Insights on manufacturing-based pollution in sub-Saharan Africa and South Asia: what does this mean for oceans

Professor Lisa Emberson
and lots of others….

UNIVERSITY of York

SEI Stockholm Environment Institute

Circular Economy, Oceans and Plastics Pollution – Geneva, 11 September 2019

What role does sub-Saharan Africa and South Asia play in plastics in the marine environment?

SEI Stockholm Environment Institute

Circular Economy, Oceans and Plastics Pollution
Geneva, 11 September 2019

University of York

Causes

- Population
- Growth in GDP per capita
- Poor waste management systems
- Poor lifecycle design of plastic products

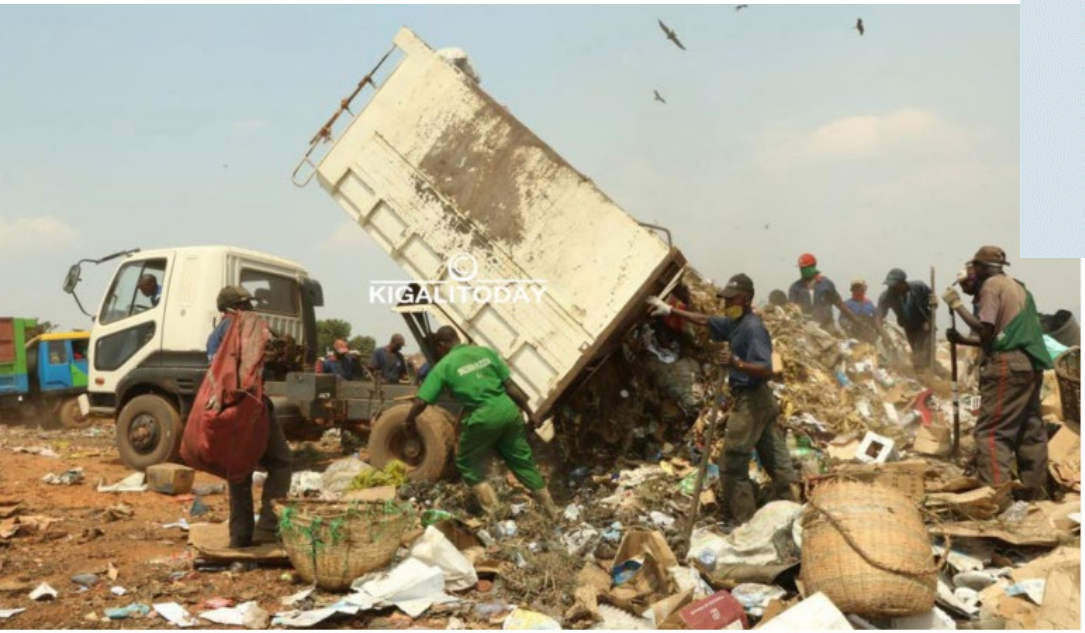
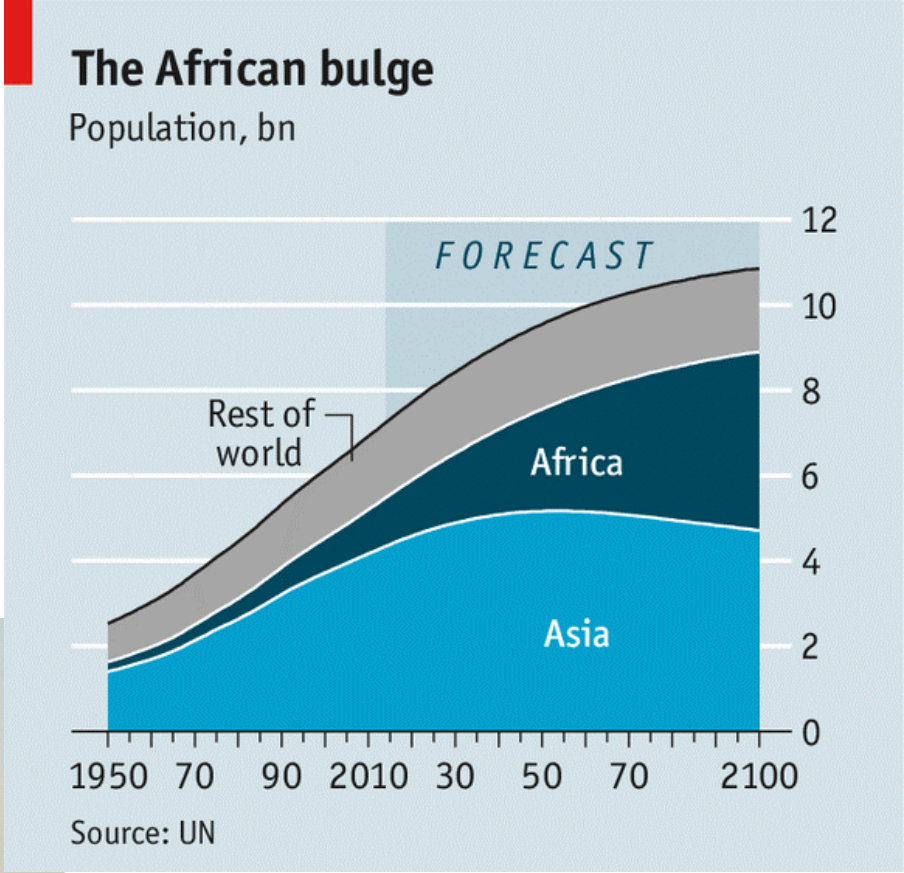
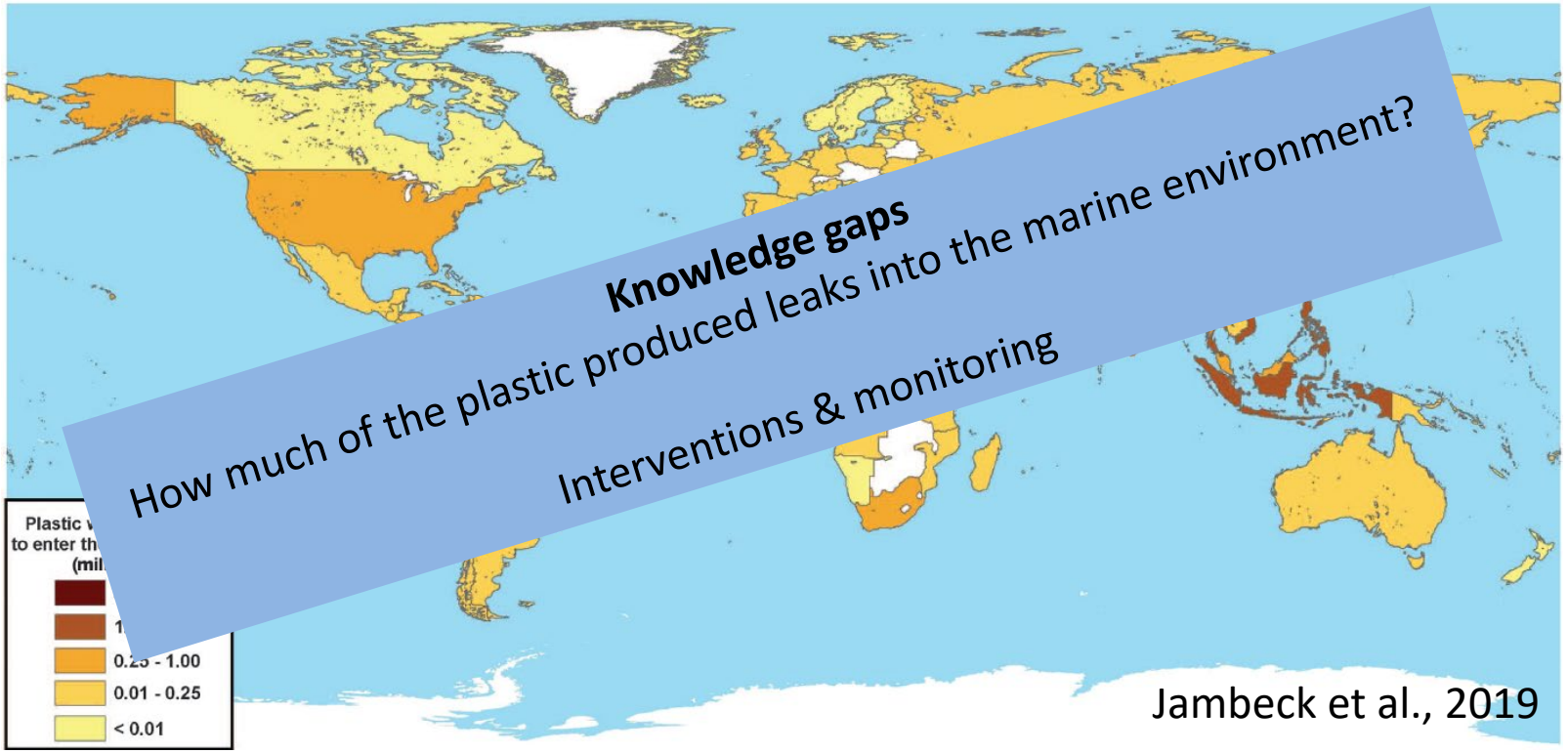


Image courtesy of Kigali Today



Estimated mass of mismanaged plastic waste (millions of metric tonnes (MT)) generated in 2010 by populations living within 50km of the coast



Top 20 countries ranked by mass of mismanaged plastic waste

South Asia: Sri Lanka (5); Bangladesh (10); India (12); Pakistan (15)

Sub-Saharan Africa: Nigeria (9); South Africa (11)

Cause & Consequence

The role of freshwater systems in plastic pollution?

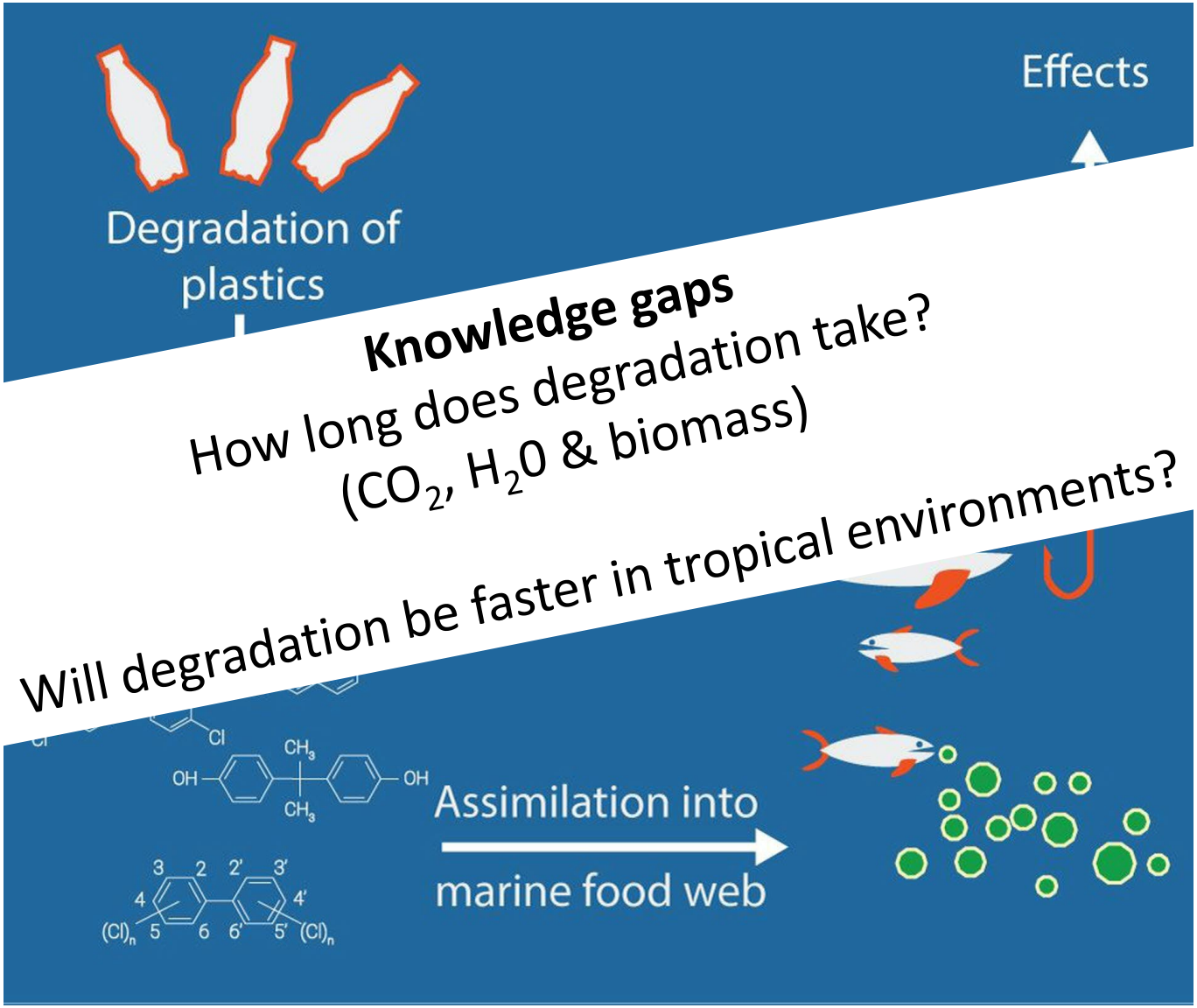
> 25% of global waste is discarded into watersheds of only 14 continental rivers (including the Congo, the Niger, the Nile, the Zambezi and the Ganges)

Consequences

- Toxicological & ecological consequences on biota & human health
- Interference with subsistence fishing practices
- Creation of unattractive coastal land & seascapes for ecotourism
- Inhibition of wildlife conservation efforts

Consequences

Microplastics



Consequences

- **Toxicological & ecological consequences on biota & human health**
- Interference with subsistence fishing practices
- Creation of unattractive coastal land & seascapes for ecotourism
- Inhibition of wildlife conservation efforts

Macroplastics
Ingestion and entanglement

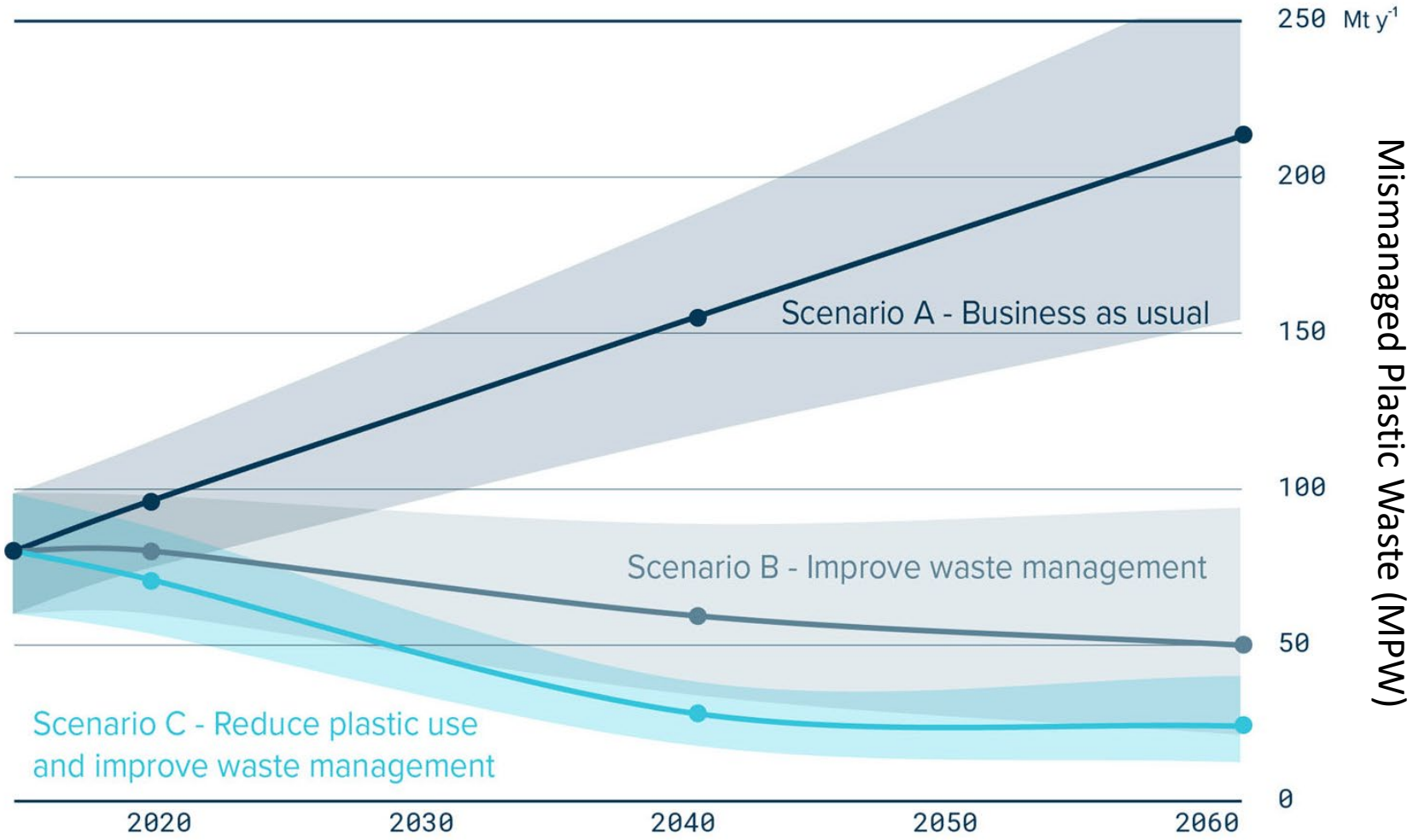
→ Morbidity & mortality

Microplastics
Absorption of organic contaminants (PCBs, POPs, DDTs) & heavy metals

→ **Knowledge gaps?**
Oxidative stress
Immunological response
Altered gene expression
Disrupted endocrine system
Reproductive abnormalities
Morbidity & mortality

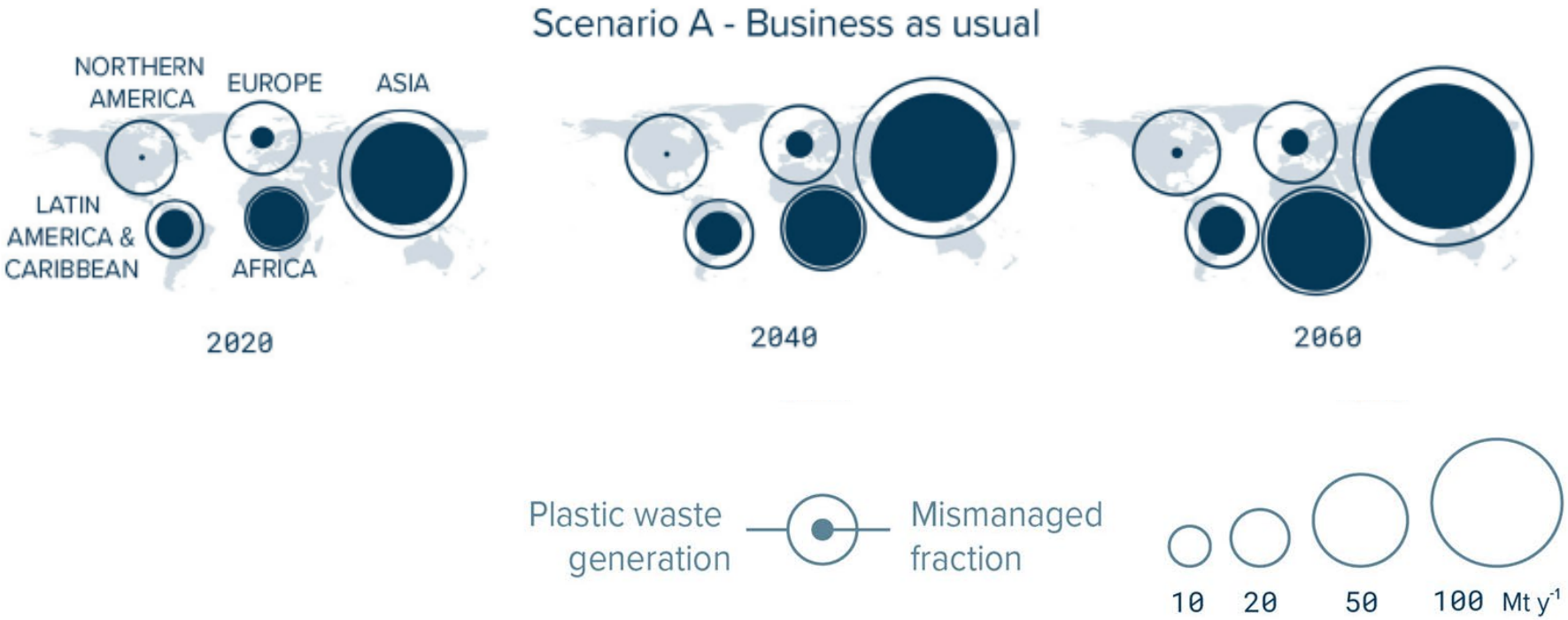
? Human health impacts *via* bio-accumulation in food chain?

Trends



Lebreton & Andrady, 2019

Trends

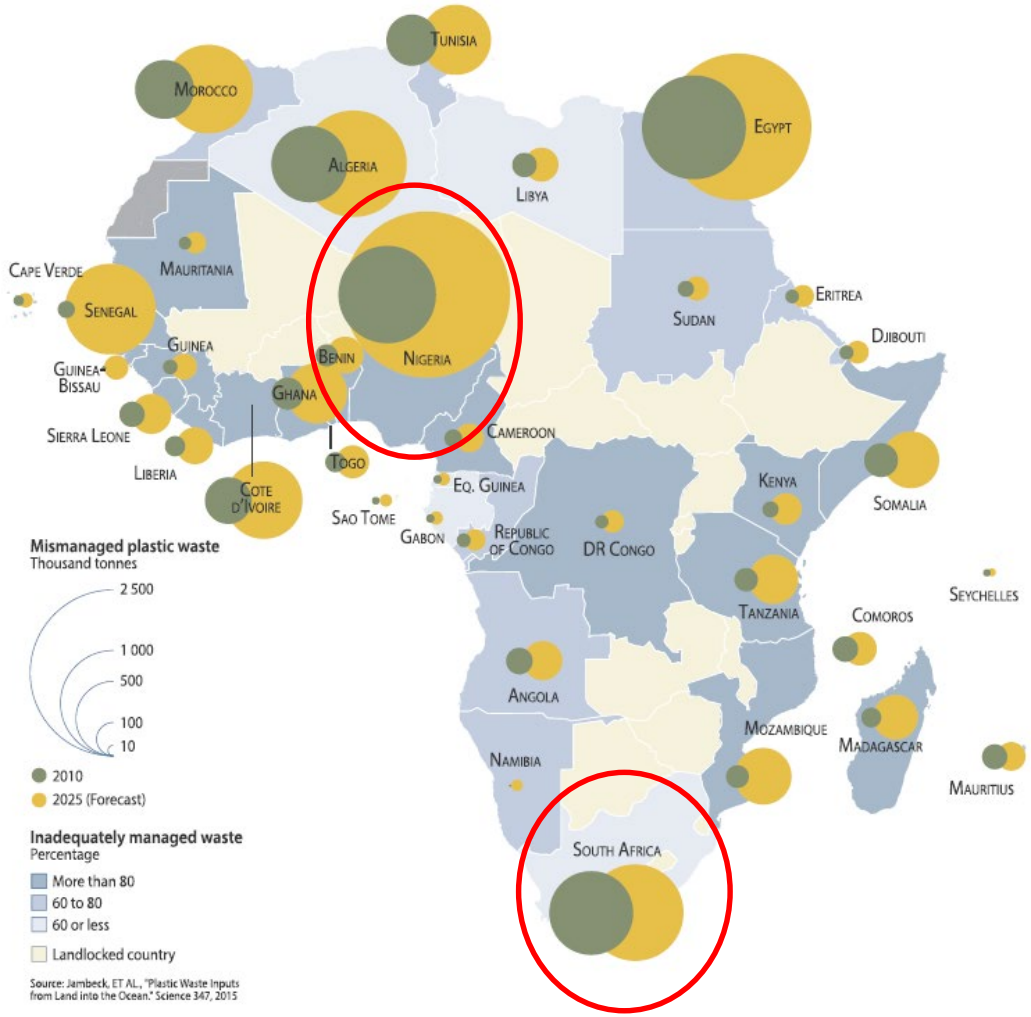


India will become largest producer of MPW by 2050
Kolkata & New Delhi reach 1 MT/yr before 2060

Lebreton & Andrady, 2019

Challenges

Mismanaged plastic in Africa in thousands of tonnes as of 2010 (green circles) and projection of waste management forecast in 2025 given current practices (yellow circles)



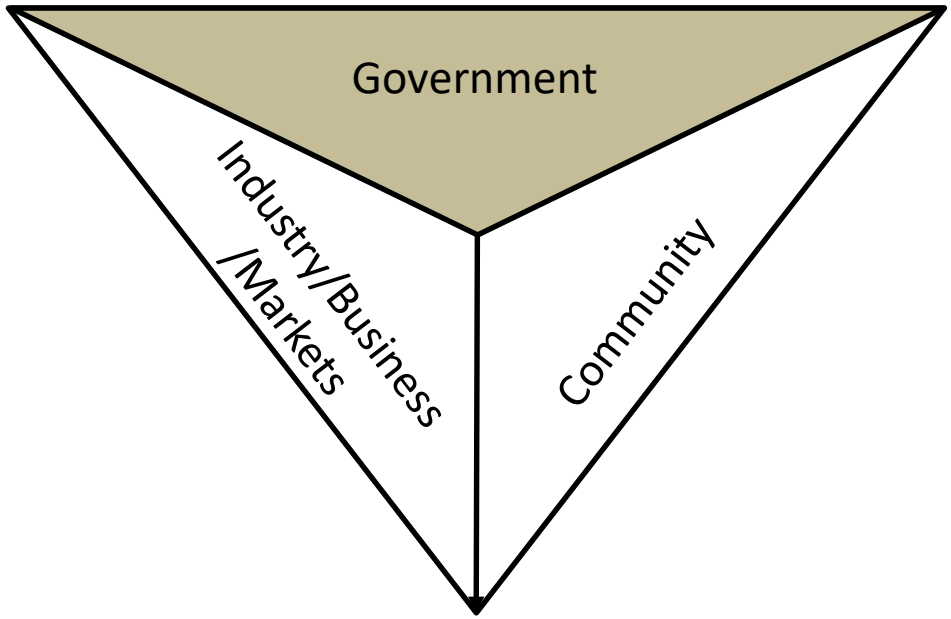
Solutions

Ban it, replace it, close the tap

Modified from Jambeck, ET AL., "Plastic Waste Inputs from Land into the Ocean." Science 347, 2015

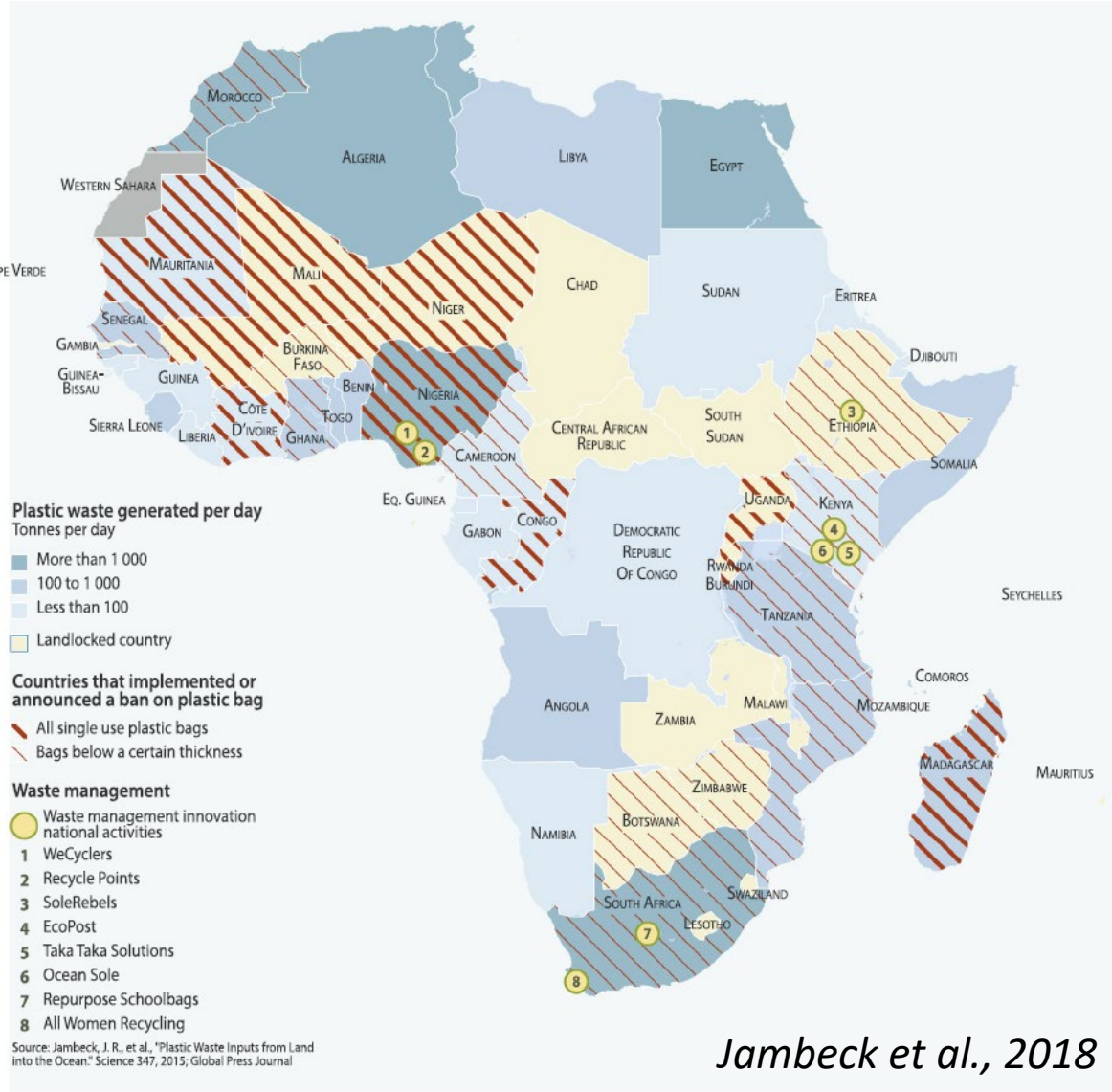
Freshwater systems

Solutions



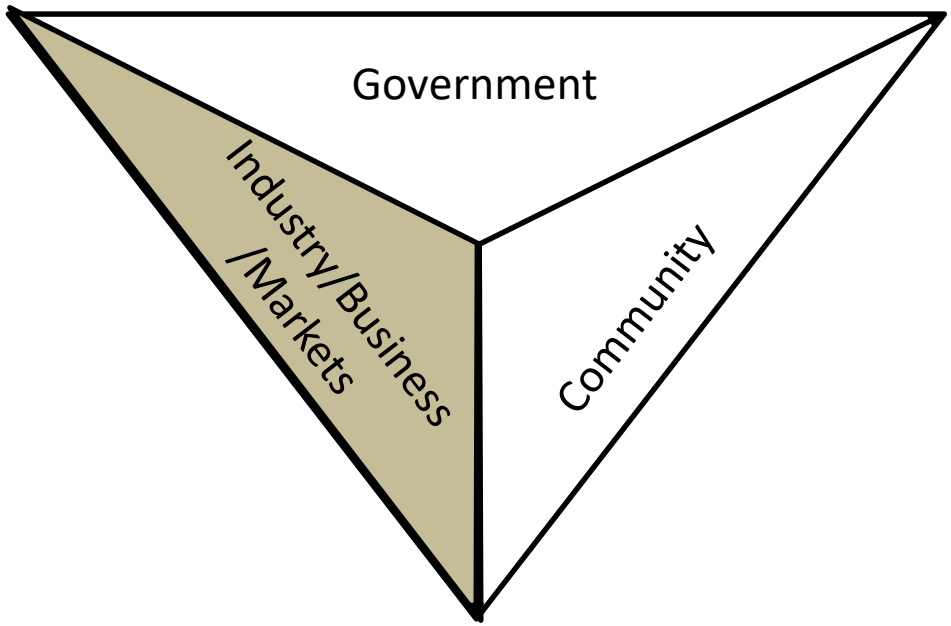
- Ban on single use plastic
- Economic instruments (e.g. taxes)
- Improve waste management
- e.g. EU – consumption reduction and market reduction measures on single use plastics and push for a 90% collection rate on single use plastic bottles

Plastic waste generation rate and projects addressing waste management in Africa



Jambeck et al., 2018

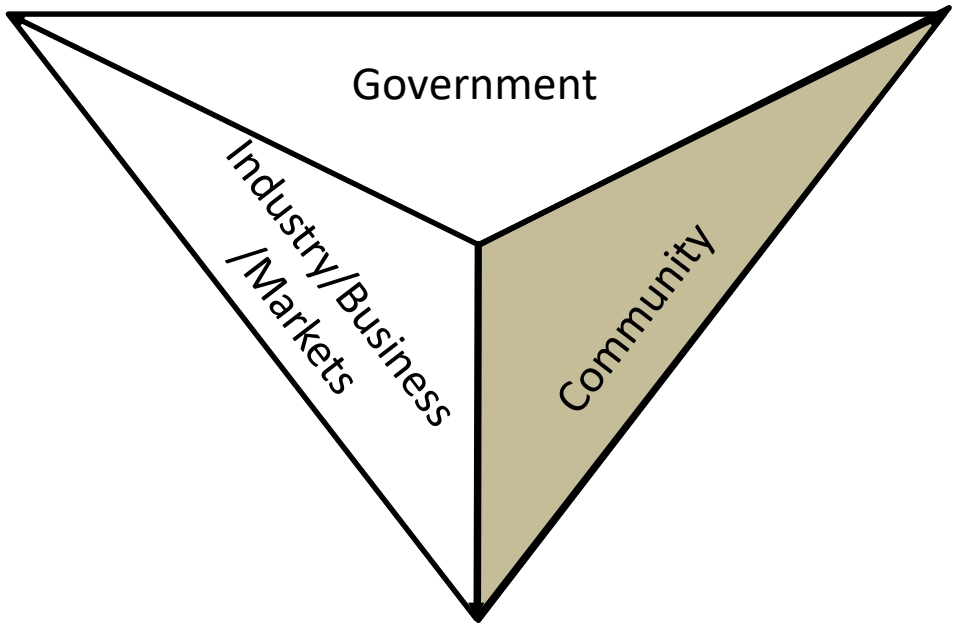
Solutions



- Change petroleum-based plastics to alternative bio-benign products (paper, glass, biodegradeable plastics)
- Make 100% of packaging recyclable, reuseable, or compostable by 2025
- e.g. 11 global brand owners, retailers and packaging companies committed to this ambition by 2025

Life-cycle Design

Solutions



- Increase social awareness and public pressure
- Voluntary reduction strategies and agreements
- Clean up programmes
- e.g. GhostNets Australia. 2004 removed 13,000 derelict fishing nets & rescued 400 turtles

Solutions

Lebreton & Andrady, 2019

The challenge

Product ban

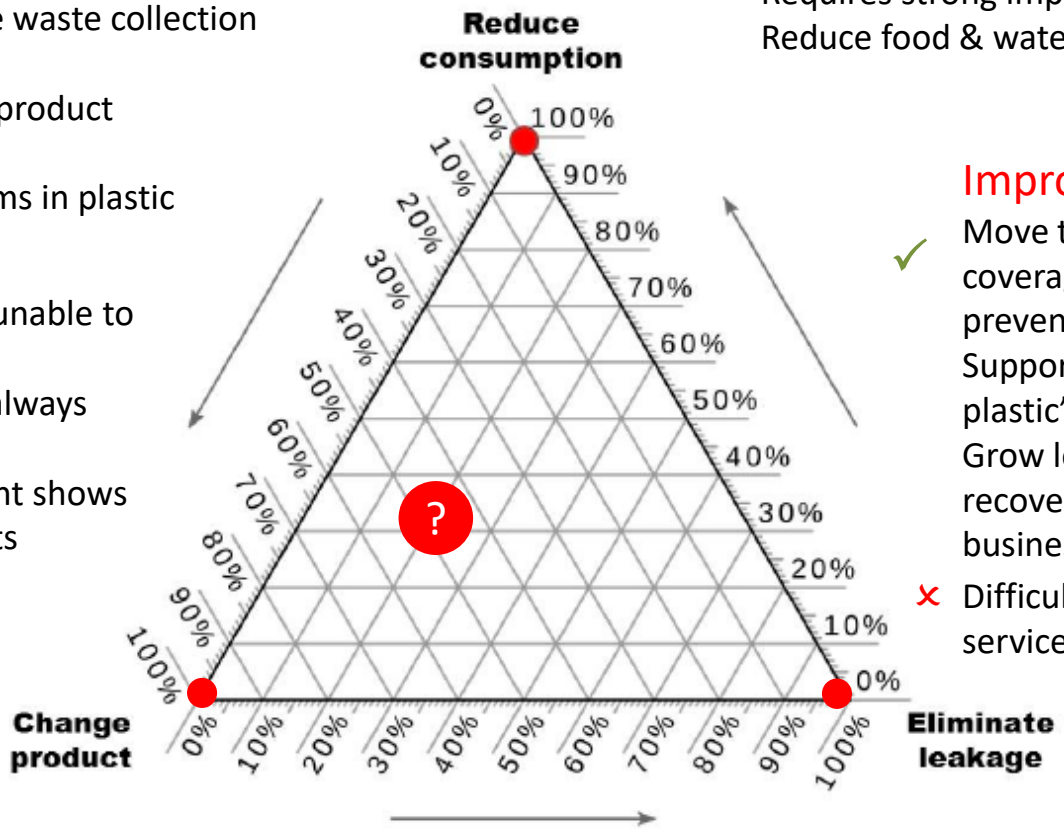
✓ difficult to improve waste collection services
Little control over product design

✗ Threat to local plastic business sector – job losses
Requires strong implementation to avoid smuggling
Reduce food & water security

Product Replacement

✓ Difficult to improve waste collection services
No wish to reduce product consumption
Overcomes problems in plastic recycling (only 9%

✗ Threat to business unable to diversify
Replacements not always biodegradeable
Life cycle assessment shows reduced net benefits



Improved waste collection

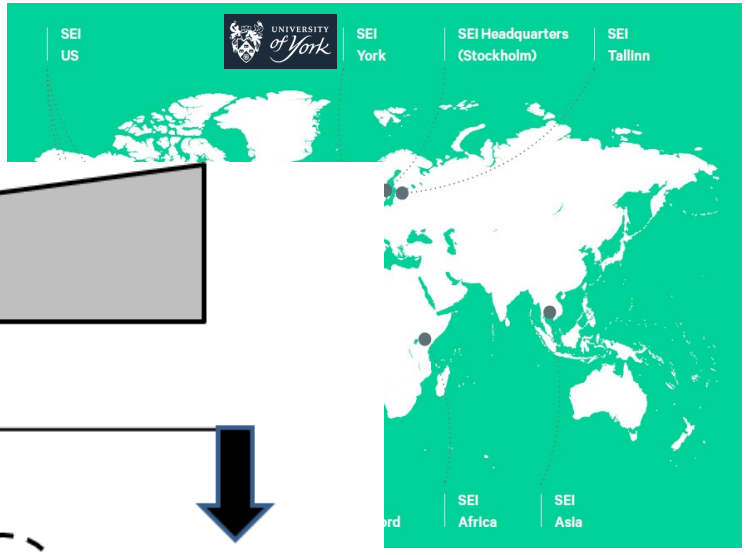
✓ Move towards 100% collection coverage which is only way to prevent waste 'leakage'
Support management of other 'non-plastic' wastes
Grow local reuse, recycling and recovery economies – partner with businesses

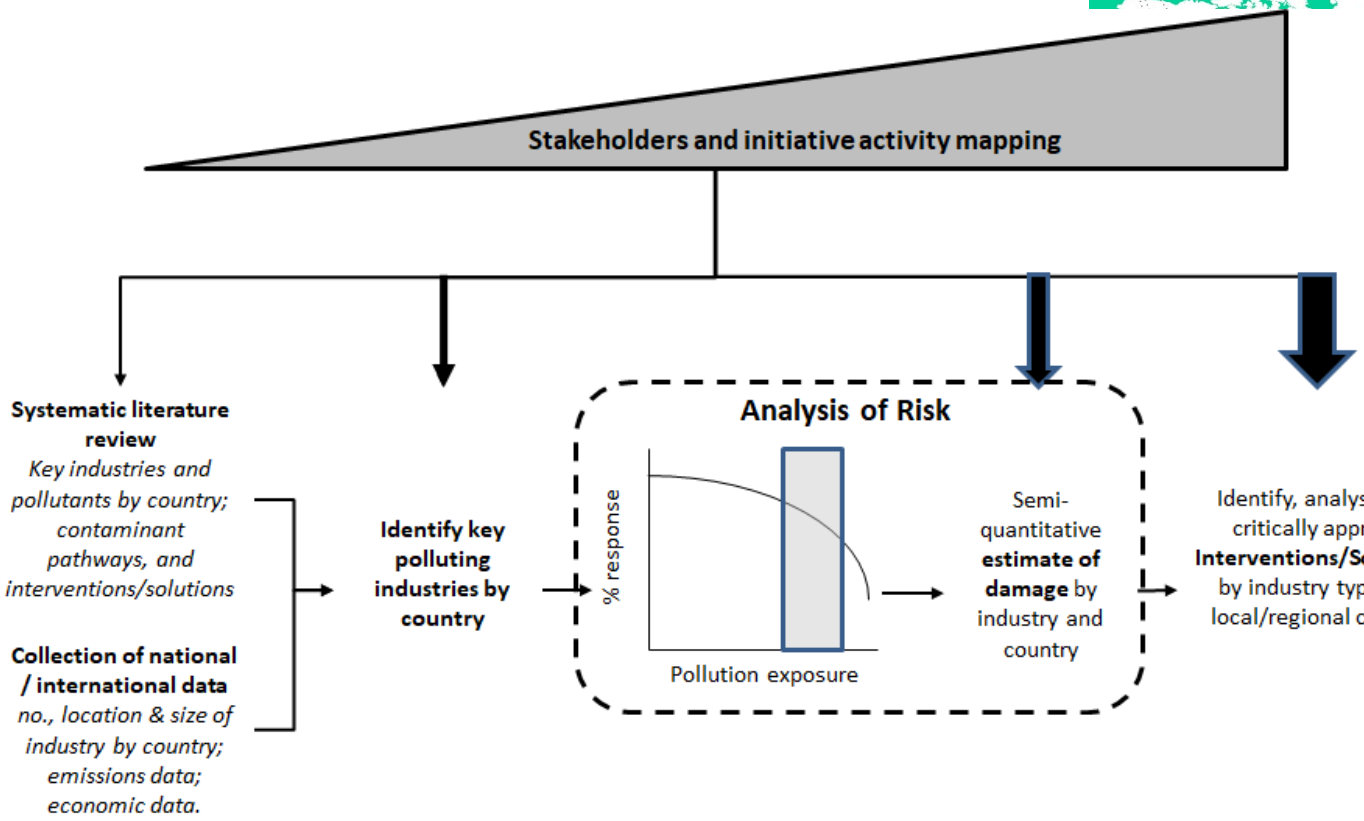
✗ Difficult to improve waste collection services

Godfrey et al., 2019

Solutions need to be country specific

SEI/UoYork Research





Phase I - Initial scoping literature review and data collection
All SA & SSA countries

Phase II – In depth literature review and data collection
Selected SA & SSA countries

Phase III - Case studies
3 to 4 SA & SSA countries

Thank you to UNCTAD and DFIDUK for supporting this research

Types of Industry

- Textiles and clothing,
- Leather,
- Food processing,
- Chemicals,
- Rubber and plastics
- Etc…

Types of stakeholders

- Multilateral initiatives on sustainable manufacturing,
- International development projects by major donor agencies and/or NGOs, Public financing facilities,
- Private investment facilities,
- Universities,
- Research institutions and technology providers

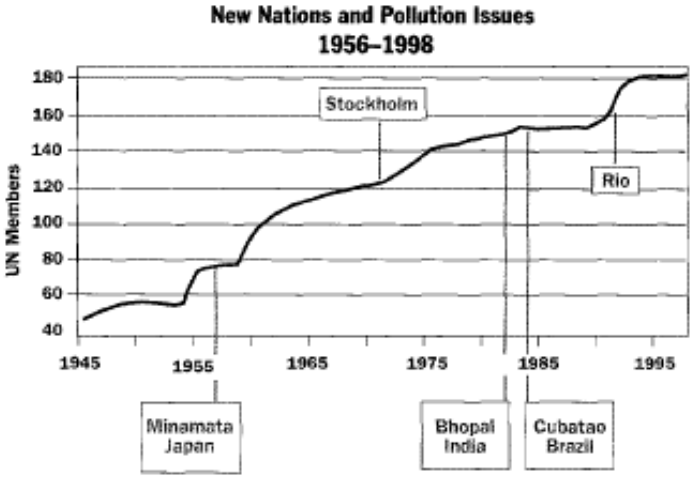
Types of solutions

- Substitution,
- Removal,
- Recycling
- Remediation

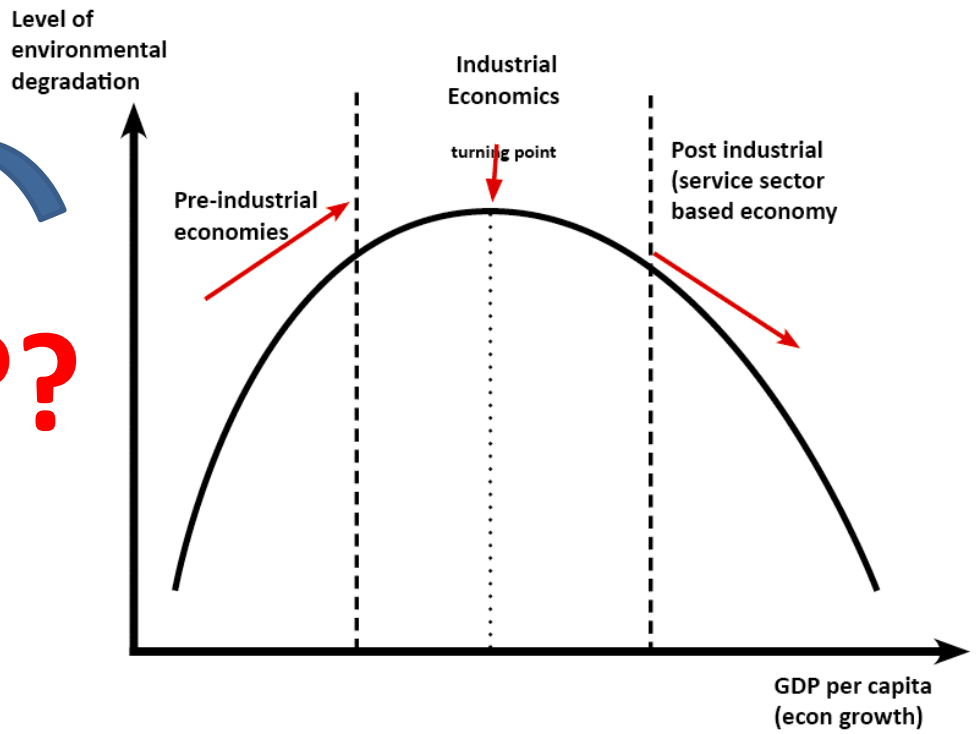
Soft approaches:
Government regulations, economic incentives, consumer demand, B2B relations, CSR, standards, PPPs.

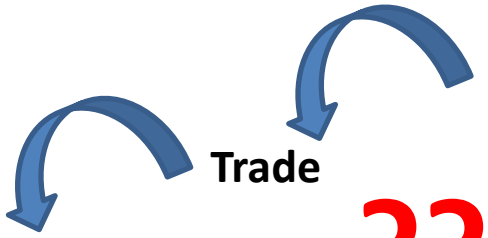
Hard approaches:
Technology adoption, equipment, innovation, chemical and physical processes

Build on WB 'Greening Industry' report (2000)



Environmental Kuznets Curve





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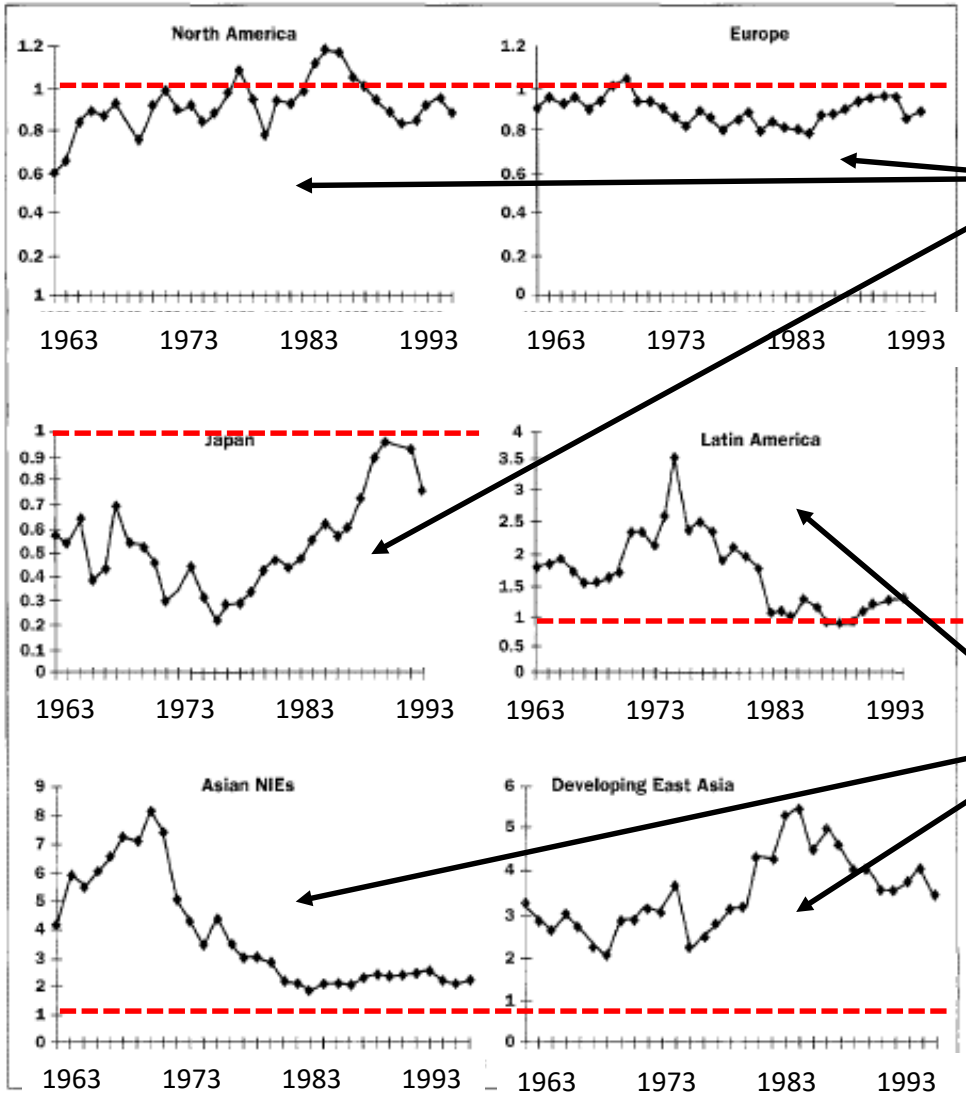
Pollution Haven Hypothesis

'differences in stringency of environmental regulations between countries may see more developed countries specialise in 'clean' production outsourcing dirty industries to less developed countries'

Support for Pollution Haven Hypothesis….
…….Import / Export ratios for Polluting Industries



More imports than exports of polluting industry products

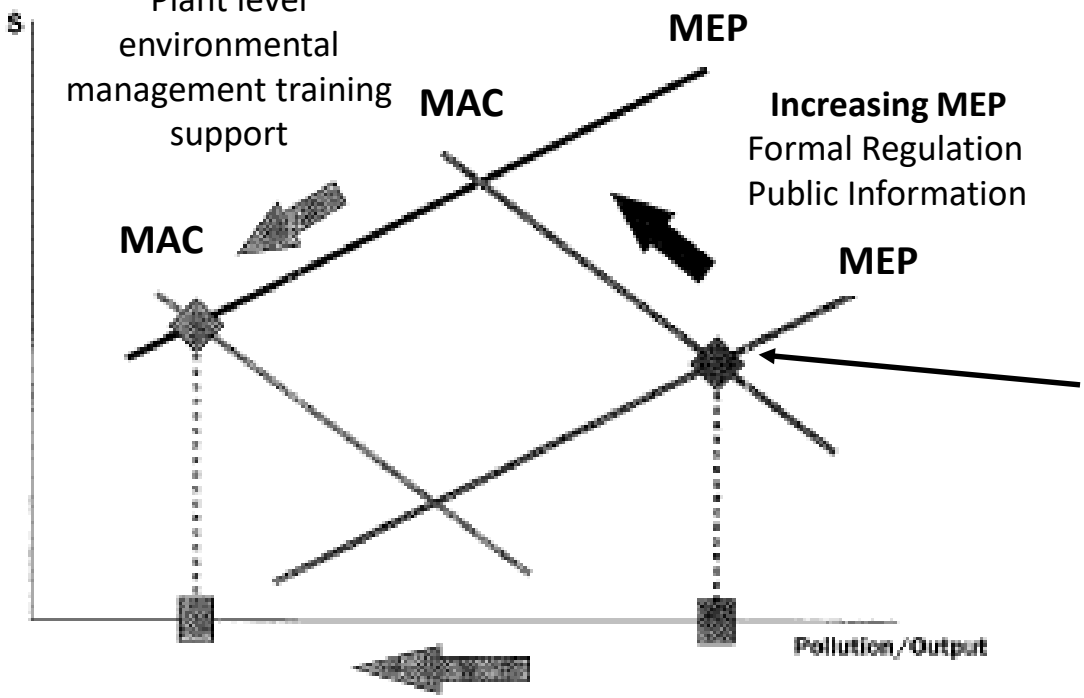
More exports than imports of polluting industry products

Mani & Wheeler, 1998

Understand the economics of pollution abatement

Reducing MAC
National Policy Reforms;
Plant level environmental management training support

MEP – Marginal Expected Penalty
MAC – Marginal Abatement Cost

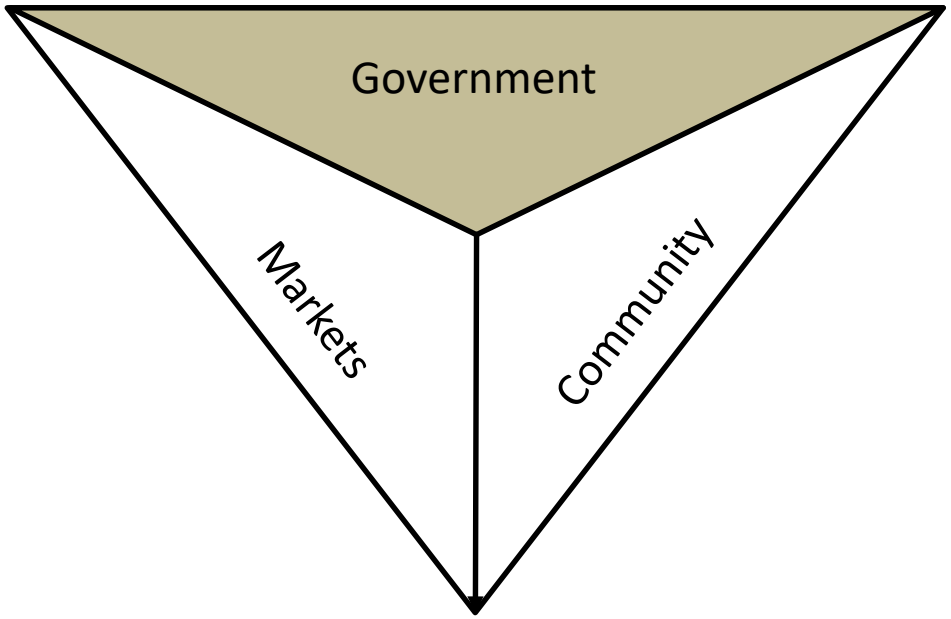


Increasing MEP
Formal Regulation
Public Information

Balance between cost to reduce pollution and cost of pollution

Greening Industry (2000)

Solutions



e.g. Discharge fees *vs* limits

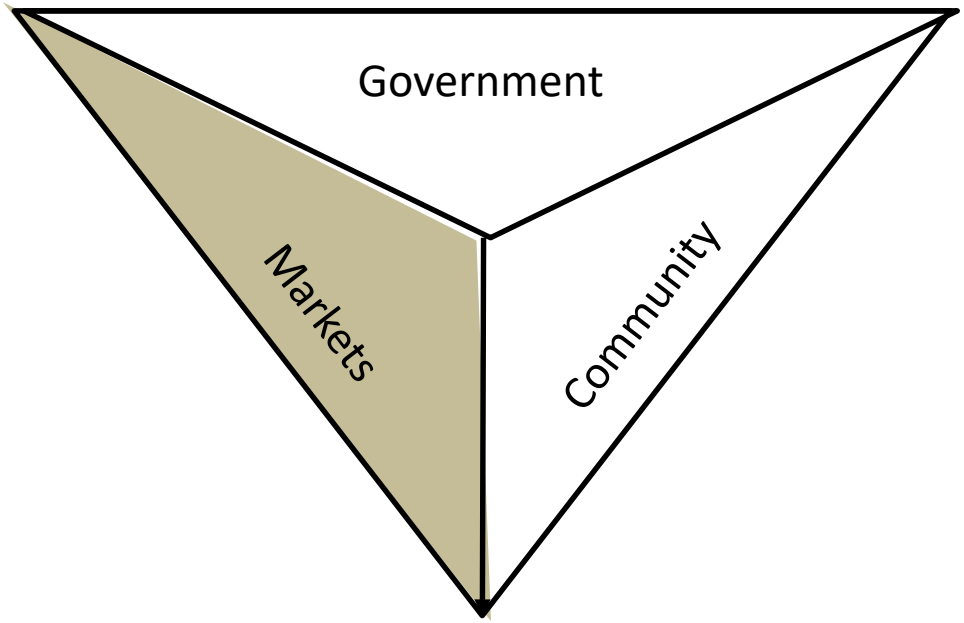
Increase MEP *but*

- *reliable monitoring a problem – especially continu… …rs and where monitoring relies on 'taxes' raised by pollution or re… …d (and open to bribery)*
- *State law enforc… …m due to lack of money*
- *Problem of secr… (e.g. nightly) discharges*
- *Problem of small/informal industries*

Problems more likely to occur in LMICs

Van Rooj et al. (2010)

Solutions



Markets

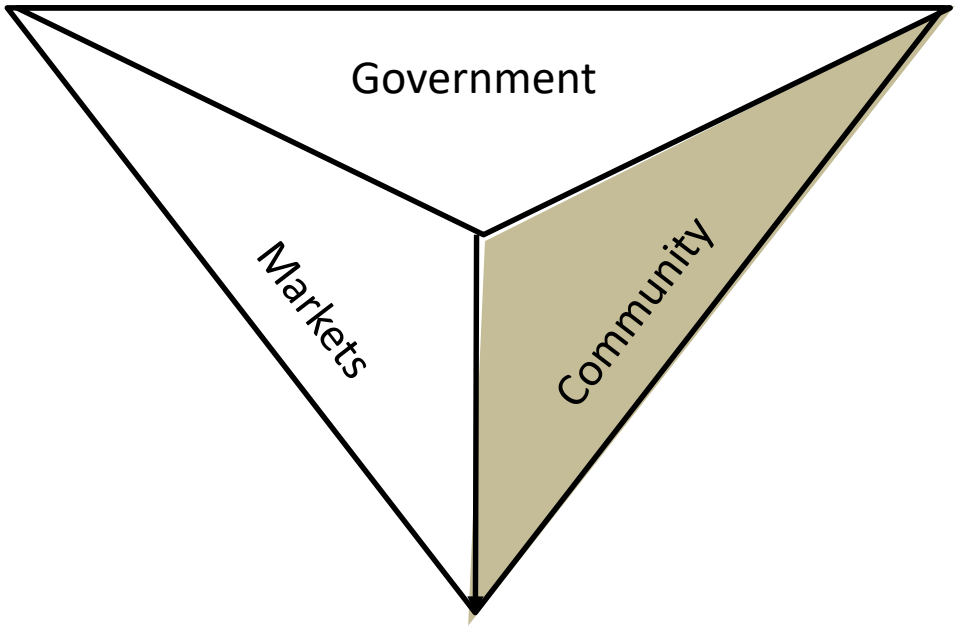
e.g. Polluting nature of products may reduce value on stock market *but*

- *Product may not market direct to consumers*
- *Small enterprises may not trade o*
- *Pressure may le*
- *Citizen action re citizens being informed and educated (and not being reliant on polluting industry)*

Problems more likely to occur in LMICs

Van Rooj et al. (2010)

Solutions



Community

e.g. Pressure from the public to reduce pollution *but*

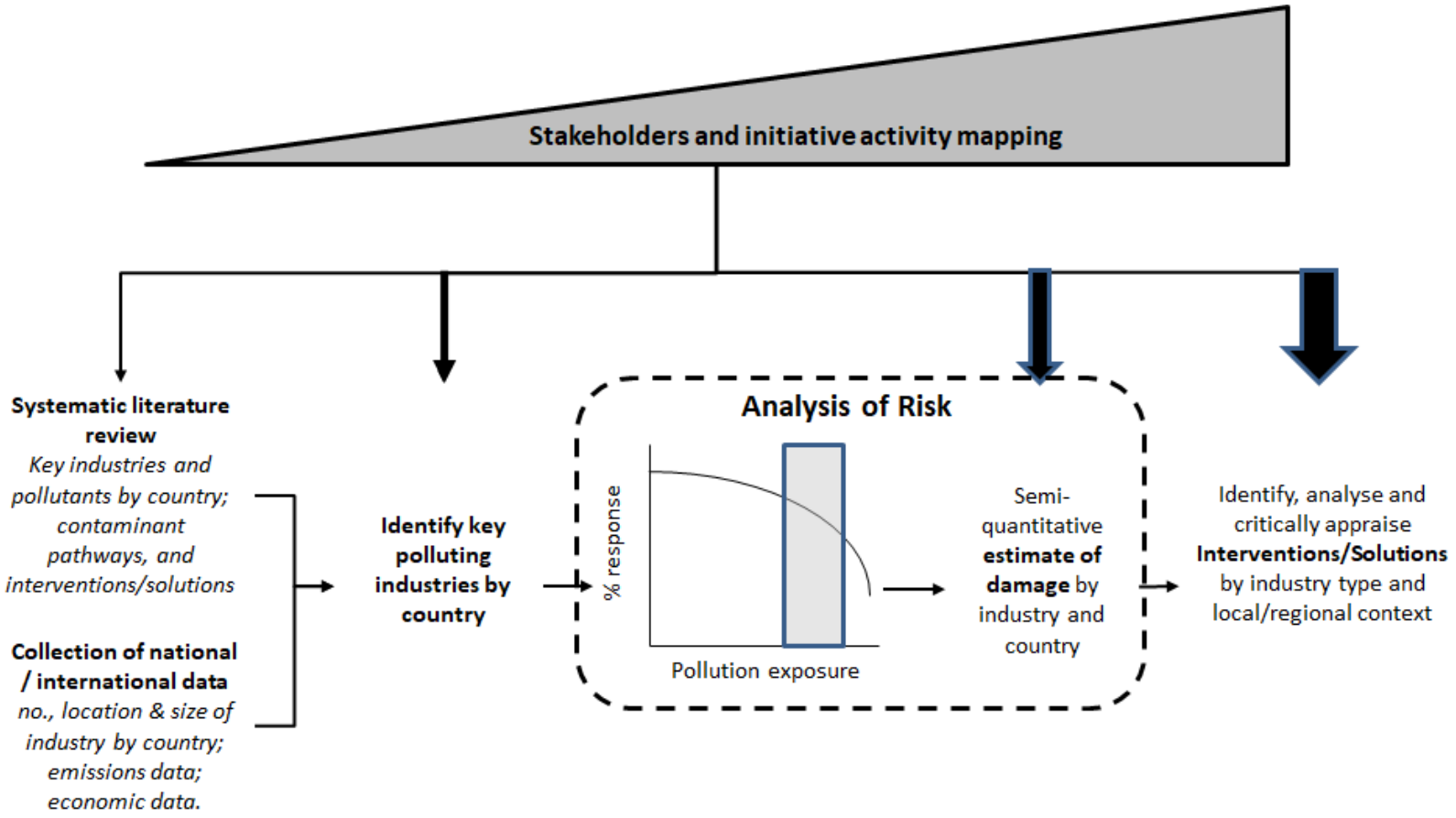
- *Public may reply on polluting industry for jobs/livel*
- *Requires educated communities (*
- *NGOs need to pl*
- *Issues over publi*

Problems more likely to occur in LMICs

the poorest most at risk)
need information
closure (and giving industries to 'clean up' before going public

Van Rooj et al. (2010)

Overview of Project



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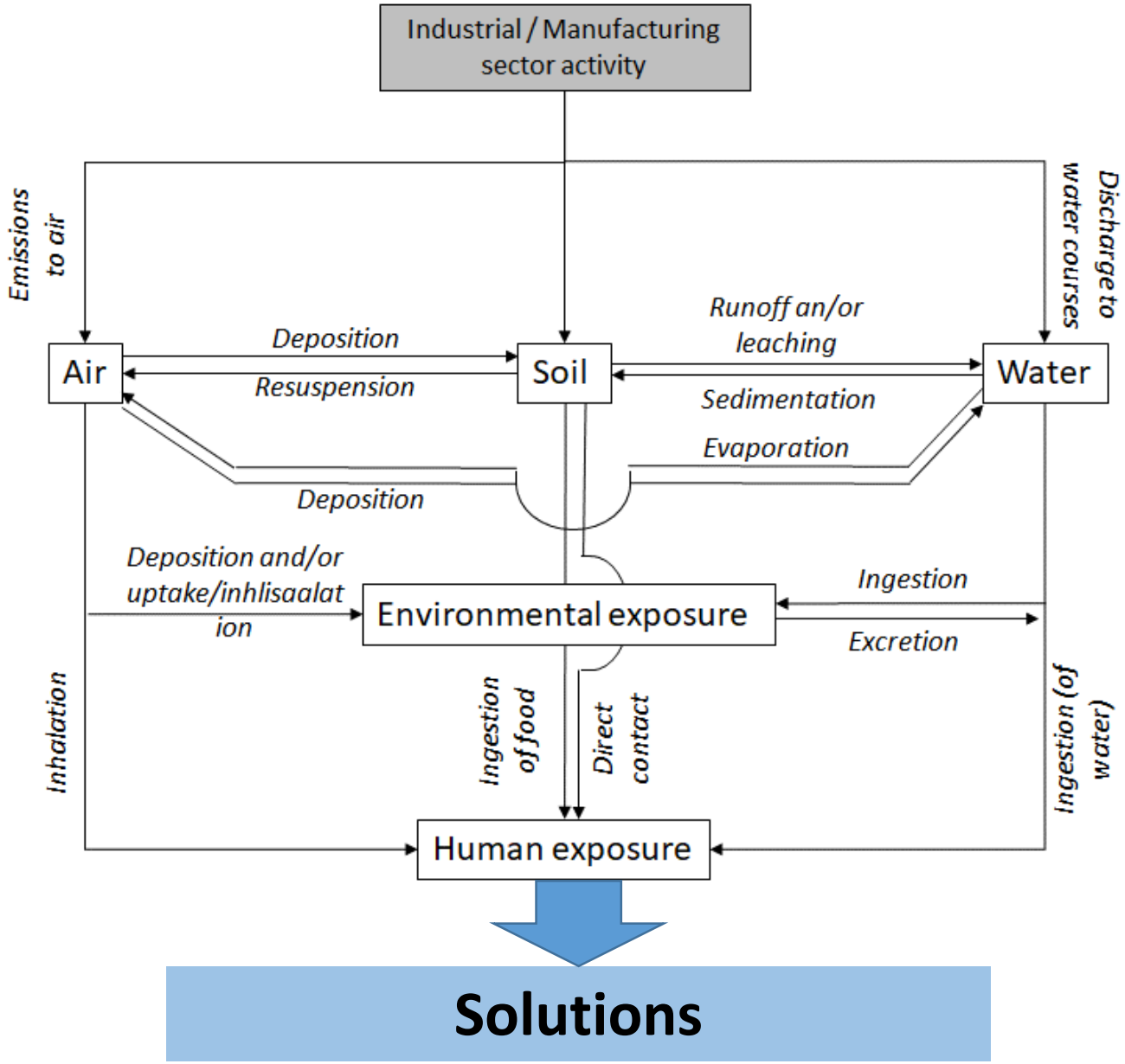
Potential contaminant pathways associated with industrial activity





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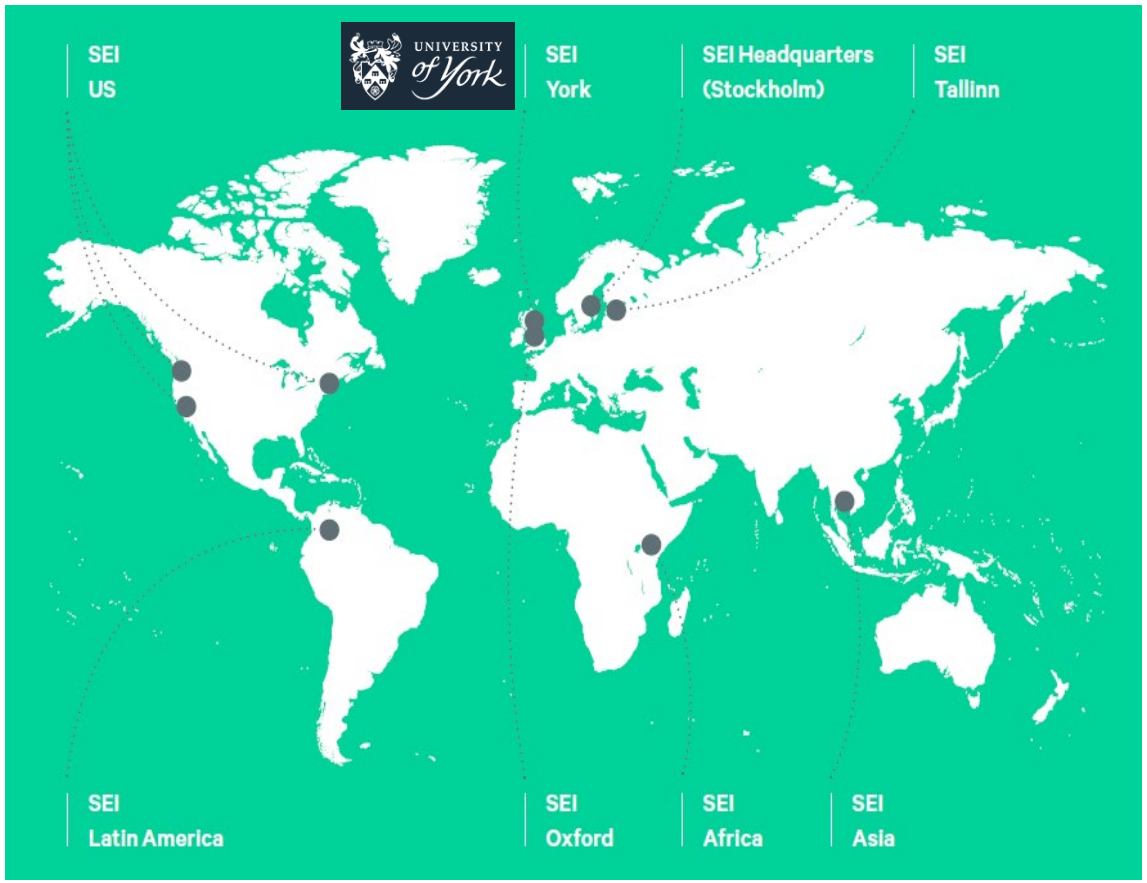
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UNIVERSITY of York
SEI York
SEI Headquarters (Stockholm)
SEI Tallinn
SEI Latin America
SEI Oxford
SEI Africa
SEI Asia


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Next Steps

Literature Review - I
WoS & Scopus
Limited search strings
1990 onwards

Downloadable metrics
Screen title/abstract

Regions + Industries + Pollutants + Stakeholders

Web Searches
Limited search strings

List key international stakeholders with SSA & SA influence

Stakeholders

Initial Data Collection
INDSTAT4

Metrics on industry (no., size, geographical location, economic activity)

Identify
Key industries + Key Pollutants + Key Countries
(by 'current day' size and geographical location)

Develop initial list of
Key Stakeholders

UN Trade Forum: SDGs and Climate Change –
Plastic pollution session
11 September 2019
Geneva, Switzerland

Plastics Meeting
15 May E&G Dept.

3rd World Circular Economy Forum 2019, SMEP Side Sessions

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SEI Stockholm Environment Institute

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