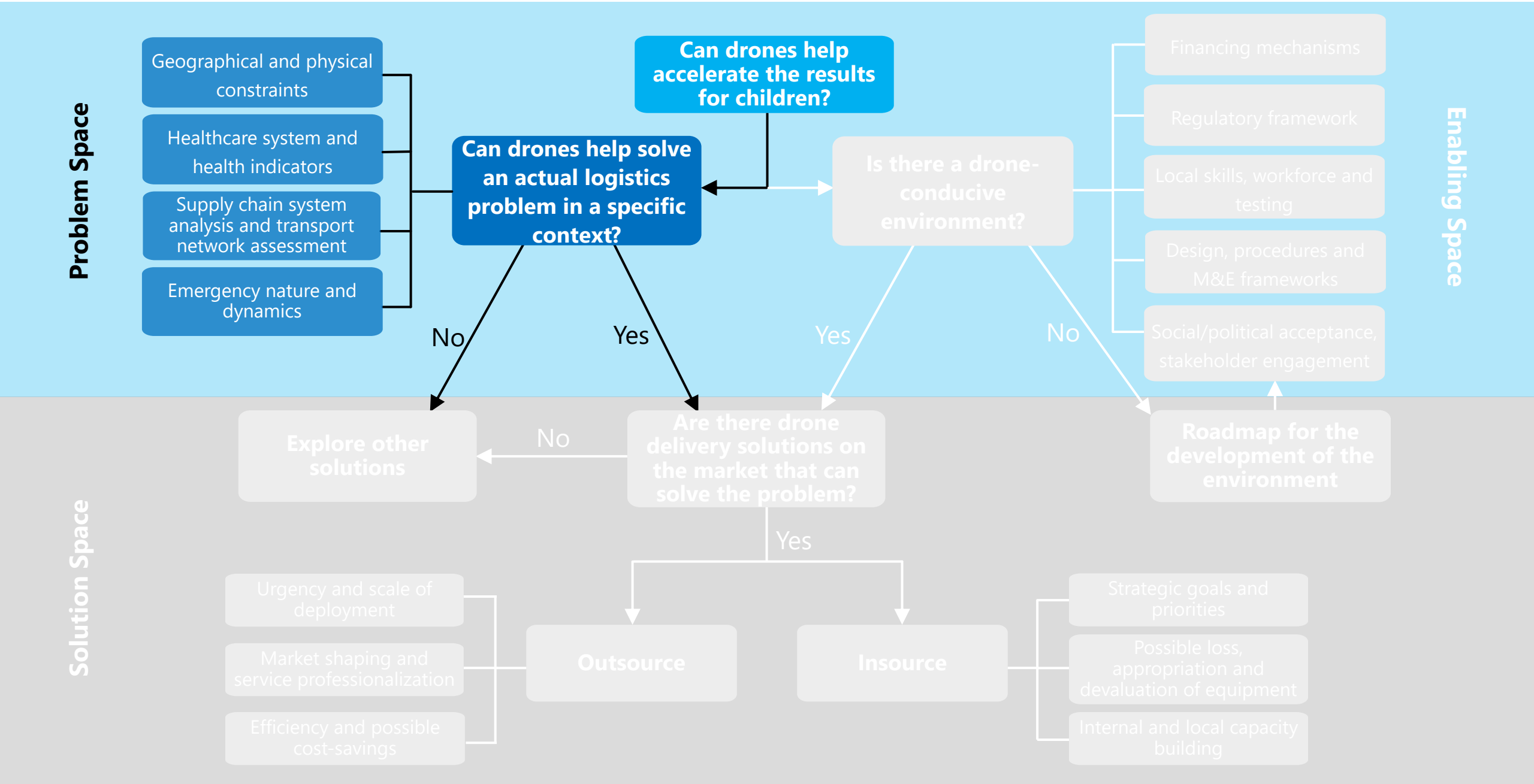
System design

Blueprint, for how the supply chain should run and how all the components of the supply chain system fit together and interact to improve health outcomes

Phase	Phase I – Advocacy and Analysis		Phase II - Phased Implementation		
Step	Advocacy and Introduction	Analysis	Initial Implementation	Scale-Up Implementation	Continuous Improvement
Cross-cutting considerations	Financing, innovation buy-in, policies, national strategies, private sector and local market potential, capacity building, available technologies and services				

How to make it work?
Identifying the need

Problem space



Should we deliver [*insert health commodity*] using drones?

Geography

1. Health Facility Density
2. Road and transport network quality
3. Health Facility Accessibility

Product and Service Demand

1. Weight
2. Volume
3. Financial Value
4. Health Value
5. Shelf-life/Difficulty to store
6. Quantity of demand at individual facility
7. Unpredictability of demand
8. Current extent of stockouts
9. Diagnostics system needs

UAV Characteristics

1. Payload Weight
2. Payload Volume
3. Range
4. Reverse logistics capability
5. Cost
   - *Fixed and capital costs*
   - *Running (per month) and variable (per-km or per delivery) costs*

Logistics and Supply Chain Performance Objectives

(Cost-Benefit, Availability of Product, Speed/Responsiveness of Delivery, Risk or Flexibility, Efficiency, Quality)

Results framework

Health Impact: Reduction in Incidence/Prevalence of Diseases

Program outcomes

- Sustainability
- Coverage
- Equity

Intermediate Outcomes/Indicators

Availability

- Stocked-according-to-plan
- Full Stock Availability
- Point-in-time stock-out rate
- Number of days stocked out
- Supply coverage
- % of lost-in-transit samples
- % of sample results returned

Accessibility & Affordability

- Number/% of communities within <5km (or other distance) from SDP
- Travel time / distance to access routine immunization, diagnostics and other health services [fixed and non-fixed]
- Travel time / distance to supply fixed and non-fixed SDPs
- Average out-of-pocket cost to access routine immunization, diagnostics, or other health services
- Number/% of planned immunization sessions held [fixed and non-fixed]
- Hours of immunization, diagnostics and related health services
- Reduction of diagnostic sample turnaround time leading to timely treatment

Efficiency

- Total logistics cost
- Logistics cost per dose administered
- Net-zero energy consumption
- Level of effort dedicated to iSC management
- Storage and wastage cost savings per facilities served

SC Outcomes

- Improved On Time and In Full (OTIF) delivery
- Improved delivery lead times and/or delivery cycle times

SC Outputs

- Number of facilities serviced
- Frequency of flights
- % of resupply events occurring according to schedule
- Distance traveled
- Energy consumption
- % of emergency requests fulfilled
- Out-of-pocket costs for travel
- Storage and wastage cost within the facilities served
- Transportation cost savings
- Time spent outside the facility for transportation of commodities
- Turnaround time of diagnostic samples
- Diagnostic sample collection

SC Activity

- Use of drones to deliver vaccines, diagnostic samples, essential, emergency and other medicines and health commodities to the access-constrained facilities

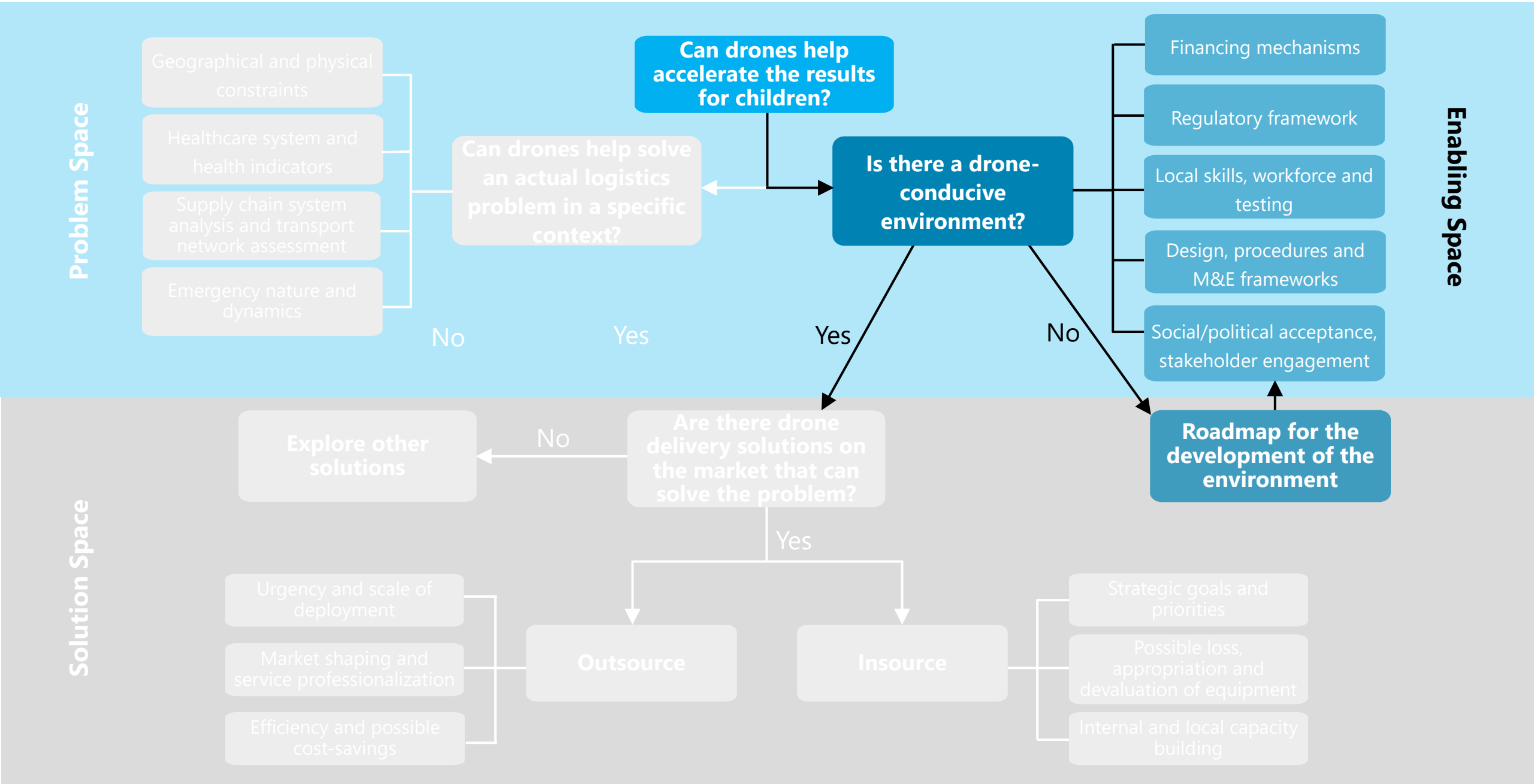
SC Element

- Logistics and Transportation

Supply Chain Inputs

How to make it work?
Enabling environment

Enabling space



Example of a humanitarian drone testing corridor

- Central piece of the enabling environment
- 40 km radius, 400 meters AGL
- Centered at the local airfield with a 1200 m runway
- BVLOS flights permitted
- 1 central hospital laboratory
- >300 schools, health centers, clinics
- National Park partially covered
- The confluence of two big rivers
- Population: 650,000 people
- Regulatory sandbox and capacity building space
- Extensive community sensitization

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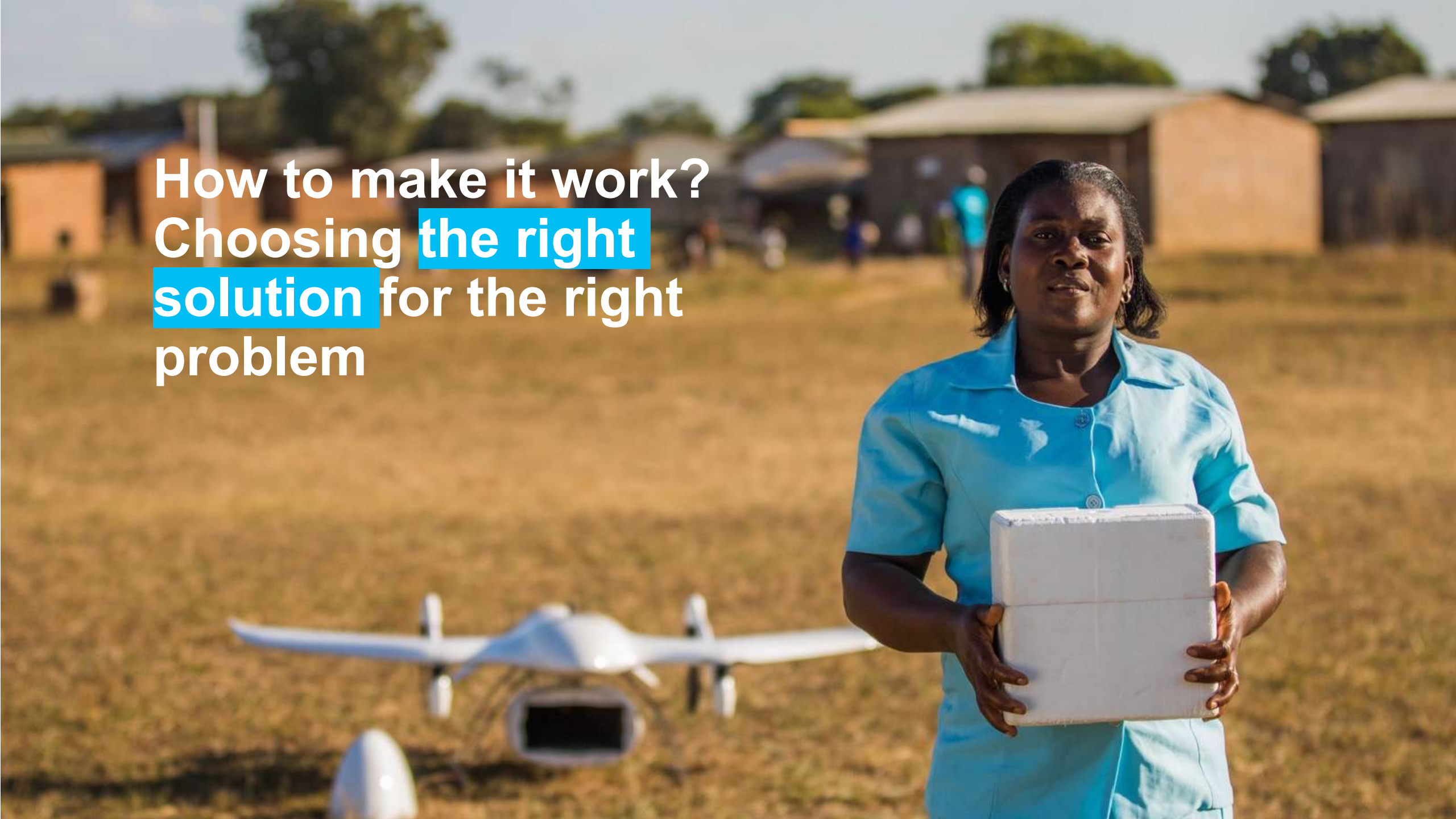
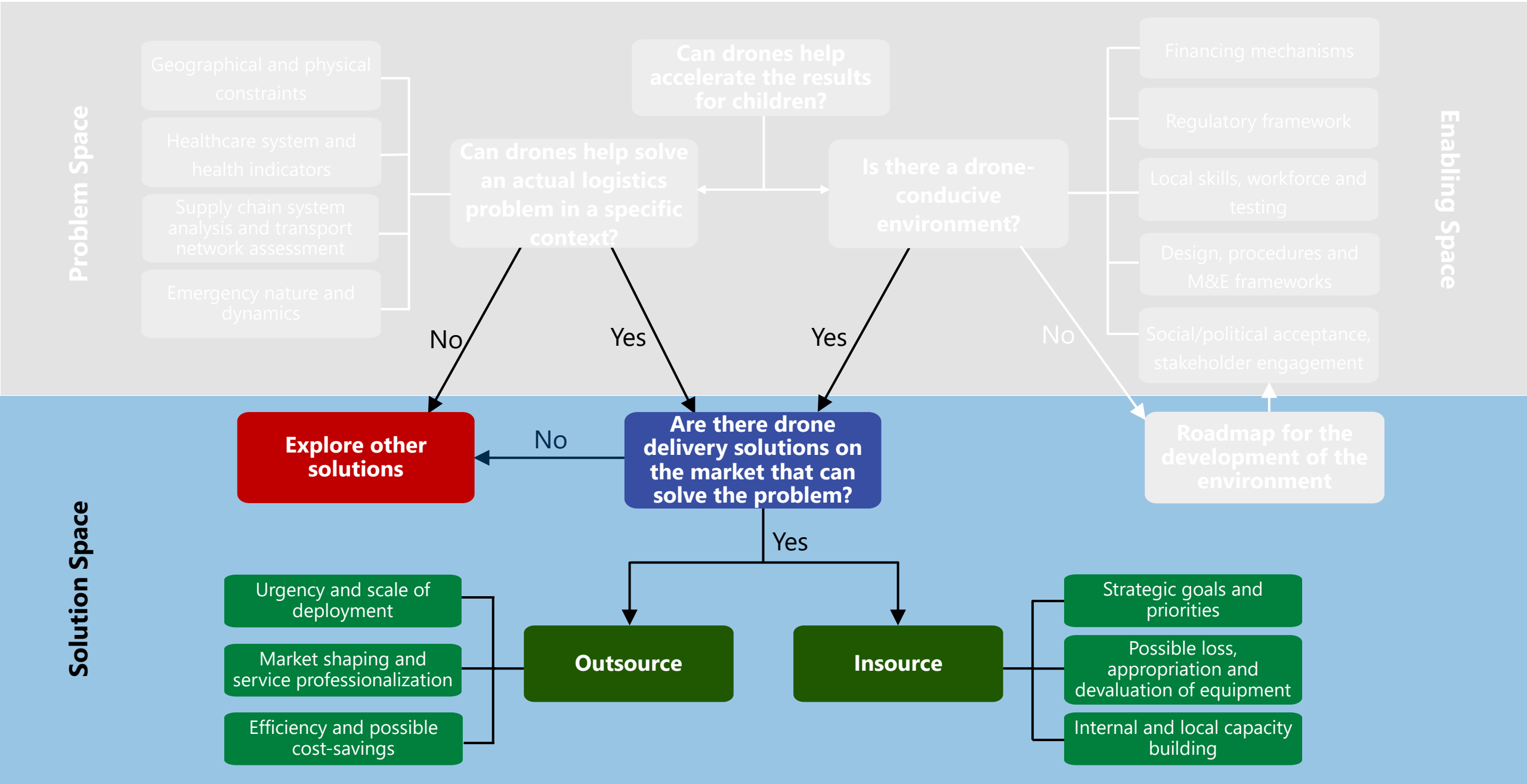
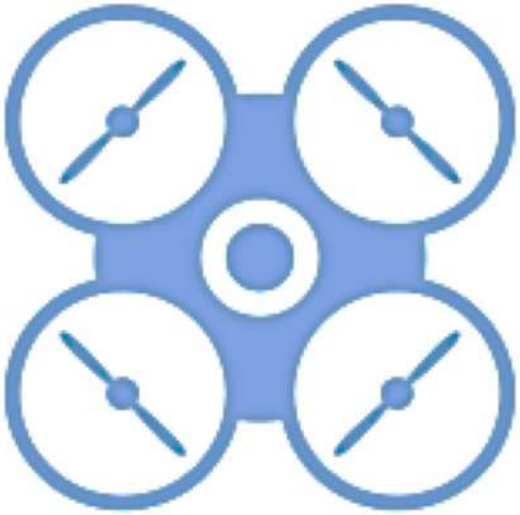

How to make it work?
Choosing the right solution for the right problem

Solution space

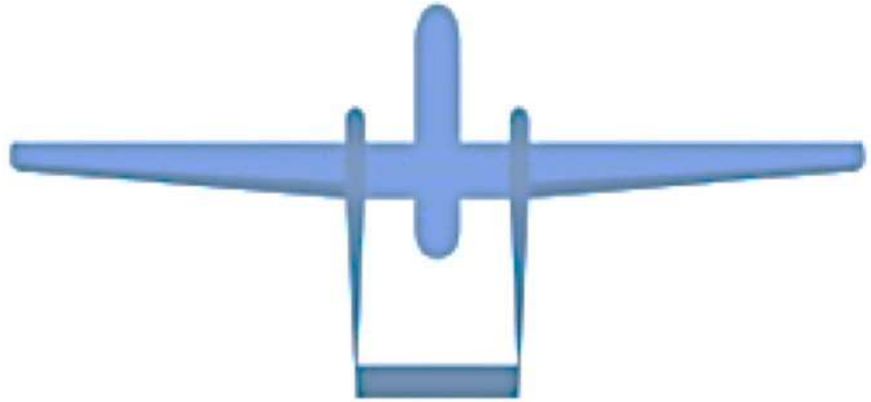


Types of drones used in delivery

Fixed-wing



VTOL rotorcraft

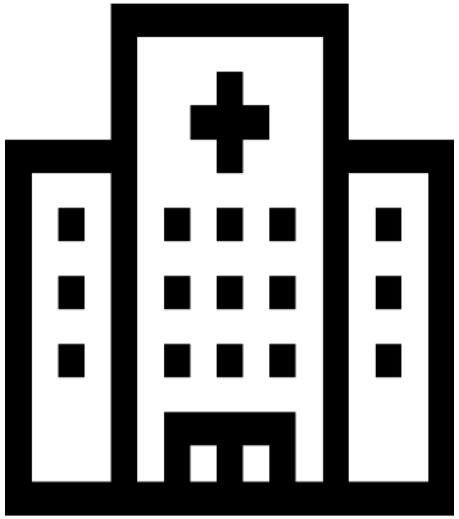


VTOL fixed-wing

VTOL – Vertical Take-off and Landing

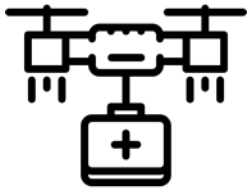
Two modes of drone delivery

District Hospital, Sub-national Medical Warehouse, or another inventory-holding facility



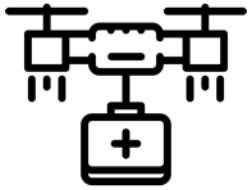
Lab sample processing facility

1) Medicines; 2) Vaccines. 3) Micronutrients; 4) Lab results, 5) Medical tools, devices and equipment; 6) Blood for transfusion*; 7) larger payloads of humanitarian aid or health supplies



Delivery (one-way or reverse logistics)

Pick-up (reverse logistics only)



1) Medical samples (laboratory specimens) for HIV, TB and other tests; 2) Medical wastage; 3) Reports and other documentation

Secondary/Tertiary Health Facility or Outreach Facility

Capabilities of drones

	Small platform	Large platform
		
Range	60 – 140 km; 400 – 800 km	100 - 2000 km
Payload	2-10 kg	<1800 kg
Cost*	$10k – 100k per month; $20-200 per flight	~$750-1000 per hour
Power	Battery or Gas	Gas
Cold-chain	Passive/Active	Passive/Active
Applications	Last-, and middle-mile distribution to health facilities	First-, middle-mile distribution of large payloads (emergency response or regular logistics)
Connectivity	Sattelite, LTE, Radio	Sattelite, LTE, Radio

Procurement: outsourcing vs. insourcing

Resource elements	Insourcing	Outsourcing
Up-front investment	Medium to High	Low to Medium*
Procurement of equipment	Needed	Not needed
Internal capacity building for drone piloting and operations	Needed	Not needed
Internal capacity to manage regulatory compliance	Needed	Not needed
Internal capacity to maintain and repair drones	Needed	Not needed
Internal capacity to manage liability and insurance aspects	Needed	Not needed**
Dedicated personnel to run the operations	Needed	Not needed
Dedicated project management staff	Needed	Needed
Individual insurance	Needed	Not needed
Risk of loss or appropriation of equipment	Likely	Unlikely
Savings/cost-efficiency	Long-term	Short/medium-term

Providing technical leadership, support, resources and tools

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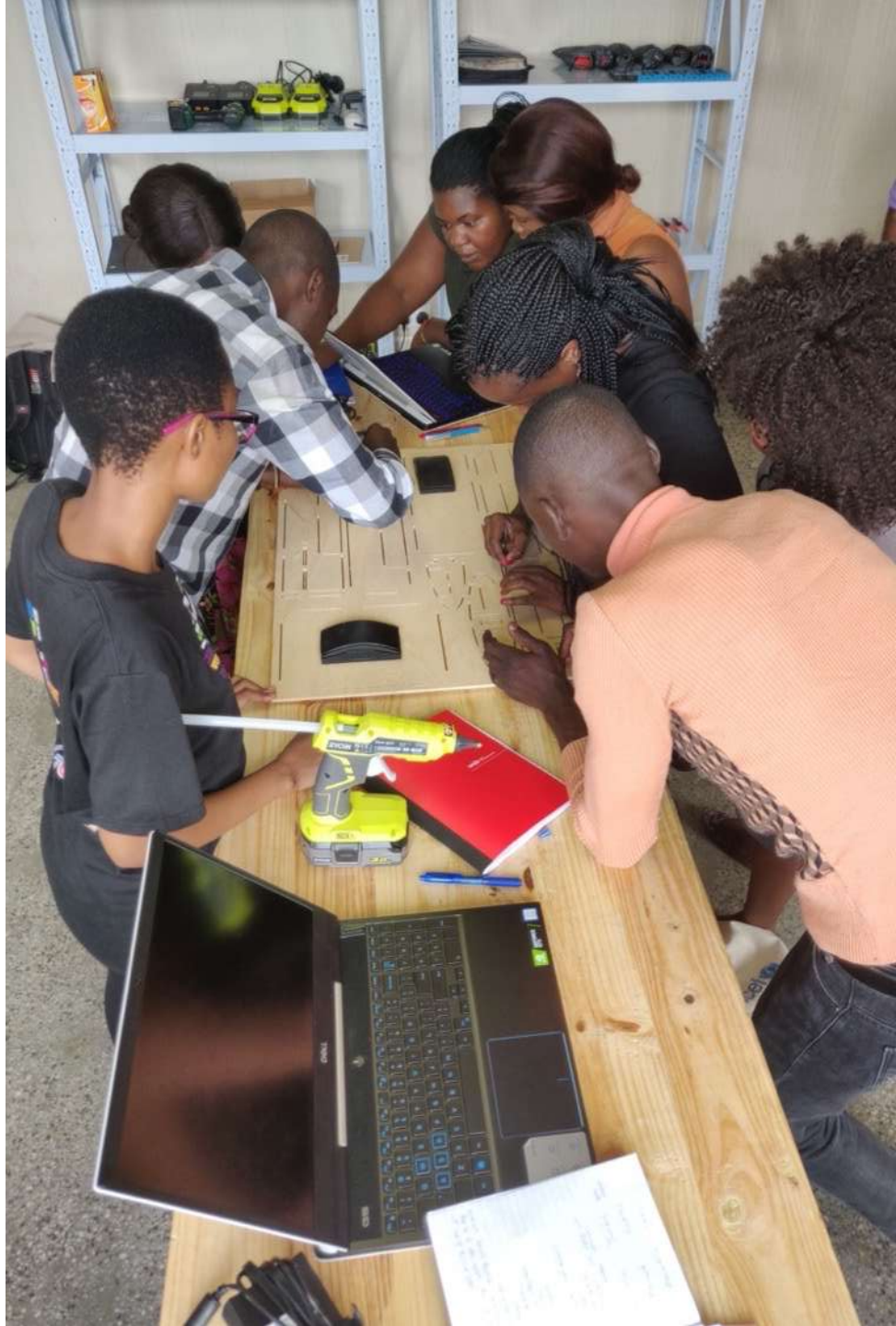
Building ownership for sustainability: the example of the African Drone and Data Academy

African Drone and Data Academy

Opened in January 2020 in Lilongwe, Malawi

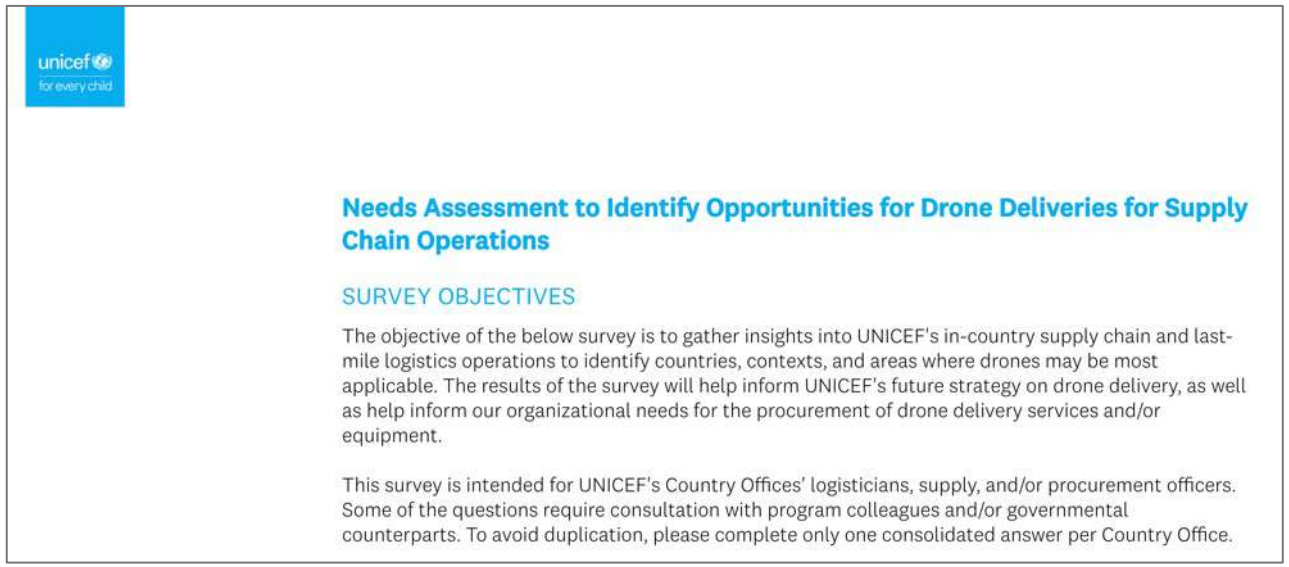
“First of its kind” developed by Virginia Tech:

- build and pilot drones
- use drones for transport and image acquisition
- use AI to harvest data out of the collected geo-referenced imagery
- Full scholarships for students
- 16 out of 26/cohort from Malawi, 10 from region
- 60% female students
- 146 out of a total of 175 students received and completed training
- 90% of graduates found employment in the sector (employed as drone pilots or data analysts, including delivery of medicines and other essential health commodities (e.g. malaria antigen, HIV viral load samples and results, HIV self-tests, antiretroviral medicines, TB Sputum samples, and sputum sample reports) to remote areas across Malawi)
- Looking to expand into additional 3 African countries



What’s next?

Country Office survey to help identify priority countries and contexts



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Needs Assessment to Identify Opportunities for Drone Deliveries for Supply Chain Operations

SURVEY OBJECTIVES

The objective of the below survey is to gather insights into UNICEF's in-country supply chain and last-mile logistics operations to identify countries, contexts, and areas where drones may be most applicable. The results of the survey will help inform UNICEF's future strategy on drone delivery, as well as help inform our organizational needs for the procurement of drone delivery services and/or equipment.

This survey is intended for UNICEF's Country Offices' logisticians, supply, and/or procurement officers. Some of the questions require consultation with program colleagues and/or governmental counterparts. To avoid duplication, please complete only one consolidated answer per Country Office.

47 Country Office **submissions**, out of which **30 (63 %)** experience logistics/transportation difficulties in reaching remote destinations

Delivery of **vaccines, essential medicines, nutrition commodities, and health tools/equipment** is most affected by the logistics challenges at the last-mile

More than 50 % of the countries experience chronic logistics issues for the last-mile distribution and emergency response.

Implementation roadmap

Year 1

Activities within the problem and enabling space

Analysis, advocacy and concept introduction

By utilizing system design approach, conducting a thorough supply chain system and drone delivery cost-benefit analysis, modelling drone delivery integration scenarios, introducing the concept to national governmental, private sector, academic and community-level stakeholders. That is followed by facilitating the creation of enabling space (regulatory environment, development of capacity and transfer of skills) and by community sensitization. Other costs include, but are not limited to, staff, communications, education programmes, infrastructure, and etc.

Year 2

Activities within the solution space and integration

Drone delivery solution integration into supply chain

By using previously developed implementation scenarios and context-specific value metrics, selecting the most appropriate solution/service and setting up the operations in a priority region or area of a country where assumptions can be tested, supply chain performance can be measured, and drone delivery gets integrated into the existing system. Major costs include set-up infrastructure, service/equipment procurement, data collection and M&E, staff, and other running costs

Year 3 and onwards

Scale-up and transition activities

Scaling up drone delivery operations

Following the results and progress achieved in the Year 2, and building on the lessons-learnt, scaling drone delivery operations to address the supply chain bottlenecks in other regions, increasing the number of flights, layering up different medical commodities and conducting thorough M&E to track the cost-effectiveness and impact of drone deliveries for the entire health supply chain system. Transitioning into a government funding scheme. Costs include, but are not limited to, scale-up of operations (services, infrastructure), data collection and M&E, staff, and other running costs.

Thank you!

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