Supply & Demand Landscape - AVMI Webinar

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Executive summary (1/4)

Context

- Following from the supplier landscaping undertaken in 2023, CHAI, PATH and Africa CDC have developed an updated landscape of the African Vaccine Manufacturing (AVM) ecosystem, to understand the progress made in the ecosystem over the past year and to outline the steps still to take in the journey towards a stable and viable AVM footprint.
- This analysis is intended as a key reference point for stakeholders to enable the uptake of African-made vaccines as they become available and from which to discuss recommendations on focus areas and priority actions moving forwards
- Our landscape identifies six key factors which contribute to long-term success of AVMs, 1. Technical Capabilities; 2. Workforce (not included in this analysis); 3. Access to Products; 4. Financing; 5. Regulatory Approval; and 6. Demand & Procurement

Technical Capabilities

- There are currently 25 vaccine manufacturing projects active in Africa, 5 of which have commercial scale facilities and TTs already signed or started, a further 5 have commercial scale facilities and are awaiting TT initiation, the remaining 15 are in various stages of development, though many have made only limited progress in the last year
- Since 2023 8 previously planned projects have been paused or stopped and 2 new projects have been announced
- Africa's installed and ordered drug product (DP) capacity is estimated at 1.4 billion doses annually under standard operations, with the potential to reach 2 billion doses in emergencies—far exceeding expected demand in 2030. These estimates have decreased by 40% since 2023, reflecting clearer manufacturing plans and the reallocation of capacity towards other biologics.
- Installed drug substance capacity is estimated at 61M doses p.a. with additional capacity of 105M p.a. planned for construction. Current estimates of continental DS capacity is equivalent to ~10% of African Vx demand

Executive summary (2/4)

Access to Products

- A significant number of AVM tech transfer discussions are underway (79 total pre-deal discussions), but only 13 tech transfers have been signed or started;
- While in some antigen markets, AVM entry may improve market health through supplier diversity (e.g., OCV), the long tail of MoUs and TTs risk global market fragmentation across some antigens, (e.g., IPV)
- Since 2023, there has been a slight shift away from SII as the dominant source of AVM tech transfers, though SII still accounts for over 50% of active or signed tech transfers
- There are 9 products with TTs underway that may enter the market as early as 2024 with marketing authorisation for the African continent; a further 9 products have TTs underway (or already completed) for domestic markets, though progress on these projects remains relatively opaque

Financing

- Most mature projects are adequately financed in terms of Capex to complete their facilities but may require additional financing for tech transfers and commercialization, while many early-stage projects lack funding to complete their facility
- There are 5 key factors that have historically caused challenges for mature AVMs to access available funding:
  - **Coordination**:Despite de-risking potential, there is limited coordination between DFIs and donors
  - **Risk appetite:** DFIs typically avoid higher-risk projects, leaving financing gaps at crucial, higher-risk steps
  - **Ticket size**: DFI risk appetite leads to a focus on infrastructure, but many AVMs need smaller financing for operations
  - **Deal terms:** Deal tenor and repayment terms are not always be aligned with commercial timelines for AVMs
  - **Access to Equity:** AVMs often don't have sufficient equity or access to new equity, restricting their ability to raise debt
- Seg. 1 & 2 AVMs have self-reported financing gaps to commercialize TTs – these may cause delays for the 9 near-to-market Vxs
- Despite limited commercial opportunities, some Segment 3 suppliers continue to attract notable funding to build new facilities

Executive summary (3/4)

Regulatory Approval

- Only mfcts. in Egypt and South Africa currently have ML3 for vaccine production and have a route to WHO PQ in the short term. Regulatory support is underway to NRAs in Ghana, Morocco and Senegal to raise the local NRAs to ML3 vaccine producing level, but the timelines are unclear for this being achieved.
- 8 of the 9 near-to-market antigens are high priority on the WHO-PQ list, thus are likely to benefit from prioritised reviews.
- The PQ process is timely when mfcts. submit quality dossiers & respond quickly to amendments – any delays to the timeline to market for the African manufacturers will likely be a result of delays in their making amendments to their dossiers or sites.

Demand & Procurement

- CHAI have mapped an optimistic case of hypothetical demand for the 9 near-to-market AVM antigens, i.e., expected to reach the market by 2030, through an analysis of manufacturers planned capacity, potential UNICEF and bilateral tender allocations, as well as country inclination to procure African-made vaccines
- Across these near-to-market antigens, bilateral markets offer limited opportunities, with UNICEF procurement responsible for the overwhelming majority of market volume - 92% for the period to 2030.
- Near-to-market mfcts. may find it difficult to find demand for their capacities, due to existing competitive market dynamics (5 of these markets already have 3 or more UNICEF tendered mfcts.) and Gavi Alliance protocols to safeguard healthy markets.
- Our analysis identifies a best-case demand scenario of 45Mn in bilateral markets, and 145Mn in the UNICEF market for these near-to-market antigens. Additional opportunities for African manufacturers, and their roughly 1B doses of unallocated DP capacity, appear extremely limited beyond this demand.

Evaluation of AVMs against Key Success Factors

- The largest challenge facing all AVMs lies in securing demand and procurement. For those Seg 1 & 2 mfcts. some other crucial barriers have been overcome, but for the long tail of Seg. 3 mfcts. significant hurdles remain across all of the areas evaluated.

Executive summary (4/4)

Next Steps

6 Priority actions can address 3 critical short-term challenges that pose material risks for commercializing African-made Vxs

A. **Key Challenge**: Uncertain UNICEF allocation and local demand for African-made vaccines
   1. **Countries** to clearly signal demand for African-made vaccines, notably for near-to-market antigens, by incorporating African-made vaccines into procurement processes
   2. **Global Procurement Stakeholders** to ensure procurement practices facilitate AVM route-to-market, in balance with other key market health considerations, and communicate mode to achieve this

B. **Key Challenge:** Expected longer timelines for new to market AVMs to obtain WHO PQ &/or local authorization to enter markets
   3. **AVMs & Global partners** to ensure PQ applications are submitted with complete dossers and adjustments are timeously addressed.
   4. **Countries & Global Partners** to strengthen NRAs, esp countries with manufacturing footprints to invest in striving towards ML3 vaccines (producing) status

C. **Key Challenge**: Funding gaps for near-to-market Vxs, but funding allocated to new projects
   5. **Funders** to develop risk-appropriate financial instruments that can close TT and TA funding gaps
   6. **Funders, Countries, and AVMs** to strategically evaluate all new projects to determine realistic commercial opportunities before investing funding into new projects

This analysis is intended as a key reference point for stakeholders to enable the uptake of African-made vaccines as they become available

Consolidates findings and key updates from 2024 AVM supply landscaping

Tracks progress and challenges towards commercial sustainability

Makes recommendations on focus areas and priority actions for success

Six factors are analysed which contribute to long-term success of AVMs, but most factors are outside of AVM's direct influence

Key success factor	AVM level of control	Target state
Technical Capabilities	High	A fit-for-purpose facility equipped with appropriate technical capabilities to produce high-quality vaccines at competitive scale
Workforce	Medium	Skilled workforce to operate facilities and manufacture vaccines *(Not in scope for this analysis)*
Access to products	Medium	Pipeline of products are secured (either self-developed or through tech transfers) to be manufactured at facility
Financing	Medium	Sufficient financing is available to sustain commercial operations and strategically invest in new projects
Regulatory approval	Low	There is regulatory capacity at the required level of maturity to provide oversight for African-made vaccines in respective markets (i.e., local and/or UNICEF markets)
Demand & procurement	Low	Sufficient demand for African-made vaccines to support commercial viability of manufacturer

Current status: Landscape

As of June 2024, there are 25 active AVM projects which can be divided into three segments based on overall supplier maturities and capabilities

Segment 1: AVMs with facilities and TTs signed or started

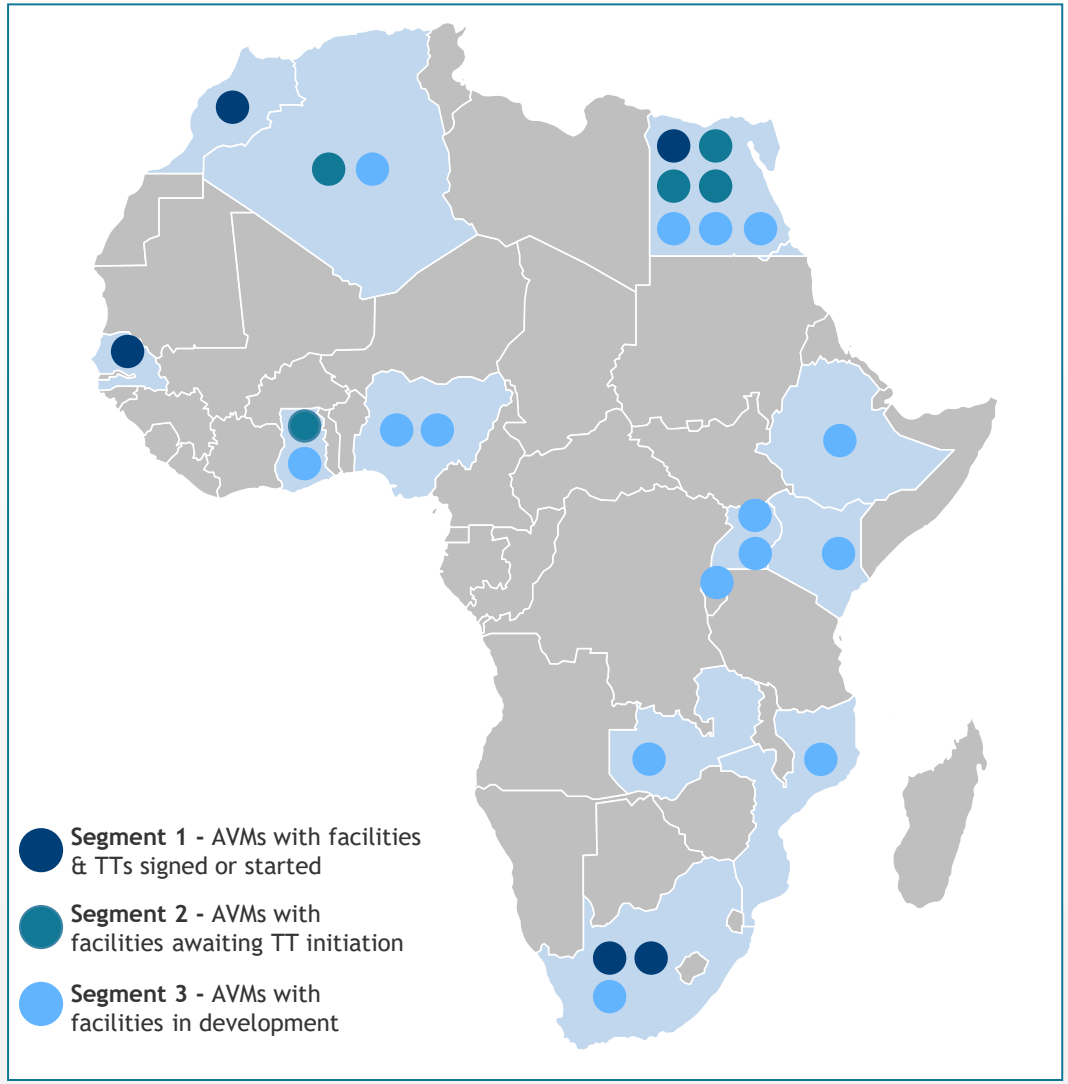
- Marbio
- **Vacsera**
- **IP de Dakar**
- Aspen Pharmacare
- **Biovac**

Segment 2: AVMs with facilities awaiting TT initiation

- Eva Pharma
- **Minapharm**
- **Biogeneric**
- Saidal[1]
- Atlantic Biotech

Segment 3: AVMs with facilities in development

- **VBC**
- Polygon
- Gennecs
- IP de Algerie
- DEK
- **Innovative Biotech**
- BVNL[2]
- **DEI Biopharma[3]**
- VAI Uganda
- Biovax
- Shieldvax
- **BioNTech**
- Yash Life Pharmaceuticals
- Mozambique Holdings[4]
- **Afrigen[5]**



Key Findings

- 5 Suppliers in Segment 1 already have commercial scale facilities and tech transfers (TTs) underway or complete
- 5 Additional suppliers in Segment 2 have commercial scale facilities qualified and ready to receive TTs
- The remaining 15 suppliers in Segment 3 are in development stages, with some being closer to qualification than others
- Rationalizing the number of AVM projects critical as the long tail of pipeline projects may struggle to gain sufficient market share
- 10 Suppliers have commercial-scale DS capacity or immediate DS plans, incl. 5 Segment 3 suppliers in development stages

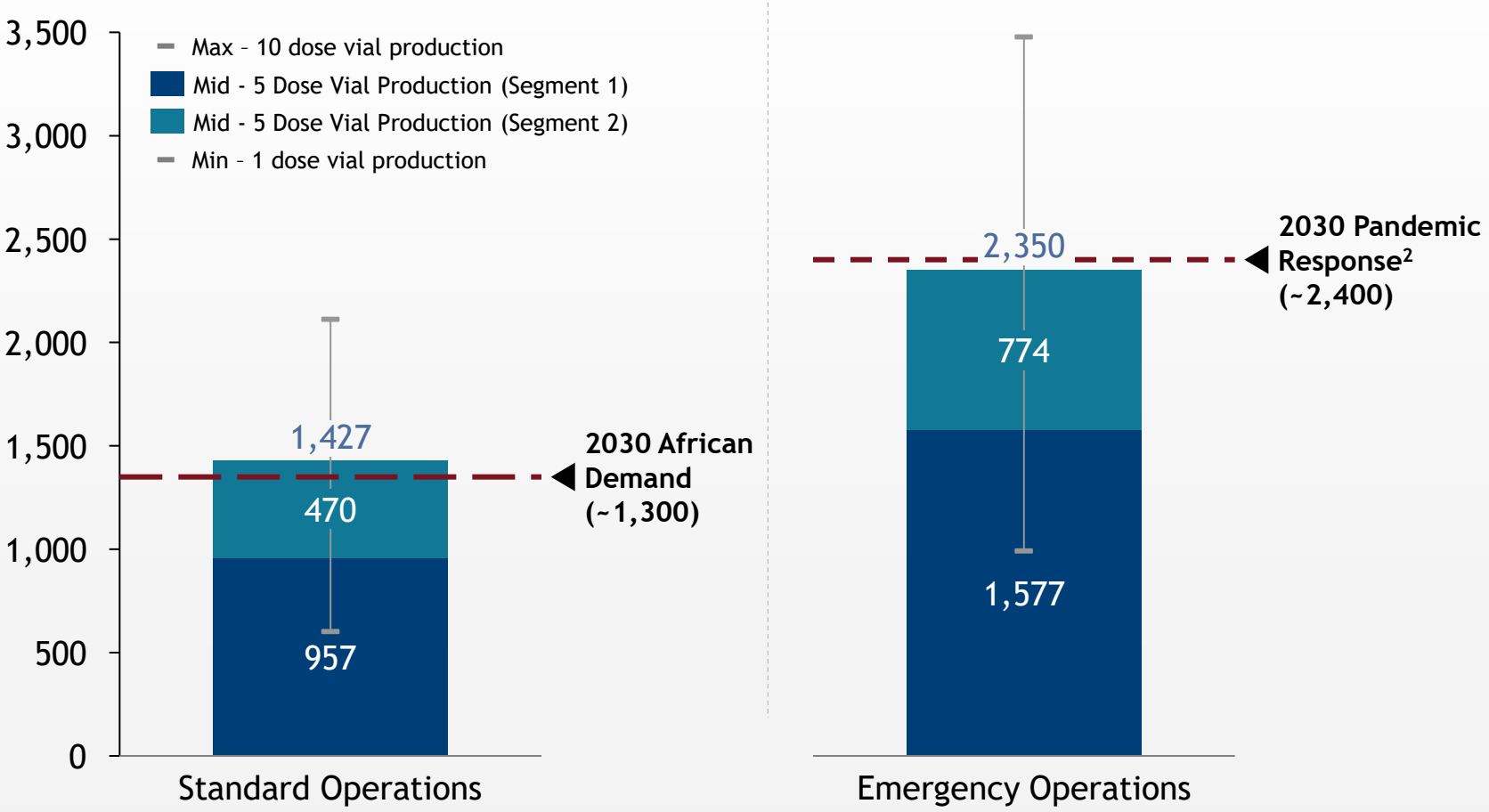
Bold = AVMs with commercial-scale DS capacity or immediate DS plans

1. Interview not yet held, but initial perspective is Saidal may also have a commercial scale facility ready to receive an influenza vaccine TT 2. As per an informal meeting with BVNL they do not have a facility yet 3. Construction of a modular Vxn facility has started in the US for shipment to Uganda in 2025 4. Mozambique Holdings have broken ground on a F/F facility 5. R&D facility complete, larger commercial facility built, expecting GMP inspection in 2025; Source: CHAI/PATH/PAVM Current State Vaccine Supply Mapping

1.4B doses of DP capacity is already installed or ordered by Segment 1 & 2 suppliers, exceeding total African vaccine demand in 2030

Annual drug product capacity of installed & ordered facilities[1],

Doses (M)



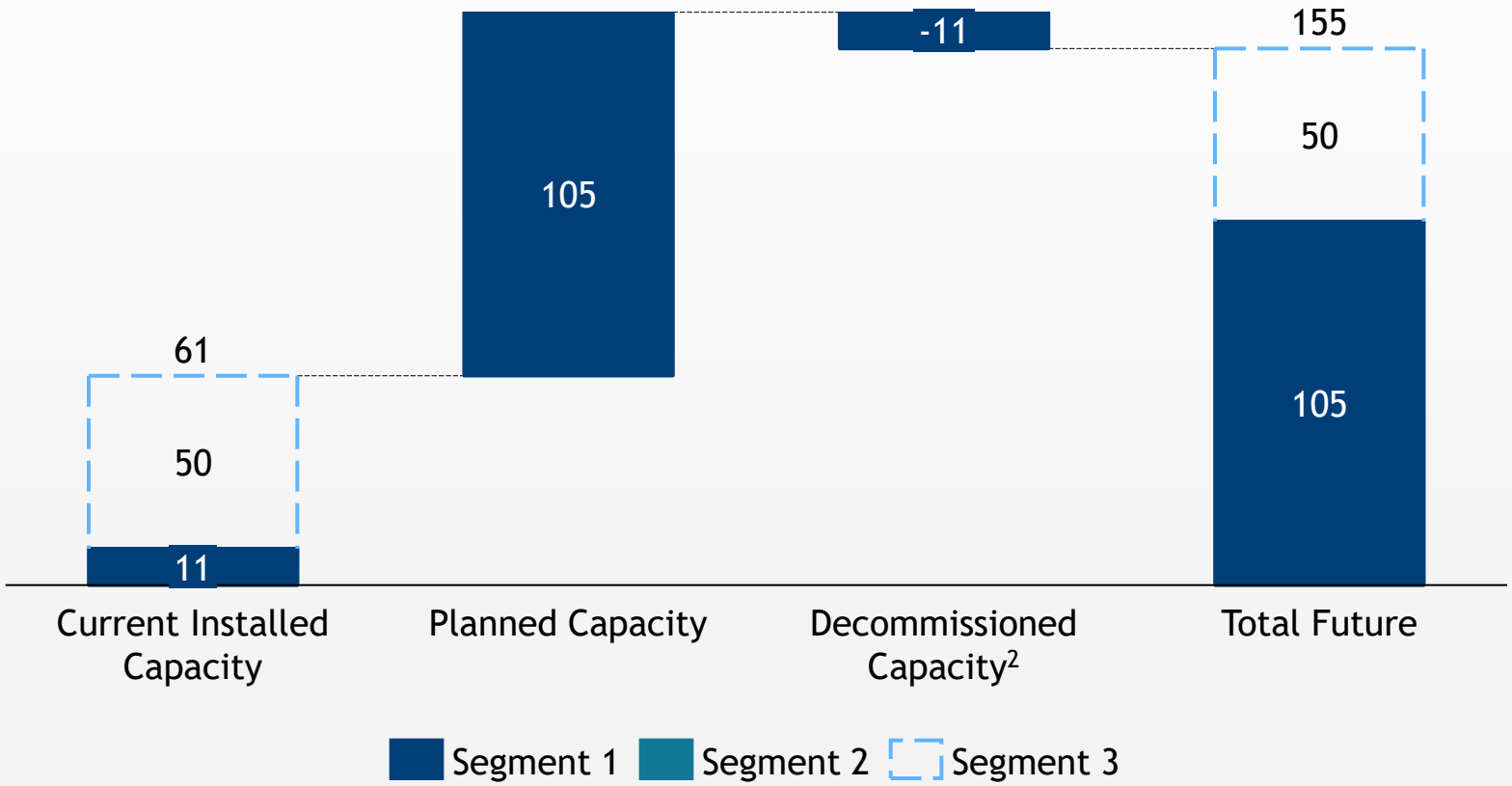
Key Findings

- Current DP capacity is 1.4B, up to 2.4B in emergency operations
- 60% of installed DP capacity is from Segment 1 suppliers
- Already installed capacity exceeds current vaccine TTs, expected demand offtake, and Africa CDC's 60% target for African manufacturing
- Since last year, capacity estimates have reduced by 40% due to greater clarity on manufacturing plans and redirection of Vx capacity towards other biologics
- As pipeline projects come online, the overall DP capacity will increase which further compounds the risk of DP over-capacitation relative to forecasted demand

1. Current estimates, potential to change over time 2. Based on 2 doses for 70% of the 2030 African population (Estimated to be 1.7B in 2030)
Source: CHAI/PATH/PAVM Current State Vaccine Supply Mapping

Most planned DS capacity is being installed in Seg. 1; Seg. 3 has significant mRNA DS capacity with uncertain commercialization plans

DS Production Capacity[1],
Doses (M)



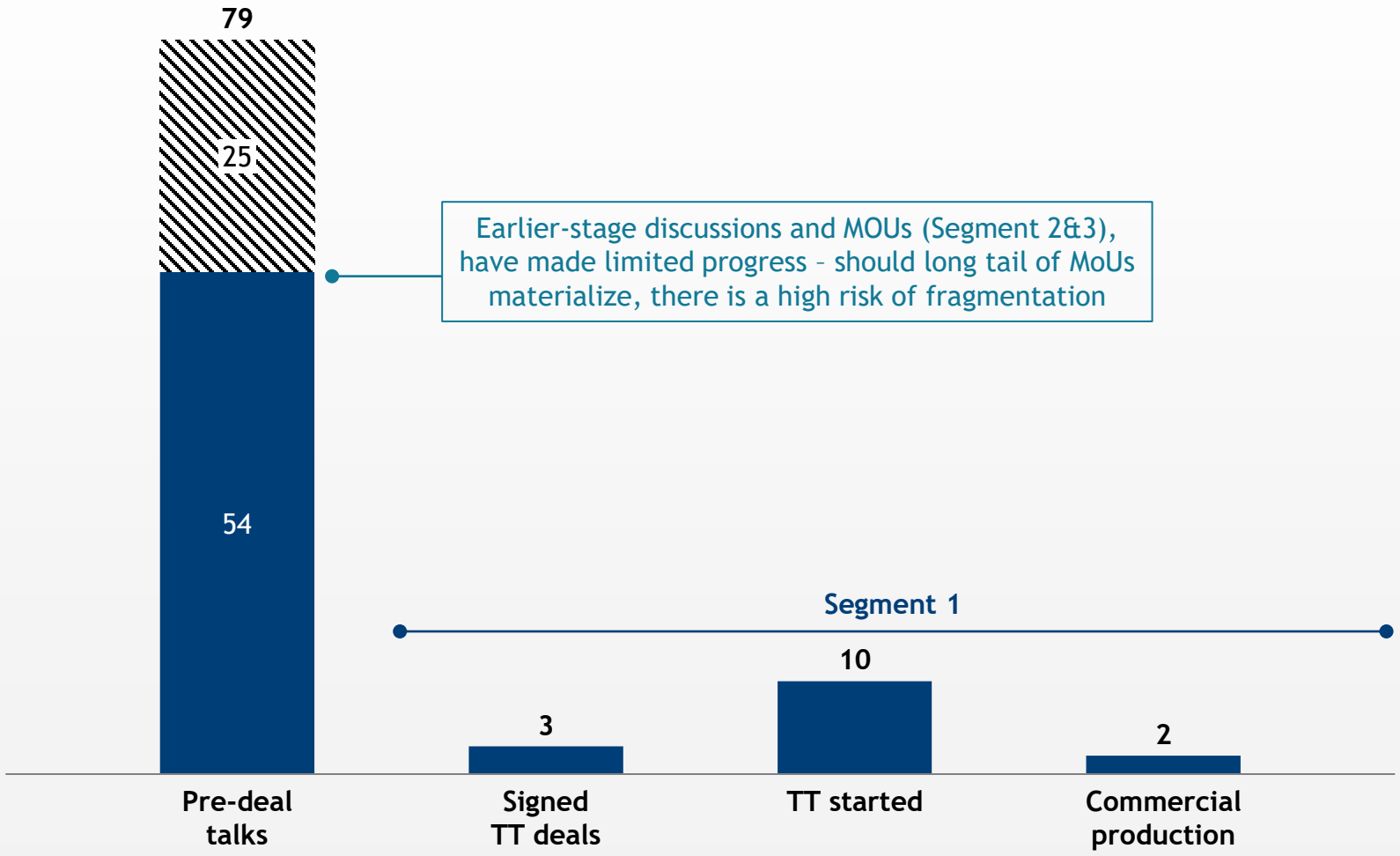
Key Findings

- Currently, there is ~61M doses per year of DS capacity installed at 3 Manufacturers - additional ~105M capacity expected at 2 of these manufacturers, leading to a total future capacity of 155M
- However, most of the installed capacity is for mRNA DS and there are currently no commercial mRNA vaccines that are planned for production in African facility; the near-term plan is for production of pipeline products
- Other manufacturers have plans for DS, but the timelines and product candidate approvals remains unclear
- Market health and pandemic preparedness goals set by partners are not sufficiently met by current DS production plans, overall DS capacity is ~10% of 2030 African demand

1. Current estimates, potential to change over time 2. 11M of the current capacity will be closed down once it is replaced by the planned future capacity for the same product
Source: CHAI/PATH Current State Vaccine Supply Mapping

Seg. 1 suppliers have 13 TTs signed or started; other suppliers are in pre-deal stages with progress remaining highly uncertain

Number of TTs by self-reported maturity status



Key Findings

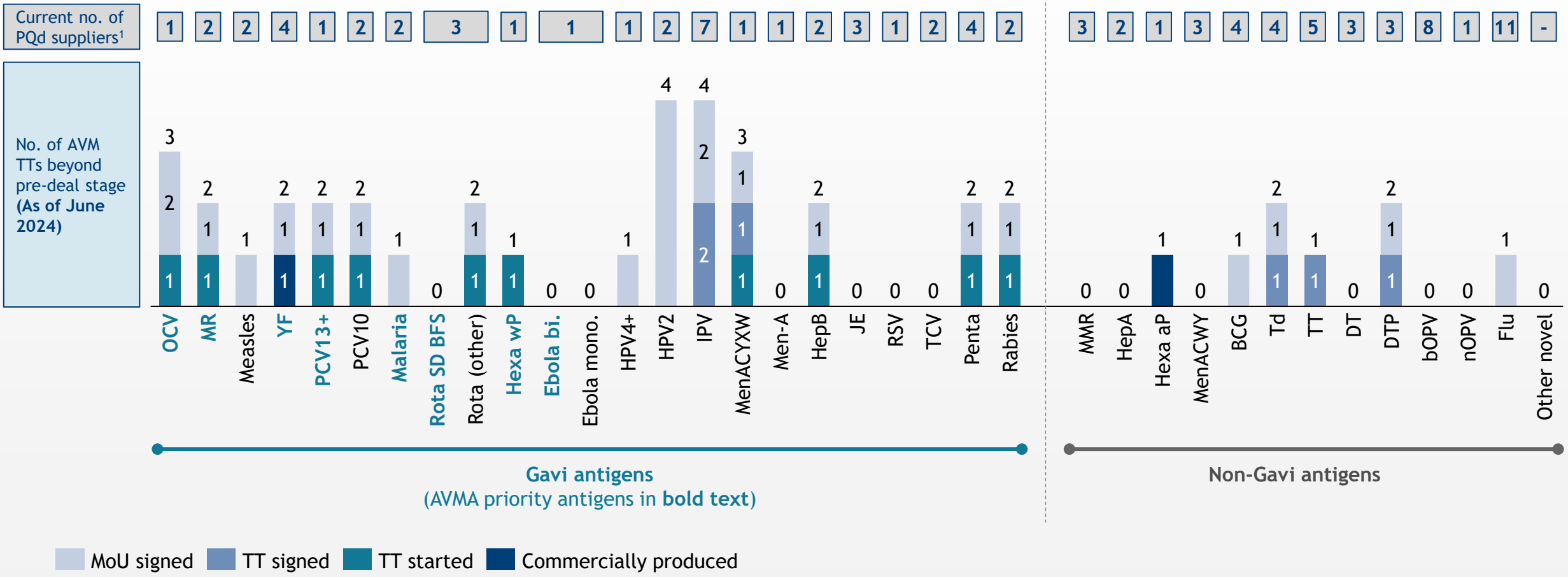
- Since 2023 5 TTs have started and 2 have been signed; However, 3 previously commercial vaccines are no longer produced
- Many pre-deal TT talks are underway, but these include very early-stage discussions, many of which may not materialize
- For some antigens, 5+ manufacturers are engaged in pre-deal talks with originators, creating high risk of fragmentation
- Most TTs are for DP manufacturing; only 3 tech transfers target DS[1]
- Serum Institute of India (SII) is the originator for 7 ongoing TTs, creating potential monopolistic influence over AVM

Note: TT = Technology Transfer
1. Includes 2 tech transfers signed with originators and one self-developed product
Source: CHAI/PATH Current State Vaccine Supply Mapping

While AVM may improve market health through supplier diversity, the long tail of MoUs risk global market fragmentation across some antigens

Number of Continental & Domestic AVM TTs and PQd suppliers by antigen

(Excludes TTs in pre-deal stage)



1. For Gavi antigens, only includes PQd suppliers on Gavi product menu

Source: Gavi detailed product profiles; Linksbridge; CHAI/PATH/PAVM Current State Vaccine Supply Mapping

8 Antigens are expected to achieve WHO PQ and enter the continental market between 2025 - 2030

Drug substance Drug product

Antigen	Country of manufacture	Year of product entry	African Demand 2030	% currently UNICEF procured
Hexa (wP)		2025-2030[1]	46 M	100%[2]
PCV			126 M	90%
MMCV			19 M	100%[2]
Rota			119 M	93%
OCV			32 M	100%
IPV			94 M	92%
YF			47 M	99.9%
MR			204 M	95%

All 8 products face limited market opportunities outside the UNICEF procurement channel.

1. Timelines premised on timely review from involved regulatory authorities; 2. Estimated % when product is launched
Source: Africa CDC, CHAI, PATH analysis and landscaping activity, Demand and UNICEF data taken from Linksbridge 2024

There are 5 key factors that have historically caused challenges for AVMs to access available funding

Coordination

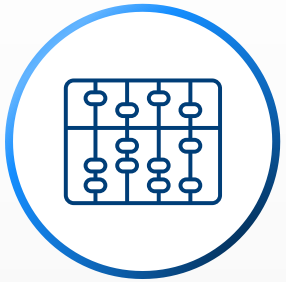
Despite de-risking potential, there is limited coordination between DFIs (who typically finance facility infrastructure) and donors (who typically finance R&D)

Risk appetite

DFIs typically avoid higher-risk projects (e.g., greenfield, R&D), focusing on lower risk infrastructure which leaves financing gaps at crucial, higher-risk steps

Ticket size

DFI risk appetite leads to a focus on infrastructure, generally with larger ticket size, but many AVMs need smaller financing for operations (e.g., working capital)



Deal terms

Deal tenor and repayment terms are not always aligned with commercial timelines for AVMs, which require longer tenor and ‘more patient’ repayment terms

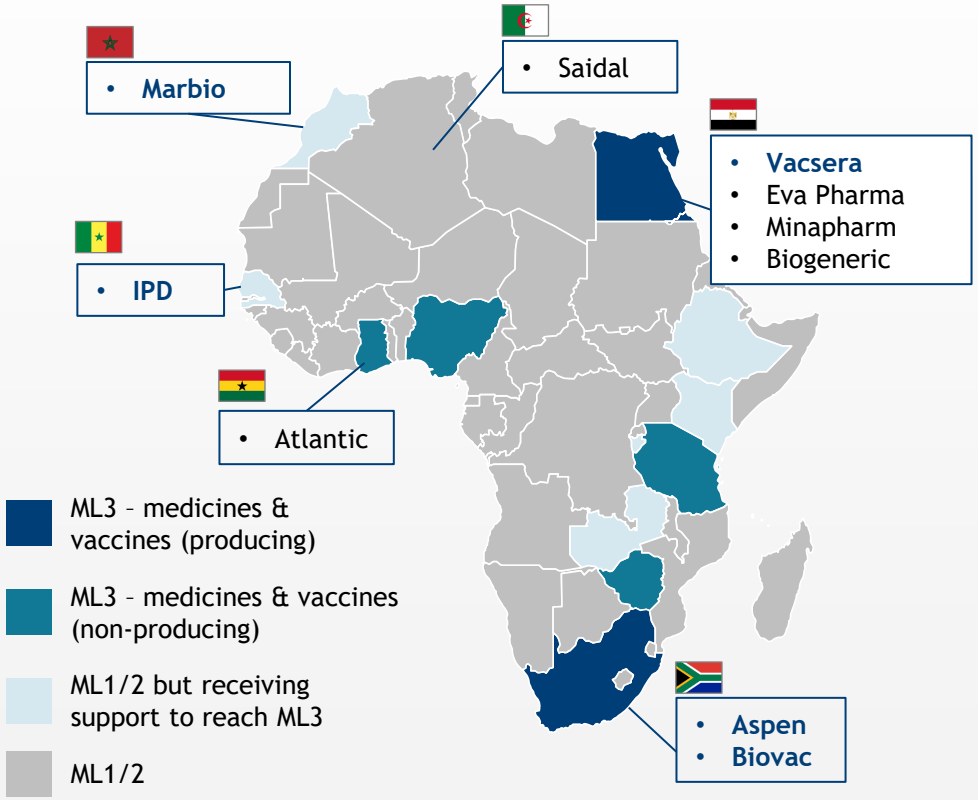
Access to equity

Non-listed AVMs often do not have sufficient equity and do not have access to new sources of equity funding, which restricts their ability to raise additional debt

Source: CHAI AVM Financing Gap Analysis

Currently only mfcts. in Egypt & South Africa have NRAs with required maturity level to obtain PQ - timelines for other NRAs remain unclear

NRA maturity level
(Only Segment 1 & Segment 2 suppliers shown)

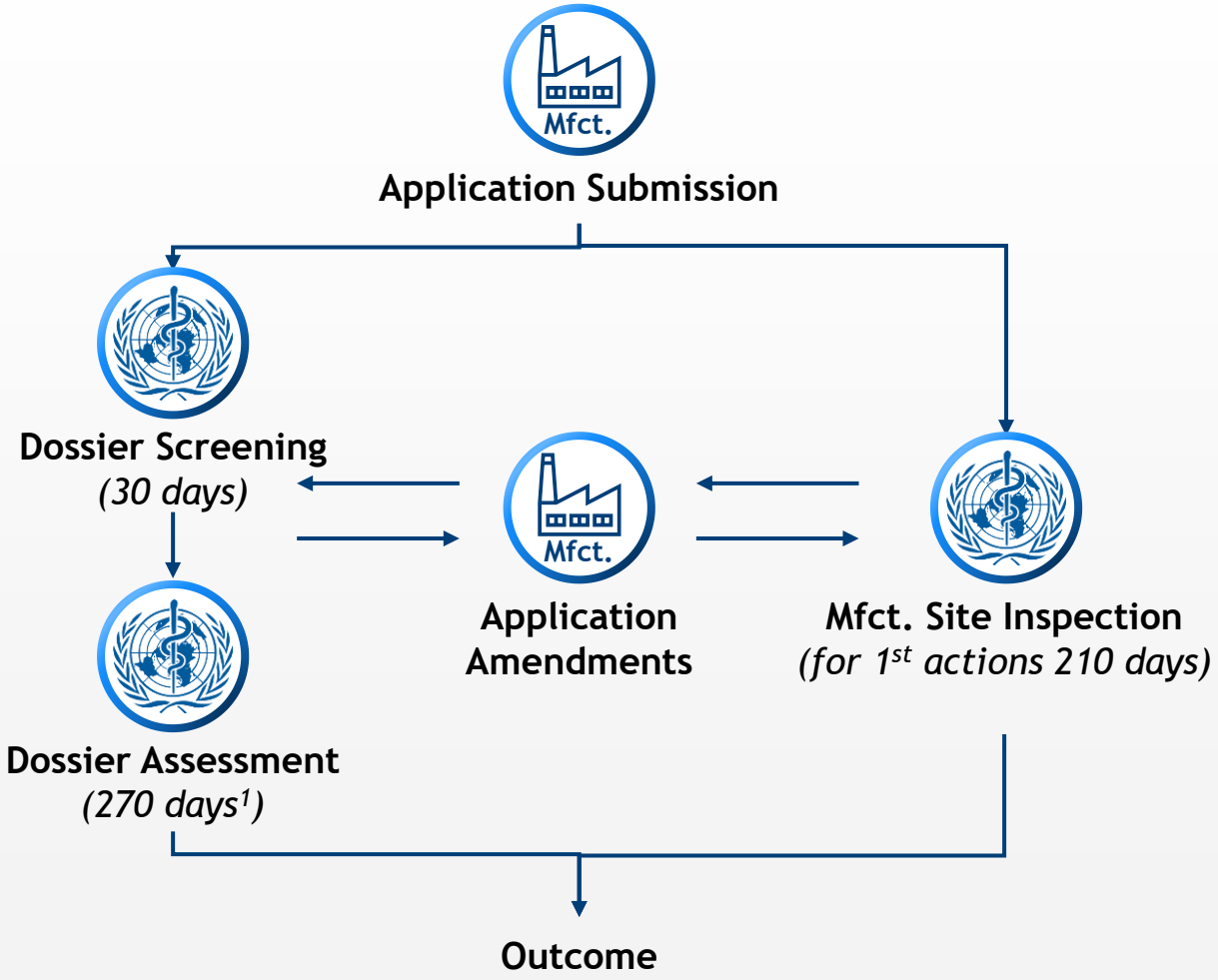


Bold = Segment 1 supplier

Mfct. Country (S1 & S2)	NRA maturity level
	**ML3 - medicines and vaccines (Vx producing)** NRA oversees all aspects of local manufacturing, including lot release which is required for releasing products to the market – enabling a path to obtain WHO PQ
	**ML3 - medicines and vaccines (Vx non-producing)** NRA can locally authorize vaccines for domestic market but cannot sponsor a locally authorized vaccine for WHO PQ consideration, restricting manufacturers from potential access to UNICEF market
	**ML1/2 but receiving support** NRA can authorize locally manufactured vaccines for domestic use and is receiving support from multiple partners (e.g., USAID, BMGF, European Commission) to reach ML3 but timelines are undefined
	**ML1/2** NRA can authorize locally manufactured vaccines for domestic use but no additional support is being received to reach ML3

Source: WHO Global Benchmarking, partner consultations

The PQ process is timely where mfcts submit quality dossiers & respond quickly to amendments, delays usually come in making amendments



- Cases of long delays in receiving WHO PQ are usually a result of delays in making amendments to either dossiers or the mfct. site in line with WHO findings.
- Applying with dossiers and manufacturing sites of a sufficient quality is essential for rapid approvals.

1. Streamlined Assessment: For vaccines that have already been approved by a stringent regulatory authority, a streamlined assessment may be conducted, taking up to 90 days
Source: A Leow et al, An overview of the WHO-PQ Process; WHO, Regulatory Meeting, Ethiopia 2024

CHAI have mapped hypothetical demand offtake in 2030 for each near-to-market antigen to inform discussions on offtake for these antigens

1 Identify near-to-market AVM antigens

8 Near-to-Market AVM Vxs:

- Hexa (wP)
- PCV
- MMCV
- Rota
- YF
- OCV
- IPV
- MR

2 Market Size for near-to-market antigens

Global UNICEF market, and bilateral markets based off of Linksbridge Africa 2030 demand forecasts, with some adaptations based on CHAI market intel.

3 Best case scenario Hypothetical market

Key Assumptions:

- Based on current procurement systems.
- No delays in AVM timelines.
- Globally competitive pricing.
- UNICEF uptake limited market health considerations.
- Country uptake limited by programmatic alignment & stated political commitment[3].

Key Omissions:

- Tender timelines or scale up scenarios not considered

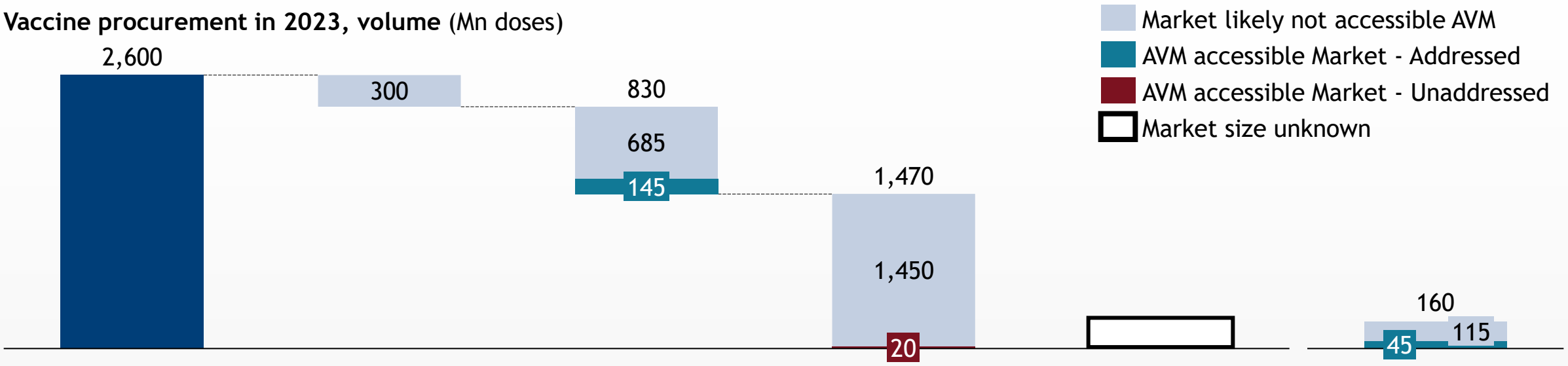
4 Conclusion

Hypothetical African demand for AVM near-to-market antigens in 2030 based on current market dynamics.

Notes: 1. This analysis focuses only on TTs that have been signed by AVMs and are already underway. Additional AVM products may come to market in addition. 2. Where Linksbridge forecast not available (OCV / Hexa) have developed CHAI forecasts based on product roadmaps shared by global partners. 3. Political will is measured using the commitment countries have shown to join the Africa CDC PPM and Regional mfct support TWG.

Beyond these near-to-market antigens, additional opportunities for African vaccine manufacturers are extremely limited

Vaccine procurement in 2023, volume (Mn doses)

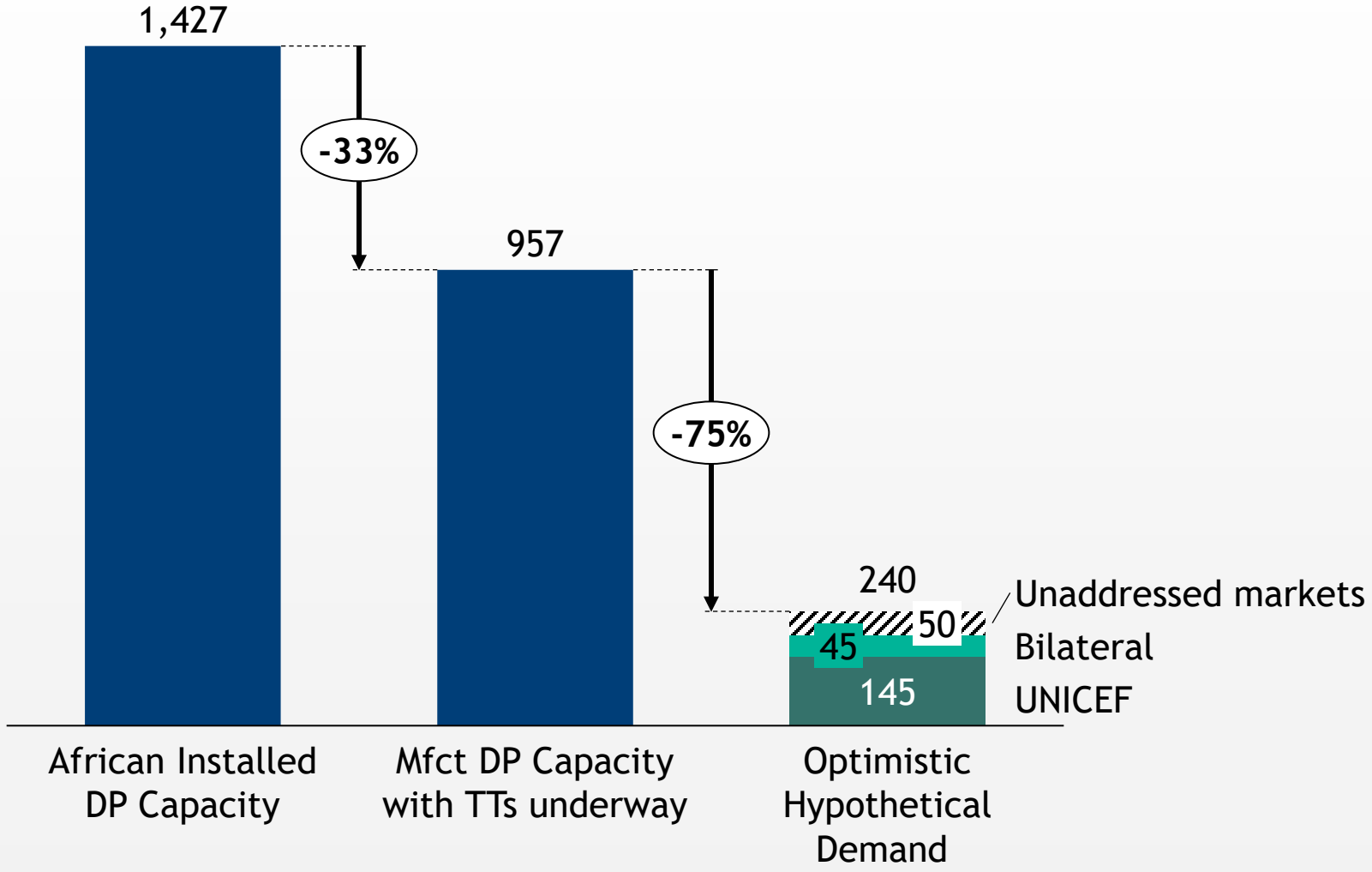


Market Opportunities	• Commoditized Vxs[1] have low margins and no AVMA support – thus a challenge for AVMs to compete commercially	• ~145Mn of hypothetical demand for near-to-market Vxs. • Market comp. limits opps. for additional AVMs	• Hypothetical accessible market of 20M in other UNICEF markets[2,3,4] • Limited appetite for TTs & market opps. may limit access for AVMs,	• Novel Vx market size remains unknown. May present additional market opps. for AVMs	• Near-to-market Vxs hypothetically likely to address a sig. portion of bilateral markets

Notes: 1. Vaccines less than $0.25 per dose i.e., BCG, DTP, Hep B & Td 2. Potential markets (80Mn doses): HPV, Ebola, Malaria, Influenza, Rabies, TCV. Markets with minimal AVM potential (1570Mn doses): OPV, Penta, Measles, MMR, JEV, Hep A 3. Potential markets such as HPV and Malaria are expected to grow significantly in the next decade 4. bOPV is a significant market (1300Mn) that will be ceased and replaced by IPV by 2030.
Sources: CHAI analysis, Linksbridge

Presently there is overcapacity of DP & underutilisation of the capacity that is built on the continent compared to expected demand

African Vaccine Volumes in 2030, Doses (M)



Key Findings

- There is a significant shortage of Vx TTs relative to total production capacity, limiting potential output and raising the risk of over-capacitation and under-utilization.
- In relation to the African market's potential, efforts are needed to ensure demand materializes to match the available capacity.
- Even in optimistic scenarios, market opportunities for current technology transfers remain limited, highlighting the need for additional market support to sustain these businesses.

Sources: CHAI analysis, Linksbridge

Next steps and call to action

6 Priority actions can address critical short-term challenges that pose material risks for commercializing vaccines

	Demand & procurement	Regulatory approval	Financing
Critical challenges	Uncertain UNICEF allocation and local demand for African-made vaccines	Expected longer timelines for new to market AVMs to obtain WHO PQ &/or local authorization to enter markets	Funding gaps for near-to-market Vxs, but funding allocated to new projects
Priority actions required	1 **Countries** to clearly signal demand for African-made vaccines, notably for near-to-market antigens, by incorporating African-made vaccines into procurement processes 2 **Global Procurement Stakeholders** to ensure procurement practices facilitate AVM route-to-market, in balance with other key market health considerations, and communicate mode to achieve this	3 **AVMs & Global partners** to ensure PQ applications are submitted with complete dossers and adjustments are timeously addressed. 4 **Countries & Global Partners** to strengthen NRAs, esp countries with manufacturing footprints to invest in striving towards ML3 vaccines (producing) status	5 **Funders** to develop risk-appropriate financial instruments that can close TT and TA funding gaps 6 **Funders, Countries, & AVMs** to strategically evaluate all new projects to determine realistic commercial opportunities before investing funding into new projects

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