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Federal Democratic Republic of Ethiopia  
Ministry of Health

# An Unfinished Journey: Vaccine Supply Chain Transformation in Ethiopia





In 2013, Ethiopia began a process of transforming its vaccine supply chain to improve performance and enhance sustainability. Here we outline the rationale for this transformation, what was done and why, challenges encountered, successes, failures, and lessons learned. The hope is that this document will encourage other countries to consider such a transformation, and the lessons here will help them to achieve success.

## Background

Ethiopia's EPI program began in 1980 with six antigens, and while coverage has increased over time, challenges remain to achieve full coverage. Currently the program offers 11 antigens including the most recent additions - Rotavirus in 2013 and IPV in 2015. Coverage for all eight basic vaccinations currently offered increased from 14.3 percent in 2000 to 38.5 percent in 2016 (Demographic Health Survey, Figure 1). BCG coverage over the same period increased from 45.6 percent to 69.2 percent<sup>1</sup> (data not shown). Major interventions over that period contributing to this included the introduction of a health extension program in 2003, which greatly increased access particularly in rural areas; and the introduction of the Reach Every District (RED) approach, which engages communities, introduces micro planning, and creates structured monitoring to improve immunization coverage, in 2004.

## Pre-Transformation: "Chaotic"

Prior to supply chain transformation, the vaccine supply chain in Ethiopia was characterized as "inefficient and unacceptable", and distribution was described as "chaotic" (Haghighi 2011). The system broadly followed the administrative structures of the Federal Ministry of Health (FMOH) and regional health bureaus (RHs) resulting in six levels: central – regional- zonal- woreda (district) – health facility (health center/hospital) -health post. This high number of levels increased the number of commodity hand-offs, and inefficiency,



The Last Mile, Health Extension worker in Bahir Dar about to go on a vaccine outreach

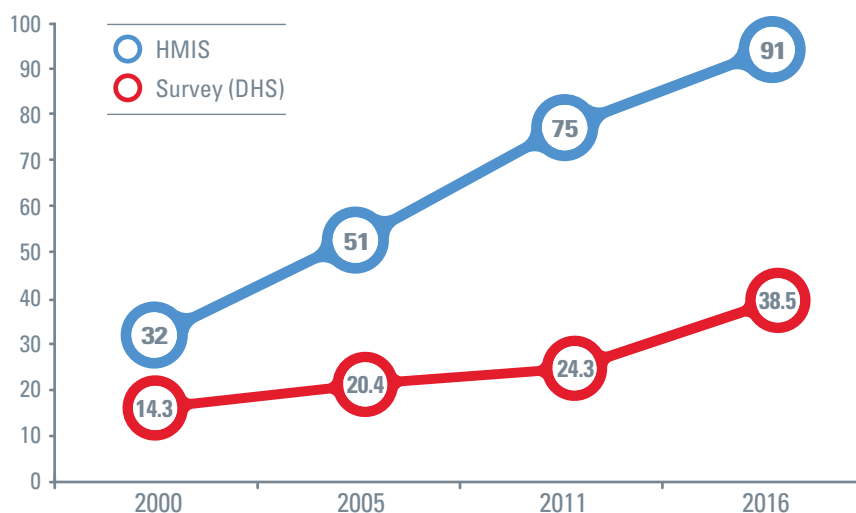
and made it more difficult to achieve visibility – the ability to know as close to real time as possible supply of and demand for vaccines at all levels and locations. With ownership and responsibility spread over so many entities,

there was an overall lack of accountability, a point raised by Tariku Berhanu of UNICEF: "We never knew who was responsible for problems. The woreda would say talk to the zones; the zone would say it's the regions issue". There was also a lack of investment and little capacity for supply chain management. Trained staff would turnover quickly, leading to a lack of institutional memory.

## The Integrated System

Meanwhile, the supply chain for other essential medicines had undergone its own transformation starting in 2005 with the Pharmaceutical Logistics Master Plan. This plan led to the creation of an autonomous FMOH agency responsible for the entire public sector health care supply chain – the Pharmaceuticals Fund and Supply Agency (PFSA)<sup>2</sup> - , and the design and implementation of an "integrated" supply chain – the Integrated Pharmaceutical Logistics System (IPLS) delivering a range of priority health commodities (HIV, family planning, malaria, maternal & child health) to most health facilities. PFSA benefited from significant

Figure 1: Percent of children 12-23 months who had received all eight basic vaccinations, survey (DHS) and HMIS data, Ethiopia 2000-2016



<sup>1</sup> Note that coverage data from the HMIS are significantly higher than DHS (survey) data.

<sup>2</sup> Note PFSA was renamed the Ethiopian Pharmaceuticals Supply Agency in 2019 (EPSA)

**Figure 2: Locations of Regional Hubs across Ethiopia**



investment in infrastructure, systems, and human capacity. As a federal agency, it could design a more “rational” supply chain - one that was not constrained by administrative boundaries. Improvements in commodity availability followed<sup>3</sup> and underpinned many of the health improvements made by Ethiopia<sup>4</sup>.

## Rationale

From its inception in 2007, PFSA's mandate was envisaged as potentially extending to vaccines. However, it was not until 2013 that the FMOH made the policy decision to transfer vaccine supply chain management to PFSA. The move was fully supported by the Maternal and Child Health Directorate and the EPI program at FMOH. The rationale for the decision was as follows:

- **Visibility:** PFSA's status as a federal agency would make it easier to eliminate levels in the supply chain to enhance data visibility and thus supply chain efficiency

- **Accountability:** Having a single agency responsible for most aspects of the vaccine supply chain would improve accountability for system performance
- **Sustainability -** By leveraging PFSA infrastructure, systems, technology and human capacity, supply chain sustainability and performance would be enhanced.
- **Efficiency:** With several new expensive, and large volume vaccines being introduced (Rota in 2013 and PCV in 2012) there was recognition that a new approach was needed for the supply chain and a reluctance to invest in the current system without major changes.

It is important to note that even in 2012/13 when transformation started, PFSA was already involved in the vaccine supply chain: the central cold room was technically under PFSA management, and the agency handled

the clearance of shipments through customs and vaccine delivery to districts for campaigns.

## The Plan

In early 2014, a Vaccine Supply Chain Management Transition Plan (FMOH 2014) was prepared. The high level plan envisaged procurement of cold rooms, refrigerated trucks and refrigerators; relocation of existing cold rooms to PFSA hubs; design and implementation of an LMIS; development of SOPs; and training and recruitment of staff; all to be completed by the end of 2015. It envisaged a phasing on a new distribution system with PFSA delivering initially from hubs to zones, later from hubs to woredas (by-passing zones) and later hubs directly to health facilities that are easily accessible.

A later plan was developed in June 2014, which envisaged a phased approach and identified three initial regional hubs – Bahir Dar, Jimma, and Mekelle – where transition would begin first, with PFSA taking over storage and distribution of vaccines from the RHB or zonal health department (ZHD). In 2018, the country developed an overall Immunization Supply Chain Management Strategy (2018-2023), which attempts to address the current and expected challenges in the iSC through strategic priorities and linked initiatives (Figure 2).

Gavi's supply chain strategy<sup>5</sup> identifies five fundamentals essential to strengthen immunization supply chains (Gavi, 2016). This report examines how supply chain transformation in Ethiopia addressed these five essentials.

## 1. Supply Chain Leadership

At the heart of the transformation was the idea of an evolution in role of the FMOH and other levels in the healthcare administration from an active hands-on role in the vaccine supply chain to more of a stewardship role: leaving

<sup>3</sup> A 2014 survey (Shewarega 2015) showed availability of select essential medicines at around 90 percent; compared to about 70 percent as reported in a similar survey in 2003 (FMOH 2003).

<sup>4</sup> For example, contraceptive use (MWRA) increased from 13.9 percent in 2005 (DHS 2005) to 35.3 percent in 2016 (DHS 2016) - nearly two percentage points a year. Under-5 mortality dropped from 123 (per 1,000 live births) in 2005 to 67 in 2016.

<sup>5</sup> <https://www.gavi.org/library/publications/gavi-fact-sheets/gavi-supply-chain-strategy/>

## Key Stakeholders

- The FMOH is the policy making and standards setting body for the healthcare sector.
- Ethiopia is a federal republic with 11 self-administering regions or city administrations. Each has its own Regional Health Bureau (RHB) responsible for management of healthcare services, with management responsibility further decentralized down to zones and woredas.
- EPSA (formerly known as PFSA) is an autonomous agency of the FMOH, with a board setting overall policy and direction; the board includes RHB representatives
- UNICEF is a key partner for the EPI program in Ethiopia, assisting with forecasting, procurement, and overall technical assistance
- Other partners for transformation included WHO, and John Snow Inc. (JSI), and the Clinton Health Access Initiative both providing technical assistance to PFSA and FMOH

the hands on operation of the supply chain to PFSA, with the FMOH, RHBs and woreda health offices focused on policy, planning, and overseeing service delivery, and holding PFSA responsible for vaccine availability.

Of note was the leadership given. Dr. Tedros Adhanom Ghebreyesus was the Minister for Health when the PLMP was developed and PFSA created, and made overall supply chain strengthening a priority for his administration. His successor, Dr. Ketema Admasu became minister in 2012, and championed the vaccine SC transformation process. This high level federal ministry leadership, combined with that of RHBs was a key success factor. Conversely, where RHBs were not fully involved transition lagged (see below).

**Challenge:** Supply Chain transformation proceeded slowly. In particular, most of the period from 2013 to 2015 was given to planning with little real progress. Some of this was due to procurement delays in receiving

items like cold rooms and refrigerated trucks, delay of installation of cold rooms, and the lack of suitable electric power for cold rooms. Even after 2015, progress was slow: of the three hubs identified to begin transition, two progressed well while one proceeded much more slowly. The difference was the level of support and engagement of the respective RHBs. Amhara and Tigray RHBs supported the new policy, and engaged with their respective hubs in Bahir Dar and Mekelle to drive transition. With hindsight, the choice of Jimma as the PFSA hub in Oromia for transition was not a good one: Jimma is located a long way from Oromia RHB (based in Addis Ababa), and so the process lacked RHB involvement and direction, and the local ZHD may not have been sufficiently empowered to drive the process.

## 2. Continuous Improvement & Planning

An EVM assessment was conducted in 2013, and the subsequent assessment report (FDRE 2013) identified several areas for strengthen-

ing that would be part of the transformation, including replacing older and under-performing cold chain equipment, building capacity of cold chain equipment technicians, implementing regular temperature monitoring, and the need for effective stock management procedures. However, a subsequent assessment has been delayed, and at the time of writing (mid 2019) – nearly six years later - had yet to take place. One of the challenges in Ethiopia has been identifying where progress has been made and where challenges remain – while all stakeholders agree that improvements have been seen, the absence of a rigorous assessment of baseline and current performance has been a handicap.

In addition, while plans were produced, they tended to be more high level, and lacking in operational details. They were also highly ambitious. Plans were also not monitored continuously and adjusted accordingly.

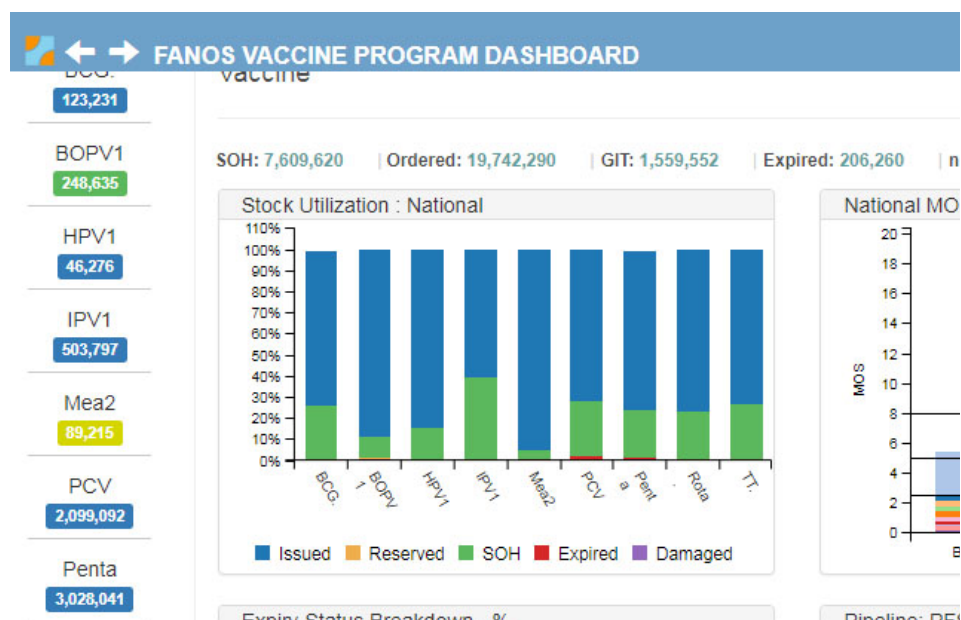
## 3. Supply Chain Data for Management

Many of the successes in Ethiopia for supply chain transformation have been related to data availability and use, even as challenges remain. Transition ensured that vaccines benefited from integration into the existing PFSA LMIS. Vaccine specific management features were introduced (such as VVM) and systems were deployed to the central cold rooms where vaccines were already being managed. Anticipating that transition might take time, PFSA and their LMIS partner JSI, decided to score a quick win and deploy PFSA's Health Commodity Management Information System (HCMIS)<sup>6</sup> to regional and zonal cold rooms before these transitioned to PFSA management, allowing for rapid data visibility where previously there had been none. When PFSA Mekelle started delivering vaccines to woredas in Tigray in 2014, the LMIS system was quickly deployed to these woredas. A key learning however was that the HCMIS system was not suitable for woredas due to connectivity challenges so a new, mobile

<sup>6</sup> The HCMIS was rebranded in 2017 to Vitas



**Figure 4: Fanos Dashboard page for EPI program includes live data for central, hub and woreda levels.**



based inventory management system was developed (mBran) and quickly deployed in 2015 (Figure 3). That system is currently deployed to nearly 700 woredas, providing live data visibility and electronic ordering, and is expected to be deployed at all 800+ woredas by mid-2019. It is also being piloted at health facility level as a precursor to potential deployment to all health facilities.

Data are captured in two dashboards: Fanos is the main supply chain dashboard with an EPI program page with summary data and individual pages for each EPI commodity with data for all levels (Figure 4). mBran also has its own dashboard with summary data for woredas only. Dashboard use is tracked on a monthly basis to identify challenges.

While there has been a significant increase in availability of data, challenges remain around improving data quality and more significantly around data use. At PFSA level, IMPACT teams have been created to provide a structured and rigorous process for data review and supply chain problem solving, growing the culture of data use. While the FMOH is working hard to build a data use culture within the health sector, challenges remain – in many cases

the existing processes do not accommodate availability of real time data. For example, vaccine forecasting is still mainly based on target and population data and not logistics or consumption data.

#### 4. Cold Chain Equipment

Investment in cold chain equipment (CCE) was a major part of the transformation agenda. There were three major investments:

1. Procurement and installation of new cold rooms at hub (regional) levels.
2. Procurement and installation of Solar Direct Drive (SDD) refrigerators at health post level.
3. Procurement of refrigerated vehicles for PFSA center and hubs to distribute vaccines down to woreda (district) level.

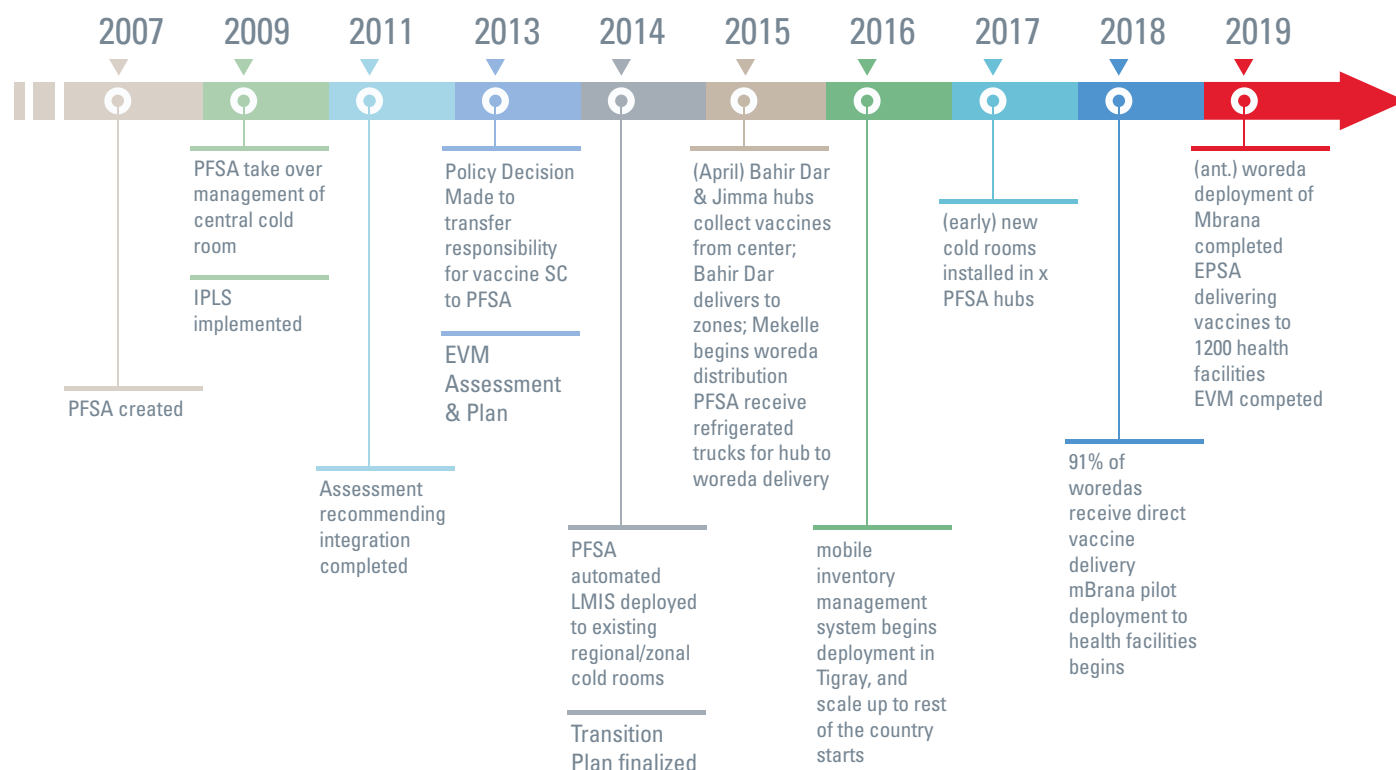
In total, 28 new walk in cold rooms (WICR) were purchased, two for each of 14 hubs. In addition, in a number of hubs existing RHB-managed cold rooms were moved to the PFSA hub or the hub took over management of the existing location. This brought the cold room capacity at national level to

117% of current required capacity (based on population level, target coverages, desired stocking levels and current antigens offered), and 148% at hub/regional level (FDRE 2018).

At health facility level, the goal of FMOH is to equip all facilities with new CCE. As of mid-2018, 64% of health centers and 25% of health posts had been equipped with new SDD refrigerators with a goal of equipping 100% of health centers and 71% of health posts" over the next few years" (FDRE 2018). This was funded with a mix of SDG and Cold Chain Equipment Optimization Platform (CCEOP) funding. There are also ongoing initiatives around Remote Temperature Monitoring (RTM) although these suffer from the lack of a coordinated effort and agreement on standardizing the information platforms including performance indicators to be used.

With a mix of funds from Gavi and other donors, PFSA procured three large refrigerated trucks (12 tonne) for center (to collect vaccines from the airport and delivery to hubs) and 17 smaller refrigerated vehicles (4 tonne) for hub delivery to woredas. There is an eventual goal to procure smaller refrigerated vehicles for direct vaccine delivery to facilities. However, there



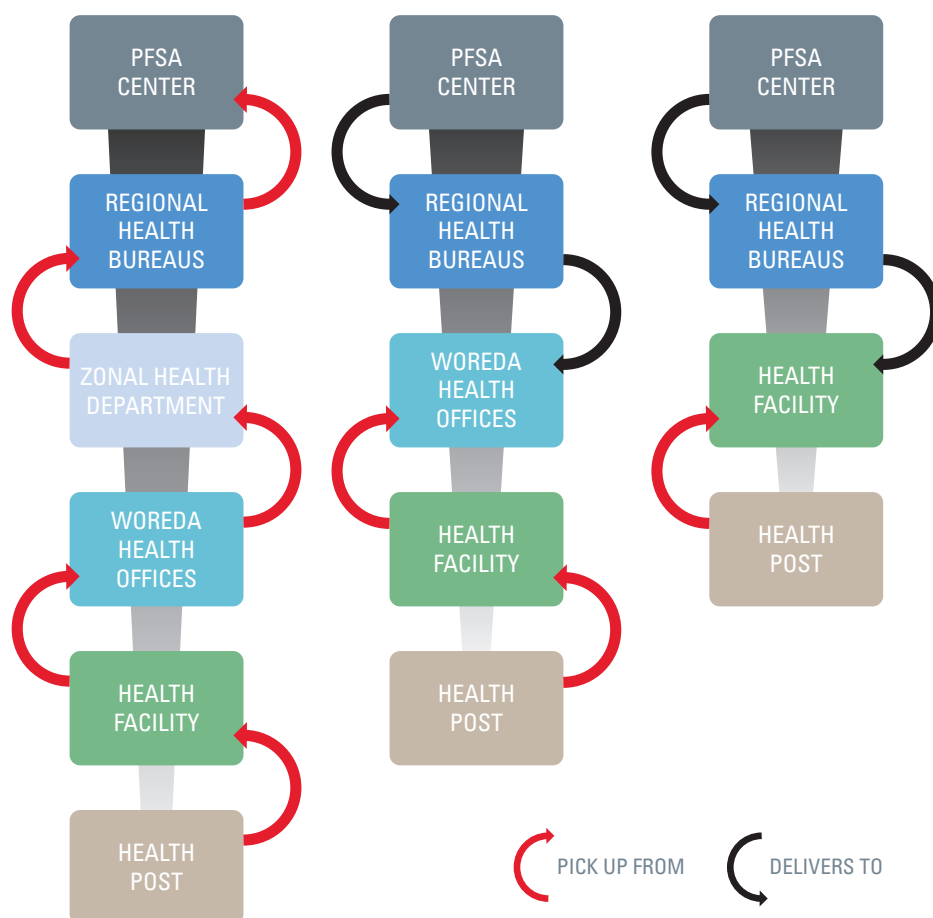


was a lack of planning as to how refrigerated vehicles would be managed – vehicles were not properly commissioned, maintenance plans were either not realistic or not implemented, nor was any real planning for delivery to hubs or woredas beyond the range of the vehicles (> 1 day) or where road conditions were unsuitable for larger trucks. This has led to situations where vaccine quality is at risk. Maintenance has been done by third party vendors paid for by a partner, but this is not a systematic approach as of yet. A key lesson from Supply Chain transformation is the importance of planning for how infrastructure and assets will be managed, operated and maintained beyond actual procurement including the funds needed and where they will come from.

## 5. Supply Chain Redesign

A number of supply chain redesign initiatives were undertaken as part of transformation. One of the main focuses of transformation was eliminating levels to enhance performance. Currently the zonal level has been bypassed and the intent is to eliminate the woreda level in the future (Figure 5). To plan for direct delivery

**Figure 5: Old, current (mid 2019), and proposed eventual vaccine SC levels in Ethiopia**



**Table 1: Changes Made to the Supply Chain**

Indicator	Pre Transformation	Current
Number of SC Levels	5	4
Real time Data Visibility (# of levels)	0	3 (Center, hub, woreda)
Direct Distribution	0	2 (Center to hub, hub to woreda)
Cold Storage Capacity (center/regions/zones)	?	827,400 m3
Woreda Level Inventory Visibility	0	650 Woredas (>80%)

to woredas, a route optimization activity, using Llamasoft software, was undertaken with the support of JSI. Detailed route maps were developed for each hub. However, application of these maps by hubs was inconsistent with many hubs preferring to use their own maps.

Costing work was also undertaken to cost direct delivery to woredas and, later, direct delivery to health facilities. This was both to generate evidence as to the potential efficiency of this change and also to identify resource needed and mobilize funding.

New standard operating procedures (SOPs) were developed and disseminated; however, the goal of having SOPs as “live documents”, being updated and used consistently still needs to be addressed.

A key operational step is just beginning: the current intention is to expand direct vaccine delivery from the current 180 health facilities being supplied to all health facilities, ideally with refrigerated vehicles. As of April 2019, EPSA was planning on an aggressive rollout of direct delivery to 1200 health facilities. However, there has been little discussion as to how sustainable this will be, including the ability of EPSA to operate and maintain such a large fleet of refrigerated vehicles, and indeed their suitability for last mile delivery. In parallel, there has been discussion around the possibility of integrated delivery under IPLS.

This would mean delivery every two months with cold boxes, meaning facilities would store larger volumes of vaccines. However, from a cost-effectiveness and sustainability point of view, this would have significant advantages since EPSA is already delivering essential medicines directly to more than half of the health facilities in the country, and the additional volumes with vaccines is negligible. Additionally, with the new SDDs in place in facilities, the cold chain would be more reliable to ensure the potency of vaccines for a two-month supply. Analysis and discussion of this remains a gap.

### Key Lessons Learned

**You can't have enough political buy-in:** Ethiopia had strong federal leadership, including from PFSA who allocated funding for workshops and training, however transformation went faster, and with fewer problems, in regions where the leadership at the RHBs bought in quickly; conversely in regions where RHBs were less convinced of its importance or less involved, it lagged.

**Don't underestimate the human challenges:** Many stakeholders stressed that they probably underestimated the degree of resistance to change by organizations and individuals. Even as people agreed that the old system wasn't functioning well, they understood their role in it and feared what change would bring: Ato Yemanberhane Taddesse,

Deputy Director of PFSA, and who led the change process says: “Don't underestimate the human part, we probably focused more on technical issues but many people feared they were losing their jobs.”

### An ambitious agenda forces change:

Despite transformation moving slowly, it is highly doubtful that as much could have been achieved if a more modest agenda had been proposed. The transformation process which was promoted both within and outside the country had the effect of forcing action and change, albeit slower than had been intended.

**Quick wins maintain momentum:** Even as procurement delayed CCE improvements and direct distribution, other activities proceeded. LMIS change happened far quicker than others, leveraging existing LMIS systems. This maintained momentum and ensured transformation did not “disappear”.

### A coordination platform can drive change.

The Vaccine and Cold Chain Management Technical Working Group (TWG) was one of the contributing factors in accelerating transformation. The TWG's role in monitoring the hub level performance on woreda delivery was paramount. Additionally, the TWG was highly involved in supporting hubs and providing performance feedback. The TWG is coordinated by PFSA with all partners (FMOH, UNICEF, WHO, JSI, CHAI and others) as members.

**Sharing experience from champions is valuable.** Lessons from the pioneers and early champions are very crucial for the late comers as they provide a 'late comers advantage'. Those hubs that were joining the transformation earlier were a learning ground for those coming later. Opportunities and challenges were discussed at performance review meetings and other experience sharing occasions.

**Creating competitive environment hastens implementation.** Woreda direct delivery was only at 35% by November 2017. Hubs with the same resources and constraints were at different stages of implementation. Monitoring hub performance and sharing the information widely created a competitive environment, which resulted in accelerated implementation of direct delivery.

### **Future Priorities**

Transformation is both a journey and a destination, and the journey continues in Ethiopia with the following priorities:

- Special emphasis on the quality dimensions of immunization supply chain management practice with the guidance and principles of EVM
- Extend direct delivery to health facilities using evidence based decision-making around the modality and the most appropriate type of transportation
- Increase facility level data visibility, data quality and use of data for improved supply chain performance
- Improved coordination amongst the stakeholders engaged on immunization activities at each level
- Cold chain maintenance – developing a detailed strategy for how CCE (cold rooms, vehicles, refrigerators at all levels) will be maintained

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