ROYAL ACADEMY OF ENGINEERING

@RAEngGlobal
#SDGs

Problem Based Learning: Teaching engineers to tackle the SDGs

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Moderated by:

Aisling Ni Chonaire
Behavioural Insights

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Educating for the end-of-engineered life: waste, risk and circular economy

Problem Based Learning - Teaching Engineers to tackle the SDGs

Royal Academy of Engineering – 4 March 2020

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Plastics pollution and circular economy research group

Plastic pollution and circular economy research group

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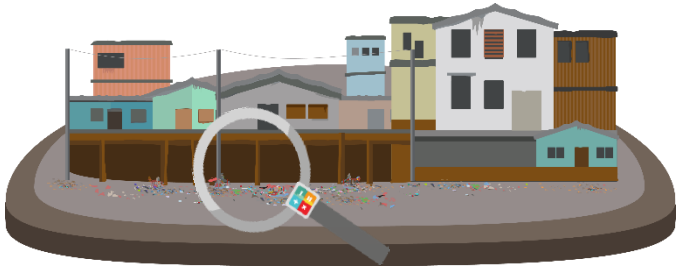
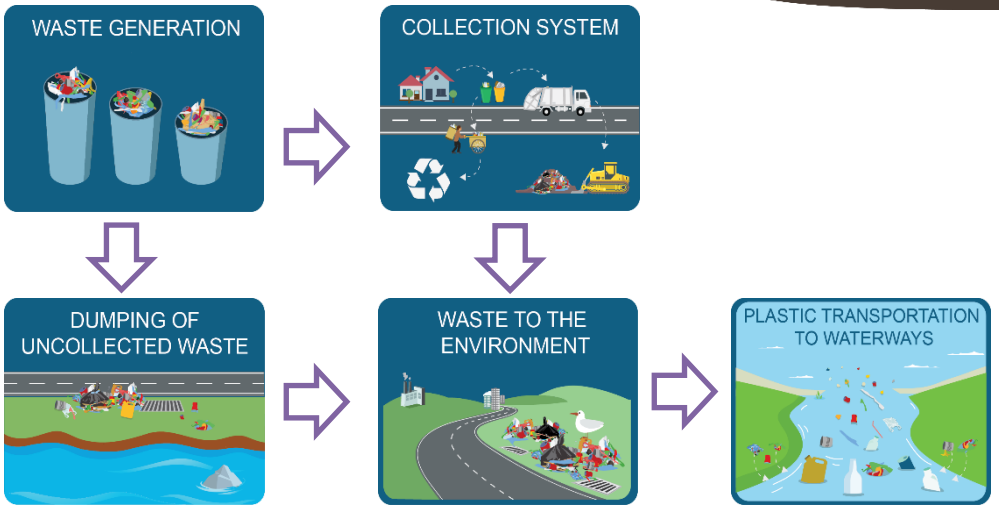
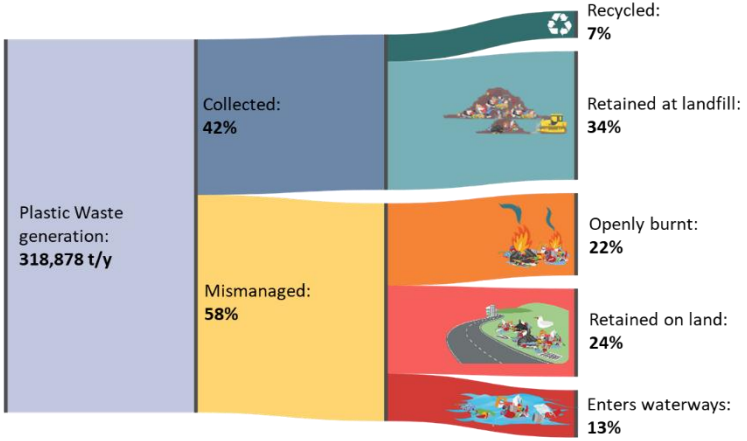
PLASTIC WASTE POLLUTION CALCULATOR







Waste flows modelled on land, before they reach the aquatic environment

Plastic pollution and circular economy research group

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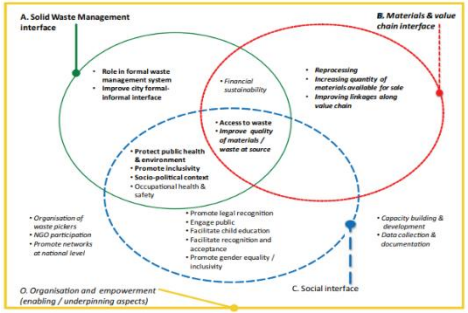

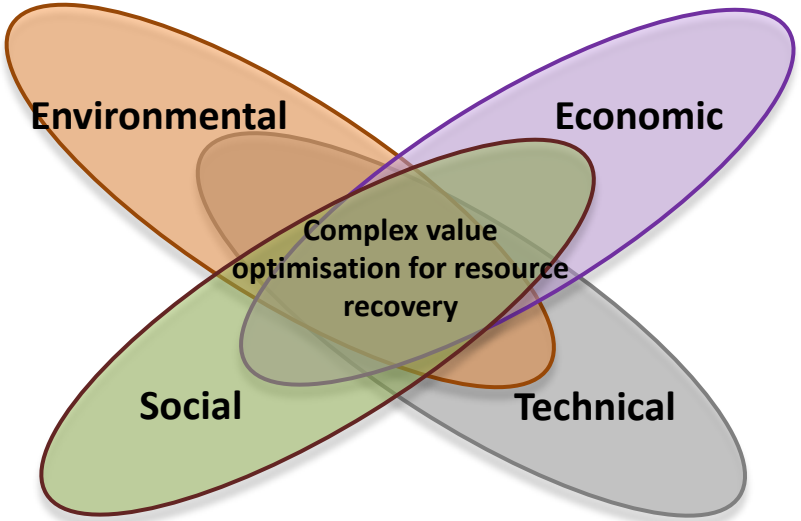

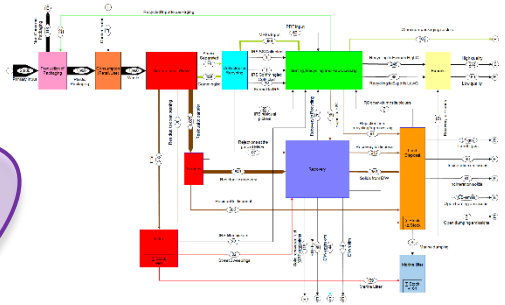

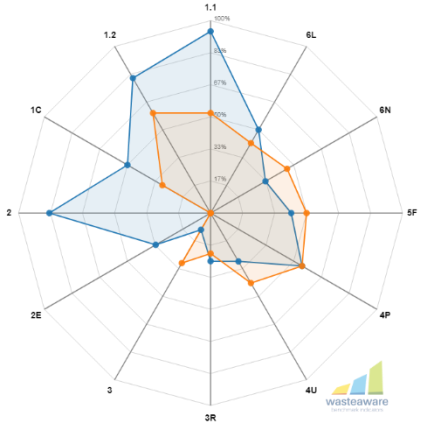

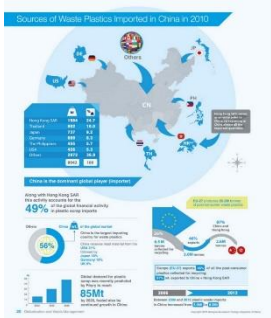

Systems approach to after-use materials

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State of global waste and resources management

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‘Waste’ concept

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‘Leakage’: open dumping, burning, marine litter and plastics pollution

Source: C Velis

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SDGs and waste management

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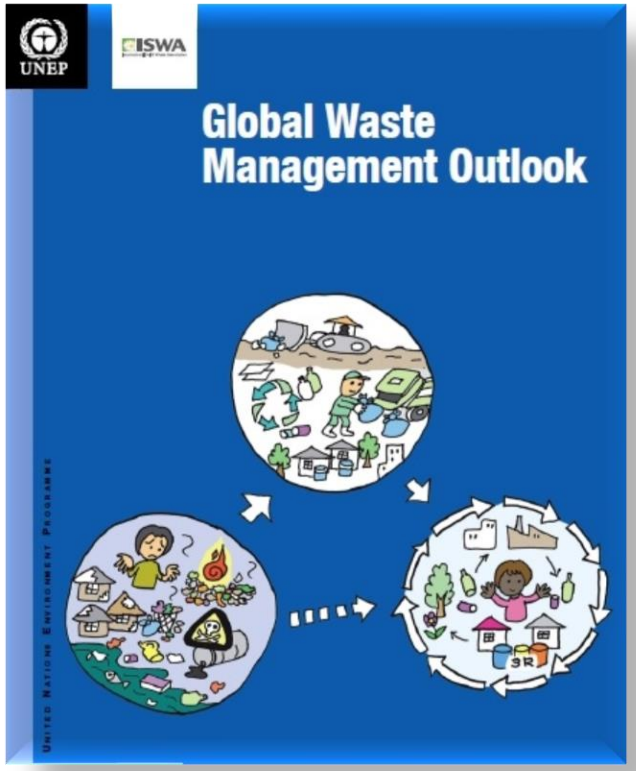
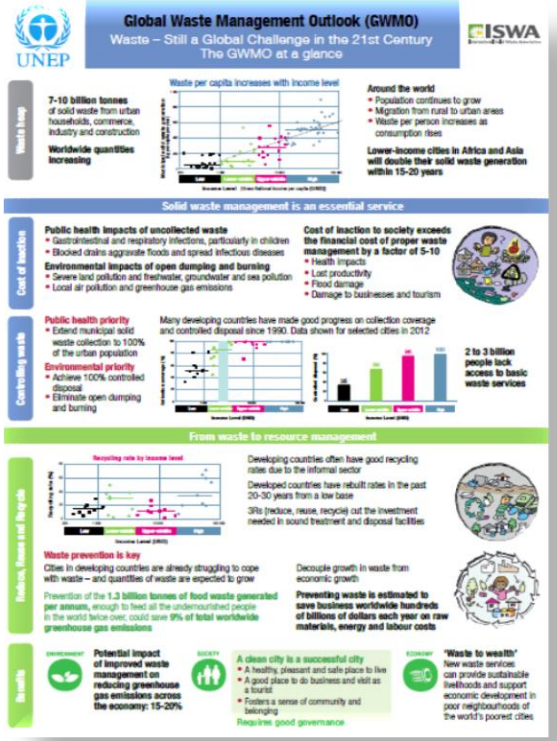


‘2 billion people without sound waste collection’

Massive environmental burden

Key priority



UN Environment: 2-3 billion people without basic waste services

How SDGs relate to waste management?

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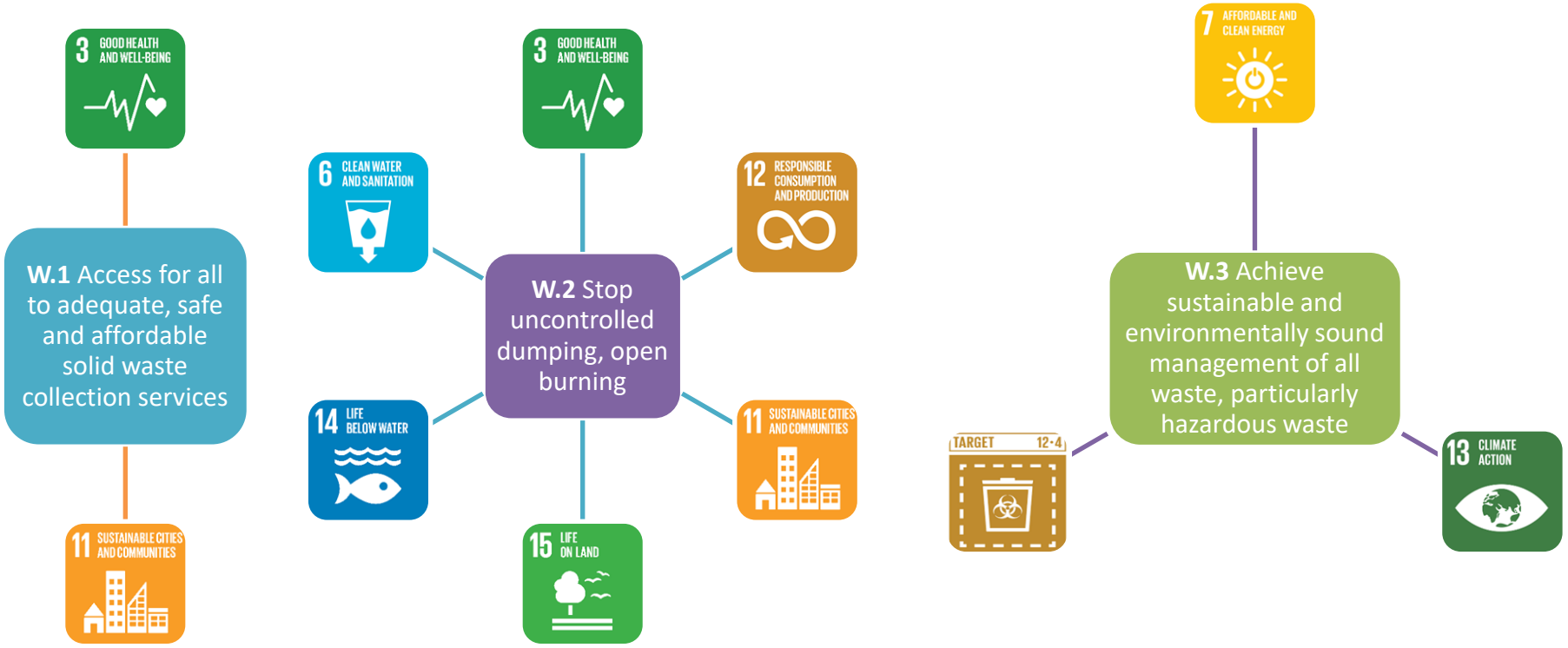

Global Waste Management Outlook Goals 2020

How SDGs relate to waste management?

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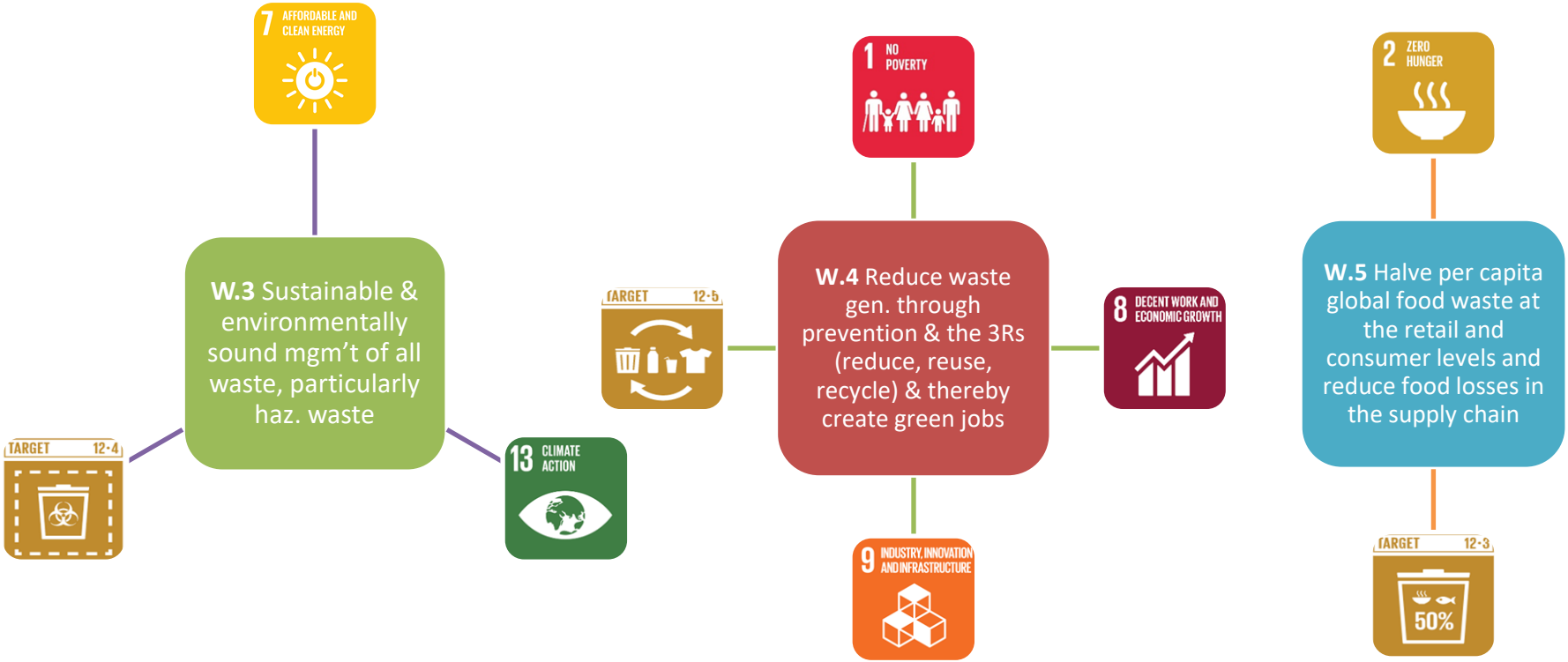

Global Waste Management Outlook Goals 2030

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SDG 12 targets and indicators

Target 12.3

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12.3: Halve per capita food waste and reduce food loss

12.3.1 (a) Food loss index

12.3.1 (b) food waste index

By 2030, halve per capita global food waste at the retail and consumer levels reduce food losses along production and supply chains, including post-harvest losses

Target 12.4

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12.4: Environmentally sound management of hazardous waste

12.4.1: Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement

12.4.2: Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment

By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

Target 12.5

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12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

12.5.1: National recycling rate, tonnes of material recycled (no data available)

By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse

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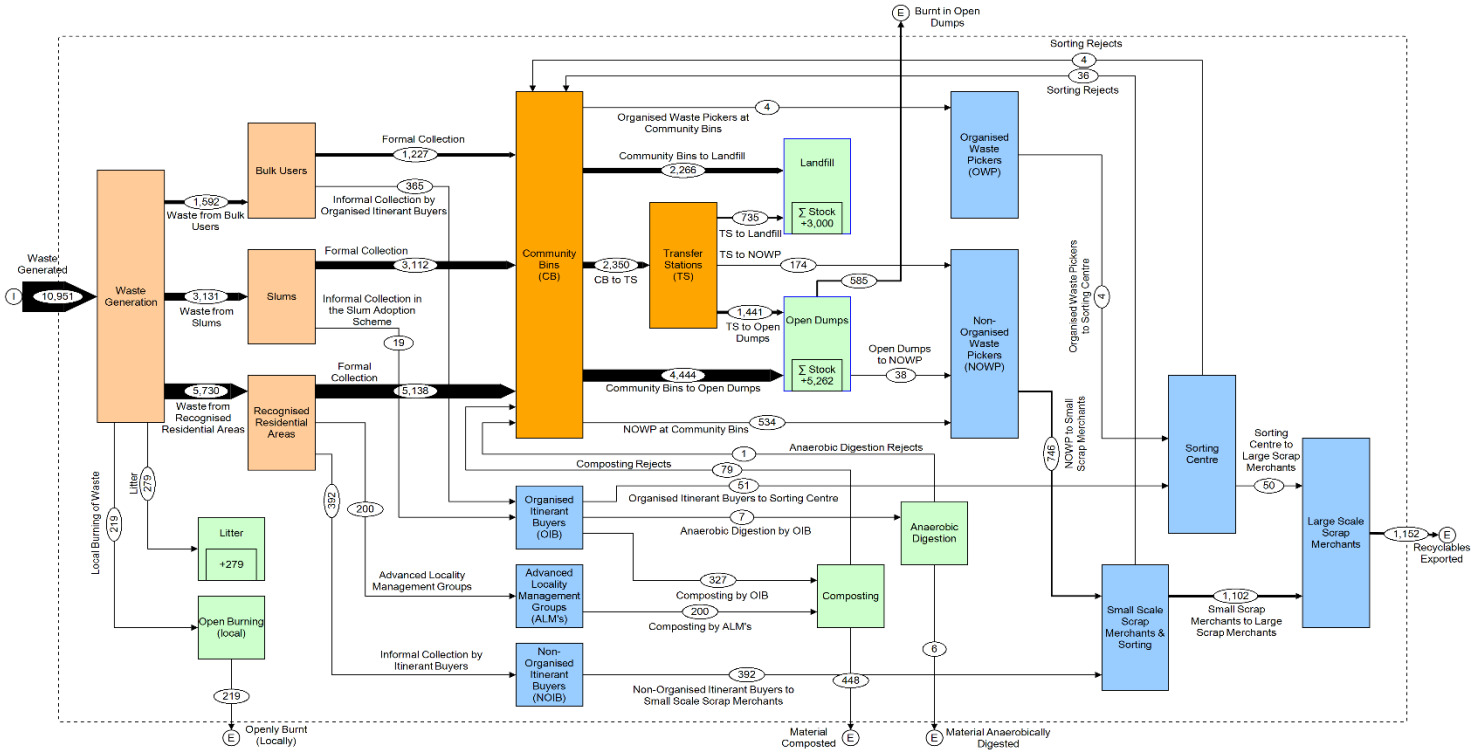

Recycling rate and systems

EPSRC
Engineering and Physical Sciences Research Council

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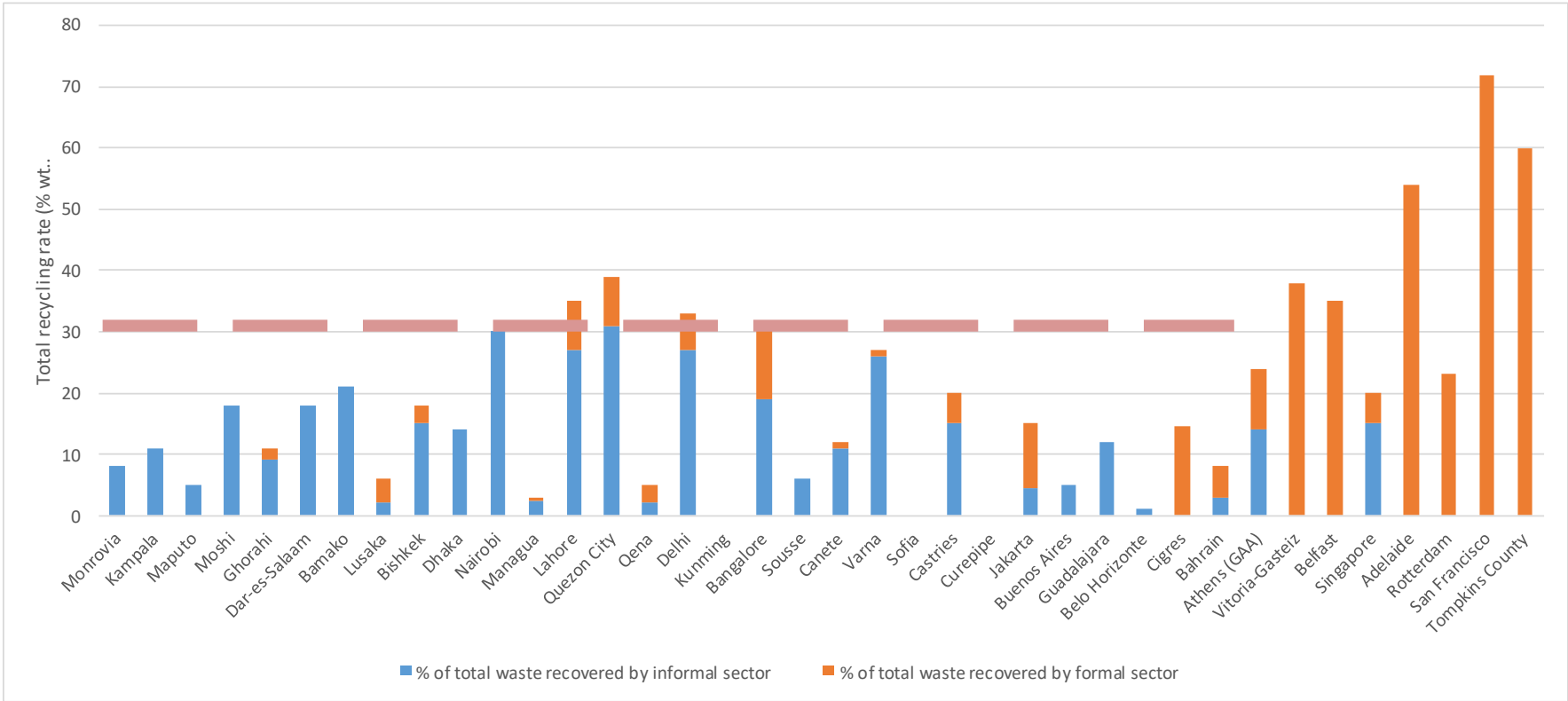

Recycling rates around the World

Source: Velis et al., in preparation

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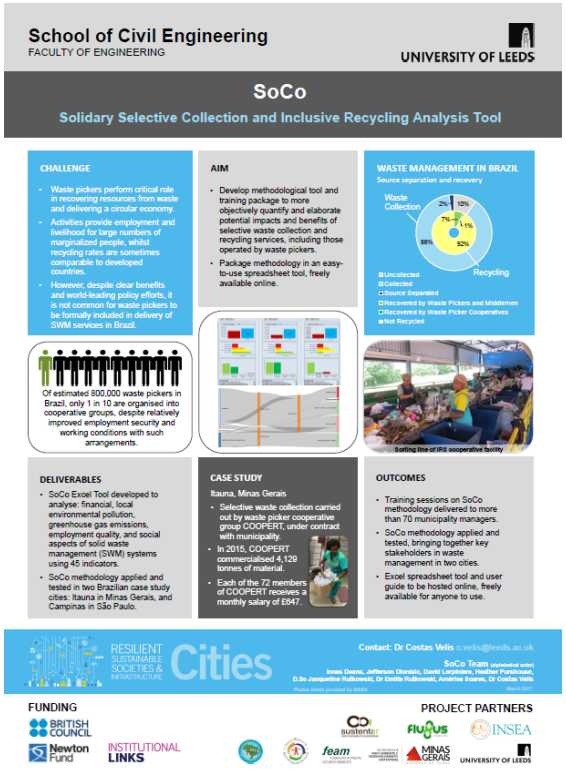

https://soco.leeds.ac.uk/

SoCo tool: Solidary selective collection

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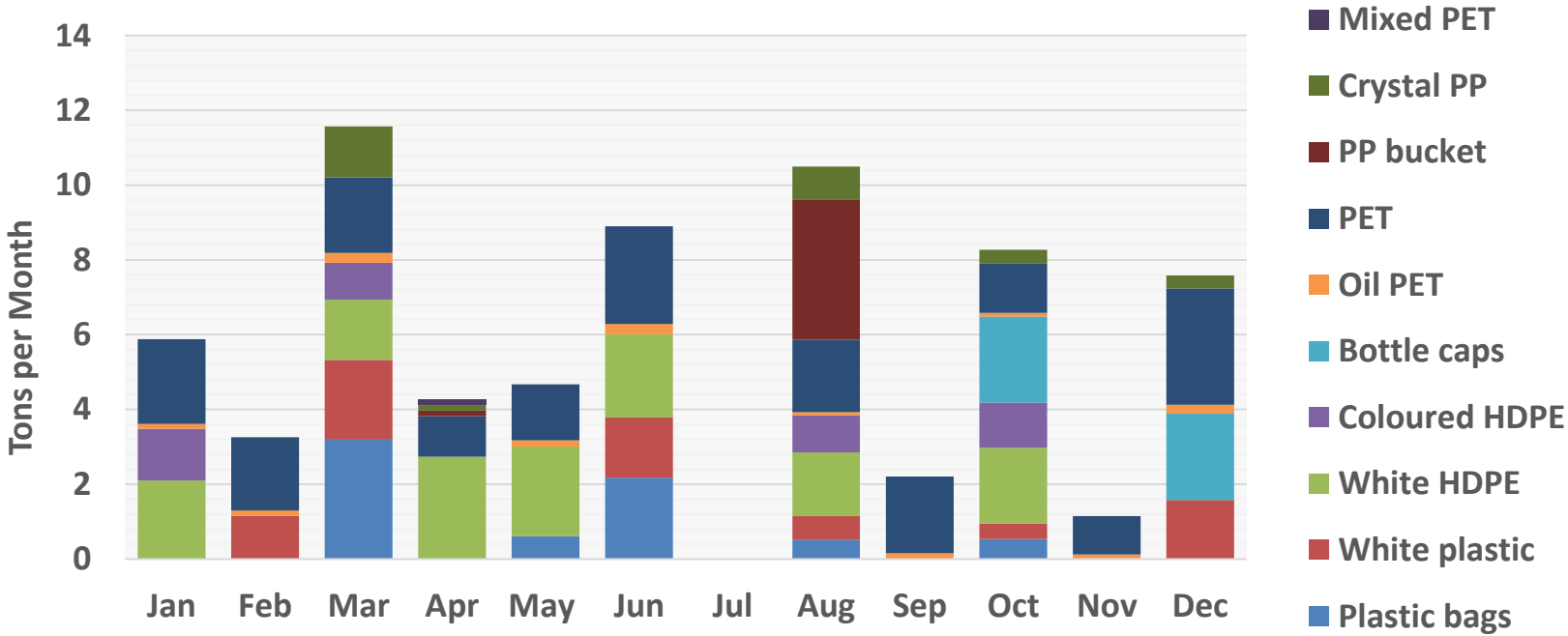
Plastics sorted in 2016



SoCo project: Cooperative in Brazil – Effective plastics sorting

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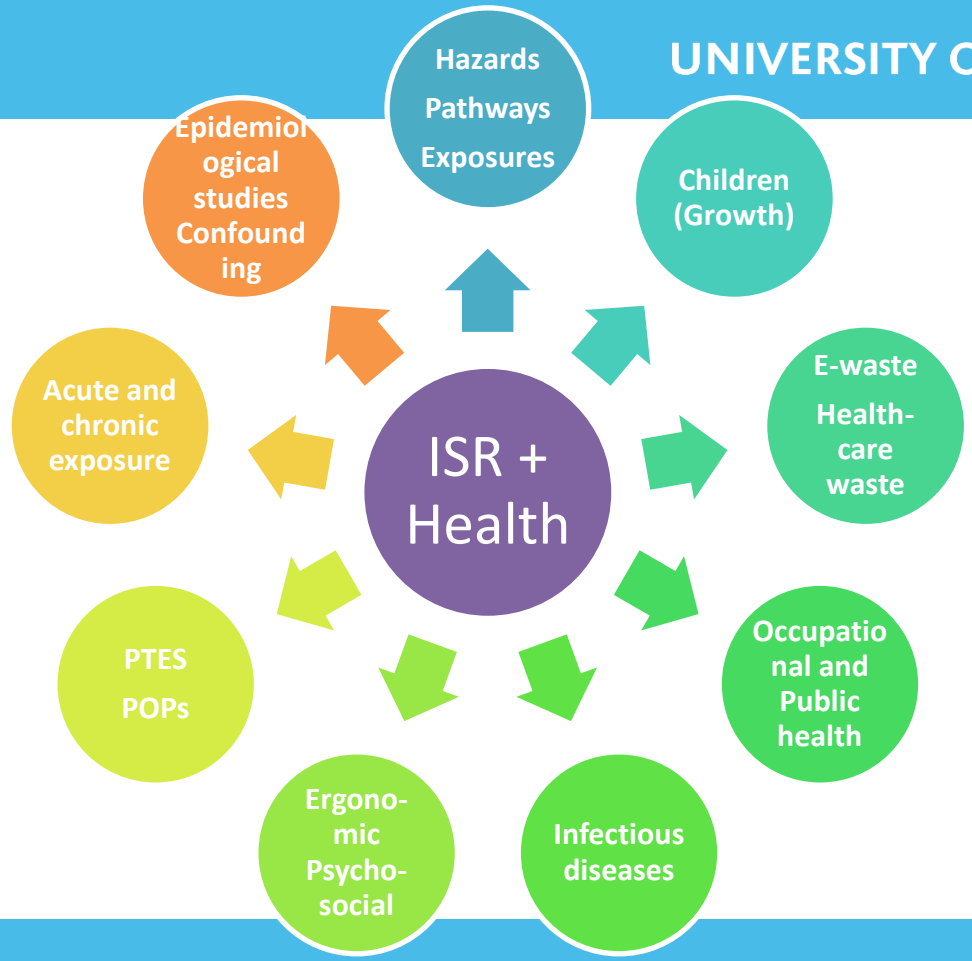

Editorial

WM&R

Waste pickers in Global South: Informal recycling sector in a circular economy era

Waste Management & Research
2017, Vol. 35(4) 329–331

DOI: 10.1177/0734242X17702024
journals.sagepub.com/home/wmr
SAGE

Informal sector activities are prevalent across the Global South (less financially 'developed' parts of the world). Waste pickers are part the informal sector and often officially referred to as the 'informal recycling sector' (IRS), or termed in the US 'scavengers' and 'catadores'/ 'cartoneros' in South America. Their informality could be viewed as an expression of the wider social organization system prevailing in their countries, as well as of the governance structures and financial activity mode of the waste management

3. Waste picking, autonomous or organised, is here to stay and thrive in the 'foreseeable' urban future. This is partly owing to the rapid, unplanned urbanisation, mainly in Africa and South East Asia, which is lacking in state-provided infrastructure, and further encouraged by (local) resource scarcity. Despite overall increases in gross domestic product (GDP) and between-country convergence, widening of within-city and country socioeconomic disparities continues to drive

Waste picking challenges

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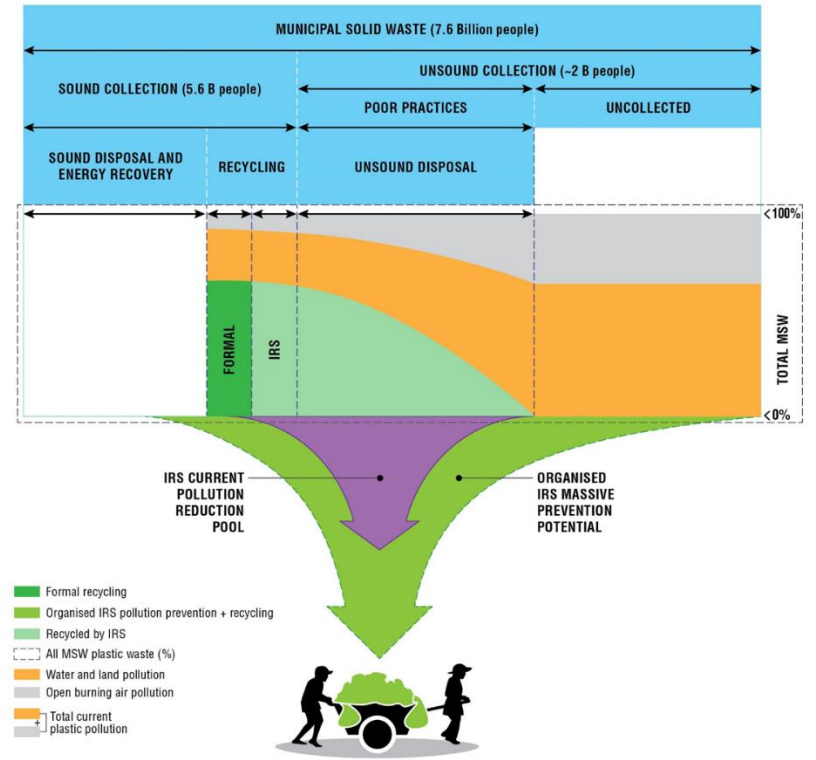

Supporting inclusion/ formalisation IRS for plastics pollution prevention

Source: CSIRO and UoL – under preparation

Recycling and pollution?

ISWA TASK FORCE
on Globalisation and Waste Management
PUBLICATIONS

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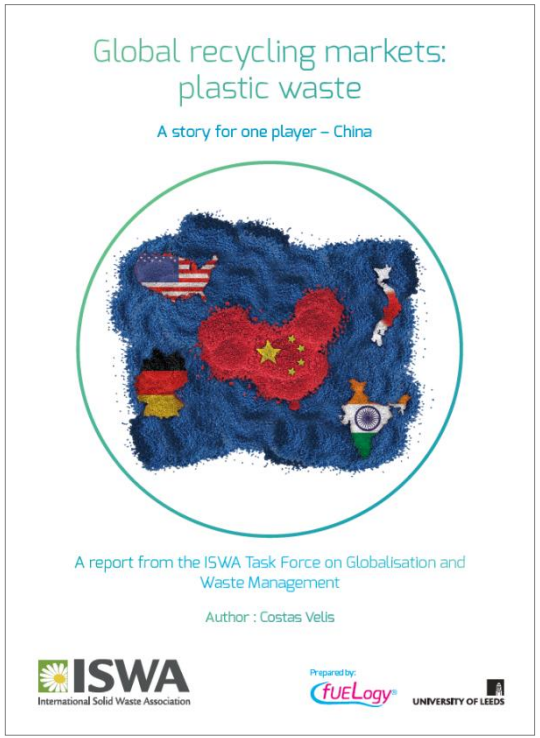

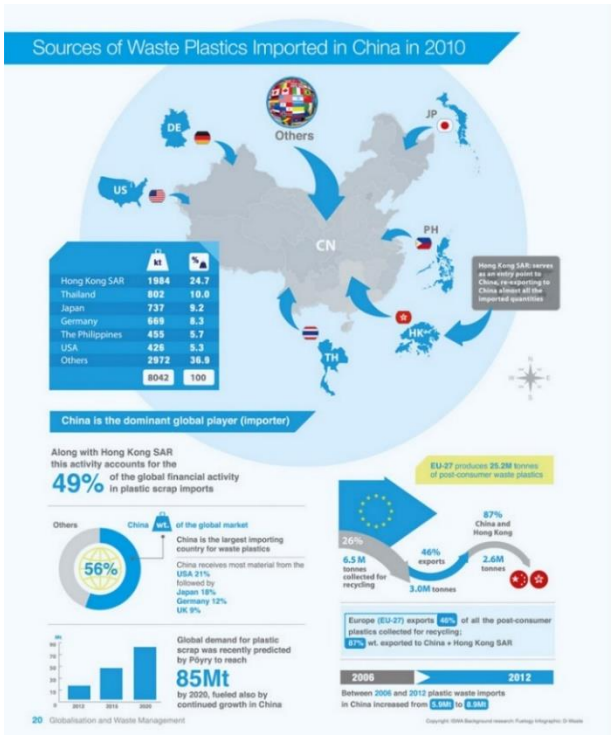

Global recycling systems rely on exports

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Uncontrolled residues management for plastics in China

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Global review on the safer end of engineered life

EngineeringX

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Lloyd's Register Foundation

The global review on Safer End of Engineered Life

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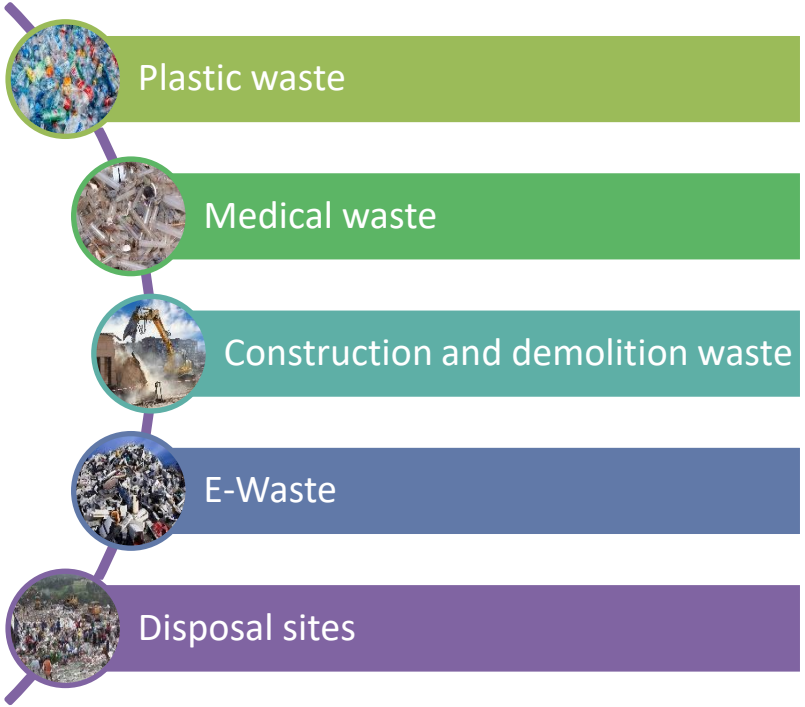

~15,000 articles reviewed

The global review on Safer End of Engineered Life

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Sources

MSW formal collection

MSW informal collection

E-waste

Pathways

MSW sorting

Careful sorting reduces risk of contamination

Despite rigorous standards, legacy substances

However lack of controls may lead to contamination from legacy substances

E-waste processing

Legacy substances may find their way into undesirable places

Thermal release of potentially hazardous substances Transformation during incomplete combustion

Receptors

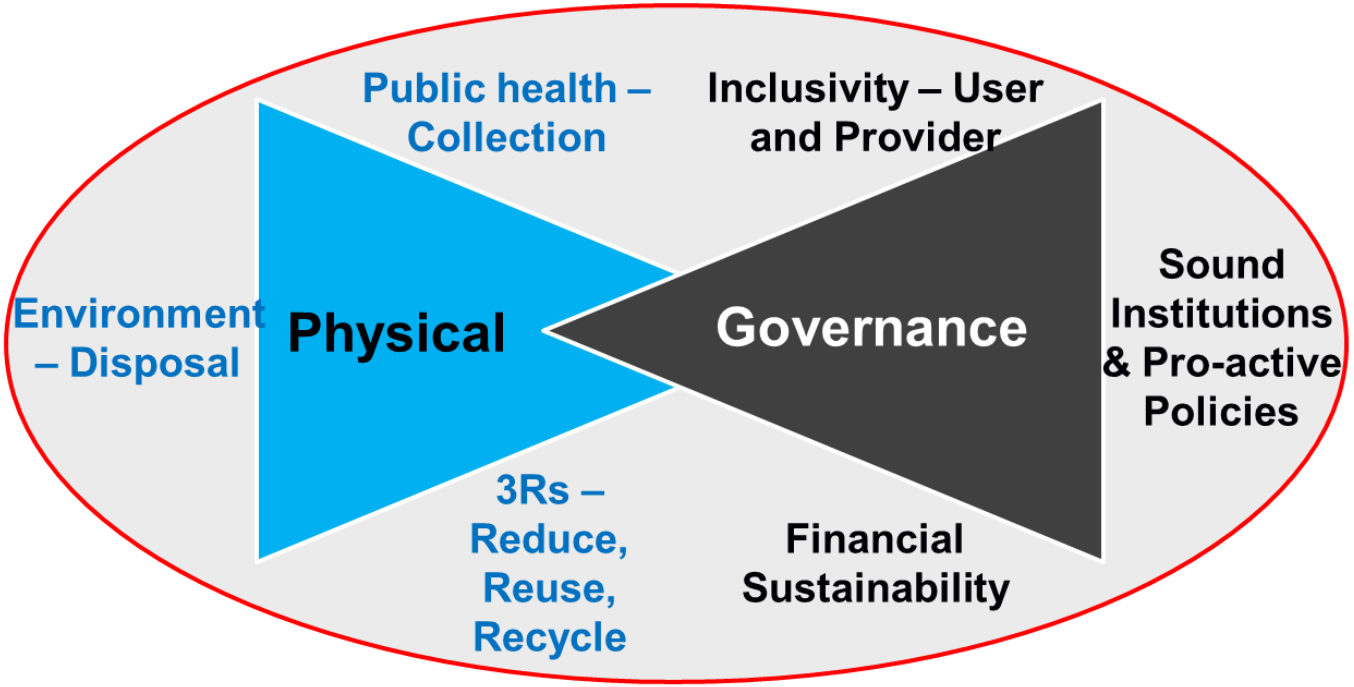
Children are susceptible because they chew toys..... and eat mud!

Inhalation of gaseous, liquid and solid substances of concern

Example of potential hazards and pathways toward sensitive receptors for plastics

Engineering solutions: YES!

But need maths and quantification put in socioeconomic context



Source: Wilson et al., 2012

Integrated sustainable waste management framework

Modelling plastic pollution complexity

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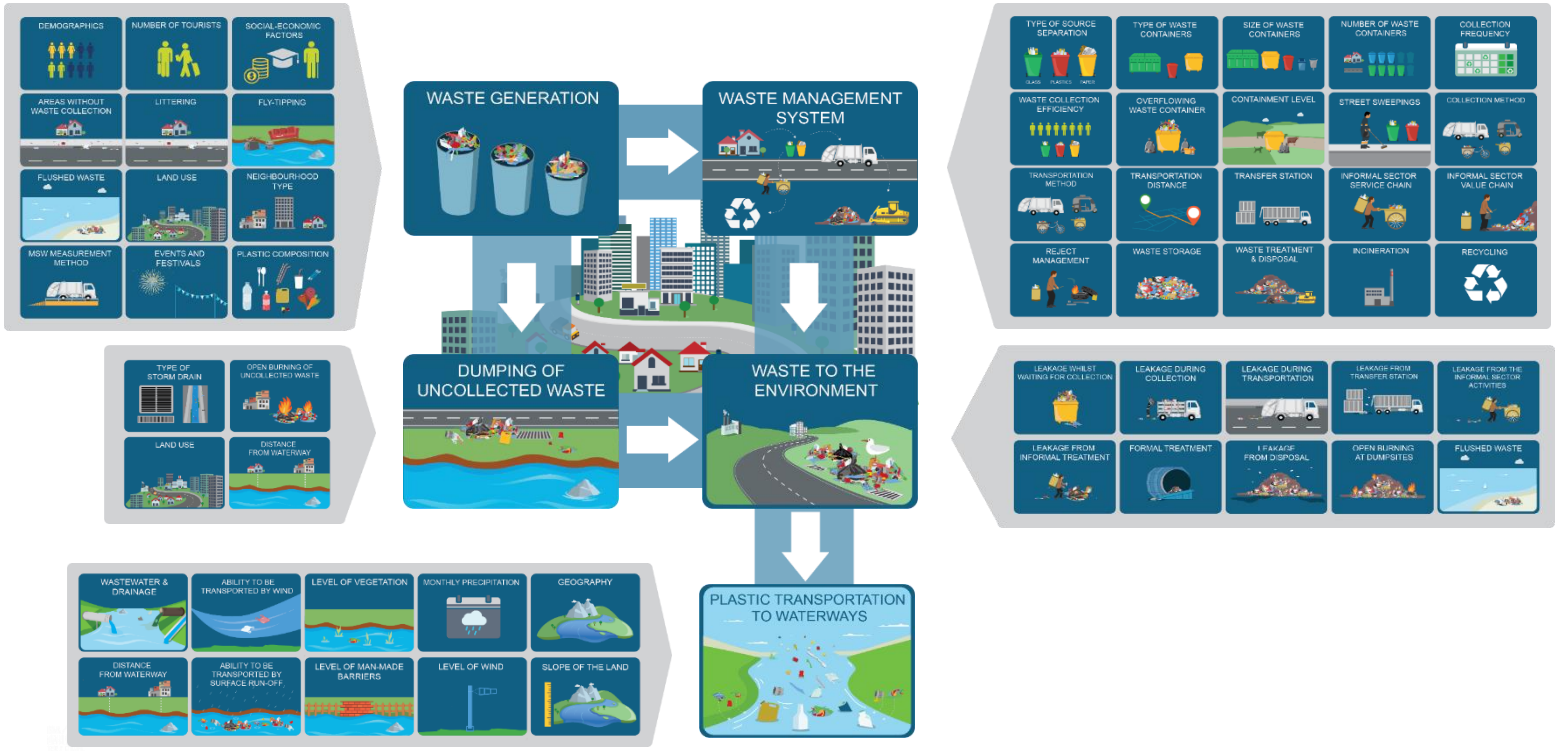

Human - engineering – environment complex systems

PLASTIC WASTE POLLUTION CALCULATOR

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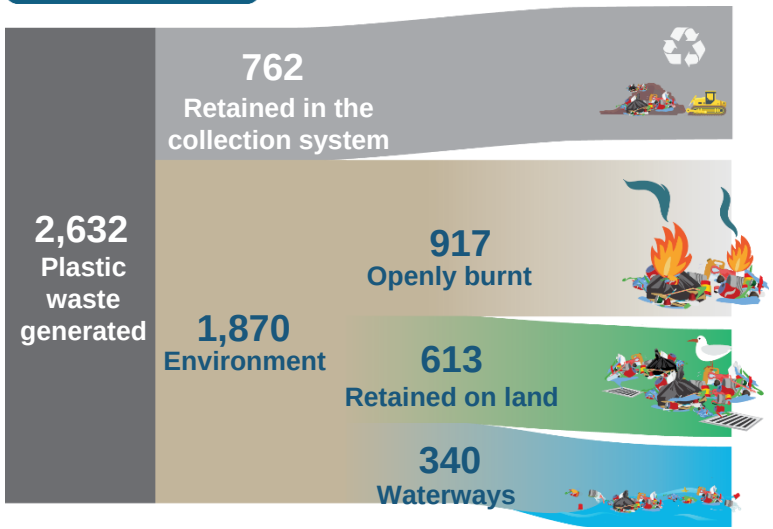
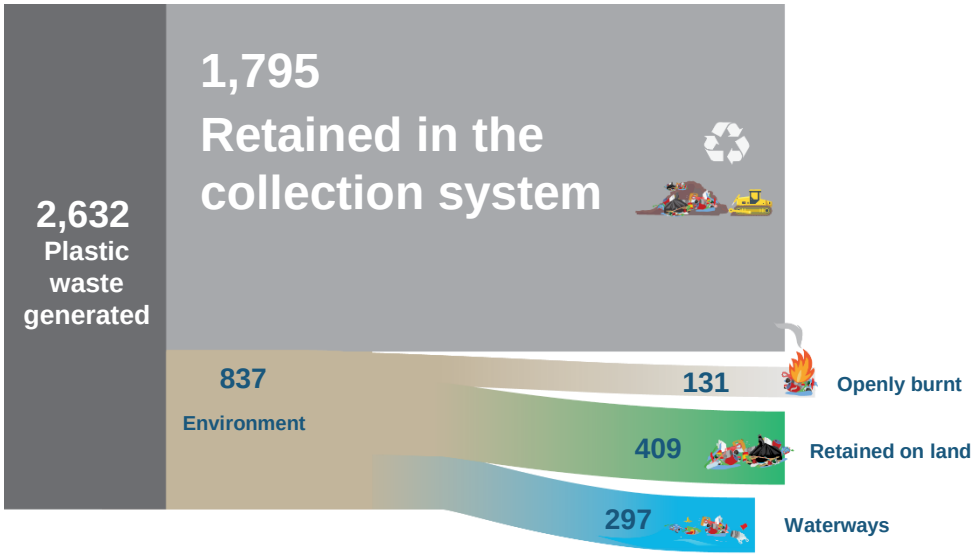
WASTE COLLECTION EFFICIENCY

30%



WASTE COLLECTION EFFICIENCY

90%



ISWA MARINE TASK FORCE

Effect of improving collection infrastructure / service

ISWA
International Solid Waste Association

Solid waste management laboratory: sample preparation

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State-of-the-art laboratory facilities for waste characterisation

Scope: Major solid waste and recourse recovery challenges

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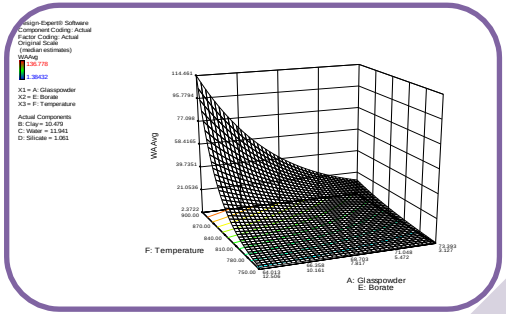
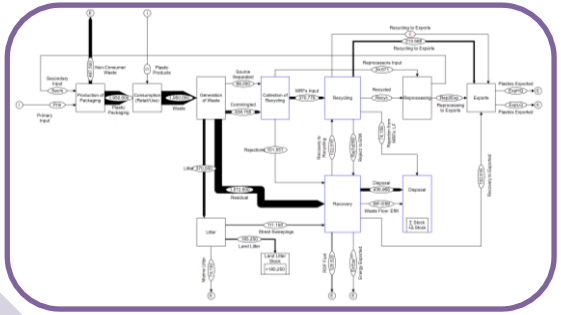


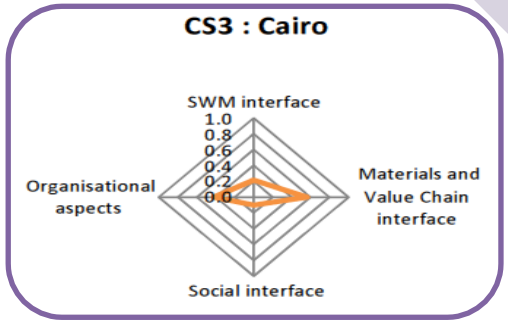
Laboratory

(characterisation – processing – sampling – uncertainty)

Modelling material flows in systems

(plant – city – country – economy level)





New analytical tools (assessment methodologies – indicators)

Global assessment and benchmarking

(city – country level)

Approach: With multiple tools – core in environmental engineering – supported by cross-disciplinary collaborations

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