Health

Best Practice Case Study: 02

Delivery of Health Commodities using Unmanned Aerial Vehicle-Drones

(Case Study of Kaduna, Cross River and Bayelsa States Health commodity delivery to last mile facilities)

NIGERIA GOVERNORS' FORUM

October 2023

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Acronyms

3PL	Third Party Logistics Service Provider
CMS	Central Medical Store
DOOR	Drugs Out of Range
DRF	Drug Revolving Fund
DRF	Drug Revolving Fund
DPS	Director of Pharmaceutical Services
EPI	Expanded Program on Immunization
E-POD	Electronic Proof of Delivery
FEFO	First Expired, First Out
FIFO	First In, First Out
FP	Family Planning
IP	Implementing Partner
KADHSMA	Kaduna State Health Supplies Management Agency
KADPPA	Kaduna State Public Procurement Authority
KSPHCB	Kaduna State Primary Healthcare Board
LMD	Last-Mile Delivery
LMIS	Logistics Management Information Systems
LGA	Local Government Areas
MDDSP	Medical Drone Delivery Service Provider
MSSV	Monitoring and Supportive Supervisory Visits
NBSC	National Blood Service Commission
NHLMIS	National Health Logistics Management Information System
NMEP	National Malaria Elimination Programme
NWAC	National Warehousing Advisory Committee
NPSCMP	National Products Supply Chain Management Programme
PPP	Public Private Partnership
PHC	Public Health Care
PHC-DRF	Public Health Care- Drug Revolving Funds
SDGs	Sustainable Development Goals
SDP	Service Delivery Point
SKU	Stock keeping Unit
SLA	Service Level agreement
SMOH	State Ministry of Health
SOPs	Standard Operating Procedures
SMSS	Sustainable Medicines Supply Scheme
UAV	Unmanned Aerial Vehicle or drone
WHO	World Health Organization
MoU	Memorandum of Understanding

Foreword

Mr. Asishana Okauru Esq.
Director General

The Secretariat

Acknowledgement

For us to have achieved the field work within the stipulated time frame, we owe it to the cooperation we received from different actors. Across the three states of Kaduna, Cross River and Bayelsa we were warmly received and provided access to different reports and also to locations that enabled us gather information critical to the deliverables of our work.

Special appreciation to the Honorable commissioners of health in the three states, they facilitated our work in the states. We want to also acknowledgement the contributions and cooperation of the following people. The Zipline field operations teams, who are all Nigerians and locals from the respective states§, we want to appreciate your commitment and time dedicate to us during our visit.

State	Name	Position
Kaduna State	Pharm. Aisha Dr Jamoh Hamza Ikara	Honorable Commissioner for Health Executive Secretary KADHSMA Executive Secretary KSPHCB Director, Disease Control & Immunization KSPHCB District Head, Pambegua Stakeholder Engagement Manager, Zipline
Cross River State	Dr Henry Ayuk Dr Etim Ayi Pharm Sunny Ezong	Honorable Commissioner for Health Executive Secretary CRSPHCB LMCU Coordinator
Bayelsa State		Honorable Commissioner for Health Executive Secretary BSPHCB

Abstract

Background

Good family planning, treatment of illness, and other health services all depend on availability of health commodities for the end user or patient. When a patient travels to a health clinic or hospital and cannot receive services because his or her commodity isn't there, it represents a failure of the health system—unplanned pregnancies, prolonged illness, and unnecessary death.[i]

Kaduna State is the first state in Nigeria to integrate the use of aerial drones in the supply chain system of the state for the delivery of medical commodities and vaccines. They were followed by Cross River State and then closely followed by Bayelsa State.

Extensive studies have shown that Universal Health Coverage particularly with the PHC approach cannot be achieved without adequate, sustained and equitable distribution and availability of health commodities at the PHC level.

Objective:

The objective of this case study was to;

I. Understand the challenges inherent in the health supply management system in Kaduna, Cross River and Bayelsa states that necessitated their adoption of the use of UAVs as a mode of transport logistics

II. Learn and understand the value additions and pitfalls that exist in the use of Unmanned Aerial Vehicles or drones for the delivery of health commodities to healthcare facilities in Kaduna, Cross River and Bayelsa States.

III. Identifying opportunities and lessons learnt from the use of UAVs that can guide appropriate recommendations for other States to learn and possibly adapt to address some of their peculiar and related last mile delivery problems.

Method

A systematic research approach using a qualitative synthesis from informal engagements with key persons and a semi-structured interviews with key informants. An observation of the process to gain primary understanding of how things work was undertaken to learn from the three states that are currently using this innovative approach to delivery health commodities, vaccines and blood.

For all case studies, a review of literature was conducted from a range of online sources. Two semi-structured interviews were also conducted with several key informant interviews.

Findings:

Our findings indicated an unprecedented steady availability of essential medicines, vaccines and blood at all times to all health facilities serviced by the drone delivery. This critical milestone has undoubtedly reduced mortality particularly in the cases of emergencies. This assumption has been made from direct field observation and Key Informant Interviews across the three study states.
There are however no empirical data to demonstrate this outcomes and impact in any of the states. It will be worthwhile to have a full fledge research conducted to understudy the impact and cost effectiveness of this novel technology.

Conclusion

The steady availability of quality and affordable essential drugs and vaccines at the last mile health facilities for clients to access and address their health needs, is the ultimate end goal of every health commodity supply chain. To guarantee the equitable availability of these health commodities in all health facilities regardless of their geographic and accessibility limitation within the state; Kaduna, Cross River and Bayelsa States have embraced the innovative use of Unmanned Aerial Vehicles or drones to effectively and efficiently deliver essential health commodities to the last mile health facilities.

Introduction

One of the major targets of the United Nations' third Sustainable Development Goals (SDG), is to ensure access to safe, effective, quality, and affordable essential medicines and vaccines, for all.[ii] At the heart of this goal is the achievement of UHC, which requires that all people have access to essential health services and medicines, from health promotion to prevention, treatment, rehabilitation and palliative care, without incurring financial hardship.[iii]

Access to essential medicines and other health products is not only a human right irrespective of setting or socio-economic status but also an important strategy to realizing the sustainable development goals (SDGs). Globally, the most leading causes of death and disability can be alleviated, treated or prevented with cost-effective essential medicines. However, unavailability and poor access to essential drugs and the limited availability of basic medical equipment remains major problems of the health system in developing countries. Only about a third of health facilities in Nigeria had essential medicines in stock (2016 National Health Facility Survey by SOML).[iv]

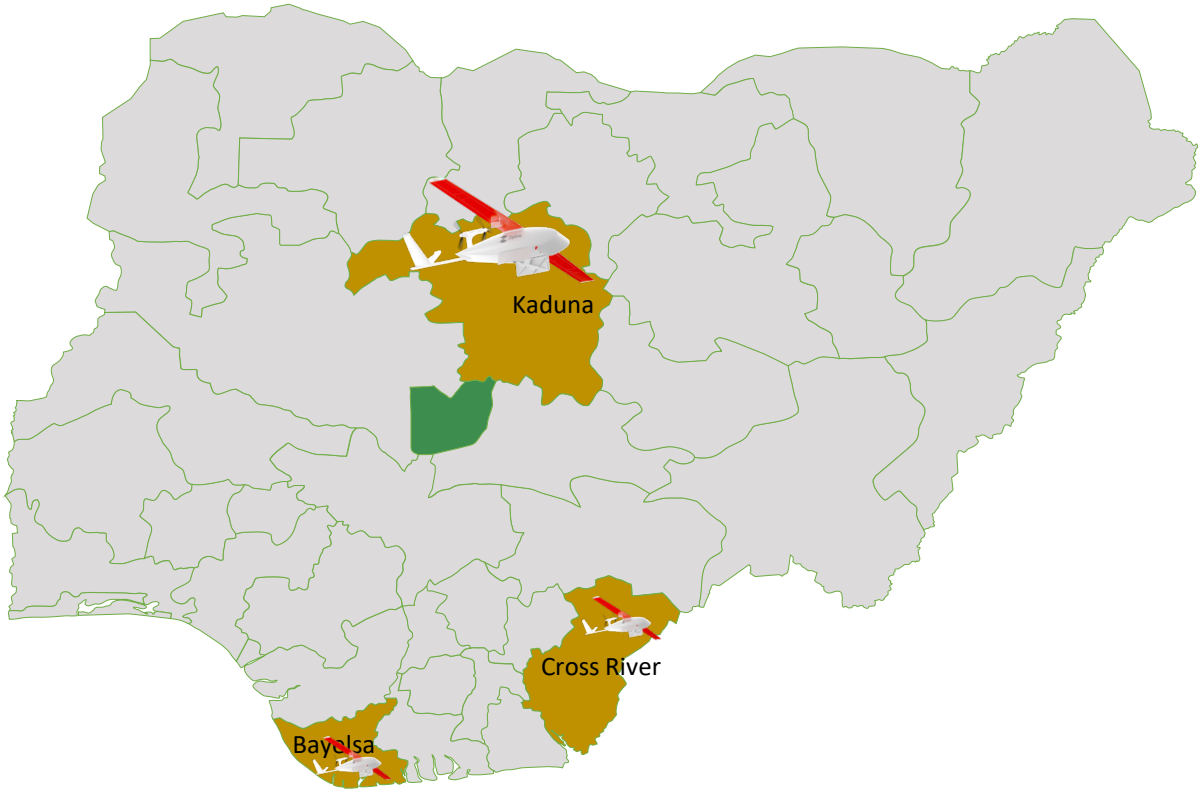
The role of the health supply chain in aiming to achieve UHC is undeniable. It acts as a key foundation to a successful healthcare system within a country, with key activities including the procurement of quality medicines at affordable prices, the successful transportation and tracking of medicines, safe storage, and distribution of medicines to every individual no matter their location or income.[v]

At the core of every healthcare delivery system is value-maximization for patients by achieving the possible best health outcomes at the lowest possible cost. Patients are important consumers in the medical commodity supply chain as they are the end recipients/beneficiaries of the healthcare delivery system. Access to medicines and related medical commodities as and when needed, in any healthcare delivery system, depends on the availability, affordability and acceptability of such commodities.[vi]

Nigeria is a country in West Africa. It shares land borders with the Republic of Benin to the west, Chad and Cameroon to the east, and Niger to the north.[1] Its coast lies on the Gulf of Guinea in the south and it borders Lake Chad to the northeast.[vii] The Federal Republic of Nigeria is a political entity located in West Africa which lies on the geographical coordinates of 10o0‟0”N and 8o0‟0”E. Nigeria has 36 states and the FCT defined across 6 geopolitical zones.

The study area for this case study is in three [3] states- Kaduna, Cross River and Bayelsa. The choice of the states was guided by the availability of study materials in only the 3 states. The use of unmanned aerial vehicle is a recent innovation in Nigeria and at the moment only the 3 states have adopted the use of the novel technology in the delivery of health commodities to the last mile health facilities.

Figure 1: Map of Nigeria showing study states



The geographic distribution of the 3 states however provides us a contextual understanding of the potential geographic adaptability of the novel technology. Kaduna State is located in the North-West geographical zone of the country. The vegetation cover is Sudan Savannah type, characterized by scattered short trees, shrubs and grasses. Most places are fairly accessible but why then is a drone necessary for health commodity delivery?

Cross River and Bayelsa States are both located in the South-South geographical zone, they are both coastal states located in the Niger Delta region. The two states have existed for many years, with the locals living a lifestyle built around the geographic disposition and have survived with access to basic social amenities like other states spread across the country.

One will then wonder why the government of these 3 states require a drone delivery service to provide the same service which they have been providing to the citizens over the past decades.

Generally, our study found that frequent breakdown of vehicles coupled with poor road network system and insecurity contributed to delay in the distribution of medicines in Kaduna, Cross River and Bayelsa states and this finding is consistent with reports from other low-middle income countries such as Malawi.[viii]

Insurgency has been a major challenge identified in the medicines and vaccine supply chain in the three study states and this was equally found in other countries around the world where insurgency have greatly impacted their healthcare delivery.[ix]

There were five major identified bottlenecks to vaccine supply chain in Nigeria which included;

1. Data availability and reliability for forecasting/decision-making,
2. Logistics distance between vaccine manufacturers and Nigeria,
3. Cost of managing vaccine through the supply chain network to service delivery points,
4. Cold chain and vaccine integrity/potency and
5. Geographical/topographic/security obstacles to the last mile delivery.

Summary of problems in medical commodity supply chain:

Transportation: Delays were often reported in transportation from the State to the health center and subsequently the community. The distance and time required to reach the health centers for resupply was also an issue, explained in part by difficult road conditions or terrain especially during the rainy season with floods making some places unreachable. Relatedly, insecurity during travel was often a concern, especially in bandit occupied and conflict-affected areas.

Due to batching and clustering of supplies to the state, the third-party logistics responsible for a cluster will in some cases use one vehicle to transport all supplies for 7-12 LGAs depending on the size of the cluster. This transport approach causes undue delay in supply to the health facilities.

Logistic management: There were often no standard procedures or formulas for calculating resupply quantities for health facilities and who should be notified if centers are understocked.

Insufficient amounts of medicines from poor forecasting do not respond to increased demand for services, including the provision of medicines. Health facility in-charges report to the LGA essential drugs manager and the Local Immunization officer [LIO] using lengthy forms that are not user-friendly, thereby creating a slow flow of data necessary to inform supply planning. In addition, poor communication between the health center and LGA store limits effective planning for stock needs.

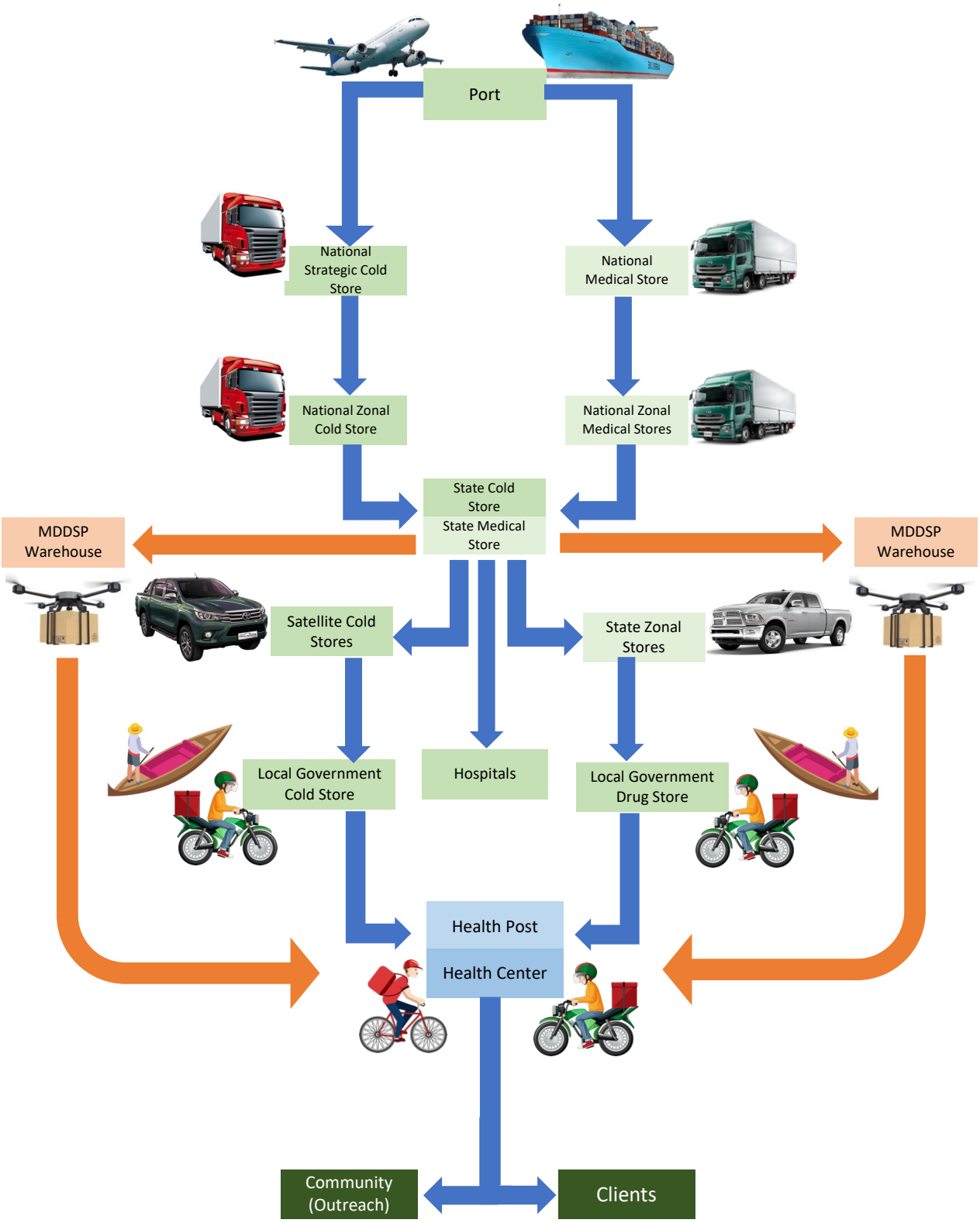
Additionally, there is a significant time lost at the LGA and at the state level largely due to weak management and planning. In sone cases, the LGA essential drug manager waits to collect and collate requisition from all health facilities in the LGA, conducts reconciliation before transmitting same to the state central store. Likewise at the state central store, there is a long wait to get all LGAs within a cluster t submit their monthly requisition and reconciliation before batching all request so that one transport allocated to the cluster can move all the supply at once.

Financial issues: There were challenges with inadequate funding from limited domestic budgetary allocation, delayed disbursements and an overreliance on unpredictable external funding, especially as termination of donor agreement often leads to disruption in supply. Furthermore, direct financial allocations to health centers often ignore the population size they cater for and the demands of the community health service provision and disbursement are often delayed and lower than the amount allocated.

Governance and coordination of commodity procurement: A key reason for stock-out was delays in procurement from lack of or inadequate governance structure. Other governance-related challenges were lengthy and unclear procurement process, frequent changes in key leadership positions within the Ministry of Health with resultant delay in obtaining approval to make orders.

Information management: Poor communication and coordination between different levels of the supply chain made obtaining information to inform supply chain decisions difficult, especially distribution. This included poor visibility of consumption data due to irregular submission of logistics reports by health center and no system to track that supply reached the last mile. This may explain the frequently used push system of distribution with a fixed supply that is not data-driven, and which ignores increased demand from awareness campaigns and consequently can result in wastage in some centers and shortage in others and expiry of medicine in centers with supply in excess of their demand.

Figure 1: Typical public sector country-wide supply pipeline plus novel drone delivery system



In the course of our investigation, we discovered a number of interesting findings that we believe will reshape the current operations of drone delivery in the three [3] states but also provide insight to the states exploring the innovative service as an option for last mile delivery. Our findings are largely related to the operations, management and coordination around the drone delivery services and the last mile facilities in the three states. We have categorized our findings by themes for ease of understanding while also carefully documenting the findings from an investigator perspective in order to help the reader make informed decision.

Table 1: Summary of findings from field visit to Kaduna, Cross River and Bayelsa states

Thematic Area	S/N	Findings
Management	1	Coordination & Management of drone delivery services
	2	Scope of drone delivery service
Drone Operations	3	Operational considerations
	4	Limited payload capacity of UAV technology
	5	Absence of Reverse logistics capability in current drone delivery service
	6	Limitations of Drone Delivery Service with No-Fly Zone Restrictions
Facility Operations	7	Non-forecasting of daily requirements by health facilities
	8	Technology Dependance of Requisitions from Health Facility to Drone base
	9	Absence of a facility-based service delivery interface
	10	Transportation of blood
	11	Cost of drone delivery versus road or sea transport delivery

1. Coordination & Management of the drone delivery services:

The effective and efficient management of any logistics management system for health commodity delivery in a state requires a number of actions.

i. Functional logistics system
ii. Reliable procurement system in place
iii. Active participation of key stakeholders
iv. Presence of an effective management structure
v. Reliable process for forecasting and quantification
vi. Availability of adequate funding

We observed that the management structures in each of the three states has a direct influence on the overall success of the innovative delivery solution, and as a result of the different management structures, the performance of the drone delivery service varies from state-to-state. We have reviewed the management structures across the 3 states and made recommendations on what should be the minimum management standard for the smooth operationalization of the drone delivery service in a state. These recommendations have been made based on certain assumptions of structures that should be available based on the National Health Products Supply Chain Strategy and Implementation plan 2021-2025.

Kaduna State:

The State government took the bold step of being the first in Nigeria to adopt the innovative technology of unmanned aerial vehicle (UAV) for last mile delivery of health commodity supplies. Before the introduction of the drone delivery service into the State Health Management Supply Chain, the state had a robust health commodity delivery system in place. The already existing ecosystem in the state made the introduction of the drone delivery service in Kaduna state smooth.

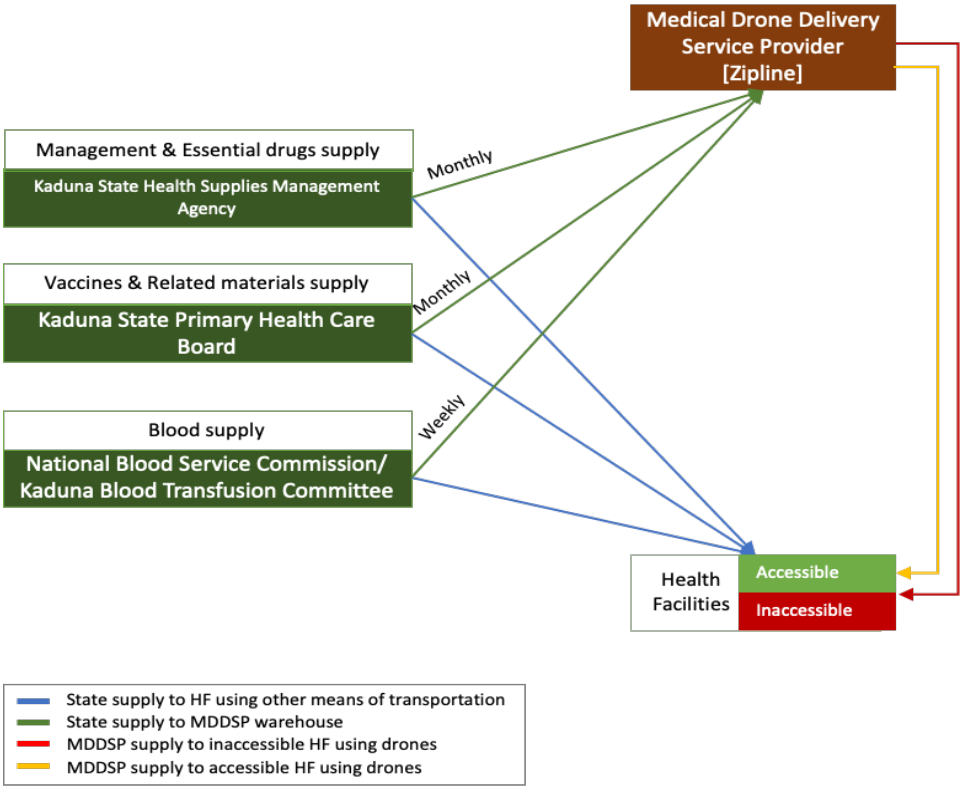
But beyond the convenience of the pre-operational setup, the challenge of ensuring the drone delivery service fits into an existing working but analogy system was obvious to us during the visit to Kaduna State.

There are 7 key stakeholders that played different roles and at different times in ensuring the actualization and operationalization of the drone delivery service in Kaduna State. Table 2 below describes the actors and the roles they play.

Table 2: Showing key actors in Kaduna State and their role in the drone delivery service

Key Stakeholders	Primary Responsibilities	Remarks
Kaduna State Government	- Project owner - Financing the project	
Kaduna State Health Supplies Management Agency [KADHSMA]	- Procurement of essential drugs - Warehousing of state wide essential drugs - Distribution of health commodities to all HF in the state	Supply to MDDSP warehouse is done monthly
Kaduna State Primary Health Care Board [KSPHCB]	- Primary owner of PHC facilities - Primary supplier of vaccines & dry material to MDDSP warehouse	Supply to MDDSP warehouse is done monthly
National Blood Service Commission/Kaduna Blood Transfusion Committee	- Primary supplier of blood to MDDSP warehouse	Supply to MDDSP warehouse is done weekly
Zipline [Drone vendor]	- Last mile delivery using drones - Warehousing of drugs, vaccines & drugs	
Health Facilities (Primary, Secondary and Tertiary)	- Primary recipient of essential drugs, vaccines and blood	

Figure 2: Showing stakeholders in the Kaduna State drone delivery Management and supply chain system



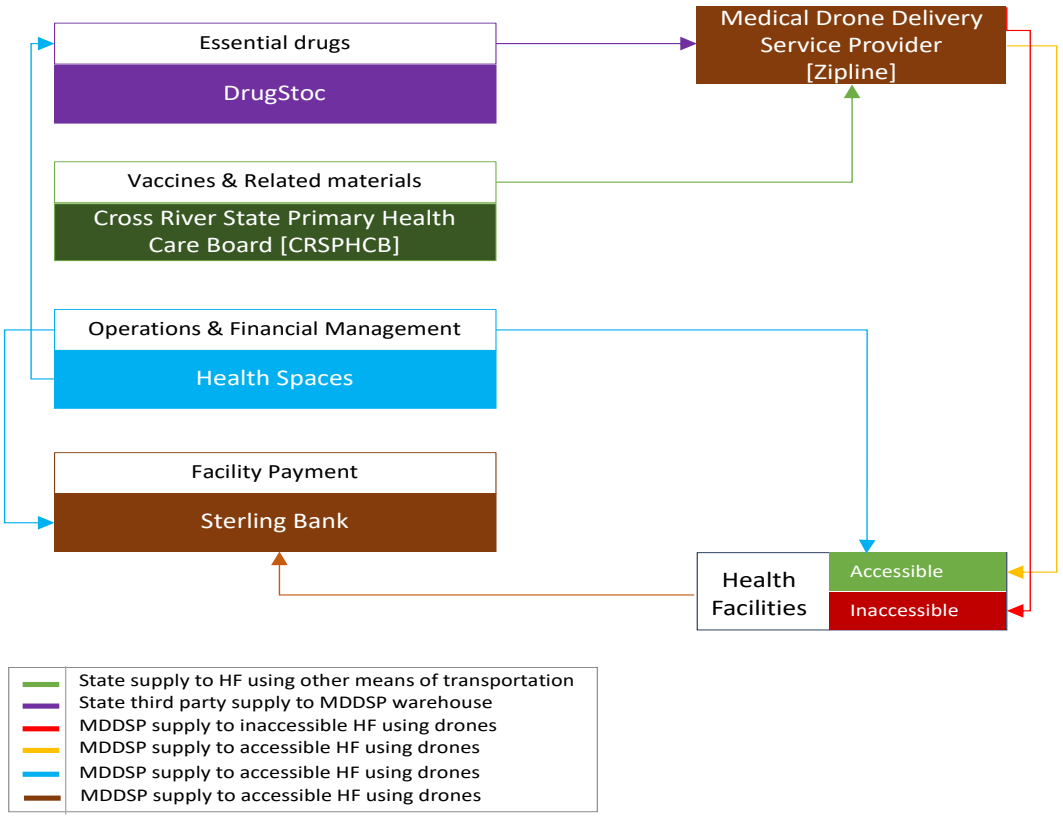
Cross River State:

The state government constituted a Public Private Partnership under the leadership of the State Ministry of Health in order to ensure the effective management and operationalization of the UAV delivery logistics. Unlike what is obtainable in Kaduna state where you have a DMA with a central medical store, the Cross River government had to constitute a multi-stakeholder partnership with each stakeholder having clear roles and responsibilities towards ensuring the effective and efficient running of UAV delivery service to hard-to-reach PHC centers. The table below breakdown the roles and responsibilities of each of the stakeholders working to make sure the issues of stock-outs are a thing of the past.

Table 3: Showing key actors in Cross River State and their role in the drone delivery service

Key Stakeholders	Primary Responsibilities	Remarks
Cross River State Government	- Project owner	
Cross River State Primary Health Care Board [CRSPHCB]	- Primary owner oof PHC facilities - Primary supplier of vaccines & dry material supplier to Zipline warehouse	
DrugStoc	- Private supplier of essential drugs to Zipline warehouse	
Health Spaces	- Management of inventory - Quantification	
Sterling Bank	- Collection of payments from health facilities	
Health Facilities (Primary, Secondary and Tertiary)	- Primary recipient of essential drugs, vaccines and blood	
Zipline [Drone vendor]	- Last mile delivery using drones - Warehousing of drugs and vaccines	

Figure 3: Showing actors in the Cross River State drone delivery Management and supply chain system



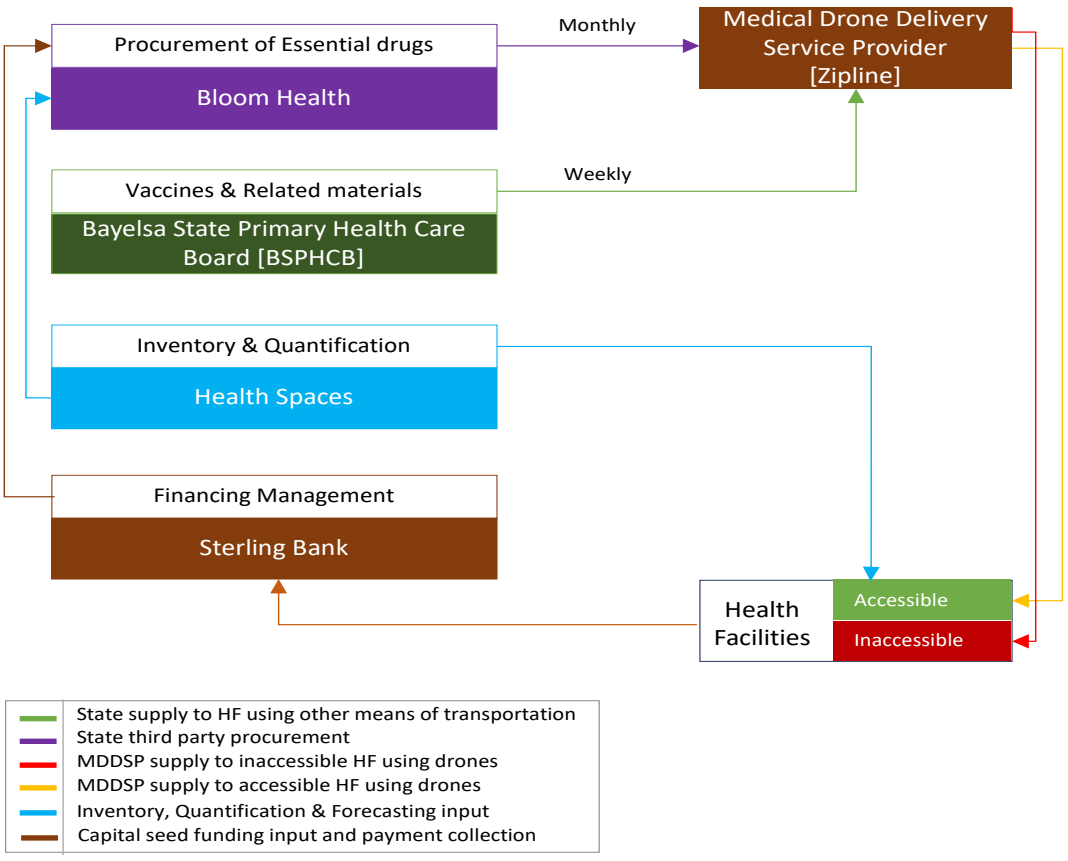
Bayelsa State:

The government of Bayelsa State currently operates a model similar to that of Cross River State. This is a PPP model, with the state taking a coordinating role and providing the necessary policy and coordinating framework for the overall success of the UAV technology introduction and health commodity supply chain. It is important to note that, the PPP model implored by the both Cross River and Bayelsa states has its merits and demerits as much as the Kaduna State model of DMA coordination as too.

Table 4: Showing key actors in Bayelsa State and their role in the drone delivery service

Key Stakeholders	Primary Responsibilities	Remarks
Bayelsa State Government	- Project owner	
Bayelsa State Primary Health Care Board [BSPHCB]	- Primary owner oof PHC facilities - Primary supplier of vaccines & dry material supplier to Zipline warehouse	
Bloom Health	- Procurement of essential drugs with seed capital from Sterling Bank - Procured drugs are warehoused at the State central store	
Health Spaces	- Inventory, quantification and forecasting - Provide logistics management support to the health facilities	
Sterling Bank	- Financial manager - Capital investment for operationalization of a drug revolving fund - Collection of payments from health facilities	
Zipline	- Last mile delivery using drones - Warehousing of drugs and vaccines	

Figure 4: Showing actors in the Bayelsa State drone delivery Management and supply chain system



2. Scope of Drone Delivery Service:

The Kaduna State Ministry of Health has a One Public Health Supply Chain Management Policy. This policy provided the general policy direction, guidance and compliance procedures necessary for the drone delivery services for medical commodities to integrate into the existing healthcare supply chain of the state. The scope for the drone delivery service is defined within 6 key thematic areas outlined below.

1. Inventory Replenishment & Redistribution Logistics
2. Inventory Management, Handling, and Storage (In compliance with Kaduna State Manual)
3. Facility Orders and Approvals
4. Delivery to Health Facilities
5. Monitoring Activities through Data and Reporting
6. Supply chain performance management

3. Operational Considerations:

For an effective and efficient operationalization of the UAV technology for health commodity delivery in the state, key operational considerations are required to ensure optimization and smooth running of the technology. These considerations are critical in the design and planning phase of the project before the deployment oof the UAV technology. These considerations are hinged on a number of factors with overlaps of these factors in some cases.

Geographical convenience: This describes the geographic proximity of the facilities in relation to the flight capability of the UAV technology being deployed. For instance; the consideration is to identify local government areas in a state within close proximity that can be covered within the flight range of the UAV technology being used. The size of the state is a key factor in the overall geographical consideration in this regard.

Based on this consideration, Kaduna State with a bigger geographical size is clustered into 3 zones or hubs. This means that all facilities within the geographical boundary of Kaduna state can be reached with the UAV technology based on proximity to the hub. Only 2 of the 3 hubs have been setup for operations in Kaduna State but only 1 hub is currently operational. For Cross River State, the state will require 2 zones or hubs in order to completely cover and reach all facilities within its geographic boundaries, however only one hub has been setup so far and currently operational. Bayelsa State on the other hand, will only require one zone or hub to cover the entire state, and the hub is fully setup and operational.

accessibility convenience.

In the design of every logistics business, it is recommended to have setup of regional distribution hubs that are carefully positioned closer to rural areas. This way, businesses can streamline processes and accelerate delivery times by cutting the last-mile delivery distance.[x]

Table 5: Showing Warehouse/distribution [hub] centers for drone delivery in Kaduna, Cross River and Bayelsa States.

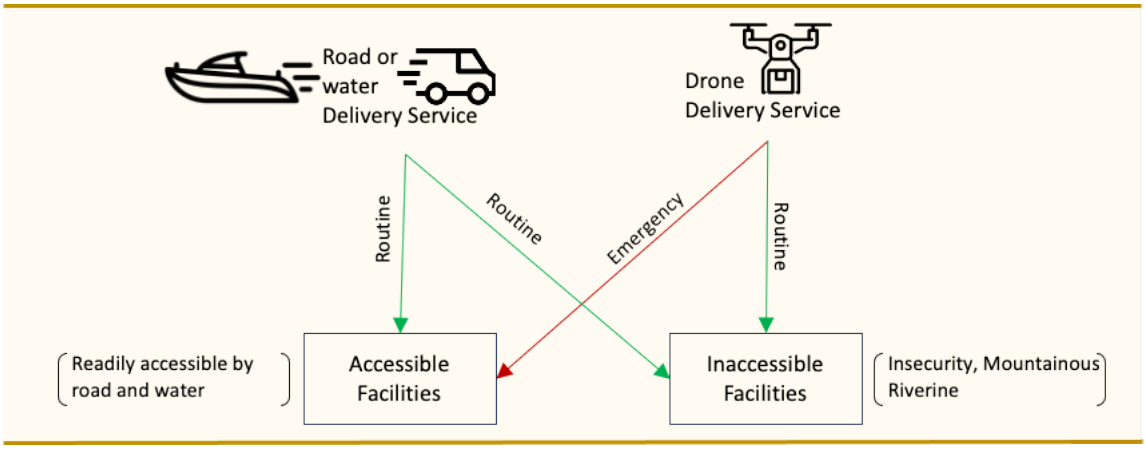
State	Zone 1		Zone 2		Zone 3	
	Nest Location	Status	Nest Location	Status	Nest Location	Status
Kaduna	Pambegua [Kubau LGA]	Active	Kafanchan [Lere LGA]	Setup but not active	Rafin Gyada [Birnin Gwari LGA]	Pending
Cross River	Ogoja [Ogoja LGA]					
Bayelsa	Yenagua		Nil		Nil	

Accessibility Consideration: This consideration is based on the eligibility of the UAV technology to different health facilities based on their accessibility status. Accessibility in this case is defined by hard-to-reach nature of the facility. However, it is important to note here that all health facilities regardless of their accessibility status are eligible for emergency UAV delivery. But for facilities that are classified as inaccessible due to any of the set criteria by the state, they are eligible for routine UAV delivery. The two broad classification for accessibility below provides further context.

Accessible health facilities: These are facilities that are readily accessible for road or boat transport delivery. These facilities are in no way hindered by any form of challenge be it security or of geographical restraints. These facilities are fully eligible for health commodity supplies through road delivery services. However, when there is an emergency situation at hand, the facility becomes eligible for drone delivery services on the condition that the required health commodity is not available in the facility or nearby facilities.

Inaccessible health facilities: These category of facilities as the term- 'Inaccessible' connotes are impacted by one accessibility challenge or another. The accessibility problem could be as a result of one factor or a multiplicity of factors ranging from insecurity to geographical limitations and many others. The health facilities in this category are fully eligible for routine drone delivery services and when the opportunity prevails, they are also supplied health commodities through road transport delivery or other means of transport.

Figure 5: Showing different transport logistics and type of health facilities they serve based in their accessibility status.



On this finding, we realized that the geographic consideration is the first service delivery framework used to define scope for the drone vendor. This requirement is critical for determining the location of the drone base [nest]. The accessibility consideration is then used within the geographic zone or hub to determine what facilities should utilize the drone delivery services and within what context [routine or emergency].

Table 6: Showing degree of geographical and insecurity limitations across the 3 study states

State	Mountainous	Riverine	Insecurity
Kaduna	✓✓✓	✓✓	✓✓✓✓✓
Cross River	✓✓✓✓✓	✓✓✓✓	✓✓
Bayelsa	✓✓	✓✓✓✓✓	✓✓✓

4. Non-forecasting of daily requirements by health facilities:

During our visit to Kaduna-the UAV technology pioneer state, we conducted observations and informal interviews at two [2] health facilities, the UAV take-off base called “nest” and the host community where the hub is located. We found out that the 2 health facilities visited were in close proximity to the nest [approximately within a radius of 10 kilometers] and part of the host community.

At the first HF which is closest to the nest, we met only the deputy officer in-charge attending to a client that left shortly afterwards. We noticed a giostyle with vaccines in it placed on a table right in the middle of the waiting lobby. Our investigation revealed the vaccines were delivered by the drone the previous day for a routine immunization session which took place the same day. Further inquiry as to why the vaccines were still in the giostyle with no ice pack to maintain cold chain, revealed that the facility had no other cold chain equipment to store the left-over vaccines and is not able to return the vaccines back to the drone base maybe through a reverse logistics system, probably with the drone during the next delivery to the facility. The in-charge had no plan for the vaccines and this could amount to significant wastage of life saving commodity and resources.

The second HF which happens to be farther from the drone base is a model PHC in the ward- fully equipped with all the right compliments of personnel and equipment. The HF also benefits from the drone delivery services like the first HF. We observed first-hand how commodity supply requests are being made using the Zip-It app and also how the deliveries are made by the drone. The time interval from the request to the delivery was between 15-18 minutes. Further investigation revealed an average of seven [7] supply requests are made daily by the HF for commodity supplies. The frequency of supply request being made, steered the investigation team into asking questions such as;

- What informs each of the supply request being made?
- Is there any way for them to determine what their daily commodity requirement will be?
- How many emergency supply requests have they had in the last 1 month?
- What other health commodities do you receive by car transportation from the LGA or State?

The response to the questions revealed a number of issues captured in the table below.

Table 7: Showing response to questions on health commodity forecasting at the health facility

S/N	Question	Response	Remark
1	What informs each of the supply request being made?	Patient flow and patient medical requirement are used to guide each supply request made.	This means as many supply request as possible can be made and by extension this has financial implication.
2	Is there any way for them to determine what their daily commodity requirement will be?	Yes! They are able to forecast for a longer period but not for one day. They forecasted when the road transport was used for delivery	No proper forecasting is done to guide the daily request made through the drone delivery.
3	How many emergency supply requests have they had in the last 1 month?	Between 3-5 emergencies last month.	
4	What other health commodities do you receive	Syringes, medical commodities	

	by car transportation from the LGA or State?		

Our conclusion on the non-forecasting of commodities to guide frequency of supply request and other observations made are summarized below.

1- Both health facility 1 & 2 shouldn't be on the list of facilities for routine supplies of health commodities except only on the list for emergency supply. This is because both facilities are not hard-to-reach or security compromised but readily accessible and are located near a well paved road.

2- The non-forecasting of daily requirements by both facility 1 and 2 to guide supply request through the drone logistics has resulted in the abuse of the drone delivery service amounting to additional service delivery cost to the government.

3- Facility 2 with all the right compliments of devices such as the Solar Direct Drive [SDD] refrigerator for storing vaccines should be supplying facility 1 with vaccines during planned routine immunization [RI] fixed or outreaches sessions. This is the reason why left-over vaccines after the sessions couldn't be returned to the facility for storage.

4- The drone delivery service should be complimentary to the existing transport system but not to take it over. This way, the state is only actively using the drone delivery service to address the last mile stockout challenges impacted by emergencies and the hard-to-reach and insecurity nature of the communities housing the health facility.

5. Limited payload capacity of UAV technology:

Payloads refer to the equipment or cargo that a drone can carry. The load to be transported are typically mounted on the drone or integrated into its frame. The payload capability of a UAV largely depends on the intended application of the UAV technology which is closely tied to the size.

The commercial drones used in Kaduna, Cross River and Bayelsa for delivery of health commodities have a limited payload of 1.8 kilograms. This payload capacity is viewed by some of the stakeholders as a limitation. Our review of this perceived challenge is disposed from two perspective.

1- This could be a challenge if the requirement of the last mile facility at a particular time exceeds the payload of the drone. And to get an appreciation of this perspective, we will use a hypothetical scenario where a request has been made by a health facility for an emergency supply of Intravenous Fluids [IV] with other drugs for treatment of a case of food poisoning. The in-charge of the health facility requested 3 bottles of 1000ml IV fluid alongside other drugs;
   a. One bottle of 1000ml of IV fluid = 1 kg in weight.
   b. 3 bottles of 100ml of IV fluid = 3 x 1kg = 3kg
   c. Weight of other drugs = 0.5 kg
   d. Total weight = 3kg IV fluid + 0.5 kg other drugs = 3.5kg
   e. The current in-country drone payload capacity is 1.7kg
   f. By implication, the emergency request from the HF is twice the carrying capacity of the drone.

   If we look at it objectively, in this scenario the current in-country capacity of 1.7kg is able to provide the immediate response treatment in the emergency situation while a second drone brings in the balance supply.

The argument here is, with a higher payload capacity, the government is able to ensure cost efficiency on essential drugs supplied to the last mile. In the current situation in Kaduna, Cross River and Bayelsa states; the delivery based on the scenario above is coming at twice the cost to the state government.

2- Our second perspective is that the current payload capacity might just be adequate and suitable for the health commodity delivery in Kaduna, Cross River and Bayelsa states. What we mean here is that, if the drone delivery service is only for addressing last mile emergency delivery response and inaccessibility challenges impacted due to riverine and mountainous terrains, insecurity and natural disasters; the payload might not necessarily be a big challenge. This can be the case when the drone delivery is complimentary to the traditional logistics supply system and not a full replacement as it is the case in some of the last mile locations in Kaduna State.

   The regular road transport delivery [typically takes 1-2 weeks to get arrive rural LGA headquarters and even more to get to facilities deep in the hinterlands] can be initiated to respond to monthly requirements forecasted based on previous history of consumption and service provision in the facilities whereas the drone delivery only serves as a compliment delivery system and supplies' requirements within current payload range to last miles.

   So, with an effective and properly managed integrated supply management system in place, the current payload of drones used in Kaduna, Cross River and Bayelsa States shouldn't pose a challenge except in situations such as the hypothetical scenario above.

6. Absence of Reverse logistics capability in current UAV technology

The design and operation of the current in-country UAV technology for health commodity supply in Kaduna, Cross River and Bayelsa States has a drawback with regards to reverse logistics. Reverse logistics is a type of supply chain management that moves goods from customers back to the sellers or manufacturers. Once a customer receives a product, processes such as returns or recycling require reverse logistics. Reverse logistics start at the end consumer, moving backward through the supply chain to the distributor or from the distributor to the manufacturer.[xi]

Instances where reverse logistics could be of great value to a medical supply chain system are provided below but are not limited to these scenarios.

1- Retrieval of drugs from one HF and supplying to another HF as a result of stock-out of that particular drug at the medical store

2- Where a mistake was made in the requisition from the HF or order from the store to the medical store:

3- In a situation where there is a bad batch of drugs supplied to the HF and that batch has to be return for investigation to be carried out.

4- Specimen samples requiring transportation for laboratory testing: There are situations where there is a disease outbreak and there are no laboratory services nearby to conduct quick and proper diagnostics; the drone used to deliver a health commodity to a facility can be reloaded with the specimen sample on its way back to the drone base and for further transportation to an appropriate testing facility. An example is in the case of stool samples for Acute Flaccid Paralysis detection and the need to transport sample in reverse cold chain and quickly too. This will be useful particularly where inaccessibility challenges can impact the travel time of the specimen sample collected.

7. Limitations of Drone Services with No-Fly Zone Restrictions

As the phrase implies- No-fly zone in layman terms is an area or space in the air where unauthorized aerial transport are not allowed to fly over. Another definition of a no-fly zone- is a restricted area of airspace over a landmark, event or geographic region in which aircraft are forbidden to fly, unless they have special authorization. Prohibited aircraft can include manned aircraft or unmanned aerial vehicles, also called UAVs or drones. Governments or representative bodies, such as the North Atlantic Treaty Organization (NATO) or the United Nations (U.N.), typically impose no-fly zones for military, security, safety or privacy reasons.[xii] These same prohibitions also apply within the Nigeria air space.

The use of UAVs for health commodity delivery in Kaduna, Cross River and Bayelsa are not exclusive and its operations limited by the defined 'No-fly zones' in Nigeria. In practical terms, the drones being used for health commodity delivery in the three states cannot fly over military installations, airport or any unauthorized area. So, the flight path of the drones must not in any way include areas mentioned above or any other area considered as a restricted flight zone. In Kaduna State, an example is the Zaria LGA Axis; where there are 5-6 military/security installations (including Air force, Navy, Army and any other National Security infrastructure) and this scenario also applies to the Kachia LGA axis.

This no-fly zone or flight restriction areas are posing a challenge to the use of drones for health commodity delivery particularly if the end delivery point is having any of these restricted areas in the drone flight path. This is also why having several zone or hubs become necessary so as to avoid the restricted areas and achieve a clear path way to all facilities.

8. Technology Dependance of Requisitions from Health Facility to Drone base:

The introduction of technology for the effective running of the drone delivery operations is one that is highly commendable. As we all know, technology brings a lot of value addition into any system; most importantly is the accountability, visibility, transparency and prompt control that is integrated into the system. The drone services in Kaduna, Cross River and Bayelsa States have an application used by the health facility in-charges for the requisition of health commodities, tracking of delivery process and for taking delivery from the drones. This application or software is called Zip-It.

The application basically provides the interface between the health facility and the drone delivery service. We observed that the owners of the service- government are not looped into this application interface. Where there is an emergency, a phone call can be placed directly to the drone base with the details of drugs being requested and delivery process commences immediately. This consideration has been made to avoid any delay that might arise in the use of the application due to network challenges or any other problem.

Considering that the drone delivery services are particularly meant to service hard-to-reach locations in the states, we foresee a few challenges

- Failure of mobile network: a situation where there is a breakdown in the mobile network around the community where the HF is located, it would mean the Zip-It application or phone call to the drone base cannot work. Similar situations like this happened in Katsina and Zamfara states when the state government turned off all mobile network services because of an ongoing military intervention to curb incidences of insecurity.
- Lack of electricity to power mobile devices: In fact, some of the HF deep in the hinterland might have challenges in getting electricity to charge their phones. A significant proportion of the rural LGAs on the national grid through the rural electrification program still struggle to get electricity for a day in an entire week.

- Dependence on smart phones: From experience, not every health worker can afford a smart phone and of those who can afford, not all of them might be able to afford a smart phone with adequate capability for applications such as the one being used for supply requisition.
- Out-of-pocket Expenses: The question around who is paying for the internet data being used by the health worker to request for the drone delivery services comes to mind with the benevolent use of a software application. During observation, we noticed the Zip-It application like many other applications struggled a bit with the internet network before it caught-on and the health worker was able to complete the requisition. We have included the Zip-It app requisition process flow in the annexures.

9. Absence of a facility-based service delivery interface:

Just as we have seen the importance of having technology integrated into the requisition component of a supply management system, so is the importance of having technology integrated along each and every value chain component of the supply system. The request and usage information from the drone supply service is not document in a technology-based tool that gives visibility to the managers of the health facilities as regards what is currently ongoing in the HF.

Our engagement with the government partners showed that the data generated as a result of the drone delivery is not captured, documented and utilized for decision making. Over time, it is possible to determine the frequency of emergency request by a facility through the drone delivery system, track the medical condition that necessitated the emergency requisition, collect data on the demography affected by the emergency condition, plan for stock-up of the medical commodity at the health facility to reduce potential cost to government from incessant request on the same medical condition using drone delivery, early determination of a potential disease outbreak in the community serviced by the health facility from the pattern of medical presentations and medical commodities requested. These and more are the different data elements that can be tracked, collated and used for prompt decision making.

10. Transportation of blood:

In the course of our findings and in this report, we have laid emphasis on health commodities and vaccines as major commodities transported by the UAV technology in Kaduna, Cross River and Bayelsa states. It will wrong to conclude this report without including the transportation of blood and related blood products using the UAV technology to the last mile facilities. This is in fact one of the most important lifesaving commodities transported by the drone delivery service in all the 3 states.

Blood transfusion plays a vital part in patient care worldwide. For example, blood and blood products are often used in maternal care for obstetric hemorrhages,[xiii] in pediatrics to treat anemia, and in surgical procedures.[xiv] In low-income and middle-income countries (LMICs), 54% of blood transfusions are given to children for various conditions.[xv] In sub-Saharan African nations this rate is even higher—young children with severe anemia account for 70% of all blood transfusions,[xvi] followed by severe hemorrhage, which is the leading cause of maternal deaths.[xvii] For many sub-Saharan African countries to achieve the health-related Sustainable Development Goals related to under-5 and maternal mortality, there is a need to improve access to safe blood.[xviii]

11. Cost of Drones delivery versus Road or Sea transport delivery:

"We believe it is important that future studies aim to quantify the health impacts of this intervention and conduct a cost-effectiveness analysis, as drone delivery is at present more expensive than road delivery in Rwanda.[xixxx]

From the above extract made from research conducted in Rwanda, there is evidence that the use of UAVs for health commodity delivery at the moment is more expensive than road or sea transport. From our findings, we are convinced beyond reasonable doubt that the cost of operating a drone delivery service for only one

zone or hub in a state is greater than the overall cost of car or boat transport for the entire state in a year. The justification for our conclusion is as follow;

- The drone delivery service is only complimentary to the larger logistic supply chain system. However, in locations that are hard-to-reach, the drone delivery service seems to do a bit more due to the limitations faced by road or sea transport.
- Going by the fact that the drone delivery service only caters for emergencies for the entire hub catchment area and for very hard-to-reach locations; It then means that the drone delivery service caters for only a fraction of the logistics requirement for the entire hub.
- There is another important cost associated with the use of the drone delivery service besides the health facility delivery fee; this cost is known as the 'hub fee'. The hub fee is charged by the vendor as an infrastructure recovery cost over a period of 4 years for the entire state. The fee is charge monthly and it is estimated based on the percentage of the total number of health facilities in the state serviced in a month by a hub. For instance, Kaduna state with two hubs is servicing 731 health facilities out of a total of 1200 health facilities in the state amounting to about 60.9%. But based on agreement with the state, this percentage is reduced to 40% and sometimes vary. An estimated $110,000 to $150,000 USD is charged by the vendor every month. This approach will guarantee a sustainable future for the drone delivery service in Kaduna state, with the infrastructure and technology now becoming the property of the state.
- The cost of operationalizing a drone delivery service for one hub is far greater than the cost of operationalizing the road and or sea transport for the entire state.
    - Using a hypothetical example of a state with 33 LGAs and 2100 functional public health facilities. The state is zoned into 3 hubs [with 682 (11 LGAs), 847 (13 LGAs) and 571 (9 LGAs) HFs] for ease of drone delivery service. This is scenario is for a monthly drone and road delivery.
    - Let's assume drone delivery operations started in the zone or hub with 847 HFs. Under **emergency requisition**, the typical scenario is the drone delivery service will provide last mile logistics to all 847 HFs and for **routine requisitions,** the drone delivery service is conducted to 338 HFs amounting to 40% of HFs in the hub that are classified as hard-to-reach. The overall cost of the drone delivery can then be estimated using some standard cost comparison elements and cost analysis.
    - Also note that a hub fee is added monthly as observed in the Kaduna example above and the 2 other states.

Drone Delivery Service [1 hub]

Delivery coverage-**Emergency Requisition [DCE]**: 847 HF in 13 LGAs
Delivery coverage-**Routine Requisition [DCR]**: 338 HF in 5 LGAs
Hub fee [regardless of the type of delivery]: $?

Estimate for Routine requisitions:

- Delivery timeline [DT]: Daily
- Delivery frequency per day [DF]: 150 Maximum
- Delivery payload [DP]: Limited [1.7kg]
- Delivery volume [DV]: Miniature supply
- Delivery location: Health facility {last mile]
- Cost per delivery [C/D]: $14 at 1N15,400
- Cost per delivery per day per hub [C/D/D]: $14 x 150 = $2,100 [N2,310,000]
- Cost of delivery per month per hub: $2,100 x 30days= $63,000 [**N69,300,000]**

Total cost per month for drone delivery service: Total cost per month plus the hub fee

N69,300,00 + hub fee

Note:

- The exchange rate is a key factor in the costing. Last year dollar to Naira was N690-810 to a dollar but currently the rate is
- These figures might vary depending on the number of deliveries and health facilities serviced.

Car Delivery Service [1 hub]

Delivery coverage: 847 HF in 13 LGAs

Estimate for Routine requisitions:

Delivery timeline [DT]: Monthly
Delivery frequency [DF]: Nil
Delivery payload [DP]: Limitless
Delivery volume [DV]: Bulk
Delivery location: LGA Essential Medicine store
Cost per delivery to 13 LGAs[C/D]: N910,000
Cost per delivery to 847 HFs: ??? [This is usually not factored in but that is not to say there is not cost]
Cost of delivery per month per hub: N910,000
Cost of delivery per year per hub: **N10,920,000**

Total cost per month for road delivery service: Total cost per month N10,920,000

Table 8: lessons Learnt

S/N	Lessons Learnt	Recommended Action
1	Need for real-time visibility into the utilization of medical commodities by health facilities from drone delivery services	- An interface that gives the government actors visibility into all transactions related to the UAC technology should be considered. - We recommend a platform, that will provide real-time visibility into the activities of the health facilities in relation to the use of the UAV technology services. This will provide analytics around the epidemiology of diseases being treated. - Additionally, a dashboard in the offices of the Commissioner for Health, ES Drug Supply & Management Agency and ES State Primary Health Care Development Agency will be very useful in deepening ownership and accountability around the drone services
2	Importance of having a management and coordinating structure for UAV technology operations	- The drone delivery service for health commodity delivery can be operationalized based on two observed management models. - One model as seen in Kaduna state, had the Kaduna State Drug Management Agency in the center of the management structure. With this model, the coordination, management, funding for technology operations, and supply of the medical commodities including vaccines are from the government while the zonal warehousing and transport are executed by the UAV service provider/vendor. There are only two major actors involved in this model; government and the UAV service provider/vendor. - The second model as seen in Cross River and Bayelsa States, have no Drug Management Agency at the time of our study and as such, they are only able to bring in a private entity to provide the health commodities. The government in this model plays a coordination and vaccine supply role with other private entities playing the others roles. There are 4-5 actors involved in this model inclusive of the government. - We are recommending a hybrid model as seen in Kaduna State and the model seen in the other states. This way the coordination and management role of the DMA will ensure standardization and compliance across board while the PPP will take away the burden of government doing business and focusing on what

		matters the most which in this case is oversight, coordination and providing the enabling environment
5	Understanding the cost requirement for setup of drone delivery services	- The initial setup cost of the UAV infrastructure based on the model being operated by the vendor operating in Kaduna, Cross River and Bayelsa states is high. This high cost is believed to be because the investment is expected to be long term. - However, we assume the perceived high cost of providing the drone service to the states could be because of the high infrastructure setup cost and other operations related cost. - It is important to note that the drone is not in any way replacing the existing supply chain system in the state but rather it is serving as a complimentary transport solution to augment the shortfall of the other modes of transport. The areas of augmentation are in cases of emergency and areas that are hard-to-reach. - We are recommending a revisit of the operational model for the UAV service provider to enable a reduction in the setup cost with the hope that it impacts the operational cost of the service.
6	Sustainability of the drone technology by future governments	- Sustainability is of paramount importance particularly when a novel technology such as the UAV technology is introduced into an already existing and working system. - Despite the high impact achieved by the introduction of the UAV technology in the 3 study states with regards to emergency supply and hard-to-reach locations, we are of the opinion that the operational model deployed by the UAV service provider is not sustainable except and otherwise some modifications are made to the model in the near future. - As a complimentary function, the current cost of operating of the UAV technology for medical commodity supply overshadows the cost of running the entire health supply chain system already existing. - We are recommending to that existing states should revisit the operations model in order to make the impact long lasting and sustainable.
7	Use of dollar as the currency in the Service Level Agreement [SLA] should not be encouraged.	- The current Service Level Agreement signed by the government and the UAV vendor across the 3 study states are factored in the US Dollar currency. This action in itself accounts for significant changes to the cost structure of the agreement due to any instability in the currency exchange. - At the time when the SLAs were signed across the 3 study states, the rate of a Dollar to Naira was $1 to N700-800. During the course of our study, the Dollar to

		Naira exchange rate at parallel market went up to about N1,700 to a Dollar. That is an over 100% increase in the cost of operations of the UAV technology based on the exchange rate during the period. - This costing structure does not make the use of the technology sustainable. - We recommend that the current SLA is revised and all future SLAs are costed using the local currency- Naira. This will ensure stability in the cost of operation.
8	Application of the UAV technology for other sectors besides health to lower cost of operations	- Several use cases exist for the use of UAVs for last mile logistics and other special operations outside of the health sector. So, it might be of great cost benefit to the states if an integrated use strategy is considered when making investment in the UAV technology. - Despite the fact that most sectors most often operate in silos and rarely share resources, it is imperative for states to consider a meeting point in the use of novel technologies such as the UAVs. - We recommend the following actions; - Conduct of requirement gathering on the use of UAV technology across the different sectors. - Consider establishing a UAV coordinating structure with representatives from benefiting sectors as members. - State government to procure, manage and operationalize the UAV technology to further lower cost and make it sustainable.
9	Having a communication strategy for UAV technology deployment is crucial.	- The need for a robust communication interface is critical to the overall success of the drone delivery service. - Communication is required in the following areas of operations; - In making request from the health facility to the drone delivery hub. This can be done via the Zip-It app however, there is a toll-free call center, telegram, WhatsApp and direct call. - In responding to the health facility on their requisition and the ETA of the drone delivery - In the drone delivery hub requesting stock-up from the state DMA on commodities running low. - Routine meetings with different stakeholders to communicate the progress being made in the operationalization of the UAV technology. - We recommend setting up a robust and effective communication strategy around the UAV technology service provision.

Conclusion

The use of UAV technology in the health space in Nigeria particularly in medical commodity supply chain is still considered novel. So far, only 3 states have demonstrated the bold interest in using the technology to address some of the service delivery challenges linked to logistics and supply chain. Before now, the drone technology is widely known and used in Nigeria for mostly surveillance purpose. Some private and corporate entities have equally deployed the UAV technology for geographical survey and mapping particularly in the oil and gas sector but also for mapping urban infrastructure. This is to say the use of UAV technology across various sectors are limitless.

In the health sector, the current use case for the UAV technology is only one of many other use cases. Nevertheless, this is one of the most critical and important use case, which is in ensuring no life is lost due to unavailability of life saving health commodities. The use of the UAV technology for last mile delivery of essential medicines, vaccines and blood in Kaduna, Cross River and Bayelsa states has impacted the lives of ordinary Nigerians through

1. Saving lives due to timely availability of affordable, safe and effective essential medicines and blood
2. Ensuring steady availability of live saving commodity by preventing stock-outs
3. Increased utilization of health care facilities
4. Making healthcare affordable to ordinary Nigerians by prevention of out-of-pocket expenses as covered by the state contributory insurance scheme.
5. Eliminate reliance on sellers of fake drugs due to stock-outs

The opportunity to scale the use of the UAV technology for last mile delivery of medical commodities shouldn't be lost with the current challenges associated with the use of the technology. There are a number of challenges that are worthy to note but, in our opinion, they should not be the reasons for not allowing the UAV technology to thrive within the current health supply chain ecosystem in Nigeria. Topmost of the challenges is the cost of operating the technology. It is important to state here that the technology in itself is not significantly expensive to acquire, however, the current model of operations in the 3 study states has made it look expensive and as a result not sustainable. It important to state here that the current and only vendor operating the UAV technology for last mile delivery of medical commodities has incorporated a sustainability plan within its operating model over a duration of years but the question is, was the sustainability framework designed alongside the states considering the financial viability of the sustainability plan within the duration?

Some of the other limitations experience by the UAV technology can be addressed with modification to the UAV technology design and configurations. We believe the current deployment model across the 3 implementing states can be revised to reduce investment cost which will invariably reduce the operating cost of the technology thereby making it more financially sustainable.

The opportunity that the UAV technology presents in the health space is limitless, and there couldn't have been a better time to adopt this novel technology to improve the health outcomes of Nigeria's growing population and in playing the much-needed last mile supply chain solution for the achievement of the Universal Health Coverage.

Recommendation for use of Unmanned Aerial Vehicles [Drones] for last mile delivery of medical commodities in other States.

Based on the conclusion above on findings made from this case study, it is imperative that other states begin to re-think and re-strategize their health commodity supply chain management system to incorporate UAV technology as an integral component of the supply chain logistics framework.

We have carefully compiled the steps required to be taken by interested states in order to actualize the integration and operationalization of the UAV technology in the medical commodity and vaccines supply chain management of their respective states regardless of their geographical peculiarities.

Table 9: Showing recommended steps for implementation of the drone delivery service in states

Step	Required Action	Key Considerations
1	Conduct a Needs Assessment to determine the current logistics gap in medical supply chain to the last mile	- Response time to emergency situations by the current logistic system compared to the use of the drone delivery - Contribution of stock-out of medical supplies to overall mortality rate in the state. - Establish understanding as to why the gaps exist and whether the use of UAVs will address the gap. - Identify what potential problems could result from the introduction of UAVs to the state's supply chain management system.
2	Identify UAV service provider vendors or UAV supply vendors, to determine what type of the UAV technology best addresses the existing gap in the state's supply chain management system.	- Choice of UAV vendor and terms of engagement vis-à-vis the financial implication - Option 1: UAV service provider vendor: they will provide the drone delivery service to the state just like what is currently available in-country. [Recommended for short-term use] - Option 2: UAV supply vendor: they will only supply the drone technology to the state based on agreed specifications and provide maintenance support. [Highly recommended for long-term use] - Sustainability of the UAV operations if embarked upon should be the utmost consideration for this step.
3	Conduct an institutional assessment to determine the best management system for the smooth running of the UAV technology if eventually introduced.	- Does the state have a Drug Management Agency to coordinate the services as seen in Kaduna State? - Is the state willing to consider a Public Private Partnership just as seen in Cross River and Bayelsa states. - Is there a robust logistic management structure in the state for a smooth running of the service? - What coordination mechanism is required to smooth integration and running oof the UAV technology

4	Develop an operational framework for the drone delivery service that is in tune with existing supply chain policy frameworks in the state	- It is imperative identify all existing supply chain policy framework for different programs that exist in the state. - The State policy on essential drugs supply chain management, the State policy on vaccine supply and distribution policy and the national blood transfusion supply chain management policy are some of the very important policy frameworks that should be consider at this stage. - There might be many more specific policy frameworks for program drugs such as HIV, tuberculosis etc. - This is a critical step that ensures the full integration and sustainability of the drone delivery services into existing supply chain management system in the state.
5	Develop a memo to the executive governor backed by the needs assessment and the UAV technology vendor analysis. This step is in order to secure approval and financial backing for implementation.	- Cost effectiveness analysis vis-à-vis the expected impact brought about by the use of the technology. - It might be imperative to review the state supply chain management policy so as to fully incorporate the UAV technology as a state-wide policy for health commodity delivery. - Note: the revised National Supply Chain Management Policy has been updated to include UAV technology as a transport logistics for medical commodities. - This national policy can equally be adapted for state application.
6	Identify and secure funding from the government and possibly from external donors for pilot phase implementation of the UAV technology.	- Based on the size of the state and distribution of health facilities, it is recommended that a zone or hub approach is deployed to minimize initial investment cost and associated risk based on the local peculiarity. - Most viable funding option for a pilot phase will be a co-funding, that is funding from government and a donor. Otherwise, the state can make the investment for the pilot phase to justify future budgetary allocation.
7	Secure relevant national and state flight permits for safe use of drones in the state. This step is to ensure compliance with national and state regulations	- If a UAV service provider vendor is engaged to implement the technology integration and operationalization in the state, they will be responsible to secure necessary drone flight permits and license. - If a UAV supply vendor is engaged to supply the technology and state will be responsible for the technology integration and operationalization, then the state will be responsible for securing all required flight permits and license for the smooth use of the technology.

8	Setup and deployment of UAV technology	- This could be either of the two options described in step 2 above. - If Option 1, the responsibility oof the setup will be entirely that of the vendor with of course some role for the state government. - If option 2, the responsibility will be more of the state government with some technical role for the vendor
9	Conduct onboarding for all relevant stakeholders	- Onboarding of all users on the new technology is very important for the overall success of the system. - Training for the operators of the technology - Training for the direct beneficiaries of the technology - Training for the monitoring and evaluation team - Training for the management on the use of dashboard to track performance and operations - Training on redress mechanism and others.
10	Sensitization of communities	- It is important to embark on a zone or hub-wide sensitization campaign to create awareness about the UAV technology so the communities being serviced by this innovative technology can protect the investment for their overall benefits.
11	Setup a monitoring and evaluation system for the drone delivery system	- Identify a remote monitoring system that tracks drone service operations as well as health commodity requisition and utilization data. - Some of the data to be monitored include but not limited to; flight operations, commodity requisitions and utilizations, emergency requisitions, client medical presentation and treatment plan etc. - Conduct impact evaluation over a period of time to determine return on investment and justification for wide use of the technology in the state.

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