Annex C: Strengthening Vaccine Production in Africa: A Dependency Mapping for the African Vaccine Manufacturing Accelerator (AVMA)

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1. Introduction

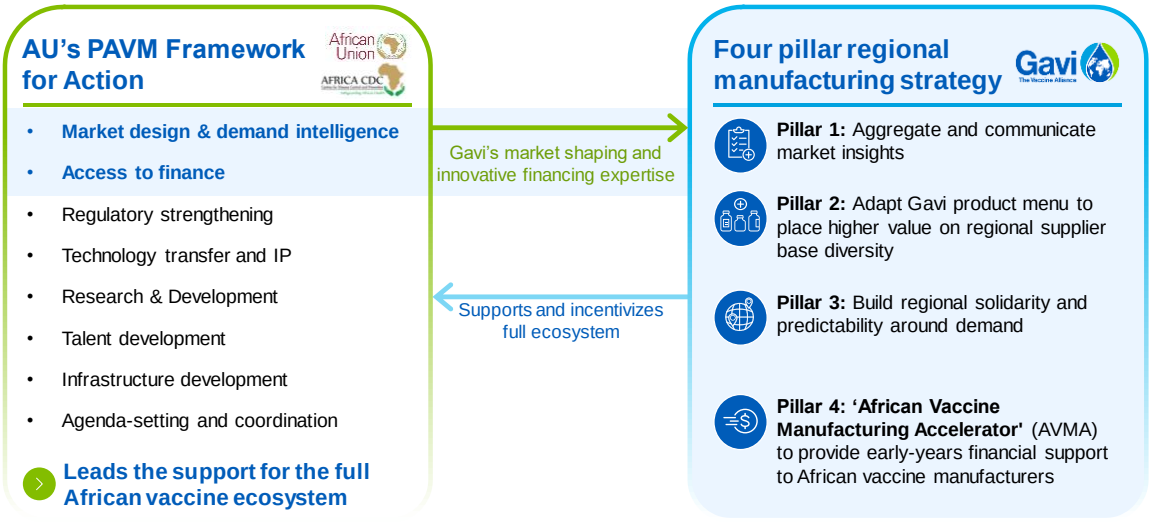
This report presents a dependency mapping of the vaccine manufacturing ecosystem and its relation to the African Vaccine Manufacturing Accelerator (AVMA). On the African continent, barriers across the vaccine manufacturing ecosystem risk seeing the continent again impacted by supply insecurity. This analysis identifies crucial interdependencies affecting the AVMA's effectiveness across the Platform for Harmonized African Health Products Manufacturing (PHAHM) Framework for Action focusing on 6 dimensions on market design and demand intelligence, access to finance, regulatory strengthening, technology transfer and intellectual property, R&D and talent development and infrastructure development. Through this lens, it explores how collaborative action across partners and sectors complement the AVMA and can together mitigate the complex challenges hindering Africa's vaccine production. Ultimately these initiatives will cultivate a durable, sustainable vaccine manufacturing ecosystem, which is essential for securing long-term health and economic stability and equity across the African continent.

1.1 Context

With its call for action in the Platform for Harmonized African Health Products Manufacturing (PHAHM), Africa CDC underscored that building African vaccine manufacturing capabilities will take concerted efforts across the ecosystem if the various interrelated challenges facing the sector are to be addressed. Gavi has committed to contributing to this joint agenda and has laid out its planned contribution to PHAHM's objectives in Gavi's Regional Manufacturing Strategy (RMS).

The RMS spans four pillars (see Figure 1) that leverage Gavi's 20-year track record in market shaping and innovative finance. These four pillars are directly aligned with the two PHAHM dimensions of "market design & demand intelligence" and "access to finance". Under Pillar 1, Gavi aims to aggregate and communicate market insights, under Pillar 2 it is adapting the Gavi product menu and frameworks to place higher value on regional supplier base resilience, and under Pillar 3 it is supporting the development of regional solidarity and demand predictability for African-made vaccines.

Figure 1: Gavi's contribution to the PHAHM Framework for Action



As Pillar 4, the African Vaccine Manufacturing Accelerator (AVMA), sits at the heart of the Regional Manufacturing Strategy; using Gavi's expertise in innovative financing instruments to provide crucial financial support to manufacturers newly entering the market. The AVMA is an Advanced Market Commitment which offers eligible manufacturers incentives to help offset the high start-up costs they face in establishing manufacturing on the African continent. Details on the AVMA's design, including the eligibility criteria and incentive structure are included in Annex A (AVMA Term sheet) and PPC-2024-Mtg-01-Doc 12-Appendix 1 Framework Report.

Whilst the AVMA primarily addresses the access to finance[1] component of the PHAHM Framework, the expectation is that it will have a galvanizing effect beyond that. By reducing the risk exposure, it can fuel momentum toward additional investments by other stakeholders, under the ultimate leadership and coordination of the AU architecture.

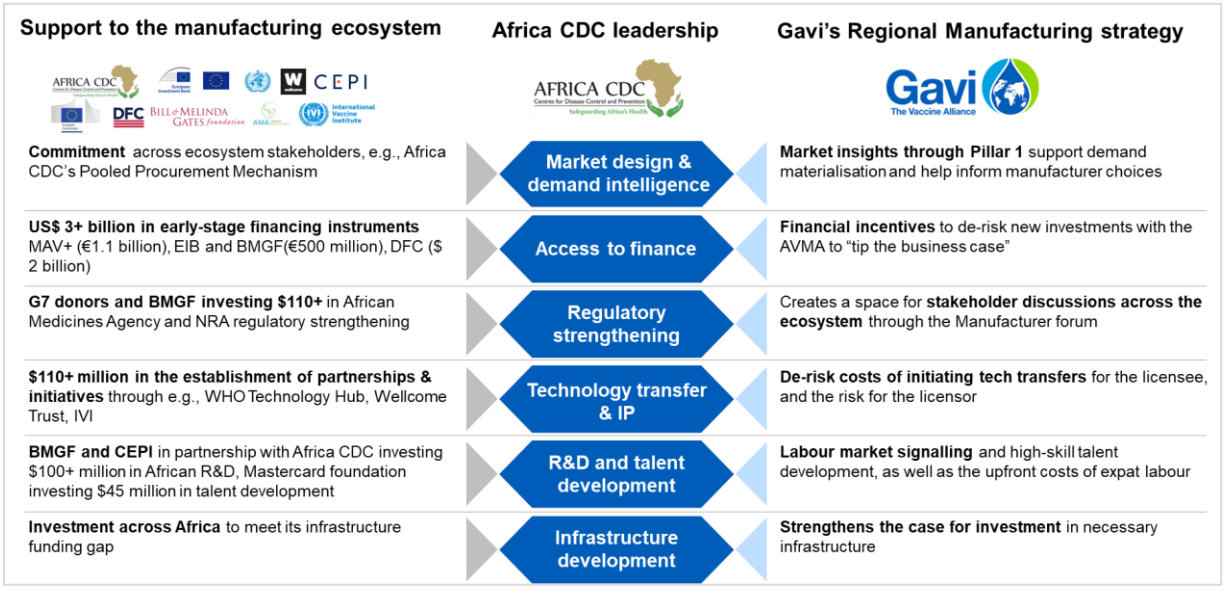
Alliance partners are establishing a substantial footprint in support of this agenda, including The World Bank, WHO, and UNICEF (e.g., with initiatives such the Africa Vaccine Acquisition

Figure 2 AVMA dependencies

Task Team[2], the Health Emergency Preparedness, Response, and Resilience Program[3], and UNICEF partnering with Africa CDC to Strengthen Health Systems and Immunization of Children in Africa[4]). These examples of coordinated efforts from actors across the ecosystem underscore the power of the Alliance and the integral roles that WHO, UNICEF, and the World Bank play in bolstering the vaccine manufacturing capabilities in Africa.

[1] Noting that the access to finance dimension also encompasses earlier stage financing to build and develop facilities, which is not covered by AVMA.
[2] World Bank and African Union Team Up to Support Rapid Vaccination for Up to 400 million People in Africa
[3] Africa Gets a $1 Billion Shot in the Arm to Boost Health Systems, Emergency Preparedness and Response (worldbank.org)
[4] Africa CDC and UNICEF Expand Partnership to Strengthen Health Systems and Immunization of Children in Africa

1.2 Monitoring of ecosystem dependencies



To monitor changes in the broader ecosystem, an analysis of ecosystem dependencies will be conducted as a component of the triennial review (2027, 2030, 2033). This review will contextualise the AVMA's progress and impact within the broader ecosystem. Gavi will commission and engage external partners to review the ecosystem to provide the in-depth analysis and mapping required for the Ecosystem Dependencies Review. The Gavi Secretariat consolidates all findings into a final Triennial Review Report, which is submitted to the Gavi Board through the relevant committees and published on the AVMA website.

1.3 Objectives of this paper

In acknowledgement of the mutual dependencies between the AVMA and other areas of action, the Gavi Board in 2023 requested a high-level dependency mapping for the AVMA. This paper sets out the key dependencies for Gavi's regional manufacturing strategy and the AVMA specifically, for key areas of the PHAHM Framework for action across 1) market design / demand intelligence, 2) access to finance, 3) regulatory strengthening, 4) technology transfer and IP, 5) R&D and talent development and 6) infrastructure development. The paper discusses:

- The key challenges to be addressed in connection with the AVMA
- How Gavi is addressing these, including through the AVMA's technical design, governance, and risk management approach
- A high-level view of efforts underway in the ecosystem to address these, as well as possible areas for further action.

The notion of the AVMA as one clearly defined part of the wider ecosystem is integral to the instrument's design, its governance, risk, and monitoring, evaluation and learning (MEL) framework (PPC-2024-Mtg-01-Doc 12-Annex B: MEL Framework). In particular this dependency mapping has been leveraged to inform MEL indicators such as indicator 9[5], 10[6],

[5] Number of national regulatory authorities (NRAs) with maturity level 3 (ML3) producing status on the African continent
[6] Number of FTEs working for AVMA-supported manufacturers

and 11[7], risks such as A3[8], D7[9], and the wider consultations with stakeholders in and beyond the Alliance. These directly integrate the monitoring and reporting of relevant wider dependencies into the structure of AVMA. Each section therefore also highlights where these dependencies have been reflected in greater detail.

2. Market design & demand intelligence

See also

- **AVMA Framework Report** (PPC-2023-Mtg-02-Doc 11b-Appendix 1) for extensive landscape analysis and detailed description how the AVMA was designed to send market signals
- **AVMA Modelling Details** (PPC-2023-Mtg-02-Doc 11b-Appendix 2) for details on the multi-level modelling conducted to assess financing needs, design incentives and calculate the total instrument size
- **AVMA Risk Management Framework** (PPC-2024-Mtg-01-Doc 12-Appendix 2) for details on how the risk of insufficient demand is assessed and managed
- **Gavi's Role in Regional and African Vaccine Manufacturing** (Board Paper 08, December 2022) for Pillars 1-3 of the Regional Manufacturing Strategy

2.1 What are the primary challenges in connection with the AVMA, under this heading?

The PHAHM framework aligns with extensive modelling conducted by Gavi in identifying how manufacturers on the African continent face particularly high entry costs. These manufacturers run a significant risk of financial failure in the early years and are likely to struggle to offer competitive prices.

The AVMA itself is designed to mitigate this financial hurdle, with incentives carefully tailored to supplement vaccine prices just enough to help offset the higher cost of goods sold in Africa[10]. The AVMA's Accelerator incentives are paid as a top-up to vaccines tendered by UNICEF, meaning that support is given to those manufacturers who have successfully met demand and priced competitively. The mechanism mitigates the need to pick winning projects ex ante, under asymmetric information between Gavi and manufacturers.

Whilst Gavi and the wider Alliance provide substantial collective purchasing power to implementing countries, it is also crucial to underscore the role of individual country choice. African-based vaccine manufacturers can only sell into Gavi markets and receive the AVMA Accelerator payments if there is country level demand for their products, as country choice drives >60% of Gavi's allocation of vaccines.

For AVMA support to reach manufacturers, therefore, there firstly needs to be the existence of sufficient country demand for African-made vaccines. Secondly, manufacturers' ability to identify these products and subsequently supply them.

[7] AVMA priority markets with an improved assessment of the "Geopolitical and regional diversity risk" HMF attribute
[8] Risk of insufficient demand for African-made vaccines
[9] Process bottlenecks resulting from increased pressure on WHO PQ process
[10] Details on the design of the AVMA and the extensive modelling which underpins the incentive levels and design were detailed in the Framework Report and Modelling Appendix submitted to the PPC in October 2023

On demand, unless a WHO prequalified manufacturer in Africa feels confident that countries (both within Africa and in the wider Gavi-supported set) will purchase their vaccines over those of an incumbent supplier, the risk presented by demand uncertainty may be substantial. This is further compounded by their initial cost disadvantage relative to incumbents. A further complexity is the coordination of national procurement models to support demand for regionally manufactured products.

On supply, manufacturers who might apply for AVMA support would benefit from help identifying markets and products in which to invest. The Wellcome Trust[11], for instance have called for a coordination mechanism to "improve information-sharing between stakeholders, and thereby help manufacturers to make business decisions, and help donors to identify where to direct their support". Such a mechanism would help manufacturers to focus on strategic and realistic priorities to build manufacturing capabilities as well as feasible business models.

2.2 How is Gavi contributing?

Responding to manufacturers' need for demand intelligence and market insights is a core component of Gavi's Regional Manufacturing Strategy.

Pillar 4: AVMA

The AVMA itself is designed to direct investment capital towards products where there is most complementarity to global market health and supply needs by offering the highest incentives for these – in recognition of the multi-year timelines required to build production capabilities and achieve WHO Prequalification. 75% of AVMA support is ring-fenced for Accelerator payments (due to the milestone payments caps) and thus for manufacturers who are (i) responding to demand and (ii) can price competitively (from progressively scaling production and building economies of scale). Only then will the manufacturer win UNICEF tenders and consequently tap into AVMA support (through the Accelerator payment) required to enhance long-term financial sustainability.

Pillars 1-3

Under Pillar 1, Gavi offers manufacturers and investors structured insights on the market environment, through the publication of detailed market intelligence on an online dashboard. Under Pillar 2, this is reinforced by the introduction of the important regional supply resilience dimension in the Healthy Markets Framework used to guide procurement decision-making. Strong signals and shared market intelligence offer manufacturers and investors important information to inform and de-risk potential business decisions. This can help direct investment towards markets where an additional manufacturer / product profile may contribute to global market health and be most viable long term.

Finally, under Pillar 3, Gavi offers assistance in building the strength of demand signalling from African countries. This also helps to inform the risk equations which underpin manufacturers' business decisions. Upholding the principle of country choice, the Alliance will continue to work with stakeholders (such as Africa CDC) to work towards regional frameworks that support demand signalling from countries. Further details may be found in Gavi's strategy to support Regional and African Vaccine Manufacturing in Board Paper 08, Dec. 2022.

[11] Wellcome Trust (2023) Scaling up African vaccine manufacturing capacity: perspectives from the African vaccine-manufacturing industry

2.3 What action is underway in the wider ecosystem?

The African Union has placed significant political attention on the need to consolidate demand for African-made vaccines across the continent, recognising that pooling procurement across multiple countries will be required to generate the economies of scale necessary for cost-efficient production. To this end, a pooled procurement mechanism (PPM) for medical products was signed on 18th February 2024 during the 37th African Union Summit in Addis. Led by Africa CDC, this represents an important first step in allowing member states, including those who have transitioned out of Gavi support, to pool demand. This can offer reduced fragmentation, and the ability to access competitive pricing through bulk procurement and a centralised supply chain management system.

Guiding principles for the approved pooled procurement mechanism include strong political commitment; convergence of procurement policies across member states; efficient quality-control systems; public-private partnerships; capacity strengthening; and access to sustainable management planning. Developing and implementing a robust framework for this mechanism is important. Building alignment of this mechanism with the AVMA, with a view to ultimately making these tenders eligible for the AVMA, can have a catalytic effect. Both the AVMA and the Alliance represent substantial multilateral partnerships with strong technical capacity and normative frameworks. This has the potential to inform and substantially strengthen the nascent PPM.

The Africa Continental Free Trade Area (AfCFTA) agreement also offers the potential to build regional demand predictability. AfCFTA, with substantial support from Team Europe and governments of the US, Denmark, Japan, and others, is expected to facilitate the movement of pharmaceutical goods and services across the continent. By liberalising and simplifying cross-border trade, pharmaceutical companies manufacturing vaccines in Africa (and potentially supported by the AVMA) may more easily integrate into regional supply chains – ultimately reducing vaccine costs from economies of scale and stimulating further regional demand.

3. Access to finance

See also

- **AVMA Framework Report** (PPC-2023-Mtg-02-Doc 11b-Appendix 1) for extensive landscape analysis on how the AVMA fits into the financing landscape
- **AVMA Modelling Details** (PPC-2023-Mtg-02-Doc 11b-Appendix 2) for details on the modelling conducted to assess financing needs, design incentives and calculate the total instrument size
- **AVMA PPC Risk Management Framework Appendix** (PPC-2024-Mtg-01-Doc 12-Appendix 2) for details on how the risk of limited uptake if early-stage financing is missing is assessed and mitigated within the AVMA
- **AVMA Framework Report** (PPC-2024-Mtg-01-Doc 12-Appendix 1) for details on the operationalization of the AVMA as an innovative financing instrument

3.1 What are the primary challenges in connection with the AVMA, under this heading?

Manufacturers face high costs not only to import equipment and talent, but also capital, coupled with the long revenue horizon of developing and manufacturing vaccines. In the

aftermath of COVID-19, however, substantial momentum has grown to invest in African vaccine manufacturing, including US$ 600 million in joint financing packages for manufacturing facilities from the U.S. International Development Finance Corporation (DFC), and the International Finance Corporation (IFC), US$ 400 million in loan agreements to support COVID-19 responses from Japan International Cooperation Agency (JICA), and joint investment from USAID, France, Germany, and the World Bank to support the production of 500 million doses.

However, Gavi's extensive modelling, cross-validated with partners, has confirmed the significant risk that despite the upstream financing available, both the high costs and liquidity challenges may cause manufacturers to fail down the line. Prompted by experience with innovative financing instruments, including Advance Market Commitments, Gavi has designed AVMA as a pull instrument which can help manufacturers who have already been successful in coming to market reach financial viability. By helping manufacturers "tip their business case" and become financially sustainable, AVMA facilitates return on the original upstream investment.

On access to finance, AVMA and the earlier stage investments already taking place are therefore mutually dependent: without the earlier access to finance, manufacturers would not reach a point of eligibility for AVMA. Without the downstream incentives to de-risk investments, manufacturers are substantially less likely to become financially sustainable.

3.2 What is Gavi doing to support this?

Under Pillar 4, the AVMA directly contributes to access to finance, being designed as a financial instrument to support manufacturers as they gain economies of scale and pay off capital investments. Detailed discussion on how the instrument was designed to do this, the options considered, and design choices analysed can be found in the documentation submitted to the PPC and Board in 2023. Documentation on how the instrument is proposed to be operationalised and function within the landscape is set out in the submission to the PPC and Board in 2024.

In brief, the incentive structure and levels have been designed to "tip" business cases, making these viable in the medium- to long-term. This also eases later-stage investment. However, Gavi's Regional Manufacturing Strategy also indirectly supports access to finance beyond AVMA by supporting manufacturers' investment decisions and business planning through other pillars. The market intelligence provided under Pillar 1 and support for demand generation under Pillar 3 both serve to strengthen the business case and therefore de-risk investment in African vaccine manufacturing. In addition, as part of AVMA governance, an annual Manufacturing Forum will be co-convened by Gavi and Africa CDC gathering Manufacturers, Implementing Countries, Donor, investors, UNICEF and WHO to collect perspectives of stakeholders and share annual reporting on AVMA that will help galvanize further action as needed.

3.3 What action is underway in the wider ecosystem?

Before manufacturers reach the stages at which they are eligible for AVMA support (WHO PQ and successful UNICEF tender bids), they rely on earlier stage financing from both public and private sources.

The Wellcome Trust highlighted the need for tailored and low-cost funding with longer payback periods as a route to address this difficulty. To this end, a range of financing instruments to support African vaccine manufacturing have been launched. For instance, in 2023 the European Investment Bank (EIB) and Afreximbank launched a joint health investment initiative

of €200 million, also targeting financing to the development of pharmaceutical manufacturing in Africa. Team Europe's MAV+ represents a total planned allocation of **€1.1 billion**, encompassing over €600 million in loans and other financial instruments from European Development Financial Institutions) and over €300 million in grants, budget support and blended finance. Aligned support from the Bill & Melinda Gates Foundation and EIB will take this to a figure of €1.6 billion. DFC has also played a proactive role in the wake of the COVID-19 pandemic, committing to directly investing US$ 2 billion and catalysing a total of US$ 5 billion for health.

A more detailed review of the current financing momentum behind African vaccine manufacturing is included in the landscape analysis of the AVMA 2023 Framework Report (PPC-2023-Mtg-02-Doc 11b-Appendix 1).

4. Regulatory strengthening

See also

- **AVMA Framework Report** (PPC-2023-Mtg-02-Doc 11b-Appendix 1) for landscape analysis on the regulatory conditions for African vaccine manufacturing
- **AVMA Risk Management Framework** (PPC-2024-Mtg-01-Doc 12-Appendix 2) for details on how the risk of regulatory bottlenecks is assessed and handled
- **AVMA Monitoring, Evaluation and Learning Framework** (PPC-2024-Mtg-01-Doc 12-Annex B) for details on how progress in regulatory strengthening is monitored by Gavi from an AVMA perspective

4.1 What are the primary challenges in connection with the AVMA, under this heading?

The PHAHM Framework for Action identifies Africa's regulatory landscape as a critical factor in successfully increasing vaccine manufacturing capacities in the region. Limitations in the regulatory capacity and approval processes could not only more broadly slow product development and market access, but a lack of WHO Prequalification specifically would restrict AVMA eligibility.

In Gavi's experience, key dimensions of a regulatory ecosystem which supports vaccine manufacturing include:

- Whether a suitable regulatory authority is present in the producing country (e.g., WHO National Regulatory Authority (NRA) ML3 status for vaccine production and above)
- Whether companies can deliver the necessary quality required to receive WHO PQ in accordance with WHO standards

A key regulatory hurdle that manufacturers on the African continent will face is that most African member states have not achieved an ML3 NRA status for vaccines[12][13]. Currently, the WHO only qualifies the NRAs of 5 African countries operating at a Maturity Level 3 (ML3) (i.e., Egypt and South Africa for vaccine production, Ghana, Nigeria, and Tanzania for medicines

[12] As of April 2023, WHO
[13] In the case of IPD, WHO Prequalification was reached through support and oversight also from the French NRA – alternative arrangements therefore are conceivable, if uncommon

only, and for vaccines import, not production). An overview of all African countries, their regulatory criteria for vaccines and the maturity level of their NRA is further discussed in the Gavi *Regional Manufacturing Strategy Baseline Market Report.*

On the question of whether companies can deliver the necessary quality required for WHO PQ, out of 32 vaccine identified manufacturers announcing planned developments in Africa[14], only 2 have successfully obtained WHO PQ for at least one of their products to date[15]: Institut Pasteur de Dakar (IPD; Yellow Fever vaccine, production is currently on hold pending resumption of WHO Prequalification), and Biovac (Measles vaccines). Typically, it takes 18+ months for a DS manufacturer to become prequalified, 12 months can be expected for a F&F manufacturer, with WHO guidelines suggesting a target of 1 year of less[16]. This has obvious implications for AVMA timelines. The current WHO Stringent Regulatory Authority (SRA) "fast-track" may reduce the WHO PQ process down to 90 days,[17] however, it is only applicable if a product has already been reviewed by another SRA (e.g., EMA/FDA) – meaning products produced in most African countries would not be eligible.

4.2 What is Gavi's contribution?

Although regulatory strengthening is outside Gavi's mandate and deliberately not directly addressed by Gavi's Regional Manufacturing Strategy, the success of the AVMA under Pillar 4 is strongly dependent on all the above components. The AVMA's impact hinges on policies and decision-making at a national level and outside Gavi's mandate. However, the expectation is that AVMA will help to galvanize further action, both through the substantial investment in regional manufacturing, and by bringing together key stakeholders in both the AVMA Investors Forum and the Gavi / Africa CDC Manufacturing Forum.

4.3 What action is underway in the wider ecosystem?

The necessary regulatory strengthening is subject to significant attention from partners, as seen through recent investments including (i) the European Commission and the Bill & Melinda Gates Foundation investing over 100 million from 2022-2027, (ii) several European governments including Germany, France, Belgium supporting the funding for the African Medicines Agency (AMA) both bilaterally and via Team Europe support, and (iii) establishment of the African Pharmaceutical Technology Foundation (including with support from the African Development Bank, and EUR 10 Million from Germany), which amongst other efforts will support upgrading of manufacturing plant capacities and regulatory quality to meet World Health Organization standards. Additionally partners such as BMZ and KfW are directly engaging with African National Regulatory Agencies (NRAs) in Rwanda, Ghana, and Senegal, providing the requisite technical assistanceto[18]the WHO approved maturity level to export vaccines (ML3)[19]. Standardisation across Regional Economic Communities (RECs) is driving regulatory strengthening with examples such as: the East African Community (EAC)

[14] As of April 2023, including for non-Gavi-supported vaccines and R&D/packaging value chain steps only (based on outside-in press search)
[15] WHO list of prequalified medical products sourced from GVMM (as of 5 April 2023). Manufacturers with previously obtained PQ status for one of their products include Vacsera (Egypt; in partnership with GSK) for MENCEVAX; IPD (Senegal; in partnership with Univercells) for Stabilized Yellow Fever Vaccine; Aspen (South Africa; in partnership with J&J) for Aspenovax; and Biovac (South Africa) for MeasBio
[16] Impact Assessment of WHO Prequalification and Systems Supporting Activites | WHO External Assessment Report 2019
[17] Accelerated Registration of FPPs Approved by SRAs | WHO - Prequalification of Medical Products (IVDs, Medicines, Vaccines and Immunization Devices, Vector Control)

[19] BMZ - Vaccine Production in Africa

implementing the EAC Medicines and Medical Devices Regulation for a unified medicine registration process across member states, and the Common Market for Eastern and Southern Africa (COMESA) harmonising technical standards and inspection procedures to expedite vaccine regulatory processes and quality control. ECOWAS has also launched the West African Regulatory Agency (WAAQA) to drive standardisation.

Where some stakeholders have expressed concerns around the level of existing support to this critical dependency, there are three aspects to consider moving forward. Firstly, regulatory capacity is not only a critical dependency for the AVMA. It is critical to the AU's targets, and success of upstream investments likely in the billions of dollars. Regulatory strengthening is a core priority of the PHAHM Framework for Action, Africa CDC's Strategic Plan, many National Health Strategic Plans and donor cooperation strategies.

Accordingly, the African Union is prioritising enhancing National Regulatory Authorities (NRAs) by supporting the operationalisation of the African Medicines Agency (AMA), harmonising operating models and processes, and investing in Regional Centres for Regulatory Excellence (RCoREs). Feedback to date has variously called for the broadening of Gavi's mandate to include regulatory strengthening or pausing the initiative pending a fully funded plan for regional capacity building. As a shared concern among stakeholders, the Secretariat takes the view that working to support the AU's leadership, including via the AVMA's potential to incentivise support to this agenda, is preferable to Gavi becoming an additional organisation working in this space. As these considerations will require broader ecosystem activation and not directly affect the AVMA design, they will be closely monitored as part of the AVMA's ongoing risk mitigation.

5. Technology transfer and IP

See also

- **AVMA Framework Report** (PPC-2023-Mtg-02-Doc 11b-Appendix 1) for landscape analysis on the need for tech transfer for African vaccine manufacturing
- **AVMA Risk Management Framework** (PPC-2024-Mtg-01-Doc 12-Appendix 2) for details on how the risk that manufacturers do not succeed in becoming eligible for the AVMA, including due to a lack of tech transfer, is assessed and managed
- **AVMA Monitoring, Evaluation and Learning Framework** (PPC-2024-Mtg-01-Doc 12-Annex B) for details on how progress in new partnerships on tech transfer is monitored by Gavi from an AVMA perspective**.**
- **Expanding sustainable vaccine manufacturing in Africa** (Gavi, November 2022), for further assessment of the ecosystem requirements

5.1 What are the primary challenges in connection with the AVMA, under this heading?

In addition to sufficient financing and a strong regulatory landscape, prospective manufacturers, that do not have a vaccine invention and research arm, will require technology transfer and/or IP rights to be able to produce vaccines. PHAHM estimate that to achieve their goal of producing 1.5-1.7 billion doses of vaccines per year by 2040, a minimum of 23 technology transfers would be required. Whilst the AVMA's targets would require substantially less, it is true that technology transfers are highly complex undertakings. They

require efforts from partners over many years to transfer know-how and processes, as well local capabilities and skills and historically, transfers to Africa have been limited.

Some African manufacturers, such as Aspen and Marbio either have existing fill & finish capacity, or capacity which is close to being online. CHAI landscaping indicates that not enough tech transfer agreements have been signed to date to be able to use this capacity[20]. Without further developments, this problem will continue to be exacerbated as manufacturers install more capacity.

5.2 What is Gavi's contribution?

The AVMA has been designed to incorporate some of the costs of initiating tech transfer into its incentive structure. This allows African manufacturers to offer greater incentives to potential partners, to facilitate tech transfer deals. In particular, via the AVMA's higher incentives for Drug Substance, the instrument is signalling the importance of tech transfers, and their role in facilitating end-to-end production. Beyond this, Gavi may support the enabling environment by publishing demand data and healthy market frameworks which help coordinate the ecosystem to support the development of commercial strategies for high-potential manufacturers. In addition, the Gavi-Africa CDC Manufacturing forum is intended to bring together manufacturers and others from the ecosystem to discuss.

5.3 What action is underway in the wider ecosystem?

Gavi's Regional Manufacturing Strategy does not broker or coordinate vaccine manufacturing technology transfers. The initiative's provision of financial support to aspiring Africa-based manufacturers, and complimentary work alongside partners in this sector improves the credibility of manufacturers to technology transfer.

Existing initiatives in this area include: WHO's Technology Transfer Hub for COVID-19 with US$ 117+ million in support from France, Canada, EU, AU, Germany, South Africa, Belgium, Norway and others, as well as other vaccines / routine biologics and PHAHM's proposal for the establishment of a vaccine technology transfer and intellectual property (IP) enablement unit to facilitate the transfer of technologies and IP. PHAHM's proposed unit could provide support to local manufacturers and coordinate access for instance to technical expertise, partnership, funding, and research. In its 2023 report, the Wellcome Trust also suggested collaboration between African manufacturers and partners on technology transfer as a particular area for donor support. Specific areas for support cited by CHAI (2023) include support in due diligence and negotiation processes to establish mutually beneficial collaboration terms, access to upfront financing and technical support during the technology transfer process.

Progress is beginning to be made, with the UN's International Vaccine Institute (IVI) and EuBiologics signing technology transfers with Biovac in 2022 for oral cholera vaccine, and in 2023 for a future pentavalent meningitis vaccine. Equally, Africa CDC's growing efforts to support technology transfer and the sharing of IP through an enablement unit can play a crucial role, as will the support of other funders and technical partners.

[20] CHAI (2023): Building a sustainable vaccine manufacturing sector in Africa

6. R&D and talent development

See also

- **AVMA Framework Report** (PPC-2023-Mtg-02-Doc 11b-Appendix 1) for landscape analysis including on the need for talent attraction
- **AVMA Modelling Details** (PPC-2023-Mtg-02-Doc 11b-Appendix 2) for details on the modelling conducted to set AVMA incentive levels (including labour costs)
- **Expanding sustainable vaccine manufacturing in Africa** (Gavi, November 2022), for further assessment of the ecosystem requirements
- **AVMA Monitoring, Evaluation and Learning Framework** (PPC-2024-Mtg-01-Doc 12-Annex B) for details on how progress in the African vaccine manufacturing workforce will be monitored

6.1 What are the primary challenges in connection with the AVMA, under this heading?

Insufficient local talent development initiatives, brain drain, and insufficient financing together contribute to a shortage of highly skilled labour. PHAHM points to the need of both R&D and talent development (pharmaceutical, biotechnological, and industrial) for a thriving vaccine manufacturing industry. PHAHM estimates that meeting the continent's 2040 ambitions will require a quadrupling of the current vaccine workforce to approximately 12,500 full-time employees (FTEs)[21].

For manufacturers to develop the capabilities required to reach WHO Prequalification or a UNICEF tender bid (the two points at which they could receive AVMA incentives), they will require substantial skilled labour. At present, importing the talent required for this comes at a higher cost than those faced by manufacturers outside Africa: the high cost of talent thus contributes to the high start-up costs for manufactures which AVMA incentives are designed to offset. Details of this are included in the AVMA modelling annex referenced above.

6.2 What is Gavi's contribution?

Insufficient local talent, compounded by brain drain and lack of funding, poses a significant challenge to vaccine manufacturing in Africa. While talent development and retention is beyond Gavi's primary focus, it does form part of the upstream ecosystem that will ultimately drive the AVMA's success. Labour market signalling and high-skill talent development are two decisive "swing factors" to drive down the long-term cost of goods sold (COGS) differential versus industry incumbents. In due course, this will allow the continent to reach a higher level of upstream maturity and autonomy, as regionally-driven R&D starts to feed the pipeline of regionally manufactured vaccines.

In the short-term, the need for higher-cost expat labour is a major driver of higher costs for new Africa based vaccine manufacturers. These higher initial costs have been factored in to modelling and calculating the incentive levels for Accelerator and Milestone payments. As manufacturing capabilities galvanized by the AVMA contribute to attracting, maintaining and growing local high-skill talent on the African continent, these costs will decline. The AVMA's time-limited grants and top-up payments buffer the short to medium term higher costs faced

[21] PHAHM Framework for Action (2022)

by new Africa based manufacturers, ensuring they are price competitive from the start and set up for long-term sustainability.

6.3 What action is underway in the wider ecosystem?

The PHAHM Framework for Action also identified incentivising R&D and developing local talent as a key challenge in developing a successful vaccine manufacturing industry, reaching beyond the scope of Gavi's Regional Manufacturing Strategy. The Wellcome Trust has proposed that African manufacturers could be supported in gaining practical experience through support for secondments with experienced manufacturers on the one hand, and of global experts working on manufacturing sites on the other.

On the development of local R&D capabilities, stakeholders are heavily engaged in in partnership with Africa CDC, including investments of over US$ 100 million from BMGF and CEPI. In particular, the European-African partnership EDCTP supported by the European commission and Horizon Europe is promoting clinical trials in Sub-Saharan Africa for the development of novel vaccines, alongside diagnostics and therapies.

On the development of high skilled labour both public and private stakeholders are engaging; In July 2023, Institute Pasteur Dakar announced a US$ 45 million partnership with the Mastercard Foundation on workforce development for the vaccine manufacturing industry, as well as a US$ 3.3 million contribution from DFC for technical assistance. Private actors are also contributing with Unizima, an affiliate of Univercells, partnering with the Kenyan Health Ministry to build a training and R&D program in Kenya.

7. Infrastructure development

See also

- **AVMA Framework Report** (PPC-2023-Mtg-02-Doc 11b-Appendix B) for landscape analysis including on the need for infrastructure development
- **AVMA Risk Management Framework** (PPC-2024-Mtg-01-Doc 12-Appendix 2) on how national country contexts may affect AVMA
- **AVMA Modelling Details** (PPC-2023-Mtg-02-Doc 11b-Appendix 2) for details on how costs including facility and certain infrastructure costs were modelled
- **Expanding sustainable vaccine manufacturing in Africa** (Gavi, November 2022), for further assessment of the ecosystem requirements

7.1 What are the primary challenges in connection with the AVMA, under this heading?

In certain African countries, physical infrastructure elements including power, water and transport networks are insufficient to sustain complex manufacturing at present. Soft trade enablers such as harmonization or treatment of vaccine-specific inputs and outputs (e.g., bioreactor bags) also form part of the necessary framework infrastructure for the industry. PHAHM's Framework for Action identifies the need to incentivise local infrastructure development, which is not within Gavi's mandate or capabilities. Still, the AVMA depends on investment into local infrastructure development for its success: access to efficient (and affordable) power, transportation, and other infrastructural elements have a substantial impact on lowering African manufacturer COGS. Positive externalities of such investments such as

additional job opportunities and economic development associated with infrastructure development can also be highlighted in this regard.

7.2 What is Gavi's contribution?

The development of national infrastructure is not within Gavi's sphere of action, but the additional incentives offered by the AVMA in support of investment in manufacturing can help strengthen the case for investment in the necessary infrastructure. As with other areas of dependency, investments enabled by the AVMA and the forums convened around the AVMA for donors (the AVMA Investors Forum) and manufacturers (the Gavi / Africa CDC Manufacturing Forum) can help shine a light on key hurdles and galvanize joint initiatives from others in the ecosystem to address these.

7.3 What action is underway in the wider ecosystem?

National governments, under whose remit such broader infrastructure development falls, have expressed clear interest in and commitment to their (potential or existing) domestic facilities, with leader-level announcements in Senegal, Nigeria, Rwanda, South Africa, Ghana and Tanzania. This is further supported for instance by the African Development Bank's flagship program for the support of local vaccine manufacturing, which aims to support, amongst other things, regional logistic integration.

8. Conclusion

With Africa accounting for less than 0.1% of the world's vaccine production, yet 20% of its population, a minimum level of vaccine sovereignty and pandemic security is far away. Higher start-up costs including for expat labour and capital expenditure create a barrier to entry for new manufacturers in Africa to enter the market and remedy the situation. Despite strong commitments and political support from stakeholders across the ecosystem, progress made in Africa is exposed to the risks of inaction and poorly coordinated actions.

As the largest global financer of vaccines for developing countries, Gavi has committed to playing an active role aligned with its comparative advantages of market-shaping and innovative finance, across its *four-pillar regional vaccine manufacturing strategy*. The AVMA sits at the heart of this strategy, directly addressing 'Access to Finance' while indirectly contributing to other elements of the PHAHM framework such as R&D and talent development.

Under the organizing framework provided by the AU and Africa CDC, the AVMA can act in concert with industry, Alliance, and national and supranational partners through its governance structures to coordinate innovation, health security sovereignty, and the creation of a sustainable vaccine manufacturing industry, thereby improving pandemic preparedness and vaccine access and equity. As such, the suggested AVMA governance structure allows it to act as a knowledge hub: including donors, Africa CDC in the annual review process and Industry & Alliance partners through technical and operational guidance and feedback.