Regional Manufacturing of Health Products in Africa

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Ideas to Action: Independent research for global prosperity

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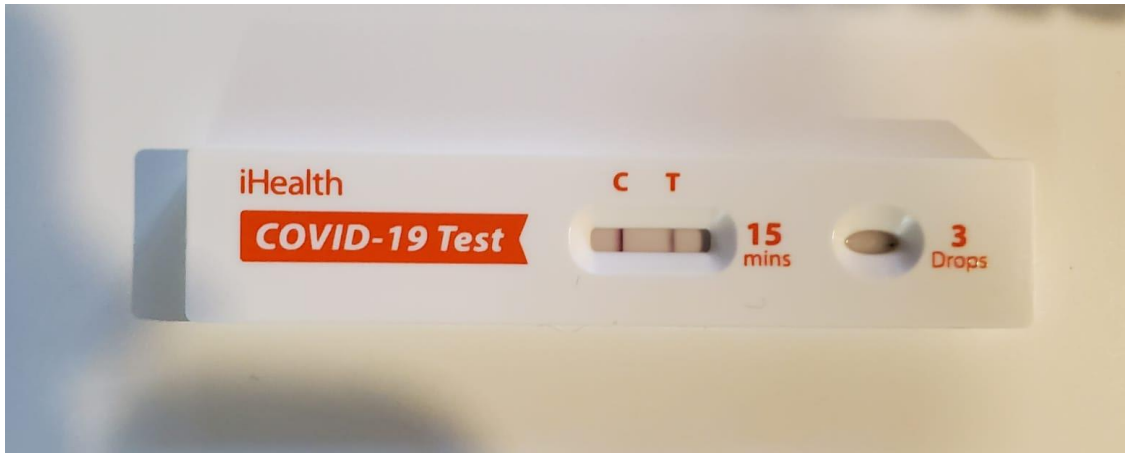
BSMA
Bio Supply Management Alliance

BSMA Africa Inaugural Conference
Kigali, Oct 31-Nov1 2022

Too bad I missed seeing you all and learning from you!



“You can plan a pretty picnic, but you can't predict the weather.
--Outkast

Five points for your attention

01 Important for all stakeholders to be extremely clear on the business case for regional manufacturing in Africa. Varying objectives create friction.

02 Long term sustainability of Africa based manufacturing plants will come from more agility and flexibility in manufacturing & distribution networks. Left to its own, the production networks may under invest in flexibility

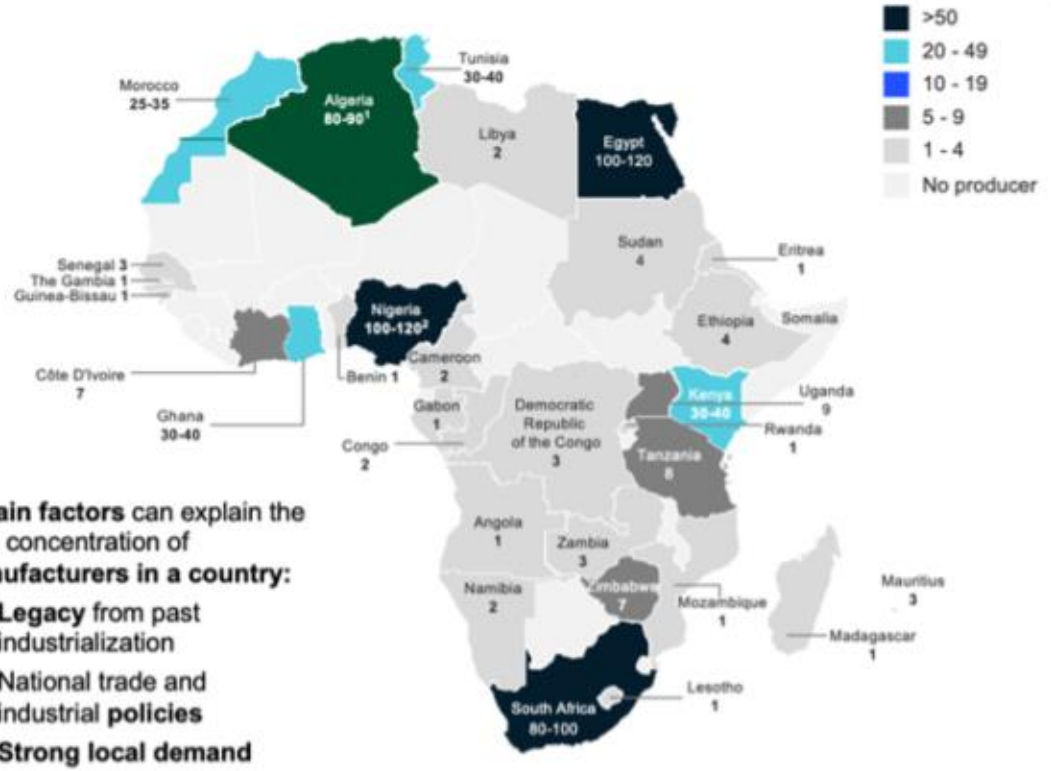
03 Potentially many new manufacturing sites in planning- Success will depend on careful choice of product mix, staff capabilities, and overall eco-system development

04 Need significant government and development finance institutions investments to cover capex and eco-system development needs

05 No sustainability of regional manufacturing without accompanying regional procurement and regional distribution models

Current landscape of pharmaceutical manufacturers in Africa

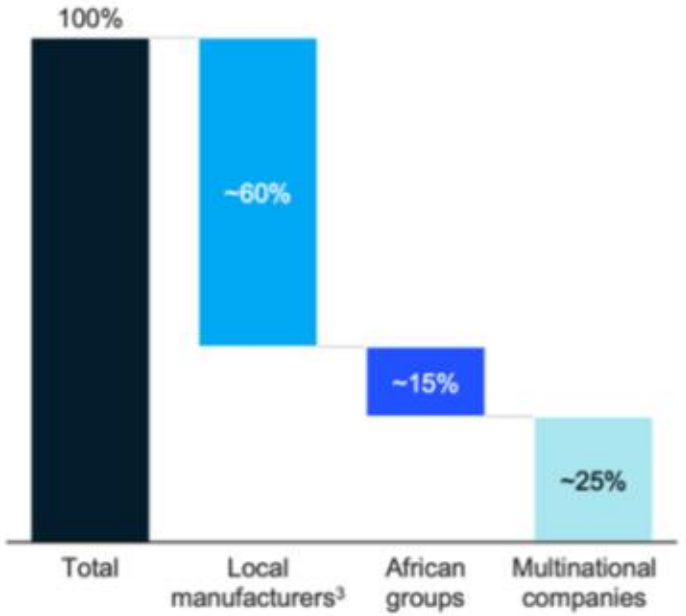
Africa's pharmaceutical manufacturers by country
2020, total = ~600



3 main factors can explain the high concentration of **manufacturers in a country:**

- **Legacy** from past industrialization
- National trade and industrial **policies**
- **Strong local demand**

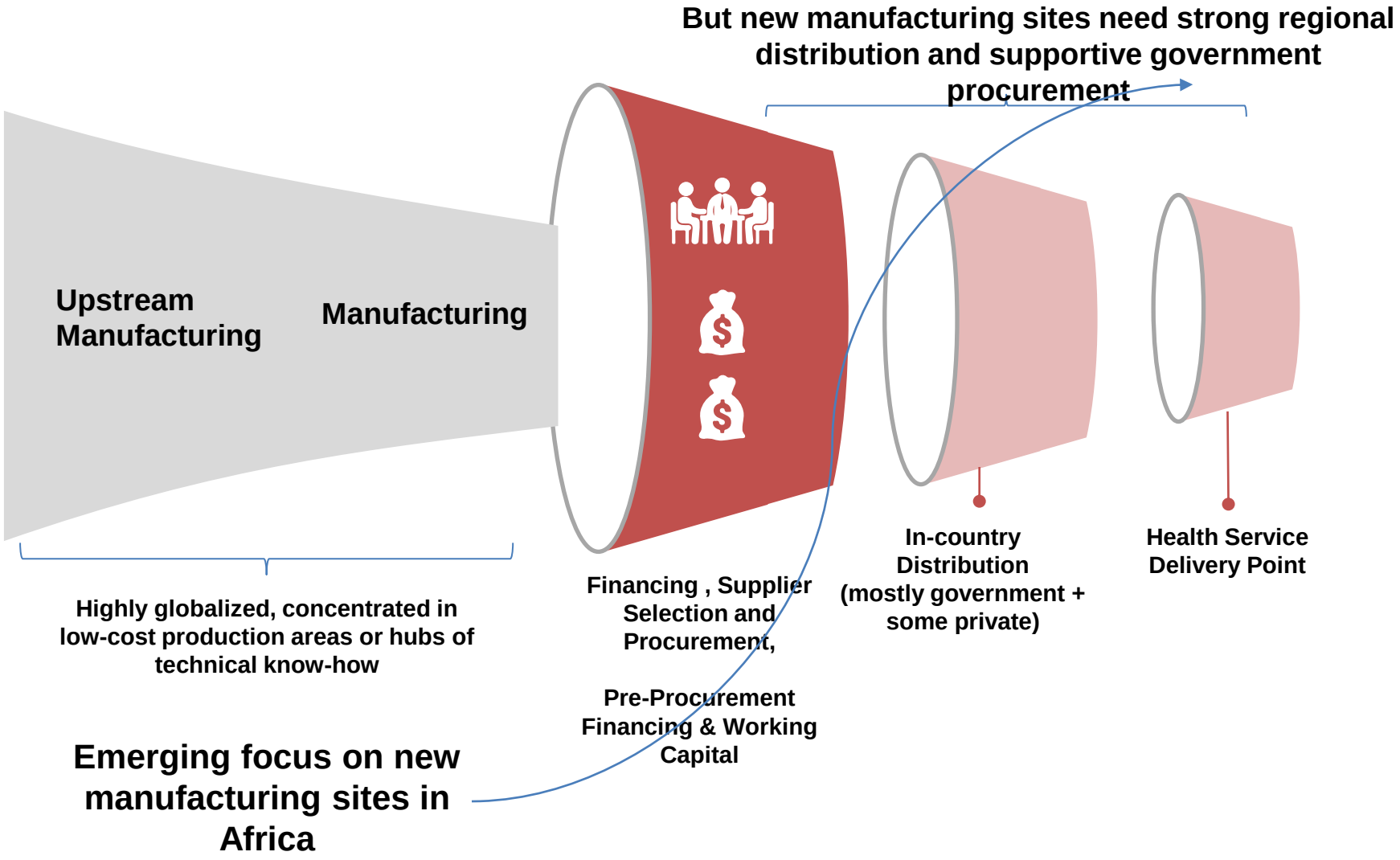
Pharmaceutical manufacturers by ownership,
2020, total sample = ~400



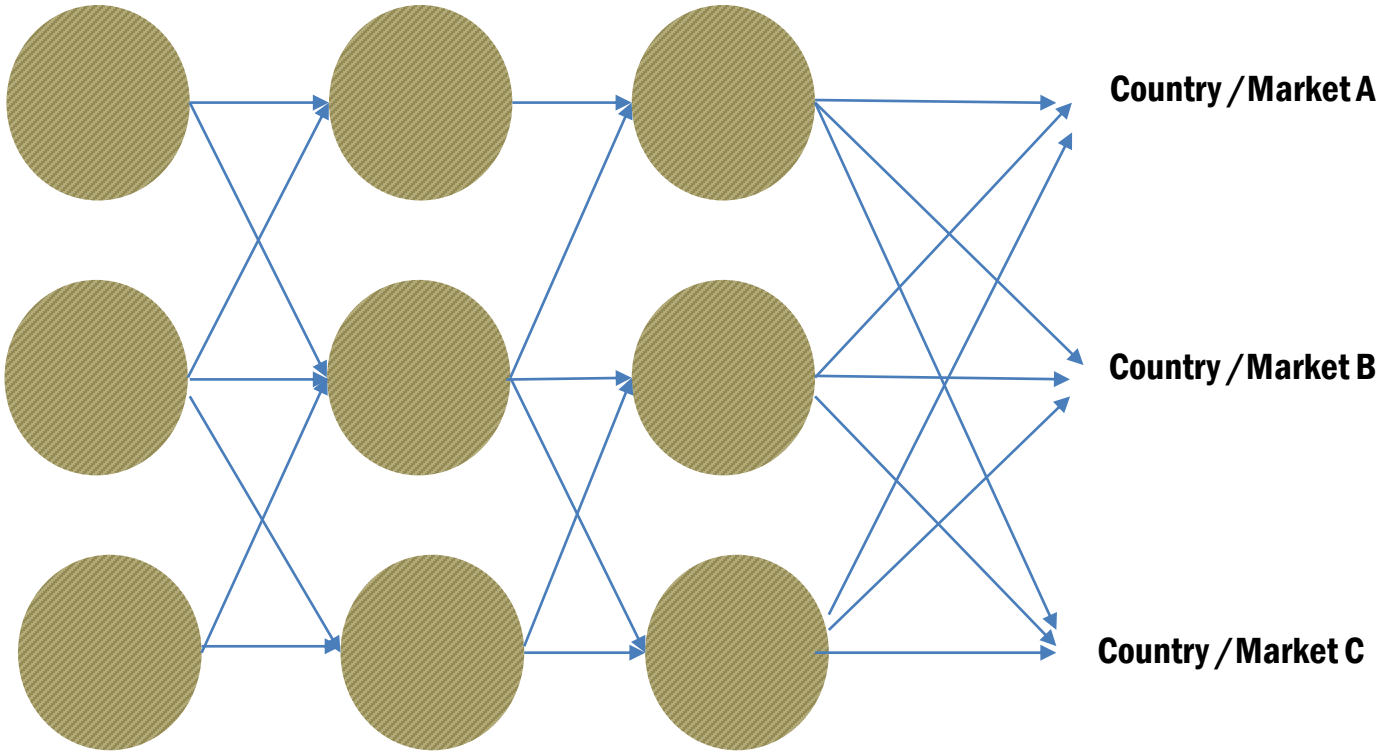
1. In April 2019, Algeria reported 87 active pharmaceutical producers (according to Fitch's report for Algeria) | 2. There are over 120 pharmaceutical manufacturers in Nigeria according to UNIDO country report, 2011 | 3. African companies with manufacturing capabilities in one country

Source: Julia Kaufman , Amanda Glassman , David Milestone and Prashant Yadav
Expanding Health Product Manufacturing in Africa: Ideas for Development Finance Institutions, Procurers, & Policymakers, CGD Paper. Feb 2021.

Health product manufacturing in Africa: high level overview



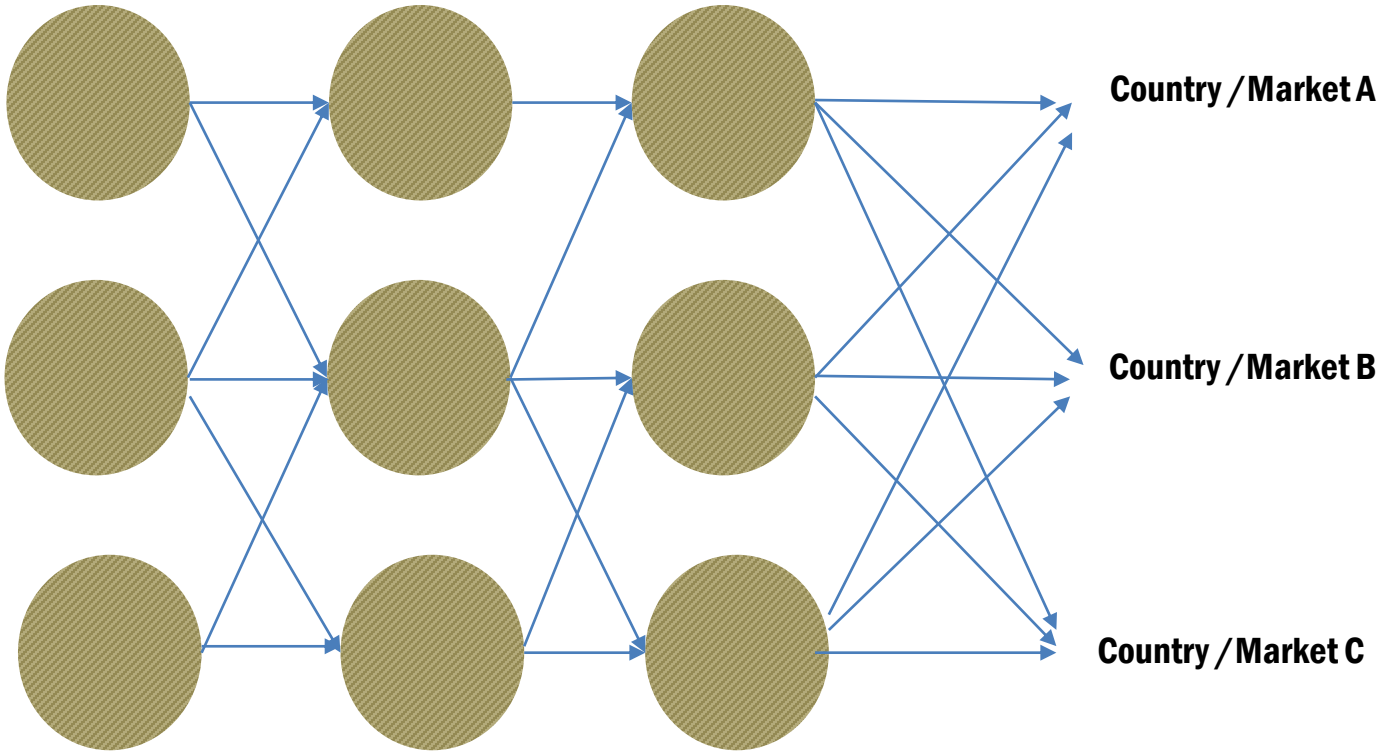
Why do we care about additional manufacturing nodes in the production network for vaccines, medicines and diagnostics?



Each stakeholder has a slightly different answer

Answer requires us to think carefully what performance do we want from the production network?

Equity and resilience are not free. We need to accept the tradeoffs and create the financing instruments to pay for it



Maximum Flow?

Equity of Flow for Each Market?

Robustness to Node(s) put under Export Control?

Lowest Cost per Unit Dose of Output?

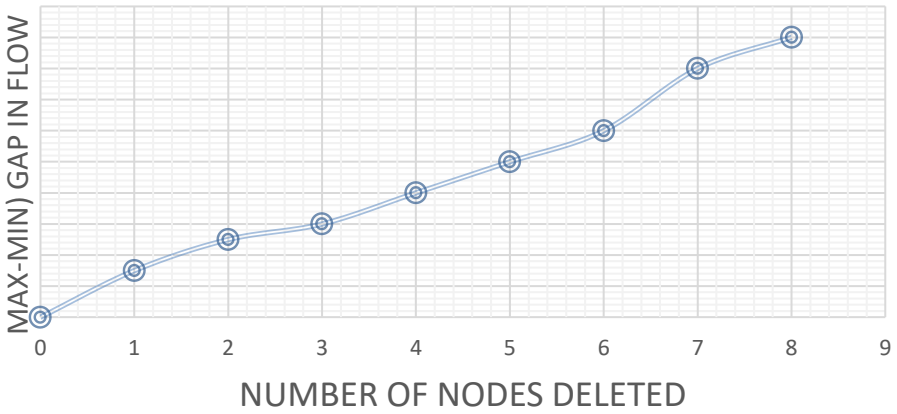
Network Time to Start?

Health Product Manufacturing Network Resilience and Equity

- How do the SC network's output performance change when a random or targeted node is deleted (e.g., export control, supply disruption)? *Well studied problem in supply chain literature*

- How do the SC network's equity performance change when a random or targeted node is deleted (e.g., export control, supply disruption)? Less studied (except in public transport network design and health provision networks)

Equity of a network's supply output



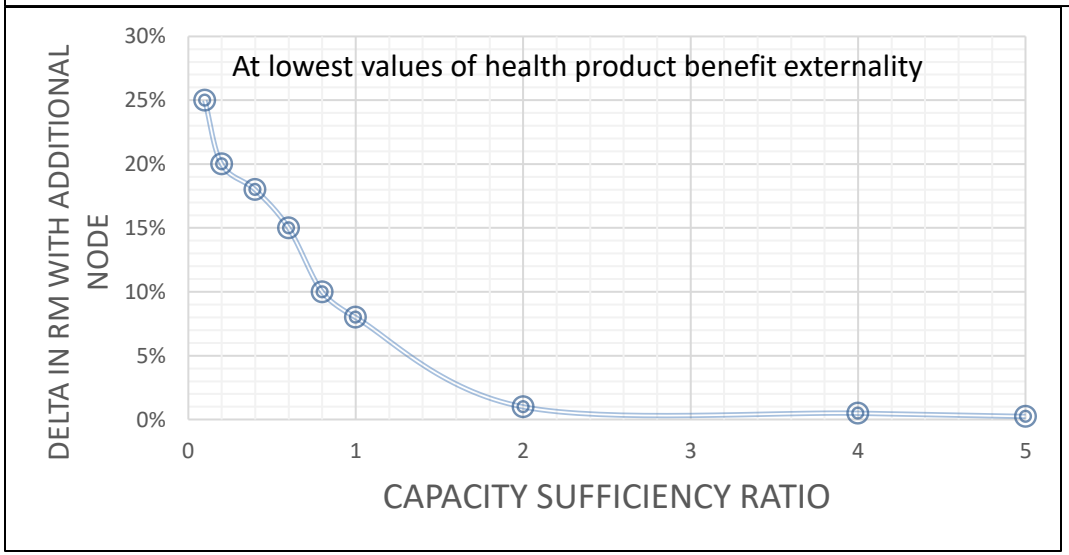
For a hypothetical network with zero Max-Min gap at start, and identical nodes

Resilience Benefits Depend on Global Market Dynamics & Capacity

A health product Manufacturing Network with a greater number of nodes achieves greater "resilience" (equity after node deletion metrics)

Each additional (non correlated risk) node in the health product Manuf Network creates additional welfare *Rm* for society. *Rm* depends on/*N*/

Change in Aggregate Societal Benefit when a new uncorrelated node is added
X Axis = Ratio of Current Capacity of Network to Global Need



So we can't design additional production nodes in isolation of global network capacity. Overall global market dynamics matter. Pick products where there isn't a glut/excess production capacity

New production sites and need for flexibility in production assets

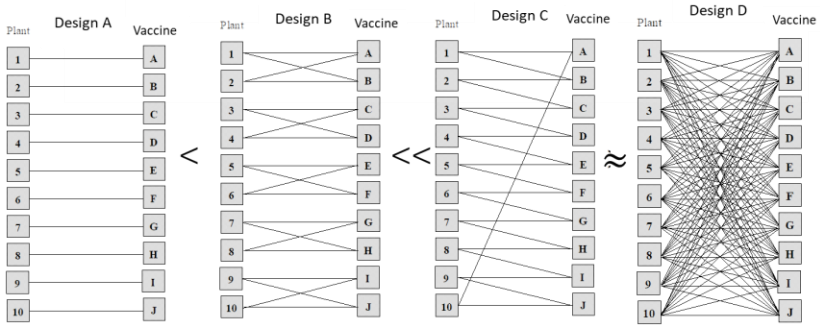
Most new manufacturers are unclear about what product mix will they choose?

COVID BCG DT DTP Cholera Flu Hexa HepB MCV PCV Rabies Tetanus Typhoid YF Malaria MenA Malaria Medicines

Some portion of demand uncertainty can be hedged by highly flexible production assets

Comes at higher capital expenditure and higher operating expenditure

Limits of scale in a single facility



Source = Desir and Yadav 2021

Large scale = more cost efficient? But will not pivot quickly to new technologies, new products

If we collectively want more flexible production networks, should we then pay for the flexibility “collectively”?

African manufacturing cannot be an effort led by private firms alone. Needs government and institutional investments

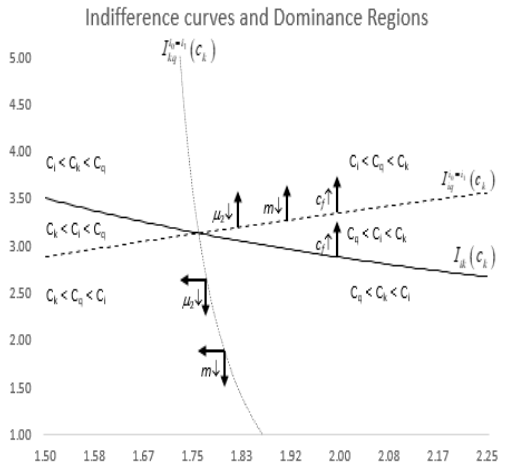
What form?

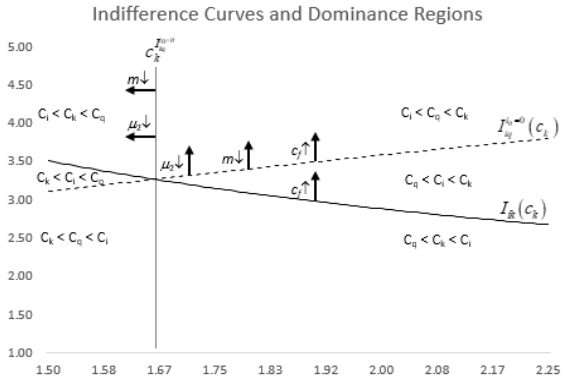
1 Capital grant, concessional loan or equity

2 Working capital facility, seconded staff, other mechanisms for overhead reduction

3 Purchasers agree to pay a time limited premium

4 Advanced purchase agreement, volume guarantee





Comparison of different instruments assuming static production cost-curves (some analysis in Kazaz, Webster, Yadav 2020)

Learning curve effects and dynamic production cost curves ?

Leapfrog directly to new generation vaccines e.g. broader/longer protection vaccines (e.g., COVID, influenza)

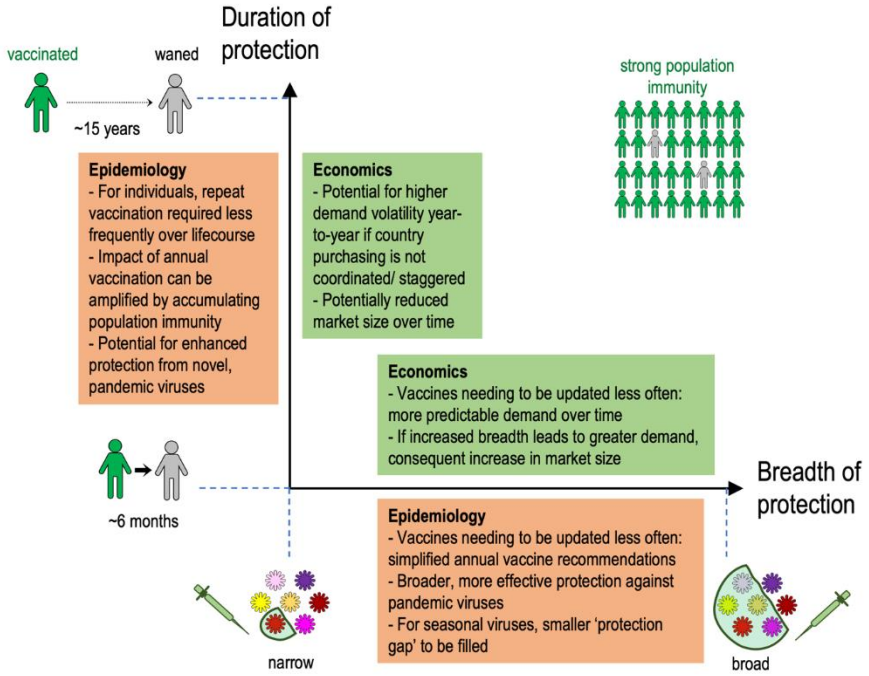


Figure: schematic illustration of economic and epidemiological considerations for future influenza vaccines, associated with their breadth and duration of protection. Coloured boxes show key factors (discussed further in the text) associated with increasing vaccine performance along the associated axis.


Science
AAAS
VOL. 376, NO. 6592

POLICY FORUM

GLOBAL HEALTH

A global system for the next generation of vaccines

COVID-19 has shown that hurdles can be overcome

By Nimalan Arinaminpathy[1,2], Chadi M. Saad-Roy[3], Qiqi Yang[4], Isa Ahmad[1,2], Prashant Yadav[5,6], Bryan Grenfell[4,7]

years. New vaccines would transform these production methods. For example, both mRNA and viral vector technology bypass

Arinaminpathy N, Saad-Roy CM, Yang Q, Ahmad I, Yadav P, Grenfell B.
A global system for the next generation of vaccines. *Science*. 2022 Apr 29;376(6592):462-464.

Select readings re Vx manufacturing

NY Times Essay-Thoughts on vaccine manufacturing geographical diversification and choice of small population countries
https://www.nytimes.com/2021/05/20/opinion/india-covid-vaccines-covax.html

HBR- Miscellaneous thoughts on vaccine manufacturing and SC expansion including marketplace for raw materials
https://hbr.org/2021/05/4-strategies-to-boost-the-global-supply-of-covid-19-vaccines

Flexibility in vaccine manufacturing https://knowledge.insead.edu/operations/boosting-vaccine-production-needs-the-right-degree-of-flexibility-17621

Musings on how to make overall MCM supply chain better prepared
https://knowledge.insead.edu/operations/are-our-supply-chains-ready-for-the-next-global-health-crisis-18741

Foreign Affairs--How to Make COVID-19 Vaccines Available to All--Manufacture the Right Kinds in the Right Places
https://www.foreignaffairs.com/articles/world/2021-12-27/how-make-covid-19-vaccines-available-all

Foreign Affairs—Need for CMC and other tech know-how key bottleneck in expanding manufacturing capacity (not patents)
https://www.foreignaffairs.com/articles/united-states/2021-05-10/producing-vaccine-requires-more-patent

Science. 2022 Apr . A global system for the next generation of vaccines. Issues pertaining to breadth and duration of immunity https://www.science.org/doi/10.1126/science.abm8894

HBR-April 2020 (much before vaccines) article re business model innov for equitable Vx distribution
https://hbr.org/2020/04/a-covid-19-vaccine-will-need-equitable-global-distribution

Thanks for your attention

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