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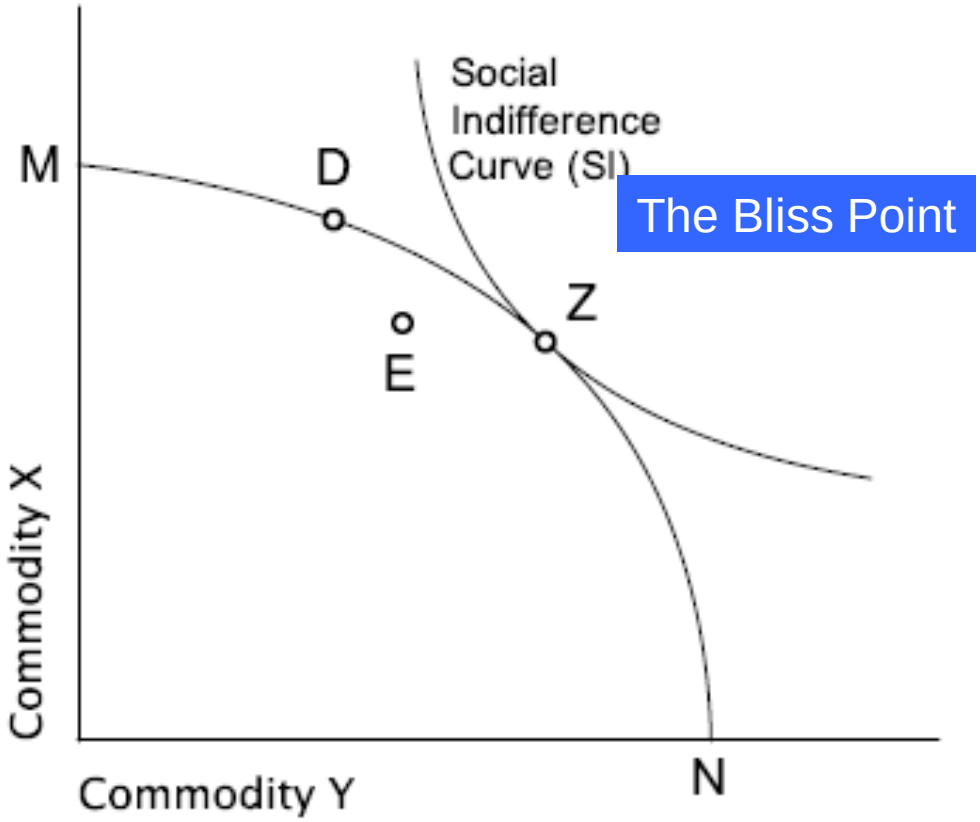
How undervaluing vaccination risks undermining its sustainability and diversity.

Mike Watson, Dec. 2016

There are mathematical approaches to finding the Pareto efficient/Ramseyan Bliss Point that optimises utility for all for ever.



The Bliss Point

Curve MN = social utility frontier.
Point D = social utility frontier
Point E lies inside the social utility frontier (indicating inefficiency)
Point Z = Optimal Social Utility

But - Perception of value data usually biased by:

Perception of value determined by:

World view
Motivation mix
Ideologies
Recent experience
Time frame
Your employer/funder & their success metrics
The means at your disposal
Ease of measuring impact
Etc.

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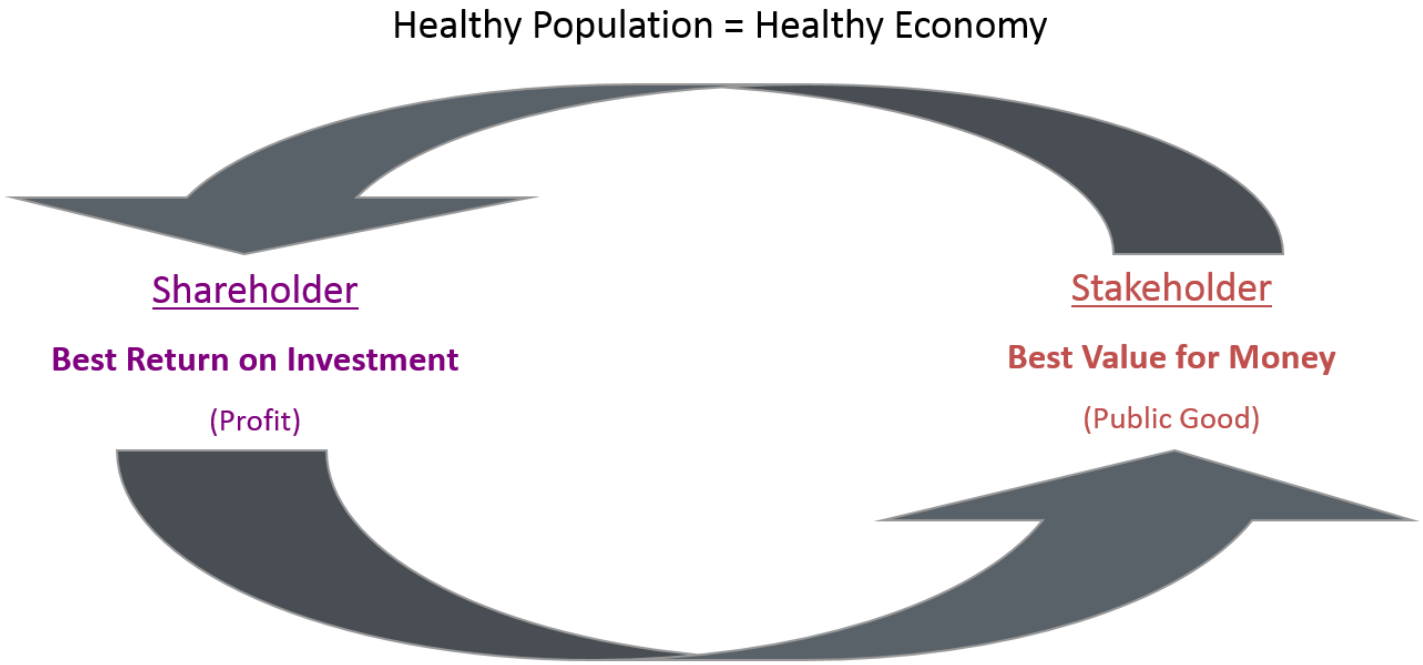
In reality these are two positives that should attract not repel



1. Smith, Adam (1776), *An Inquiry into the Nature and Causes of the Wealth of Nations*, 1 (1 ed.), London
2. Smith, Adam (1759), *The theory of Moral Sentiments*, (1 ed.), London

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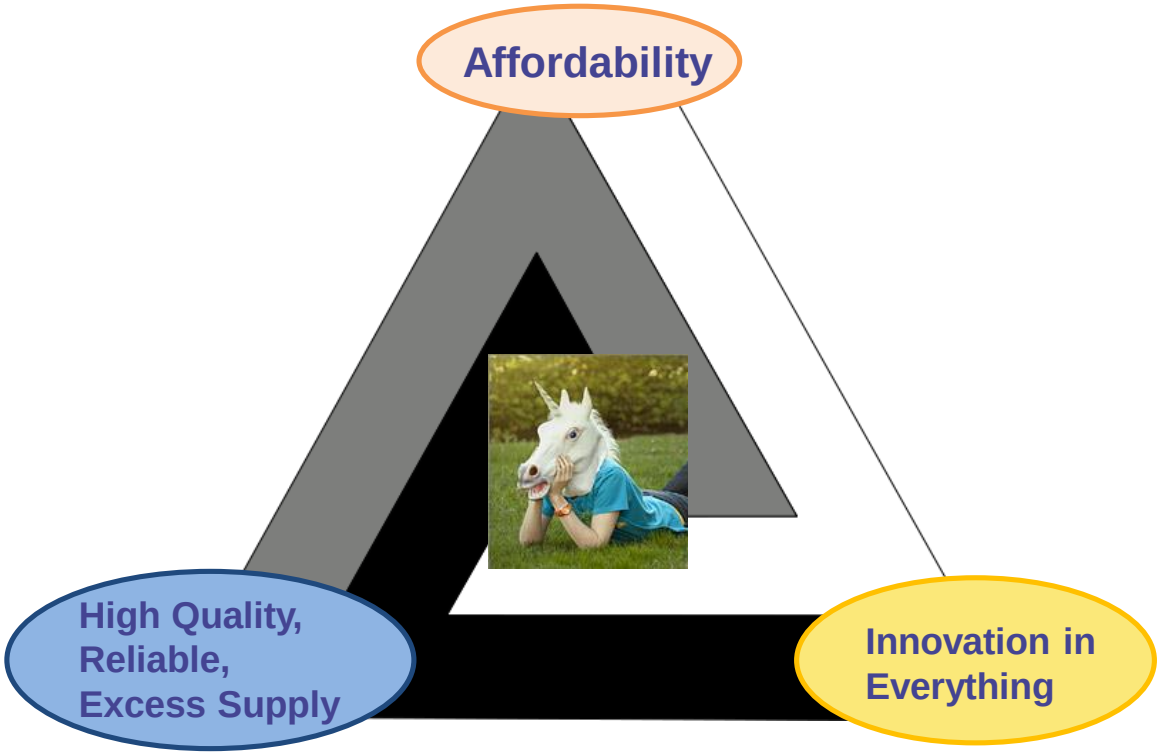
What are the success metrics for vaccination? It's a question of balance

Not the same as low price



Short, medium & long term

What are the incentives & rewards?
Why work on vaccines not cancer

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Balancing can be difficult and deceptive

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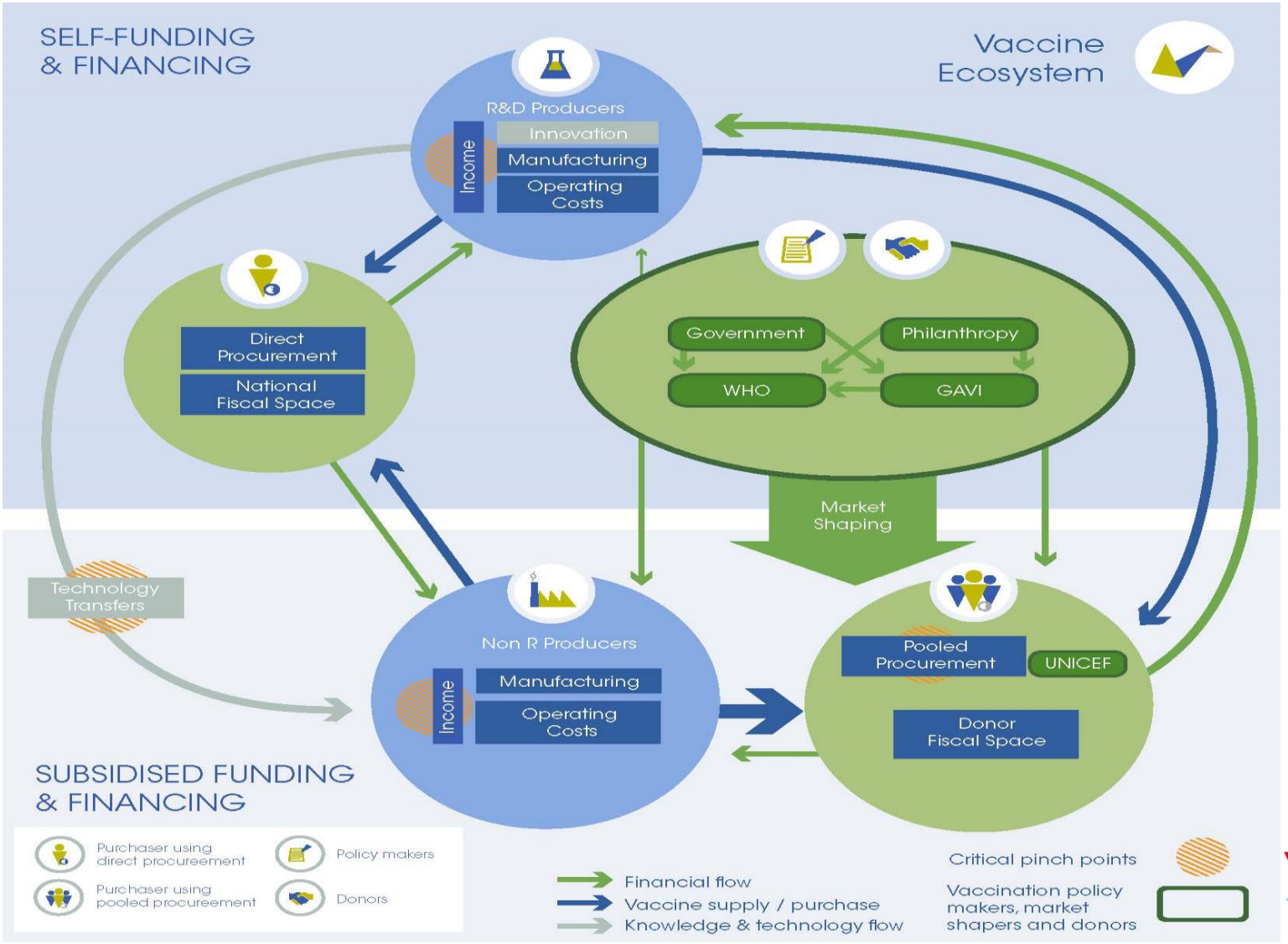
We have to assess value for a complex interlinked ecosystem

Watson M, Faron de Goër E. Are good intentions putting the vaccination ecosystem at risk? *Human Vaccines & Immunotherapeutics*. 2016;12(9):2469-2474. doi:10.1080/21645515.2016.1172162.



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Potential unintended consequences of undervaluing vaccination

The affordability metric

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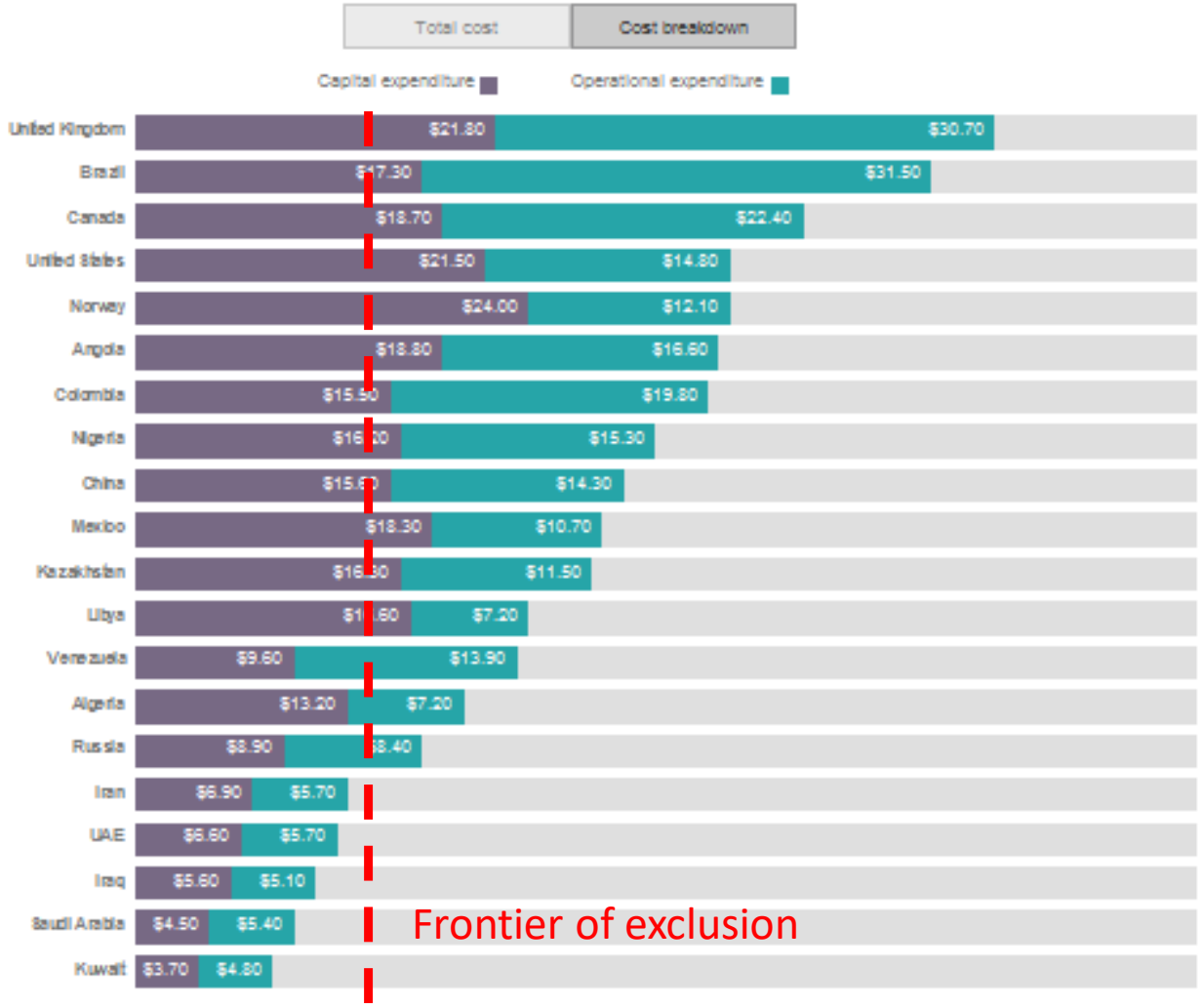
What happens if affordability is reduced to low price?

The collapse in the price of oil has squeezed energy companies and countries that were betting on higher returns. Here's what it costs on average to pump a barrel of oil in the 20 biggest oil producing nations.



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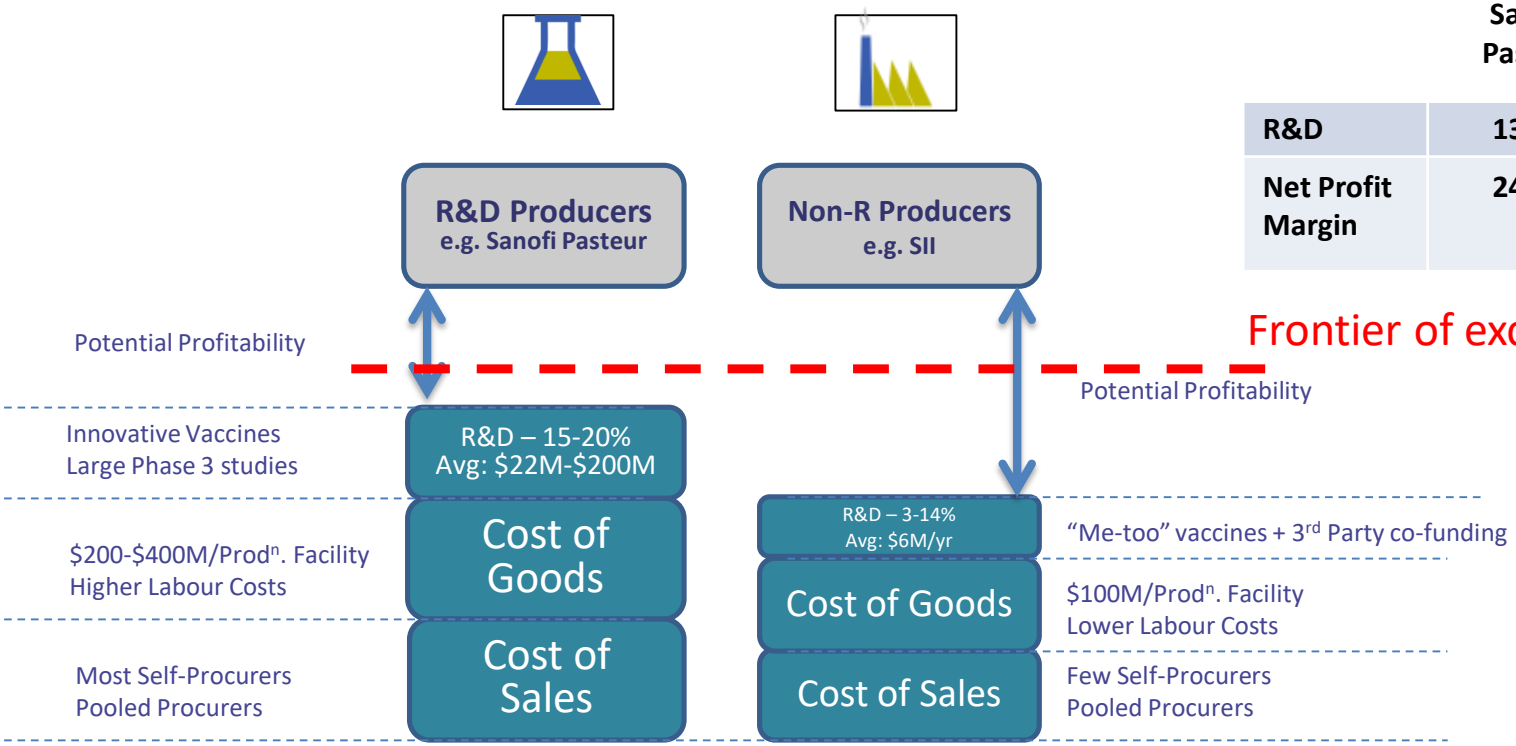
Comparing price for heritage vaccines to price for innovative vaccines risks an artificial Frontier of Exclusion



	Sanofi Pasteur	Serum Inst. India
R&D	**13.8%**	**3.1%**
Net Profit Margin	**24.5%**	**49.5%**

2012 P&Ls

SANOFI PASTEUR

1. Evaluation of the GAVI Phase 1 Performance (2000-2005); October 2008; Available at: file:///C:/Users/I0221215/Downloads/GAVI_Phase1_Report_FINAL_to_SC_Oct21.pdf

2. MSF (Médecins Sans Frontières), 2012, *The Right Shot: Extending the Reach of Affordable and Adapted Vaccines*, p. 7. Available at: http://www.msf.org.uk/sites/uk/files/Vaccines__the_Right_Shot_May_2012_201205155725.pdf

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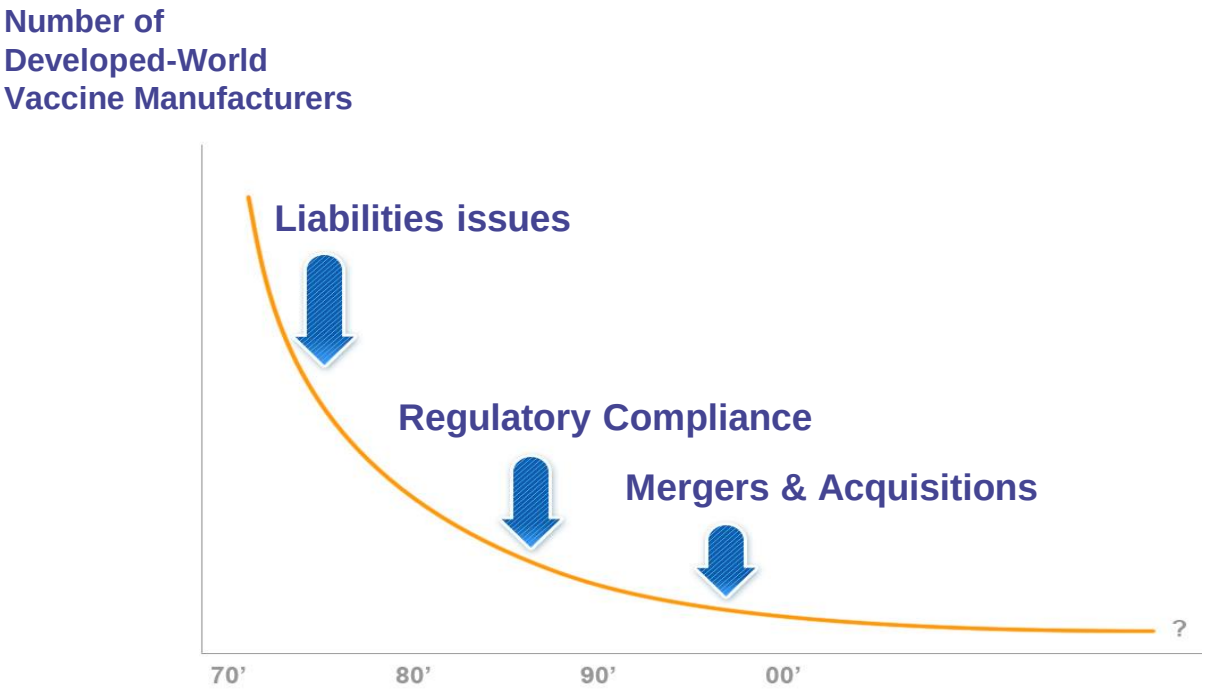
Competition on unequal margins can be countered by economies of scale – Mergers & Producer contraction



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Competition on unequal margins may force low margin companies to exit certain vaccines.

- **Loss of Suppliers**
  - SP & Crucell exited Measles Containing Vaccines – Single supplier of MR vaccine
  - YF – SP effectively the only reliable supplier – Recurrent shortages
  - Rabies – Who will supply long term?
  - Snake anti-venoms – Inefficacious products & shortage of product & producers
- **More vaccines with single suppliers**

	2001		2014	
Number of awarded UNICEF Vaccine Suppliers	13		16	
	R&D Producers	**Non-R Producers**	**R&D Producers**	**Non-R Producers**
	6	7	6	10

Vaccines With Sole Supplier	**R&D Producers**	**Non-R Producers**	**R&D Producers**	**Non-R Producers**
	MenPS - **SP** DTP-HB-Hib - **GSK**		YF** - **SP**	MR - **SII** MenAconj - **SII** Rabies - **SII** DTP – **PT BioF** MMR* - **SII**

**Sanofi Pasteur production of MMR has ceased and final deliveries of measles containing vaccines will occur in late 2014/early 2015.*
***Only Sanofi Pasteur has been able to supply consistently. (ref. UNICEF YF supply report)*

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Optimistic supply forecasts can't hide an unhealthy market

Vaccine	Form	Presentation	Number of awarded manufactures	Storage space (cm^3/dose)		VVM	Product availability			Projected Weighted Average Price per Dose		
				Vaccine	Diluent		2014	2015	2016	2014	2015	2016
Yellow Fever	Lyophilised	10 ds +diluent	2	1.4 - 2.96	1.4 - 2.96	Yes	Limited supply	Limited supply	Needs planning	$1.13	$1.16	$1.20
Yellow Fever	Lyophilised	20 ds +diluent	1	0.70	0.7	Yes	Limited supply	Limited supply	Needs planning	$0.70	$0.77	$0.77

PRODUCT MENU FOR VACCINES SUPPLIED BY UNICEF FOR GAVI, THE VACCINE ALLIANCE

Vaccine	Form	Presentation	Number of awarded manufactures	Storage space (cm^3/dose)		VVM	Product availability			Projected Weighted Average Price per Dose		
				Vaccine	Diluent		2016	2017	2018	2016	2017	2018
Yellow Fever	Lyophilised	5 ds +diluent	1	3.60	3.60	Yes	Limited supply	Needs planning	Needs planning	$0.84	$0.84	Pending tender
Yellow Fever	Lyophilised	10 ds +diluent	4	1.4 - 2.96	1.4 - 2.96	Yes	Limited supply	Needs planning	Needs planning	$1.04	$1.10	Pending tender

Source: UNICEF – Product menu for vaccines supplied by UNICEF for the GAVI alliance

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Potential unintended consequences of undervaluing vaccination

The innovation metric

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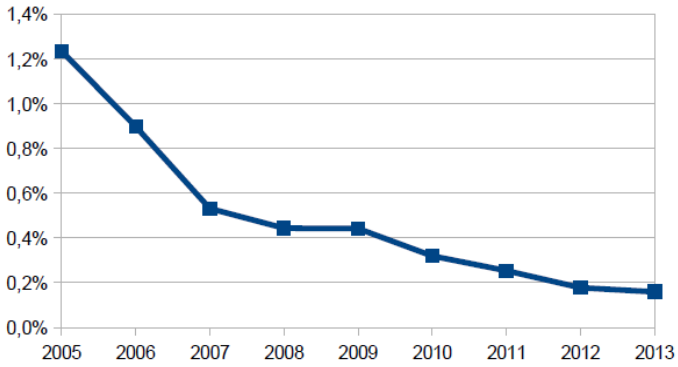
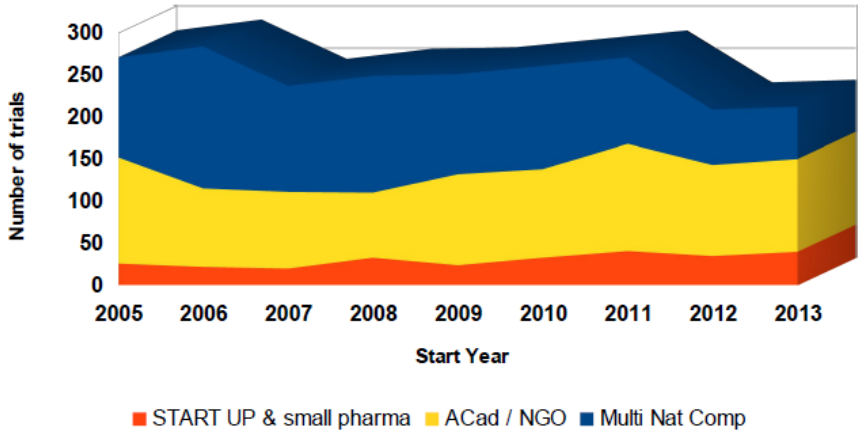
Who ensures that there is enough vaccines R&D going on? This is normally the role of a healthy market

Vaccine trials as % of all trials



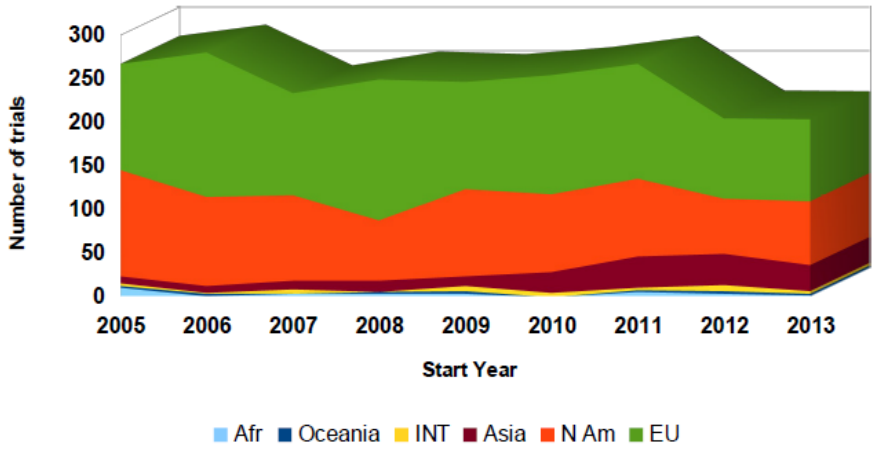
Vaccine trials by sponsor Status

Clintrial.gov only; Without flu



Vaccine trials by sponsor HQ location

Clintrial.gov only; Without flu



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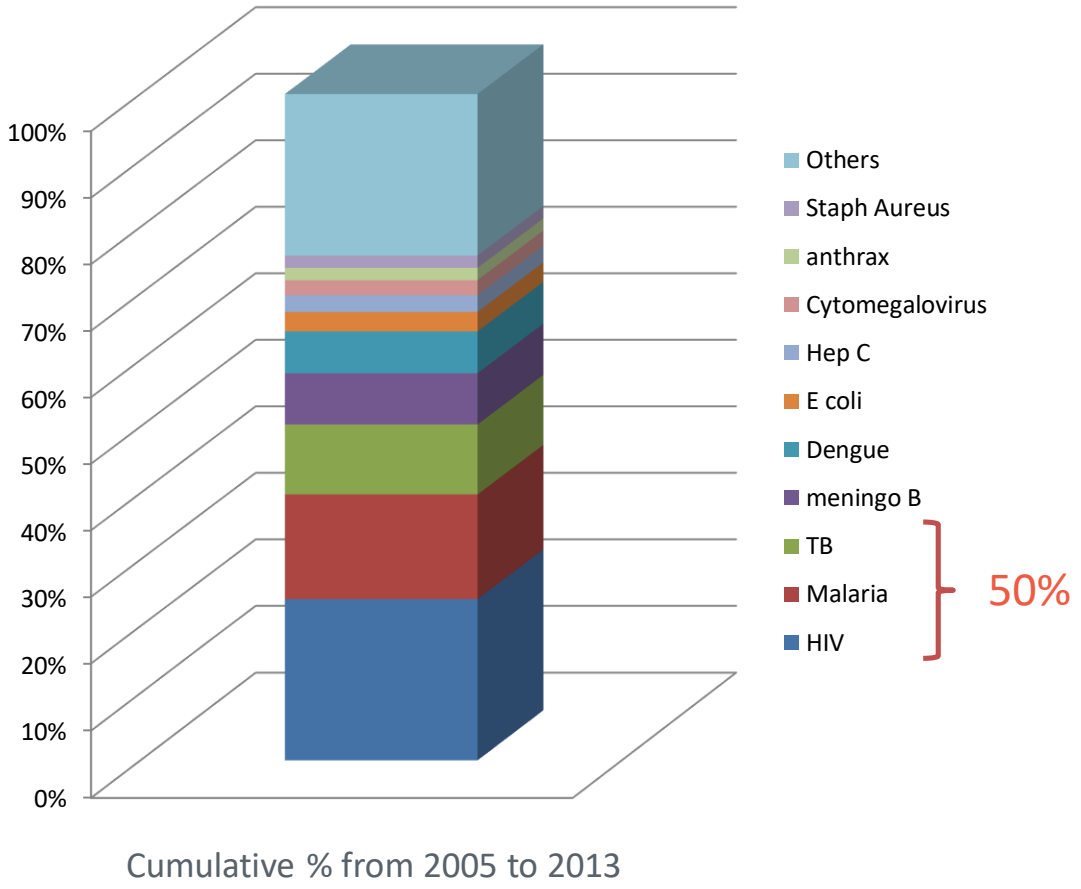
https://clinicaltrials.gov

Investment in some vaccines (e.g. HIV, TB & Malaria) may be hiding under-investment in other targets

- HIV, Tb & Malaria
  - 50% of all trials
- Top Ten targets
  - 76% of all trials
- 38 different targets - 24% of trials:



Cumulative % from 2005 to 2013

https://clinicaltrials.gov

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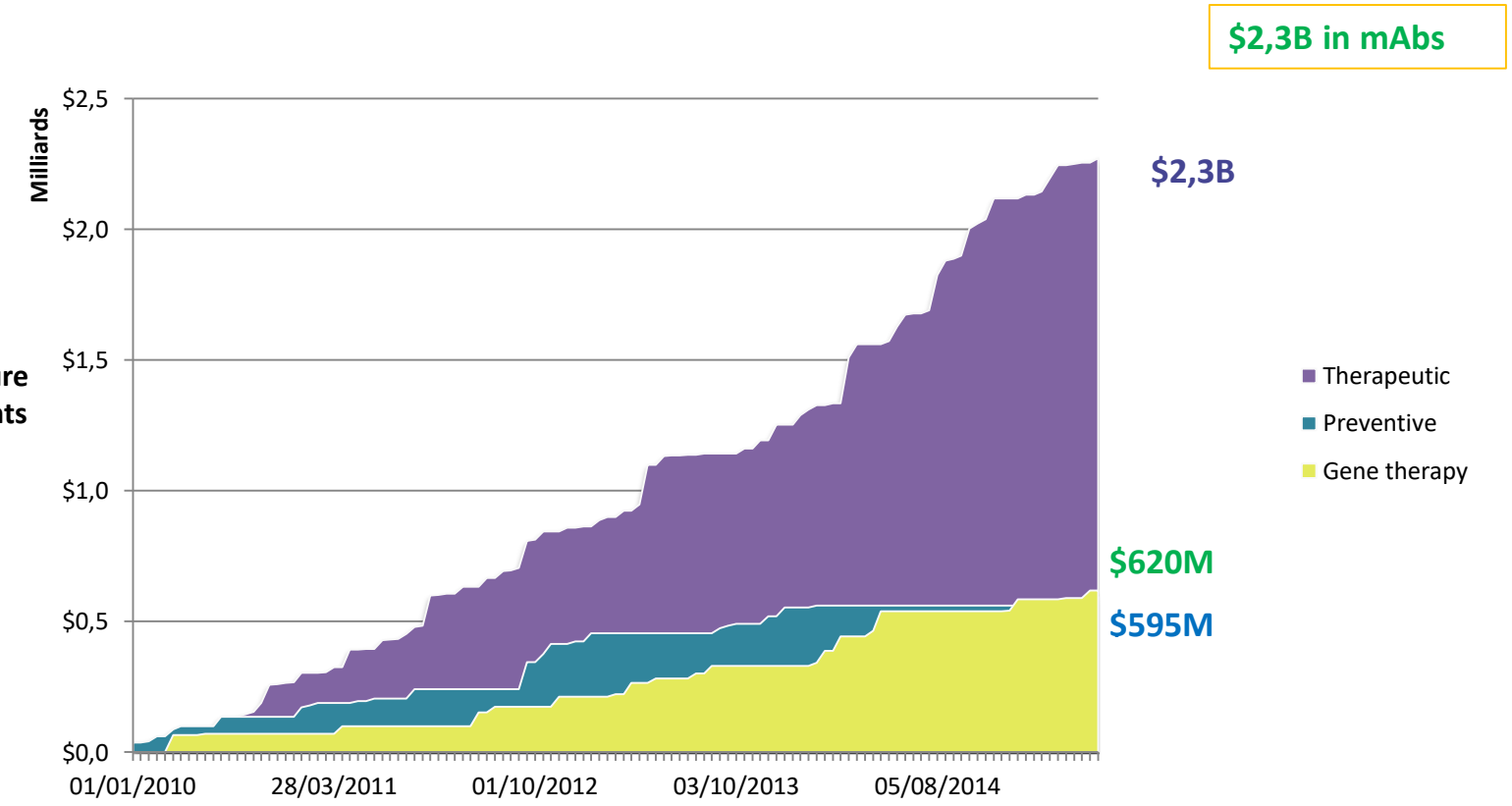
Venture capital will seek out the healthy & valuable markets

Cumulative Venture Capital Investments (2010-2015)



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Potential unintended consequences of undervaluing vaccination

The quality metric

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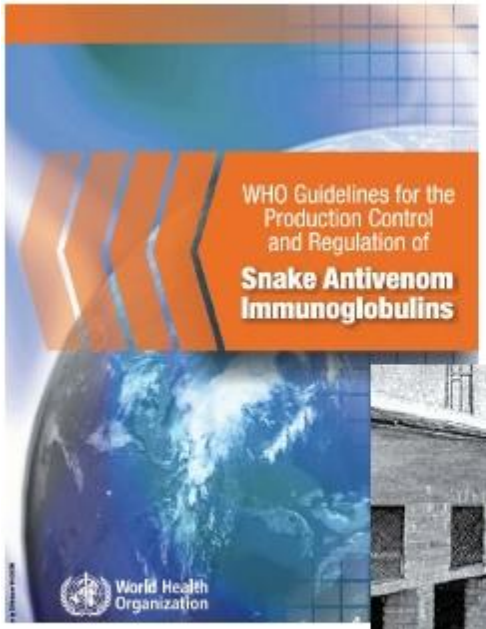
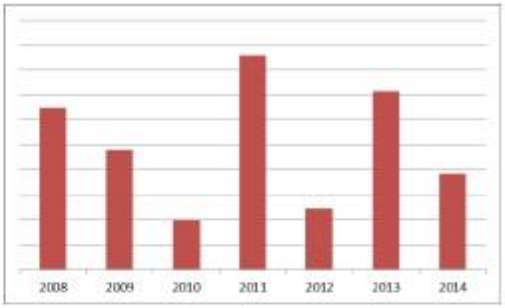
Snake antivenom Market failure: (Antibiotics?)

1. Neglect of snakebite victims
2. Poor understanding of cost-effectiveness
3. Unstable demand
4. No quality requirements
5. Equine polyclonal serums considered as outdated

Short communication

Antivenom: The most cost-effective treatment in the world?





What gaps must we fill?

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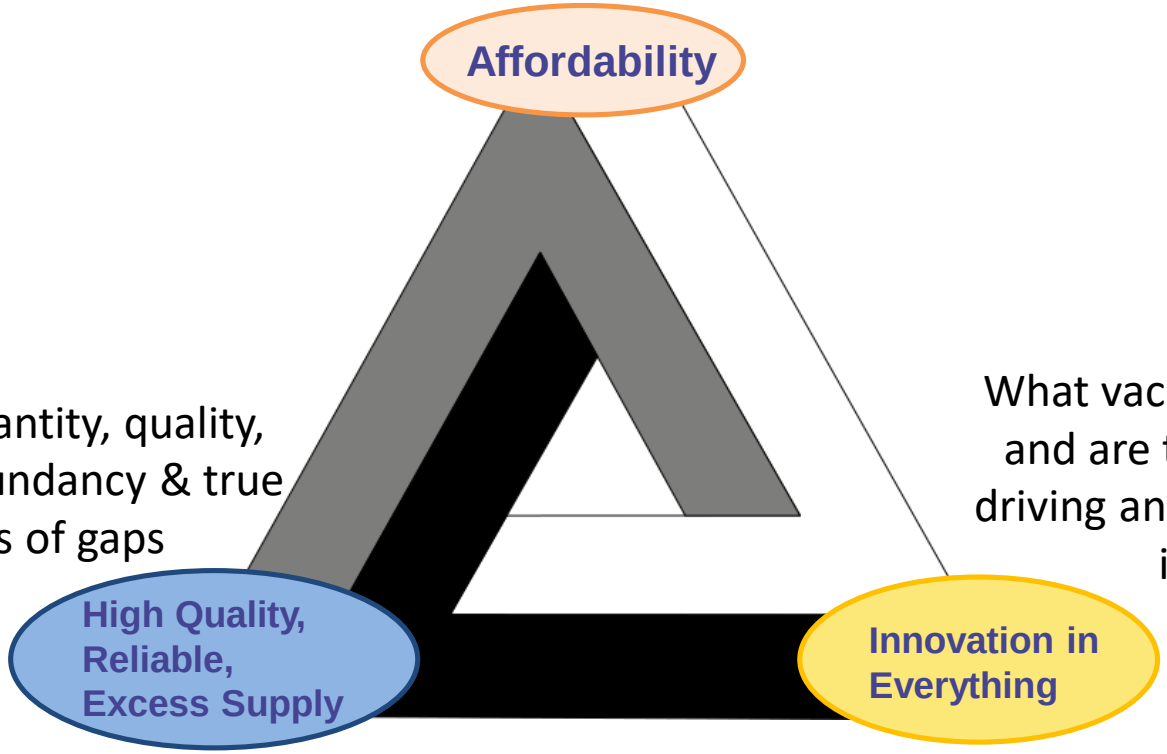
What are the data gaps?

Pricing and funding driven by holistic metrics of impact – A healthy market



Track supply quantity, quality, reliability, & redundancy & true root causes of gaps

What vaccines do "we" want and are the pushes & pulls driving and incentivizing their innovation

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Ways to create more value for everyone – Pushes & Pulls

	RoI criteria	Public Health criteria	Potential financial mechanisms to reconcile interests
Research	Lower/share costs Lower/share risk	Product adapted to health needs	Push Mechanism (PDPs) e.g. BARDA, CEPI & Wellcome
Development	Predictable demand	Affordable prices	Pull Mechanisms: e.g. AMC, GAVI, ?
Production	Lower COGS/ Maximize production capacities	Security of supply	Subsidies based on Volume/Price agreements
Quality	Protect trust/confidence	Reliable safety	Push mechanisms Regulatory pathways

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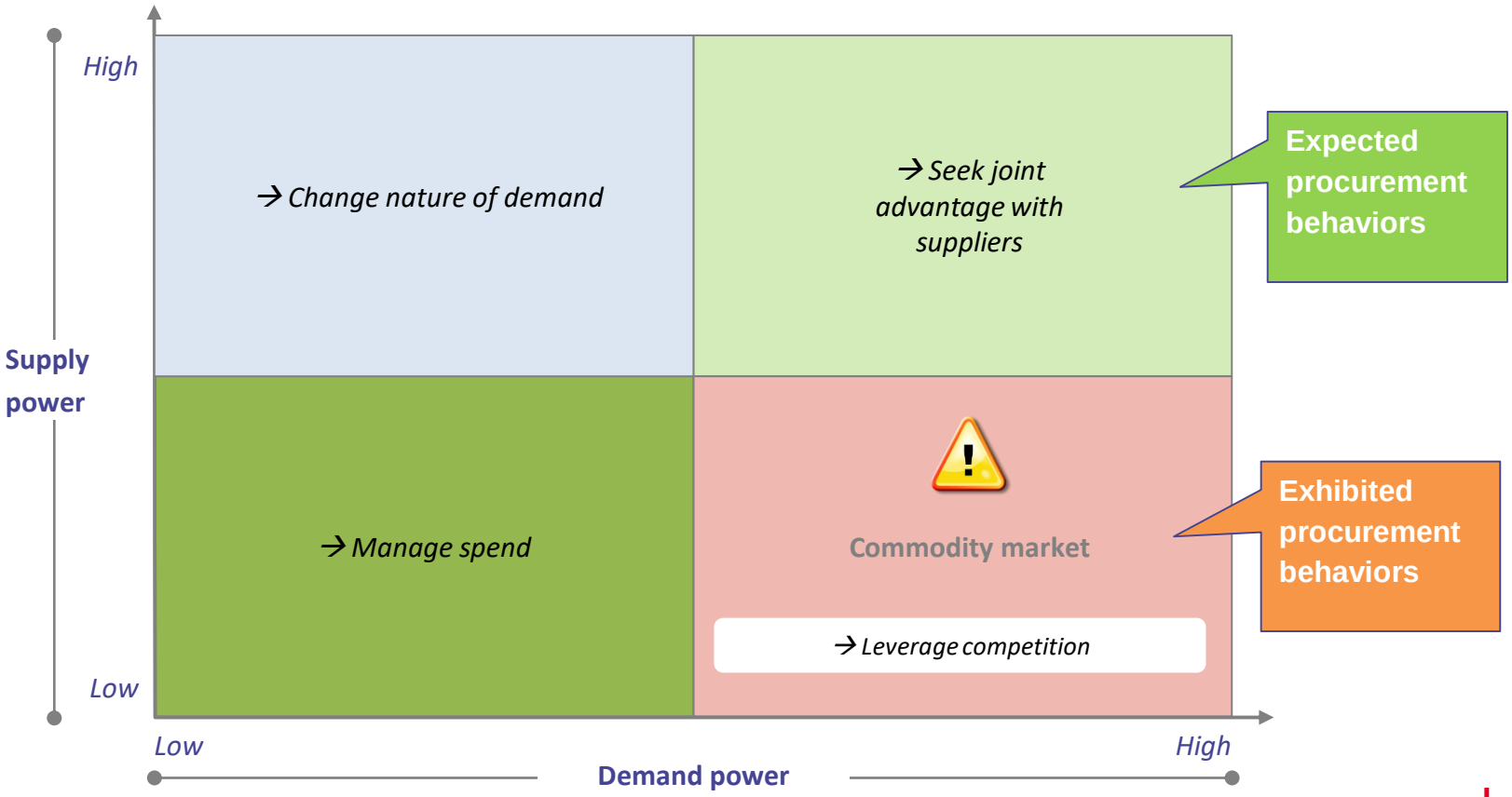
Ways to create more value for everyone – Procurement Practices

Market dynamics scenarios and corresponding procurement levers



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“Mostly it is loss which teaches us about the worth of things.”

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