Affordable Medicines by Design?: Evidence from Alternative R&D Models for National and Global Public Health

DukeNUS Medical School | Centre for Outbreak Preparedness

DukeNUS Medical School | Centre of Regulatory Excellence

Wednesday, 5 March 2025

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Wednesday, 5 March 2025
3 – 4:15PM SGT
Amphitheatre, Duke-NUS Medical School

Speaker
Suerie Moon

Visiting Professor, SingHealth Duke-NUS Global Health Institute

Professor of Practice in International Relations & Political Science, Graduate Institute Geneva

Guest speaker
John CW Lim

Executive Director, Centre of Regulatory Excellence (CoRE)

Lead (Policy) SingHealth Duke-NUS Global Health Institute (SDGHI)

Moderator
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Affordable Medicines by Design?:
Evidence from Alternative R&D Models for National and Global Public Health

Jointly organized by the Centre for Outbreak Preparedness and Centre of Regulatory Excellence, SDGHI

Singapore, 4 March 2025

Suerie Moon, MPA, PhD
Visiting Professor, Centre for Outbreak Preparedness, SingHealth-Duke NUS Global Health Institute
Professor of Practice, International Relations & Political Science Department & Interdisciplinary Programmes
Director, Global Health Centre, Graduate Institute of International and Development Studies, Geneva

With thanks to Adrian Alonso Ruiz, Marcela Vieira, Yiqi Liu, Iulia Slovenski, and Kaitlin Large for research contributions

Overview

1. Motivation: Why alternative innovation models for medicines?
2. Project background, methodology & conceptual framework
3. Three Alternative innovation models: with case studies
4. Conclusions

Motivation 1: 4 main critiques of status quo

Lack of innovation when market incentives fail

Slow pace of progress in some areas

Risk of harm

Restricted access: high prices, insufficient supply

Source: Swaminathan S, Pécoul B, Abdullah H, Christou C, Gray G, IJsselmuiden C, Kieny MP, Mazzucato M, von Messling V, Ogutu B, Reeder J, Røttingen JA, Swarup R, Tanner M, Trindade Lima N, Childs M, Harris A, Torreele E, Moon S. Reboot biomedical R&D in the global public interest. Nature. 2022 Feb;602(7896):207-210. doi: 10.1038/d41586-022-00324-y. PMID: 35140380.

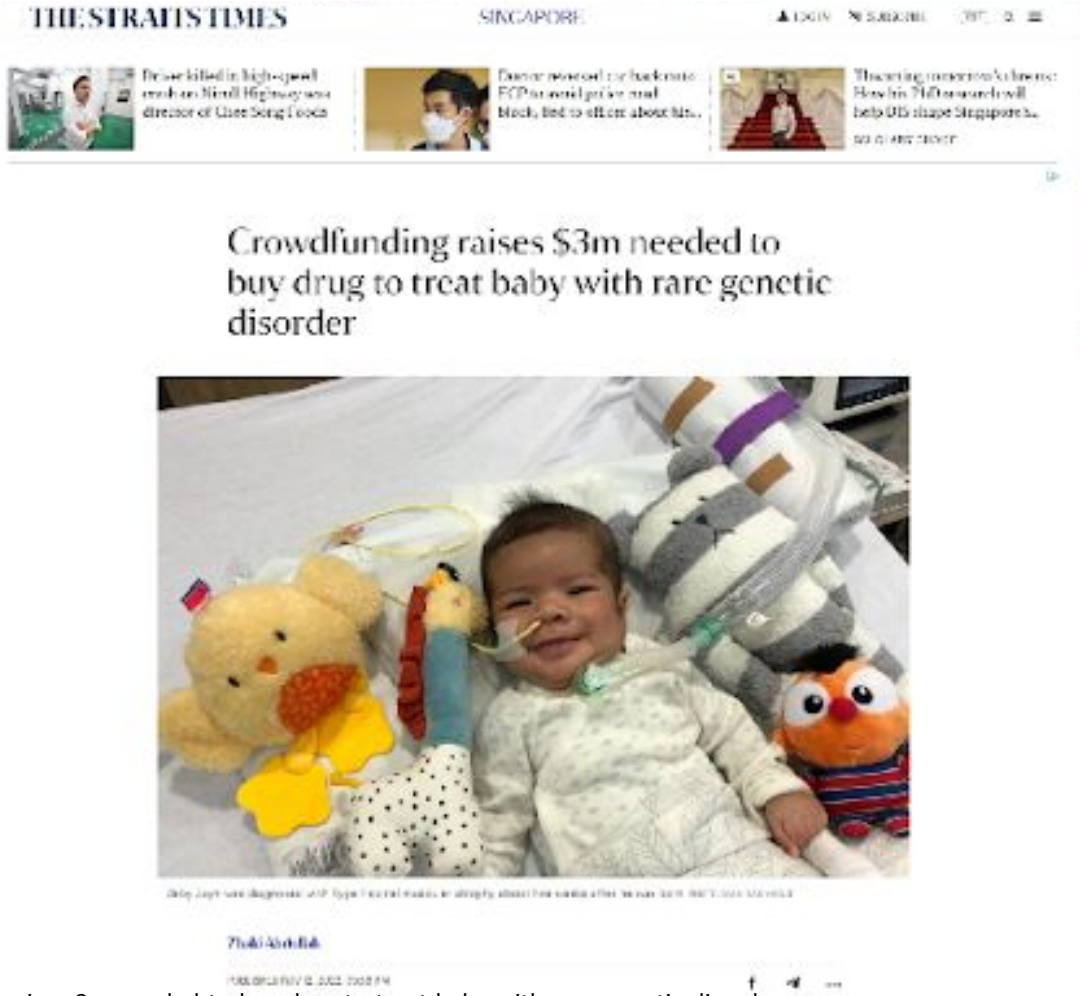
"Vaccine equity must be a key priority for all of us. .. the truth is that **we have fallen short**.

Going back earlier, to the 2009 H1N1 pandemic, low- and middle-income economies **struggled to access vaccine doses**…even though these same vulnerable countries were often the first in readily sharing their data and pathogen samples.

I am also reminded of the Ebola vaccine… I was just informed that Heidi is married to Peter Piot, who played a key role in helping to discover the Ebola virus. He made that discovery in 1976 – that is 49 years ago. And yet **there was no breakthrough in the development for the Ebola vaccine** until the devastating 2014–2016 epidemic in West Africa, which then led to a scramble for investment and development.

Clearly, even in this day and age, **this paradigm does not work**.
– Foreign Minister Vivian Balakrishnan, 11 Feb 2025

"Medicines for rare disease patients can exceed $200,000 per patient annually, with varying efficacies, and our healthcare financing system **is not designed to support such high-cost treatments**,"
– Health Minister Ong Ye Kung, 26 Nov 2024



THE STRAITS TIMES SINGAPORE

Crowdfunding raises $3m needed to buy drug to treat baby with rare genetic disorder

Source: https://www.straitstimes.com/singapore/health/crowdfunding-raises-3m-needed-to-buy-drug-to-treat-baby-with-rare-genetic-disorder

Motivation 2: research gaps & policy relevance

Research gaps:

- Rich literature on specific problems, laws & policies, initiatives
- Gap: Conceptual frameworks of pharmaceutical innovation as a complex adaptive system
- Gap: Broad empirical data collection on R&D initiatives operating on alternative innovation models

Policy relevance:

- Growing societal concern about affordability and access to medicines
- Growing policymaker understanding that seeds of access planted in R&D phase
- Growing interest in alternative innovation models for public interest

What are alternative innovation models?

Mainstream Innovation Model

- Represented by a private, profit-maximizing firm that conducts later-stage R&D, commercializes the final product, usually based in high-income country.

Alternative Innovation Model

- Differs from mainstream innovation model in one or multiple ways (e.g. mission, organizational form, priority-setting, financing, IP, pricing, home country).

What is the mainstream innovation model?

THE STRAITS TIMES OPINION LOG IN ST SUBS

Forum: Shingles vaccine too costly in Singapore

UPDATED NOV 22, 2024, 02:32 PM

Currently, the cost of the Shingrix vaccine for shingles in Singapore is $400 (plus GST) for one dose, and a complete two-dose regimen costs $800 (plus GST).

Source: https://www.straitstimes.com/opinion/forum/forum-shingles-vaccine-too-costly-in-singapore

What is the mainstream innovation model?

"As Singapore is a small market deemed to be high income, we often end up paying more for our drugs, including vaccinations…To be clear, I am not begrudging the industry here, but explaining this is how the industry works, in order to pay for the large investments in research and development to develop the new drugs.

In fact, this differential pricing system is in turn founded upon intellectual property protection, and is one of the basis for pharmaceutical companies to invest in production plants in Singapore. However, when it comes to procuring the drugs, Singapore is in a disadvantaged position under this system."
– Health Minister Ong Ye Kung, 10 Feb 2025

Source: https://www.moh.gov.sg/newsroom/speech-by-minister-for-health--mr-ong-ye-kung--at-the-launch-of-the-centre-for-infectious-disease-emergency-response

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Research Project

- 5-year research project (**2019 – 2024**)
- Funded by **Swiss National Science Foundation**
- Research questions:
  - How do **alternative models** of pharmaceutical innovation that may better serve the **global public interest** emerge, survive and even thrive within the pharmaceutical innovation system?
  - What do such models **look like** and how do they **operate**?
  - How do **actors, resources and rules** interact to facilitate or impede such alternative innovation models from achieving their **objectives**?

Methodology

1. Conceptualization

- Literature syntheses (e.g. R&D characteristics, challenges within pharmaceutical R&D subsystems)
- Developed conceptual frameworks

2. Empirical Research

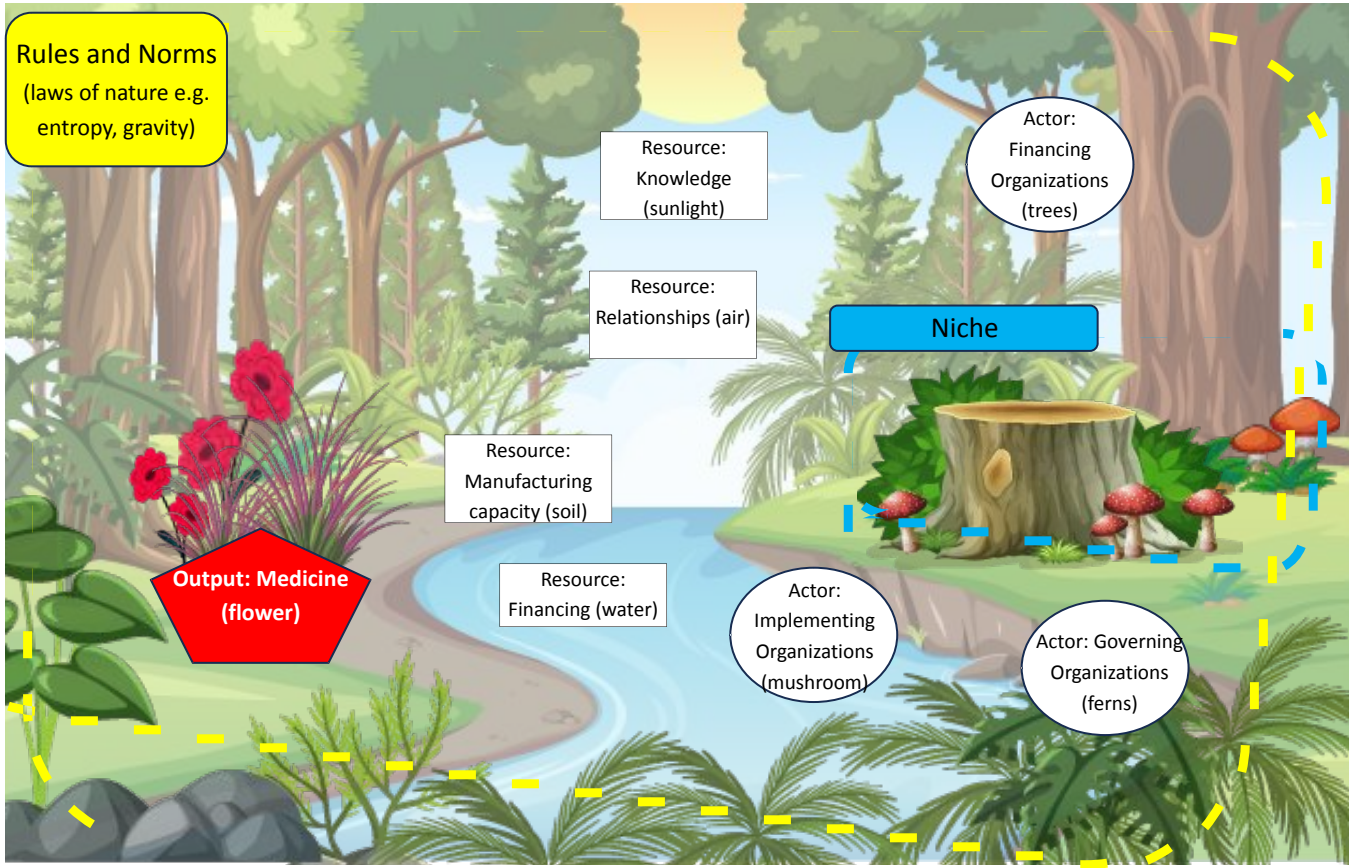
- Developed alternative R&D initiatives database
- 53 semi-structured interviews with 47 *alternative* initiatives
- 3 in-depth case studies (47 interviews)

100 interviews in total

3. Analysis

- Interview coding
- Developed a thematic framework for analysis of alternative innovation models
- Project conclusions: 9 journal articles + 4 expert feedback workshops; 13 journal articles published on related topics and 5 additional grants (TDR, OSF, WHO EURO, WIPO, TBA)

Complex Adaptive Pharmaceutical Innovation System



Niches in Areas of Market Failure

"RE:ROUTE, A map of the alternative biomedical landscape" (Kiddell-Monroe, Greenberg and Basey, 2016)
n=41

"Non-commercial R&D: What do neglected diseases suggest about costs and efficiency?" (Vieira M, Kimmit R and Moon S., 2021)
n = 30

Internal knowledge, literature synthesis, non-systematic online searches
n = 48

Snowballing
n = 11

Database of initiatives
n=130

Rare Diseases

Antibiotics

Neglected Diseases

Pandemic Preparedness

Others
- Microbiome transplant (FMT bank)
- Psychedelic-mediated therapy
- Biosimilar production

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Archetypal Alternative Models: Soup, Sandwich, or Salad?

Mainstream commercial

1.Soup

National Publicly-Focused

National public institution sets priorities to reflect national needs, finances and facilitates R&D

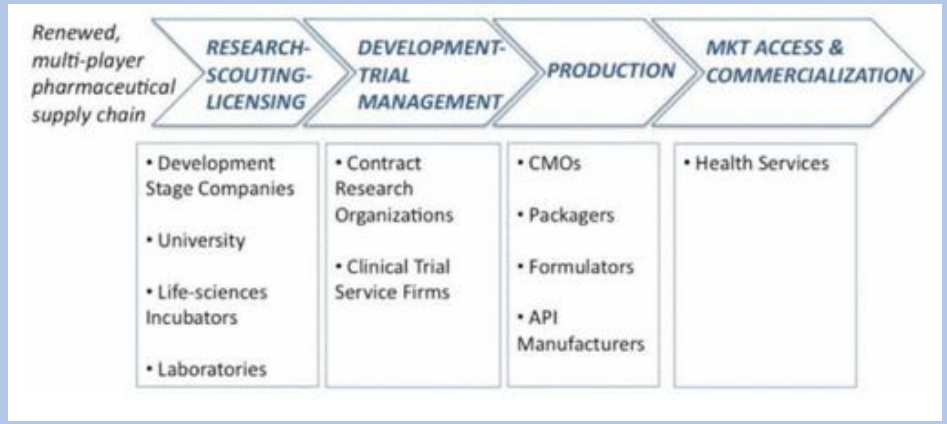
Private actors may also be involved but do not drive R&D

1. Soup: National public sector: US BARDA (biosecurity)

Public R&D grants & loans

Public sector technical support & regulatory advice

Long-term public funding for basic scientific research



Public stockpiles, advance purchase agreements

Public sector priority-setting, coordination & match-making among firms

2007-2020:
51 products developed

Sources: Capo, Brunetta & Boccardelli (2014) and Moon et al (forthcoming)

Archetypal Alternative Models: Soup, Sandwich, or Salad?

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2. Sandwich

Public-Private Partnership

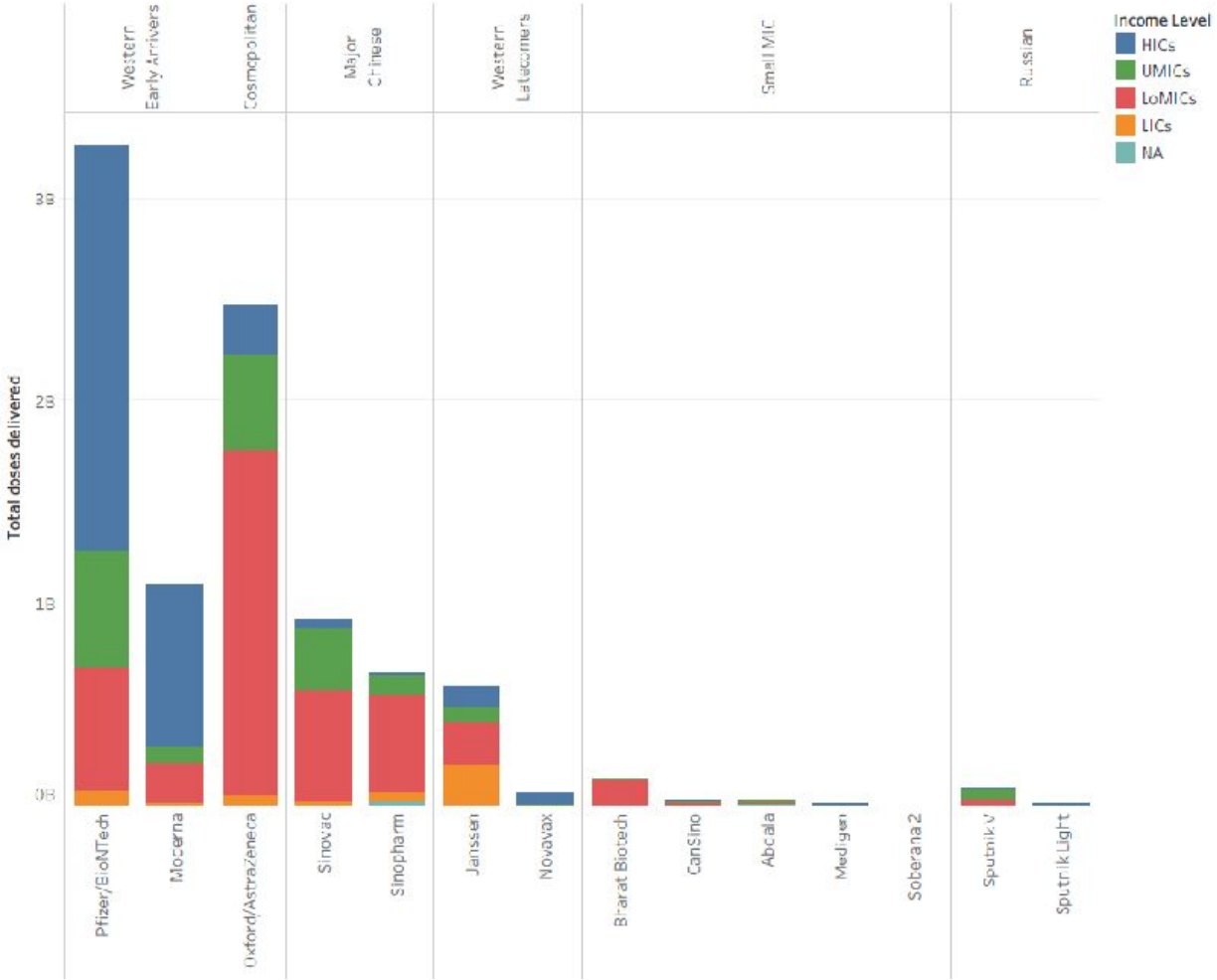
Public and/or philanthropic priority-setting, financing to private firms to de-risk, address market failures, for public goal

Academic, NGOs also involved

2. Sandwich: PPP: Oxford/AZ Covid-19 vaccine

- Technology invented at a university
- Partnership with AstraZeneca for development, production, distribution
- Global access agreed as shared objective
- CEPI & UK government push funding
- Technology transfer to Serum Institute (India), others
- Bilateral purchase and Covax “pull” funding
- Large-scale rapid use, relatively affordable and equitable distribution

Exported Covid-19 Vaccine doses by income group of the recipient country



Archetypal Alternative Models: Soup, Sandwich, or Salad?

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3. Salad Collaborative Network

Open collaborative knowledge flows, networks of actors perform different R&D stages or tasks

Largely academic, public sector, non-profit actors, with some private firms

3a. Salad: Oral cholera vaccine

PLOS Global Public Health

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OPEN ACCESS PEER-REVIEWED

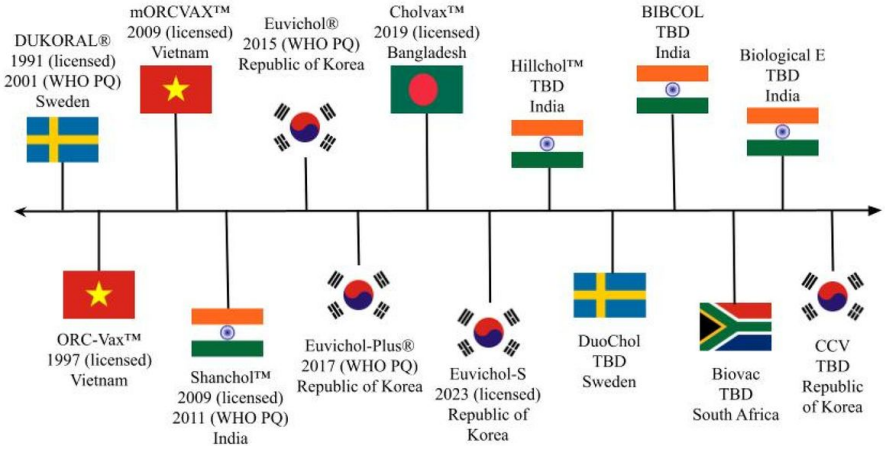
RESEARCH ARTICLE

The 30-year evolution of oral cholera vaccines: A case study of a collaborative network alternative innovation model

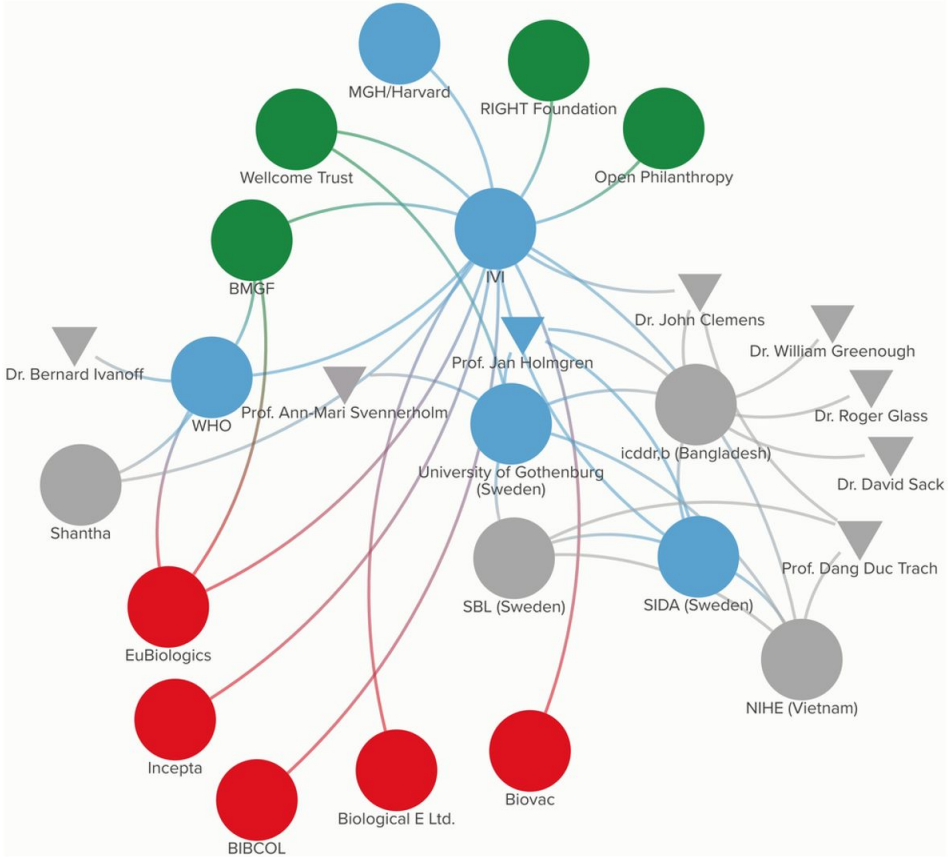
Kaitlin Large, Adrian Alonso Ruiz, Iulia Slovenski, Marcela Vieira, Suerie Moon

Published: January 17, 2025 • https://doi.org/10.1371/journal.pgph.0003599

- Market failure: low-income, episodic market
- 3+ generations of continuous technological improvement
- Developed through informal network of academic, public, philanthropic, private entities over 30 years
- Low prices by design
- Technology transfer for local production to meet national needs



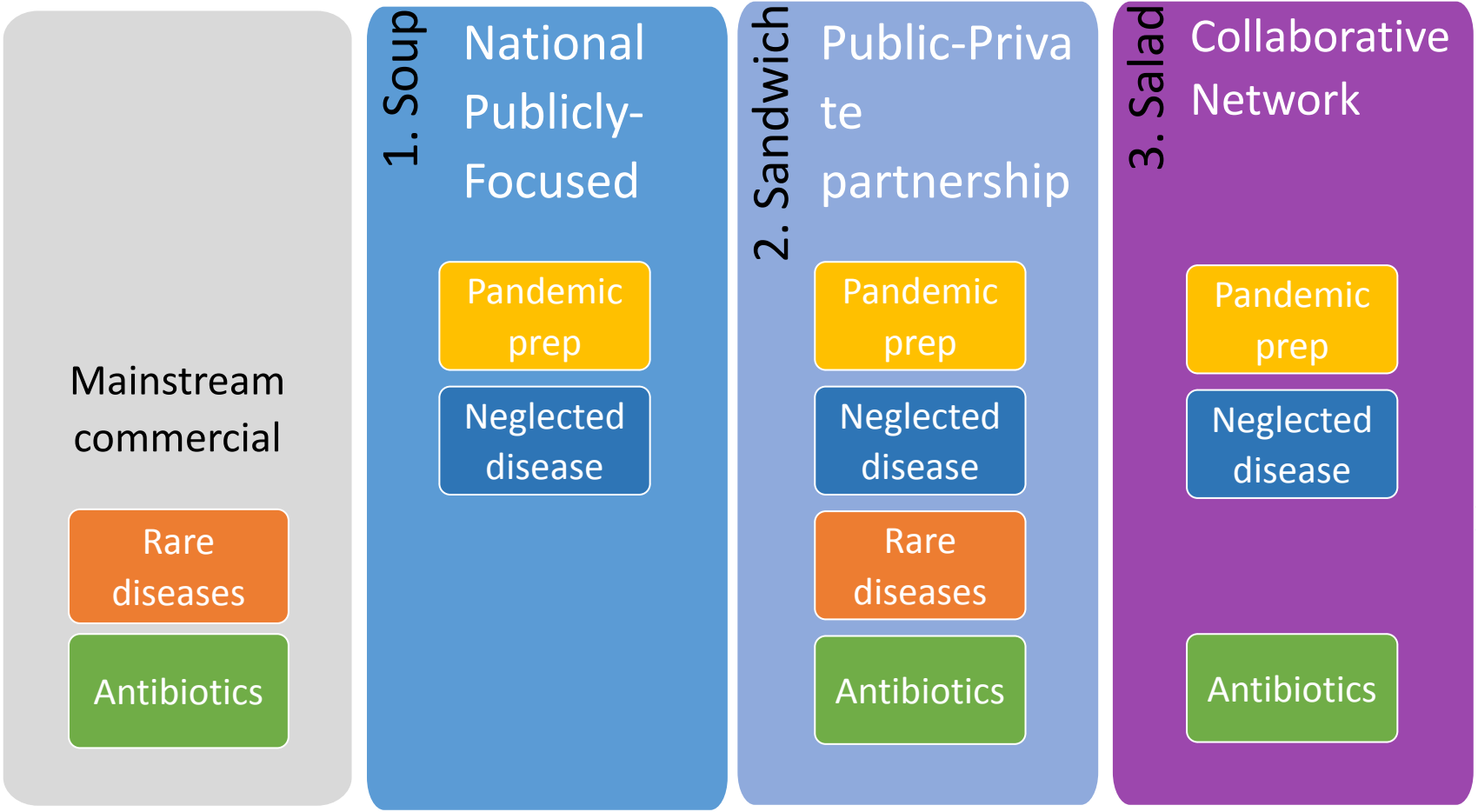
Shape Key		Color Key	
Shape	Type	Color	Resource
▼	Individual		Means of manufacturing
●	Entity		Funding
			Knowledge



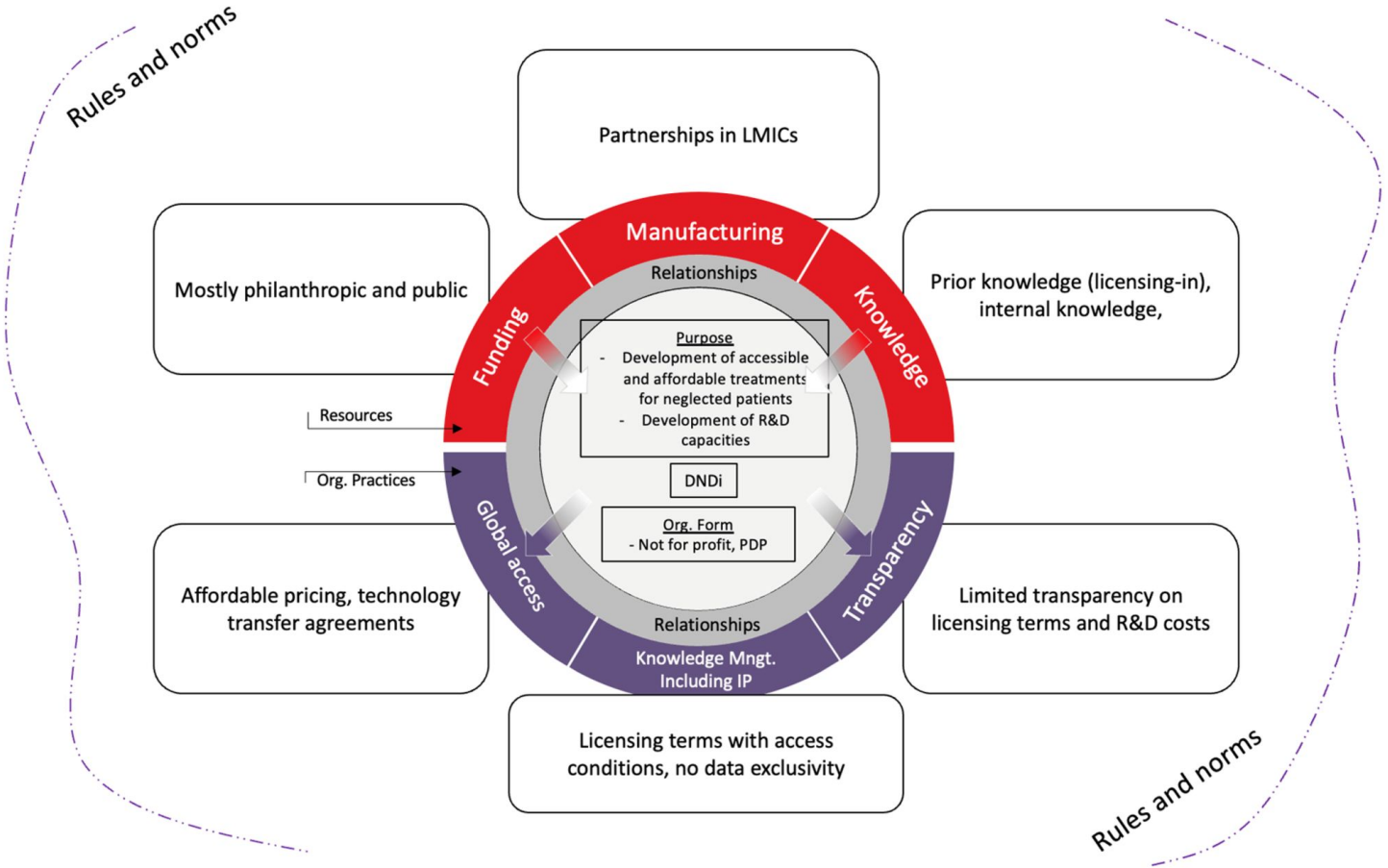
3b. Salad: Academic hospital CAR-T

- U.Penn **academic exchange trains** Hospital Clinic Barcelona researchers
- Public academic hospital researchers and clinicians develop **CAR-T for rare disease Acute Lymphoblastic Leukemia**
- 2021: ARI-0001 (Varnimcabtagene autoleucel) **approved** in Spain
- EU regulatory **"hospital exemption"** for ATMPs prepared on "non-routine basis" for individual patients
- **86,000 EUR** (vs ~300,000 EUR industry price)
- **EMA** approval to be sought after 5-country trial across Europe
- Potential **technology transfer** to Brazil, Egypt, Colombia, India
- 2024: ARI-0002h **approved** in Spain for multiple myeloma

Alternative Innovation Models: Soup, Sandwich, or Salad?



3c. Salad: Low-cost hepatitis C drug (ravidasvir)



Conclusions

1. Alternative innovation models can deliver more affordable medicines by design

2. Three archetypes: each with strengths and weaknesses
   - Solutions tailored to specific diseases, products, contexts
   - Entrepreneurialism and creativity
   - No single recipe, but still soup, sandwiches, salad

3. Can be implemented at small scale in emerging national R&D systems

4. Appropriate laws and policies needed to enable and consolidate benefits of alternative innovation models (e.g. regulatory, IP, financing)

Thank you & Comments Welcome

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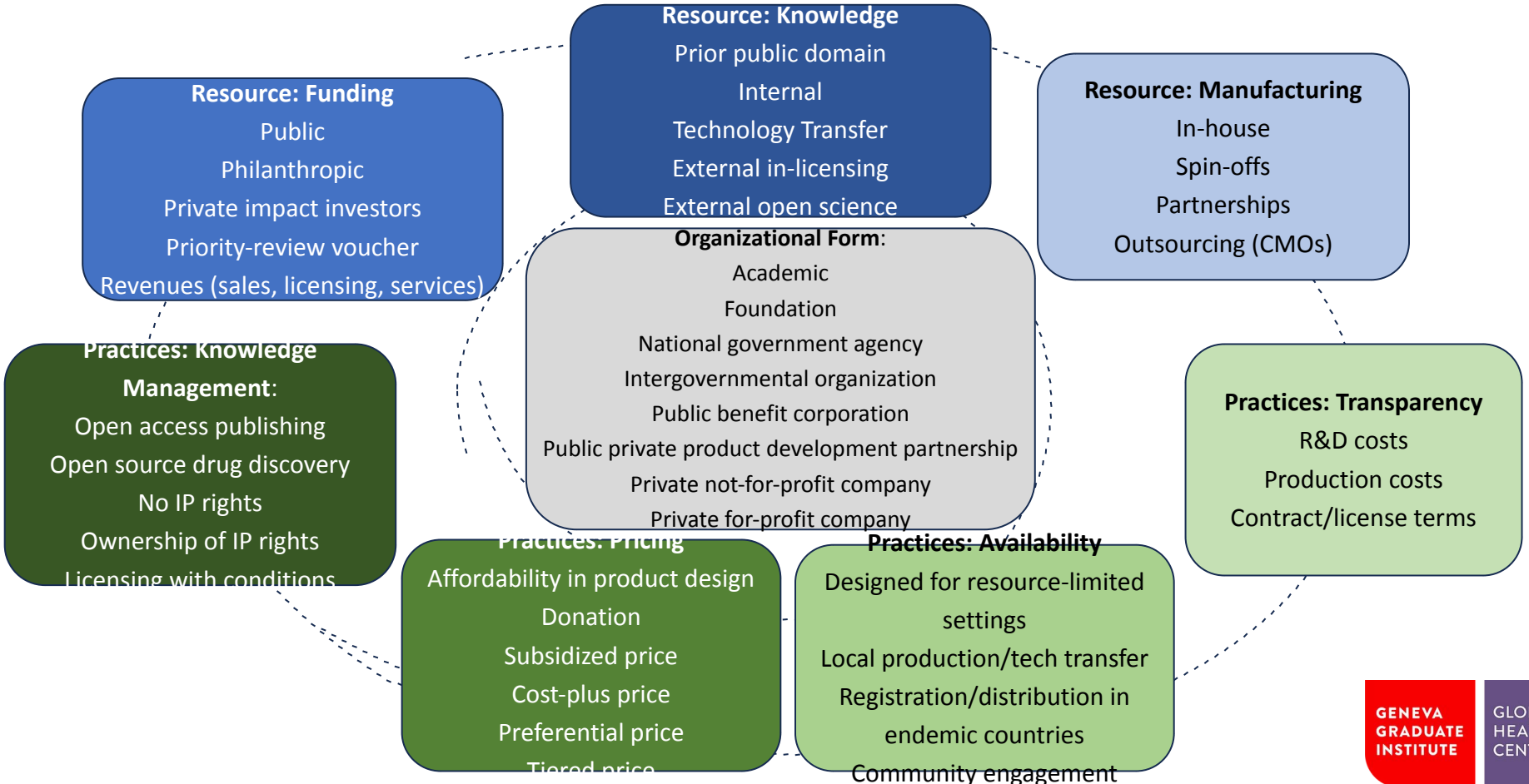
Extra slides

Alternative Innovation Models: Organizational Ingredients



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Mainstream innovation model

- A **commercial profit-maximizing firm** conducts at least the later stages of R&D (e.g., pre-clinical to clinical trials) and brings a product to market.

- Market incentives and competition between companies influence:
  - **Financing:** profit-maximizing investors, revenues from product sales
  - **Priority-setting**: profitable diseases or technologies
  - **Knowledge management**: data kept confidential, IP used to block competitors from using knowledge
  - **Regulatory strategy**: in most profitable markets
  - **Production**: profit-maximizing production strategy, subject to quality requirements
  - **Marketing**: significant investment to promote product uptake
  - **Distribution**: to profitable markets
  - **Pricing**: profit-maximizing price – what market or price regulator will bear

- Usually, this firm is based in a **high-income country**

Alternative innovation model

Alternative innovation models can differ in a number of ways from traditional models, including the organization's:

- **Mission: e**.g. equity, health impact, joint profit and health goals
- **Organizational form:** e.g. nonprofit, public benefit corporation
- **Financing: e**.g., mixed private and public, philanthropic or social impact investor funding
- **Priority-setting:** e.g., unmet health need
- **Role in different phases of the R&D process:** e.g., academic institutions conducting later-stage development
- **Knowledge management:** e.g., open science, public and private collaboration, data sharing, no patenting, non-exclusive licensing, or participating in patent pools
- **Regulatory strategy**: e.g., active collaboration with regulator; prioritizing developing country regulators
- **Manufacturing strategy:** e.g., small scale, collaborative agreements
- **Distribution**: e.g., prioritizing disease-endemic developing countries
- **Pricing**: e.g., affordability caps, limited profit, tiered pricing
- **Home country:** e.g., low- or middle-income, international network

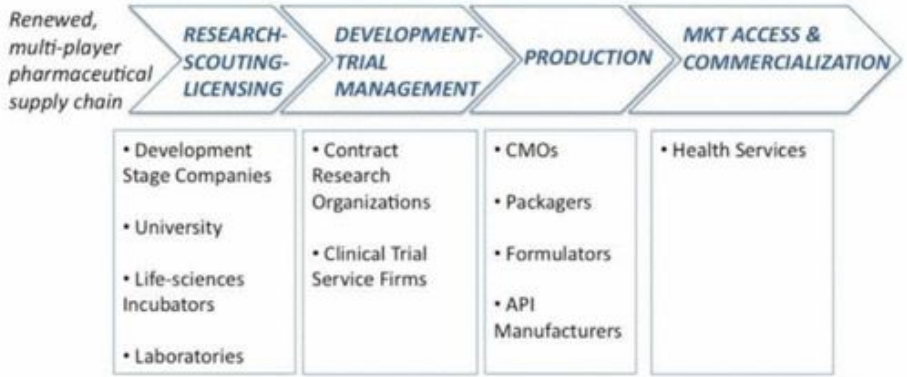
Initiatives may differ in *one or more* of these characteristics, but *not necessarily all*.

Source: Database of Alternative R&D Initiatives. Available: https://www.knowledgeportalia.org/database-of-alternative-r-d-initiatives

Public & private roles for **non-pandemic** health technologies

Public R&D grants & loans

Long-term public funding for basic scientific research



Sources: Capo, Brunetta & Boccardelli (2014) and Moon et al (2022)

AIM 1. Soup: Example: National public sector: US BARDA (biosecurity)

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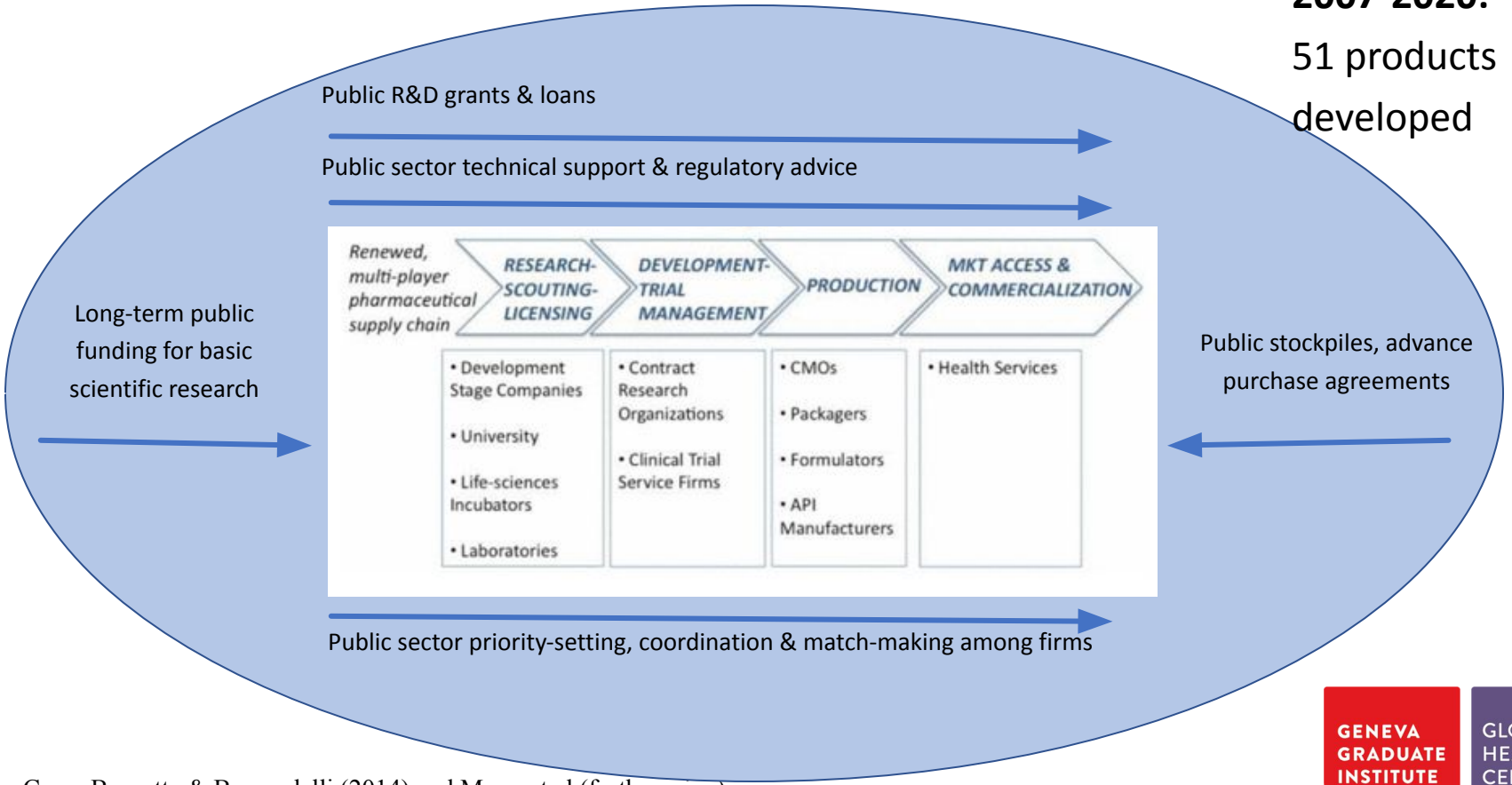

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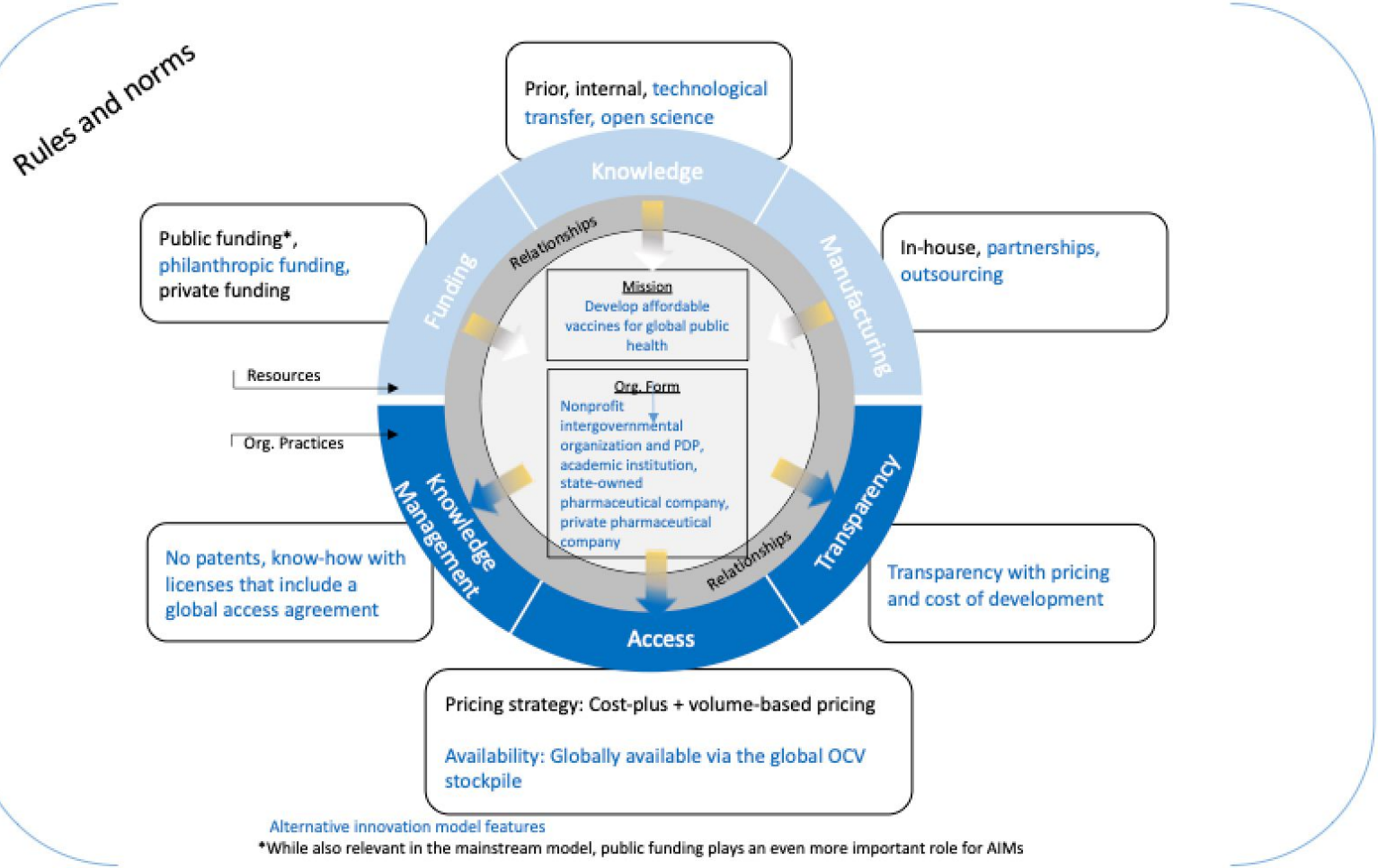
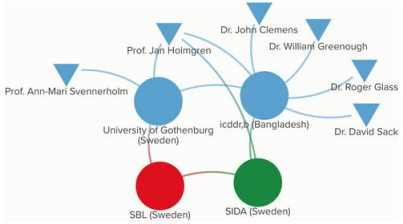
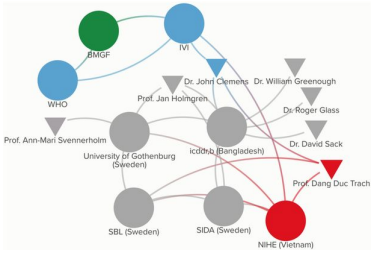
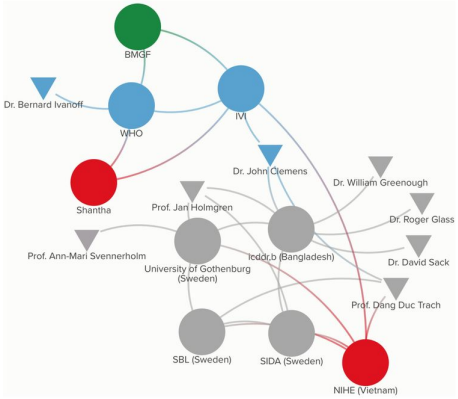
AIM 3. Salad: Example: Open science network: Baylor Covid-19 vaccine

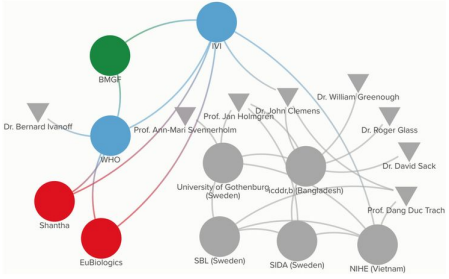
- **Baylor College of Medicine** researchers develop Covid-19 vaccine using established protein technology with small-scale philanthropic funding
- Offer patent-free candidate vaccine with data, technology transfer to any interested **LMIC producers**
- **Biological E (India):** conducts clinical trials, production, registration: 84 million doses administered in India for adolescents
- **Biofarma (Indonesia):** halal vaccine, 10 million doses administered


Rules and norms
Prior, internal, technological transfer, open science
Knowledge
Public funding*, philanthropic funding, private funding
Funding
Relationships
In-house, partnerships, outsourcing
Manufacturing
Mission
Develop affordable vaccines for global public health
Org. Form
Nonprofit intergovernmental organization and PDP, academic institution, state-owned pharmaceutical company, private pharmaceutical company
Resources
Org. Practices
Knowledge Management
Transparency
Relationships
No patents, know-how with licenses that include a global access agreement
Transparency with pricing and cost of development
Access
Pricing strategy: Cost-plus + volume-based pricing
Availability: Globally available via the global OCV stockpile
Alternative innovation model features
*While also relevant in the mainstream model, public funding plays an even more important role for AIMs









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●	Entity		Funding
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