The Pasteur Network Vaccine Manufacturing Initiative
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Bridging the gap: the Pasteur Network's approach to equitable vaccine development and manufacturing

The Pasteur Network Vaccine Manufacturing Initiative[1*]

Abstract

Equitable access to vaccines remains a cornerstone of global health security, yet persistent gaps in regional manufacturing capacity continue to undermine timely and fair distribution. The COVID-19 pandemic exposed the risks of highly concentrated production systems and underscored the need for locally anchored manufacturing models capable of responding rapidly to public health emergencies. The Pasteur Network (PN)—a global consortium of 32 public health and research institutes across Africa, Asia, Europe, and the Americas—offers an operational example of decentralized vaccine manufacturing embedded in national public health systems linking regional manufacturing capacity with public health priorities. Here, we examine the contributions and challenges of members within the PN engaged in vaccine manufacturing. Twelve members currently produce more than 525 million doses annually, covering a broad range of human and veterinary vaccines. Embedded within national health systems, the PN members combine research, development, and partial or end-to-end manufacturing capacities, ensuring close alignment with national public health priorities. Several members within the PN also contribute to global initiatives, including the Coalition for Epidemic Preparedness Innovations (CEPI) manufacturing network, reinforcing their role in global preparedness efforts. Despite these strengths, common barriers persist across the PN, including workforce retention challenges, limited sustainable core funding, supply chain vulnerabilities, fragmented regulatory pathways, and insufficient coordination. We argue that the PN illustrates a scalable, public-health-embedded manufacturing model that complements existing industrial and technology-transfer approaches and should inform future global financing and governance.

Keywords Vaccine equity, Regional manufacturing, Network, Health sovereignty, Global health preparedness

Background

Equitable access to vaccines is a critical component of global health security and a significant challenge underscored by recent pandemics [1]. Historically, vaccine manufacturing capacity has been concentrated in a small number of countries, resulting in a strong dependence of low- and middle-income countries (LMICs) on imports. This concentration increased vulnerability to supply chain disruptions and contributed to inequitable access, particularly during periods of high global demand [2]. Today, the global vaccine market is still highly concentrated, with manufacturers based in high-income countries capturing approximately 85% of total financial value while accounting for only about one-third of global vaccine volumes. In contrast, manufacturers in developing countries supply over half of global vaccine doses but capture a disproportionately small share of market value [3]. Addressing these imbalances requires the development of more geographically distributed manufacturing

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capacity and the promotion of collaborative models that enable regions, particularly in the global south, to produce vaccines for their own populations [2].

Founded in 1887 with the creation of the Institute Pasteur in Paris, the Pasteur Network (PN), has expanded into a global alliance of research and public health institutions united by a shared mission to advance science and improve global health. Over more than 130 years, it has built a strong presence in regions at the forefront of infectious disease emergence and biodiversity, fostering deep engagement with local health authorities and communities. Today, the PN comprises 32 members across 25 countries on five continents, employing more than 25,000 researchers, clinicians, and technical staff. It includes 22 members in LMICs and 11 in high-income countries—three of which are French overseas territories, https://pasteur-network.org. The PN hosts 54 national and regional reference centres and 19 World Health Organisation (WHO) collaborating centres and is formally recognized as a WHO non-state actor.

The 2024 Pasteur Network Annual Meeting, held from 21 to 23 October in Rio de Janeiro, brought together representatives from all 32 members as well as key stakeholders. A key outcome of the meeting was the decision to convene a dedicated group of PN members with vaccine manufacturing capacity or vaccine development programs to collaborate more closely on advancing vaccine sovereignty and improving equitable access, particularly LMICs. Unlike manufacturing networks that focus primarily on industrial scale or technology transfer, the Pasteur Network Vaccine Manufacturing Initiative (PN-VMI) integrates vaccine research and development (R&D), manufacturing, and public health functions within nationally embedded members. This structure enables alignment between surveillance, research priorities, and production decisions—an integration rarely achieved in existing global manufacturing initiatives. This Perspective argues that the PN-VMI represents a distinct, underutilized model of decentralised, public-health–embedded vaccine manufacturing that can strengthen equity and preparedness if supported by appropriate policy and financing frameworks.

The PN-VMI as a case for vaccine equity and access

To focus specifically on vaccine research, development, manufacturing, and equitable access, the PN established a dedicated group, the PN-VMI. The PN-VMI is a voluntary collaboration within the PN, established in 2024 to coordinate members with vaccine manufacturing or advanced vaccine development capabilities. It is not a separate legal entity but operates as a structured working group under PN governance. PN-VMI currently comprises 13 institutes with either existing or developing vaccine manufacturing capacities, including the Institute Pasteur (IP) of Algeria, Dakar, Iran, Morocco/Marbio, Nha Trang/Institute of Vaccines and Medical Biologicals (IVAC), Tunis; Hellenic; Fiocruz/Bio-Manguinhos; and the National Institute of Hygiene and Epidemiology (NIHE)/Vabiotech. Additionally, several members—those in Ho Chi Minh City, Korea, Lille, and Paris—focus on active vaccine development programs or platform development, contributing their research expertise and capabilities to the initiative. The complete list of participating members and their individual capacities around vaccine are available in the Supplementary material 1 and Supplementary material 1: Fig. S1 and moreover, a dedicated website has been developed for more details about the PN-VMI activities [4]. To gain a comprehensive understanding of the PN-VMI's actual capabilities and to systematically identify shared challenges and opportunities for collaboration, we designed a survey to capture the full scope of vaccine manufacturing and development capacities across the members. Data from a questionnaire, that can be found in Supplementary material 1, were self-reported by 12 participating members of the VMI and were not independently audited, representing a limitation of this analysis. Institute Pasteur Lille expressed interest in joining the group after the survey had been completed and was therefore not included among the initial recipients. The survey covered six domains (capabilities, objectives, needs, challenges, network strategies, and demand) and was complemented by follow-up interviews and a validation workshop held in Morocco in May 2025 [5]. This work supported the development of a comprehensive "PN-VMI Business Case" which aims to showcase and consolidate the PN's vaccine manufacturing capacities and goals in a single document to better collaborate and engage the broader network and partnerships.

Broadly, the PN-VMI members collectively recognized that its members have substantial vaccine development and manufacturing capacities, which can serve as a case study for distributed production and support equitable access. The PN-VMI illustrates a distinctive model of vaccine manufacturing that integrates research, production, and public health functions within nationally embedded institutes. Unlike purely industrial manufacturing networks or stand-alone technology transfer initiatives, PN-VMI members operate at the interface of surveillance, R&D, and production, allowing public health priorities to directly inform manufacturing decisions. This structural integration enables a more responsive alignment between local epidemiological needs and production strategies—an approach that proved largely absent during the COVID-19 pandemic and is explicitly reaffirmed in the Pasteur Network's Rio Declaration, presented during the G20 Summit 2024, which commits the

PN to strengthening vaccine sovereignty, preparedness, and equitable access [6].

Collectively, PN-VMI members already operate at meaningful scale. Twelve institutes report a combined annual production exceeding 525 million doses, covering vaccines against more than 26 pathogens, including yellow fever, BCG Bacillus Calmette–Guérin (tuberculosis vaccine), influenza, hepatitis B, and COVID-19. Several products are WHO-prequalified, enabling procurement by Gavi, the Vaccine Alliance, which works to improve access to vaccines in LMICs, and by United Nations International Children's Emergency Fund (UNICEF), the world's largest vaccine buyer and distributor for public health programs worldwide. A particularly illustrative example is yellow fever: Fiocruz/Bio-Manguinhos and Institute Pasteur Dakar together produce an estimated 110–130 million doses annually, representing approximately 80–94% of global needs [7], underscoring the PN-VMI's strategic importance for global health security.

The PN-VMI's added value also lies in its coverage of the vaccine value chain. Across members, capabilities span R&D, preclinical and clinical development, drug substance and drug product manufacturing, and fill-and-finish operations, with several members possessing end-to-end production capacity. Others are actively expanding their technological scope, including through platform-based approaches such as messenger Ribonucleic Acid (mRNA) [8]. This distributed but complementary configuration allows the PN-VMI to function as a coordinated ecosystem rather than a collection of isolated producers.

Geographically, manufacturing and advanced development capacities are distributed across Africa, Asia, Europe, and Latin America, and most members are embedded within national health systems. This positioning facilitates a focus on regional disease priorities while maintaining the ability to contribute to global supply. At the same time, several members are actively engaged in international initiatives, including the WHO mRNA Technology Transfer Hub and the Coalition for Epidemic Preparedness Innovations (CEPI) manufacturing network, demonstrating that locally anchored production can be compatible with, and additive to, global preparedness efforts.

Finally, the PN-VMI is underpinned by a growing framework for structured collaboration aligned with the Rio Declaration's call for collective action [8]. Members have identified shared priorities in workforce development, technology transfer, joint R&D, and coordinated manufacturing strategies. Early examples include a multilateral memorandum of understanding to advance mRNA platform development among several institutes. Together, these elements position the PN-VMI not merely as a collection of manufacturers, but as a coordinated, public-health–oriented manufacturing network with the potential to strengthen both regional vaccine sovereignty and global equity.

While the PN demonstrates the promise of distributed, locally grounded manufacturing capacities capable of advancing vaccine equity, the full realization of this potential depends on addressing several systemic and operational barriers that continue to hinder collaboration and scale-up.

Obstacles to advancing vaccine equity through collaboration

The PN-VMI demonstrates that geographically distributed, public-health–embedded manufacturing is both feasible and already operational at scale. However, realizing its full equity potential requires structural policy support beyond institutional commitment. Three strategic shifts are particularly critical. Despite its strengths, the transition from potential to impact remains constrained by structural and contextual challenges that limit the ability of members to collaborate effectively and sustain and expand vaccine production in their own countries, regions, and across countries.

Moving from project based grant to sustained core Financing. One of the most significant barriers limiting the ability of institutions to fully engage in vaccine R&D and manufacturing is the persistent shortfall in core funding and the lack of sustained, targeted investments [9]. The PN-VMI members are currently financed through a variety of models that reflect national contexts and institutional mandates. IP of Morocco operates under public–private partnerships with Marbio, a private company involved in vaccines production and distribution, reinvesting returns on investments into R&D [10]. Others, including IP Nha Trang and IP NIHE, partner with state-owned enterprises such as IVAC and Vabiotech structures comparable to the Fiocruz/Bio-Manguinhos model in Brazil. In contrast, IP Dakar follows a contract development and manufacturing organization (CDMO) model, providing development and production services for external partners, including governments and international organizations, while advancing its own vaccine programs. The majority members remain publicly owned research institutions, relying primarily on national public funding and international grants to support their operations. Unlike time-bound project-based grants, core funding provides the financial stability necessary for strategic planning, talent retention, infrastructure maintenance, and long-term capacity building. Nevertheless, many members of the PN operate with limited and project-based funding often restricts their ability to make long-term strategic investments in

infrastructure, workforce, and technology transfer—reinforcing the need for sustainable financing mechanisms. Moreover, donor-driven funding often imposes rigid conditions that restrict how members can allocate resources, reducing their responsiveness to local priorities. The absence of risk-tolerant capital further limits support for innovative or early-stage vaccine development. These challenges are compounded by disparities in global funding allocation, which continue to favour institutions in high-income countries and widen the resource gap [11]. Moreover, insufficient funding undermines cross-collaboration, reducing coordination, shared initiatives, and the efficient exchange of expertise.

Advancing regulatory harmonization and mutual recognition. Fragmented regulatory systems significantly delay market authorization and cross-border supply. While WHO prequalification remains essential, overreliance on centralized approval pathways can create bottlenecks during global emergencies. Regional regulatory harmonization mechanisms, mutual recognition agreements, and strengthened national regulatory authorities in LMICs are essential to unlock the efficiency gains of distributed manufacturing networks. For networks such as the PN-VMI, harmonization would allow complementary production capacities to function as an integrated ecosystem rather than isolated national units.

Incentivizing collaborative manufacturing ecosystems. The absence of real-time communication platforms or shared knowledge hubs often leads manufacturers to operate in silos, limiting opportunities for strategic alignment. In addition, intellectual property barriers and the lack of clear technology licensing pathways, particularly for advanced platforms like mRNA, can obstruct even well-intentioned collaboration efforts. Low trust and perceived competition among regional actors may further inhibit openness and willingness to share expertise. Finally, weak coordination between manufacturers and academic or public sector R&D institutions reduces the flow of transferrable innovations, constraining the broader ecosystem's collaborative potential [12, 13]. The PN-VMI highlights a different model: coordinated, multi-site manufacturing embedded in national public health systems and hight trust among members. This configuration allows surveillance data, R&D priorities, and production strategies to inform one another. Policy frameworks should therefore incentivize network-based manufacturing approaches through; support for joint R&D platforms and shared clinical trial infrastructures; structured technology transfer pathways across network members; regional procurement mechanisms that reward collaborative production and dedicated funding for supply chain coordination and shared procurement. Such measures would transform distributed capacity into a resilient manufacturing ecosystem capable of responding collectively to both routine immunization needs and emerging threats.

Addressing these interconnected barriers requires not only institutional commitment but also strategic policy interventions that align national, regional, and global priorities. The following section explores how such policy and strategic measures can transform the PN's collaborative potential into a sustainable framework for equitable vaccine manufacturing and access.

Policy and strategic implications

The PN's manufacturing ecosystem is actively and strategically oriented towards addressing the critical issue of equitable vaccine access. By consolidating and enhancing the capabilities of its diverse members, the PN offers a tangible pathway to increasing global vaccine supply and distribution, particularly in regions historically underserved [14]. The collective capacity to produce for approximately 7.5% of the total global vaccine market volume in 2023 [3], underscore the PN-VMI's significant contribution to global supply.

The PN-VMI's primary strength lies in its integration of vaccine R&D, manufacturing, and public health functions within nationally embedded institutes. Unlike purely industrial manufacturing networks, PN-VMI members operate inside public health systems, allowing surveillance data, research priorities, and production decisions to inform one another. This structure enables locally driven agenda-setting while contributing to global supply—an arrangement that proved largely absent during COVID-19 [15]. This "local agenda setting for global impact" directly counters the historical inadequacy of a global market driven primarily by the demands and priorities of wealthier nations. For example, the International AIDS Vaccine Initiative (IAVI) and IP Dakar have partnered to develop a vaccine candidate for Lassa fever [16]—a longstanding public health burden in Africa that has historically attracted limited commercial interest due to the small market size [17].

Furthermore, the explicit strategic objectives of improving vaccine sovereignty, increasing epidemic preparedness, and enhancing vaccine access signal a clear commitment to vaccine equity [18]. The PN's recognition that the COVID-19 pandemic highlighted the need to prioritize these aspects for LMICs nations provides a strong foundation for its current and future initiatives. In this context, while current production capacity is largely focused on human vaccines, strengthening veterinary vaccine manufacturing emerges as a complementary priority. This aligns with the One Health approach, which emphasizes the interconnectedness of human, animal, and environmental health in preventing and controlling

infectious diseases, and is vital for building resilient health systems.

The PN also sits within the broader landscape of regional and global vaccine manufacturing initiatives—such as the African Vaccine Manufacturing Initiative (AVMI), a continental platform that advocates for policies and strategies to strengthen Africa's capacity to produce vaccines locally [19] and the Developing Countries Vaccine Manufacturers Network (DCVMN), which brings together over 40 manufacturers from LMICs to promote access to affordable, high-quality vaccines through collaboration, technology sharing, and collective negotiation power [20]. The PN-VMI complements these models by offering a hybrid structure that combines R&D, manufacturing capacity, and national public health integration. Its strength, once again, lies in being anchored in local health systems while engaging in global initiatives and scientific collaboration and the longstanding relationships among its members, built over decades of scientific collaboration, trust, and shared public health missions. This dual focus allows the PN-VMI to act as both a regional driver of innovation and a global contributor to equitable access, particularly through its shared infrastructure, strategic alliances, and coordinated production capabilities.

Conclusions: the PN-VMI contribution towards an equitable vaccine ecosystem

Through coordinated expertise and strategic collaboration, the PN-VMI contributes to global, regional, and local efforts to advance equitable vaccine access, demonstrating that distributed vaccine manufacturing within public health systems is already operating at scale. By integrating surveillance, research, development, and production within nationally anchored institutes, the PN-VMI offers a model that aligns manufacturing capacity with regional epidemiological priorities while contributing meaningfully to global supply. This hybrid configuration—bridging local agenda-setting and global engagement—distinguishes the PN-VMI from purely industrial or technology-transfer–driven initiatives. Yet capacity alone does not guarantee equity. Without sustained core financing, regulatory harmonization, coordinated supply chain strategies, and incentives for structured collaboration, distributed manufacturing risks remaining fragmented and reactive. The experience of the COVID-19 pandemic underscored that equitable vaccine access depends not only on production volume, but on the resilience and connectivity of the systems that underpin it. If supported by coherent policy frameworks and long-term investment, the PN-VMI model could inform a broader shift in global health governance—from centralized production paradigms toward interconnected regional ecosystems capable of responding collectively to both routine immunization needs and emerging threats. In doing so, it advances a pragmatic pathway toward vaccine sovereignty that reinforces, rather than undermines, global solidarity. The future of equitable vaccine access will depend not on isolated manufacturing hubs, but on coordinated networks capable of linking science, production, and public health across regions. The initiative serves as a compelling example of how decentralized yet connected capabilities, coupled with strategic objectives aligned with equity, can play a vital role in creating a more resilient and equitable global vaccine landscape.

Abbreviations

AVMI	African Vaccine Manufacturing Initiative
BCG	Bacillus Calmette–Guérin (tuberculosis vaccine)
CDMO	Contract Development and Manufacturing Organization
CEPI	Coalition for Epidemic Preparedness Innovations
DCVMN	Developing Countries Vaccine Manufacturers Network
DP	Drug product
DPT	Diphtheria–pertussis–tetanus (vaccine)
DS	Drug substance
Gavi	Gavi, the Vaccine Alliance
GMP	Good Manufacturing Practice
IAVI	International AIDS Vaccine Initiative
IP	Institute Pasteur
IVAC	Institute of Vaccines and Medical Biologicals
LMIC(s)	Low- and middle-income country (countries)
mRNA	Messenger ribonucleic acid
NIHE	National Institute of Hygiene and Epidemiology
PN	The Pasteur Network
PN-VMI	Pasteur Network Vaccine Manufacturing Initiative
R&D	Research and Development
Tdap	Tetanus, diphtheria, pertussis (acellular, booster vaccine)
TT	Tetanus toxoid
UNICEF	United Nations International Children's Emergency Fund
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1 – (Supplementary Material 1.docx). This document contains additional information on the members of the Pasteur Network Vaccine Manufacturing Initiative (PN-VMI) and the survey instrument used for data collection. It includes (i) "FigS1 Pasteur Network Vaccine Manufacturing Initiative Members' Capacity Overview" an overview figure presenting the participating institutions and their manufacturing capacities, and (ii) "The Pasteur Network Vaccines Manufacturing Initiative's members composition", the full list of PN-VMI institutions name; (iii) "Survey Questions", the full list of survey questions used to assess institutional capabilities, objectives, needs, challenges, collaboration strategies, and vaccine demand across the PN-VMI.

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Authors' contributions
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Competing interests
Dr Hung Van Pham is the director of Vabiotech company. Mr Brent McCann is a manager at Camber Collective. Ms Manali Kulkarni is an associate at Camber Collective. The remaining authors declare that they have no competing interest.

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