School of Civil Engineering
Institute for Resilient Infrastructure (iRI)
Institute for Public Health & Environmental Engineering (iPHEE)
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Informal / inclusive recycling in the Global South: 10 challenging ideas

Dr Costas Velis

ORIS Workshop 2016: Urban Waste Problem or Solution?
Belo Horizonte, Brazil
06 July 2016

University of Leeds: Cross- disciplinary teams and expertise

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CERRY: Circular Economy & Resource Recovery

Part of University Theme on

Cities, Sustainable Societies and Infrastructure

Informal sector recycling: A continuum / wide spectrum

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Partially misleading terminology

Definition from a 2006 GTZ study (Wehenpohl *et al.* 2007; Scheinberg *et al.* 2010):

'*the informal solid waste sector refers to individuals or enterprises who are involved in recycling and waste management activities but are not sponsored, financed, recognised or allowed by the formal solid waste authorities, or who operate in violation of or in competition with formal authorities*'.

e.g. Completely uncontrolled autonomous activities at dumpsites

e.g. Legal and tax-paying formal orginisations (co-operatives, associations)

ISWA Workshop in Buenos Aires 2011

ISWA TASK FORCE
on Globalisation and Waste Management
PUBLICATIONS

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ISWA acknowledged the role and realties of inclusive recycling

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The Informal Recycling Sector

The issue

It is estimated that some 20 million people around the world depend for their livelihood on informal recycling from municipal solid wastes (Linzner and Lange, 2013) – of the same order as the total employment in the formal waste industry. Working conditions are often unsafe and unhygienic, and child labour is commonplace. The main driver is poverty. So this is a broader development issue that has to be properly addressed, not just one for the solid waste management (SWM) sector.

The challenge for the waste sector

In many developing countries, the informal recycling sector achieves notable recycling rates. If this activity were suddenly to cease, then waste quantities requiring collection, treatment and disposal by the formal city system would increase, which could in turn further strain budgets that often are already inadequate to extend collection coverage to unserved communities to protect public health, and to eliminate uncontrolled disposal to protect the environment.

However, poor working conditions, child labour and uncontrolled dumping of residual wastes are neither environmentally nor socially acceptable and undermine the position of the formal, legitimate waste industry. Therefore, a sustainable approach to address the present situation has to be developed and pursued.

The way forward

Despite the considerable challenges, the transformation of a city's informal sector to a formalised part of the overall solid waste management system is in everyone's interests. The recyclers can then work under cleaner conditions, earn a better livelihood and educate their children. Recycling rates can potentially increase and in addition, the transition can facilitate environmental control, reducing littering and dumping of residual wastes as well as bring the 'informal' sector inside the legal and tax systems.

International activities

Many international agencies and NGOs have been active in promoting the inclusion of the informal sector within formal solid waste management systems. GIZ funded a seminal 3-year sector development programme (Gunsilius et al, 2011) - the international finance corporation and Inter-American Development Bank are also active - the informal recycling sector has been prioritised in new joint EU-African research and innovation agenda on waste management. Global brand owners are also active, on both packaging waste and waste electrical and electronic equipment (WEEE). Active international NGOs include the Bill and Melinda Gates and Clinton Foundations; the local NGO Chintan was presented with the prestigious Human Rights Special Mention Prize of the French Republic, by the French Ambassador on 26 March 2014, for its success in giving a voice to the poorest of the poor, India's waste pickers and kabaris.

Task Force Activity and Outputs

The ISWA Task Force convened an international workshop in Buenos Aires in June 2011, bringing together the formal and informal sectors in waste management, NGOs and other stakeholders. This led to a seminal paper which integrated background scientific and social science research with the work initiated in Buenos Aires. It introduced both a systematic framework – or typology – for classifying and analysing possible interventions to promote the transition of the informal recycling sector to a formal part of a city's SWM system, and a simple tool - InteRa - for use in selecting a balanced set of interventions (Velis et al, 2012). The aim of the framework (see Figure 1) is to allow the design of a specific set of interventions tailored to the local situation.

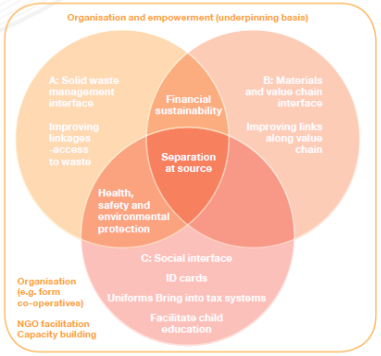

Figure 1 – Analytical framework: This shows the systematic analytical framework developed by the Task Force to aid the design of initiatives to facilitate transition into a formal part of an integrated SWM system in a specific city. Potential interventions are allocated to four categories: the underpinning organisational aspects and three primary interfaces. Some of the interventions, which span several categories, are among those highlighted in Table 4 below as key challenges.

Figure adapted from Velis et al. 2012, where a full typology of interventions is provided.

The informal recycling sector is active in many developing country cities and is a stakeholder group in SWM. Despite the considerable challenges involved (see Table 4 below), dialogue between the formal and informal sectors, and transition to a formalised recycling activity within a city's SWM system, is to the advantage of both, allowing step-by-step improvements in, inter alia, living and working conditions, livelihoods and recycling rates, and the levels of environmental control. Such integration will facilitate the transition from an unacceptable situation to the goal of a fully formalised waste management system.

Key Challenges	Messages / Proposed Solutions
Organisation, capacity building and finance	The informal sector needs to be encouraged and facilitated to organise themselves – e.g. into co-operatives, microenterprises or other legal entity – enabling them to engage responsibly with municipalities and other stakeholders. The facilitation role of local NGOs is often important, as is capacity building and making available access to affordable micro-finance.
Facilitating social acceptability	A key component of many successful schemes has been the issuing of identification cards (and uniforms) to the people doing the recycling; ready identification facilitates access to communities. Some countries have also allowed people to register 'waste picking' as their official employment (e.g. Brazil), which brings them inside the law and the tax system.
Safe working conditions	A key concern is the unhygienic and unsafe working conditions of much current informal recycling. Safe and dignified working conditions need to be promoted.
Implementing separation at source	Separation for recycling should increasingly take place at source rather than from mixed waste, which would immediately help to address the current issues of workers' health and hygiene. Itinerant waste buyers are active in many countries, which is a system that can be further built on and expanded. Source separation will increase both the quality of recycled materials and recycling rates, thus diverting wastes from landfill and improving livelihoods of the recyclers.
Elimination of child labour	Child labour needs to be addressed, by working with informal recyclers to ensure that children go to school, and that recycling activities by children under the legal age of adulthood in the country are reduced and eliminated.
Environmental control	Environmental concerns need to be addressed, with littering around sorting points and illegal dumping of non-recyclable residues being controlled and environmental standards for the sorting and processing of recyclable wastes and for the subsequent reprocessing of recyclates being raised.
Waste picking at landfills	Waste picking at the working face of a modern landfill is unacceptable, as is deliberately setting fire to the waste to recover metals.
Improving data for waste planning	In order for a city to plan for improvements to the SWM system, the authorities need to understand all the waste flows, including both the formal SWM system under their control and the informal recycling system - which will be facilitated by a transition to formalisation.

Table 4: Particular challenges and proposed solutions for integrating the informal recycling sector

Integrated Sustainable Waste Management Framework

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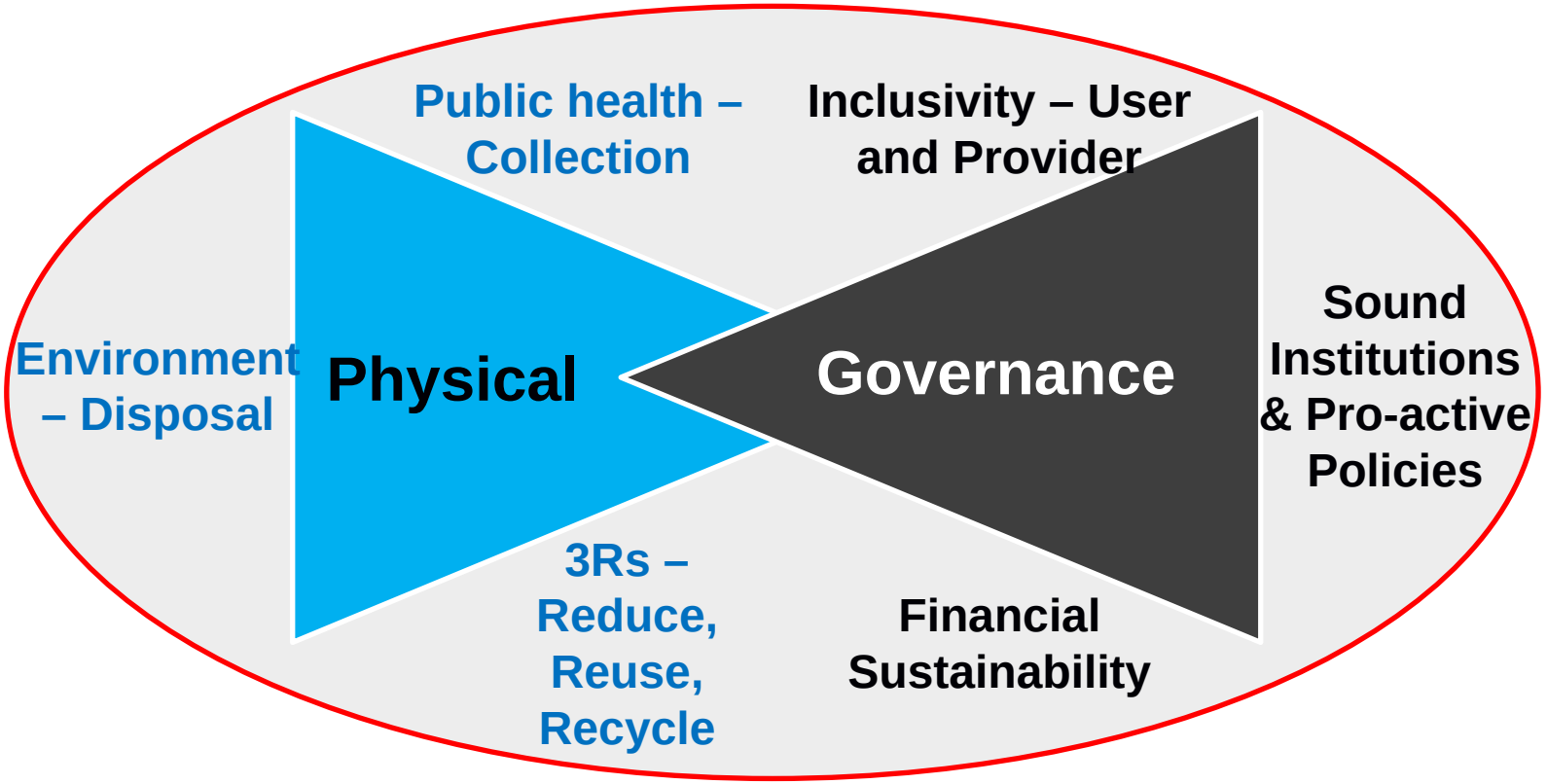

Source: Wilson et al., 2012

UNEP: National Waste Management Strategies

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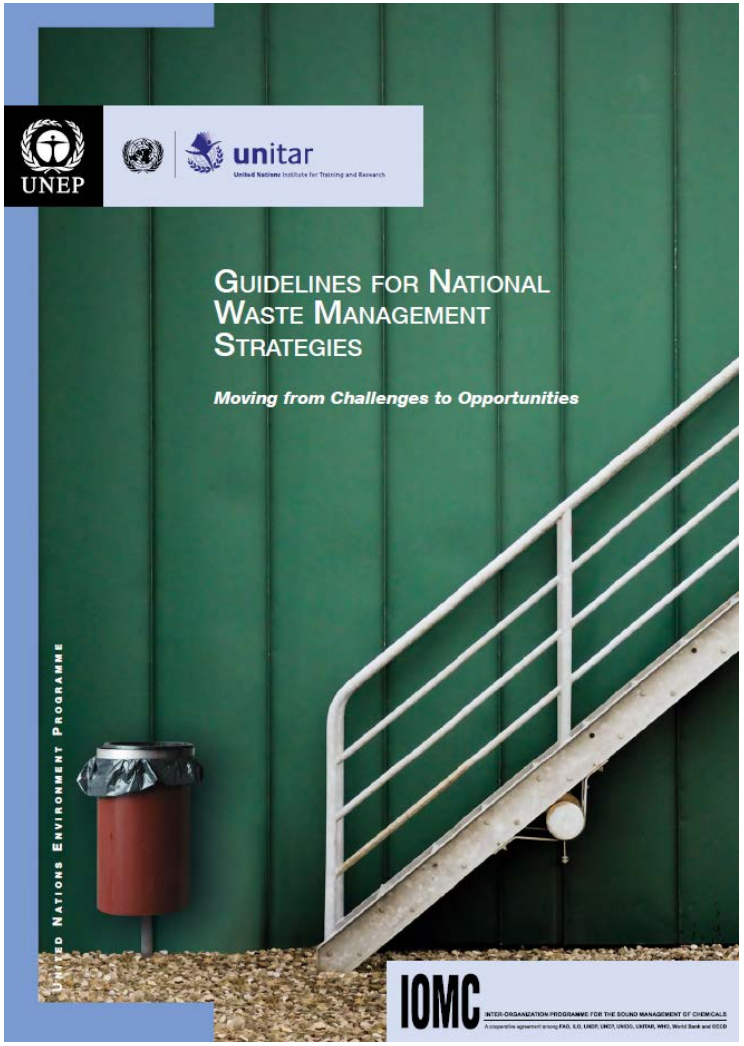

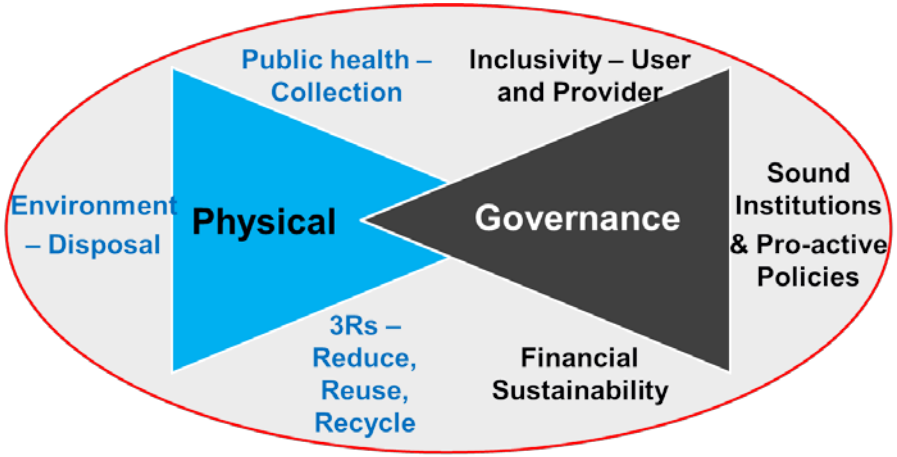

‘Wasteaware’ ISWM benchmark indicators

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Coverage:

- Both physical and governance aspects

Indicators comprise:

- 4 quantitative + 8 composite qualitative

Global applicability:

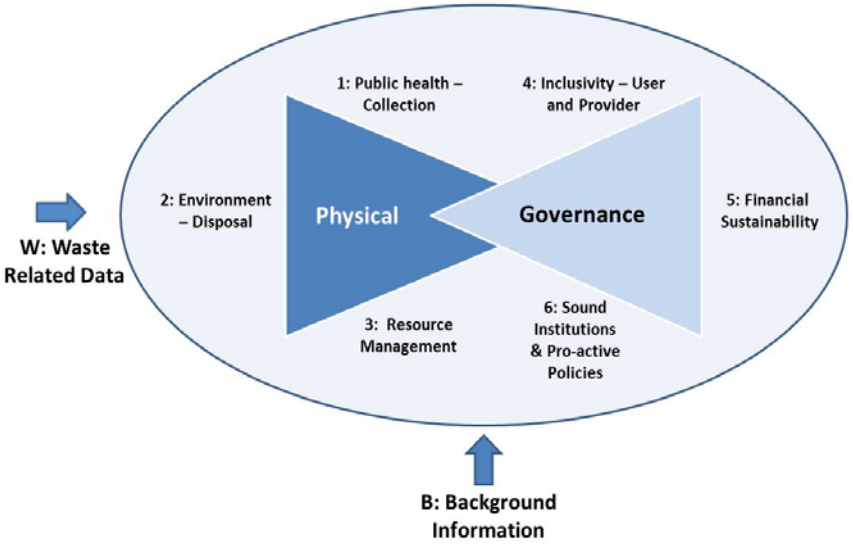
- Both ‘South’ & ‘North’

Visualise relative performance:

- Using ‘Traffic lights’ system

Ready to use:

- Tested in 39 cities in all 6 inhabited continents



Background R&D

- Based on ISWM
- Many person-years of development since 2009
- Builds on work for UN-Habitat and GIZ

Physical indicators: an example

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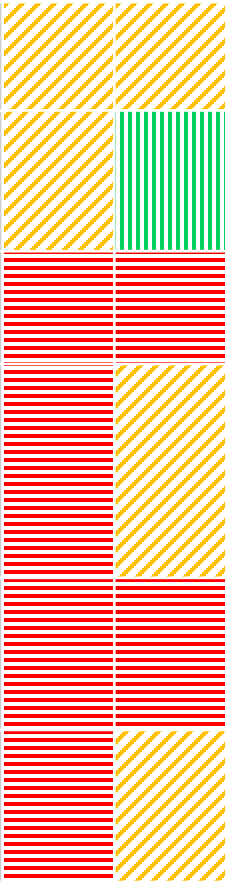
No.	Category	Indicator	Results
1	Public health – Waste collection	Collection coverage	**82%**
1Q		Quality of waste collection service	**M/H**
2	Environmental control – waste treatment and disposal	Controlled disposal	**0%**
2Q		Environmental quality of waste treatment and disposal	**L/M**
3	3Rs – reduce, reuse and recycling	Recycling rate	**< 5%**
3Q		Quality of 3Rs provision	**L/M**



‘Wasteaware’ city indicators: state of the art

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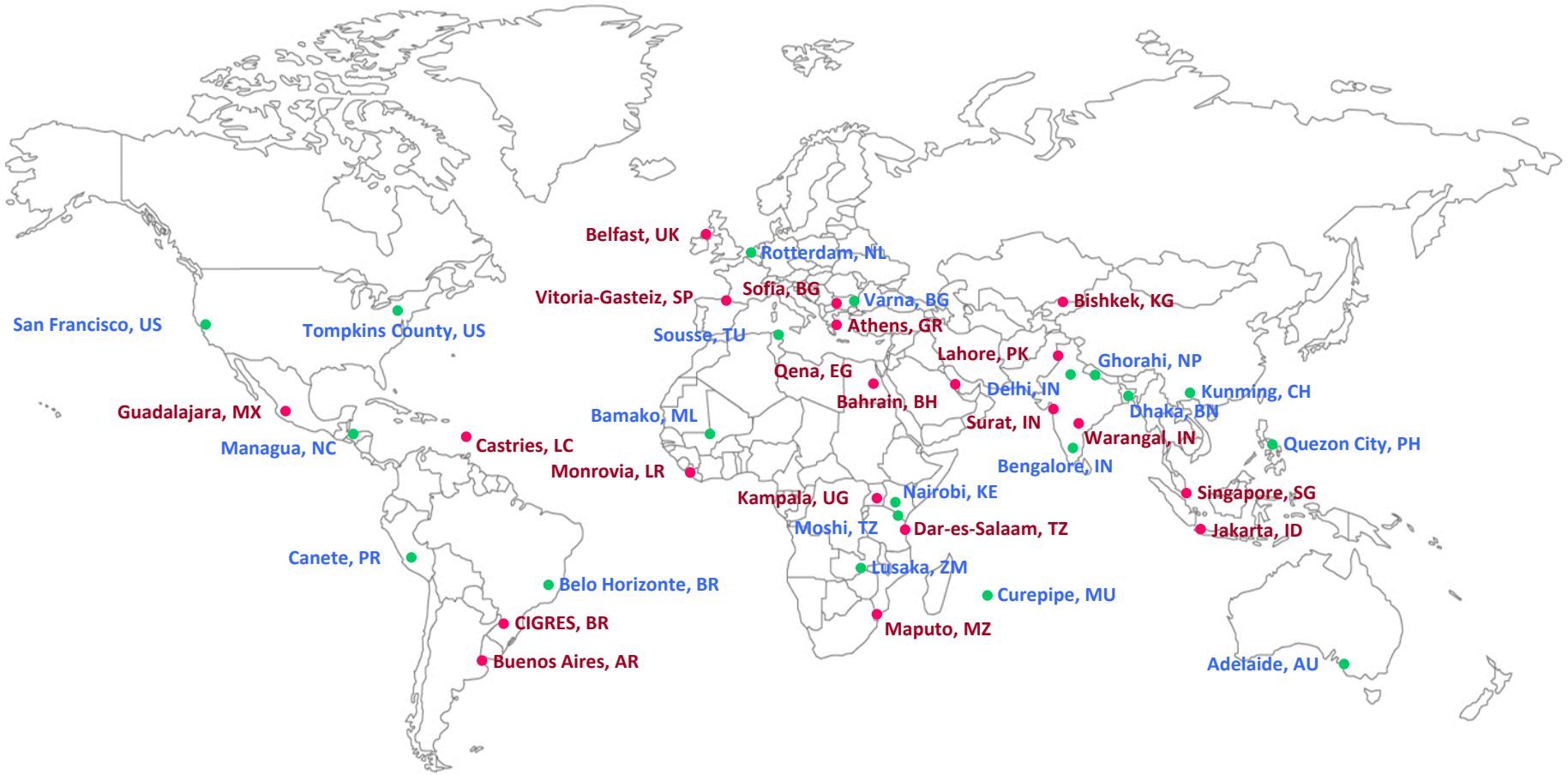

Original 20 cities **Expansion to 40 cities**

Wasteaware: Waste Generation and Social Progress Index (SPI)

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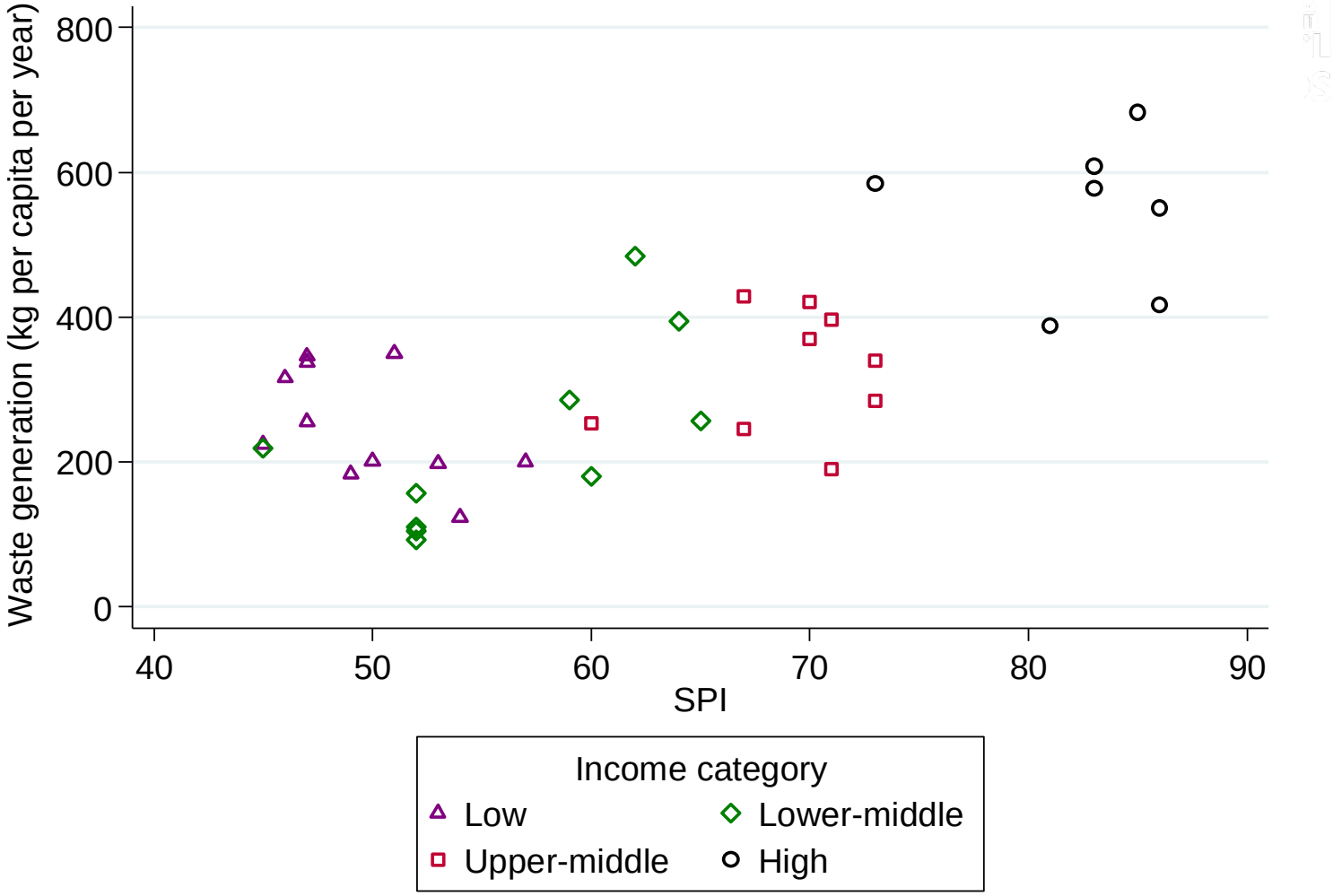

Source: Fargier et al., Unpublished

Global waste management outlook – Editorial Team

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Ljiljana Rodic

David Wilson

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Prasad Modak

Editorial Team

Mona Iyer

Reka Soos

Ainhoa Carpintero

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Otto Simonett

ISWA

International Solid Waste Association

Global waste management outlook

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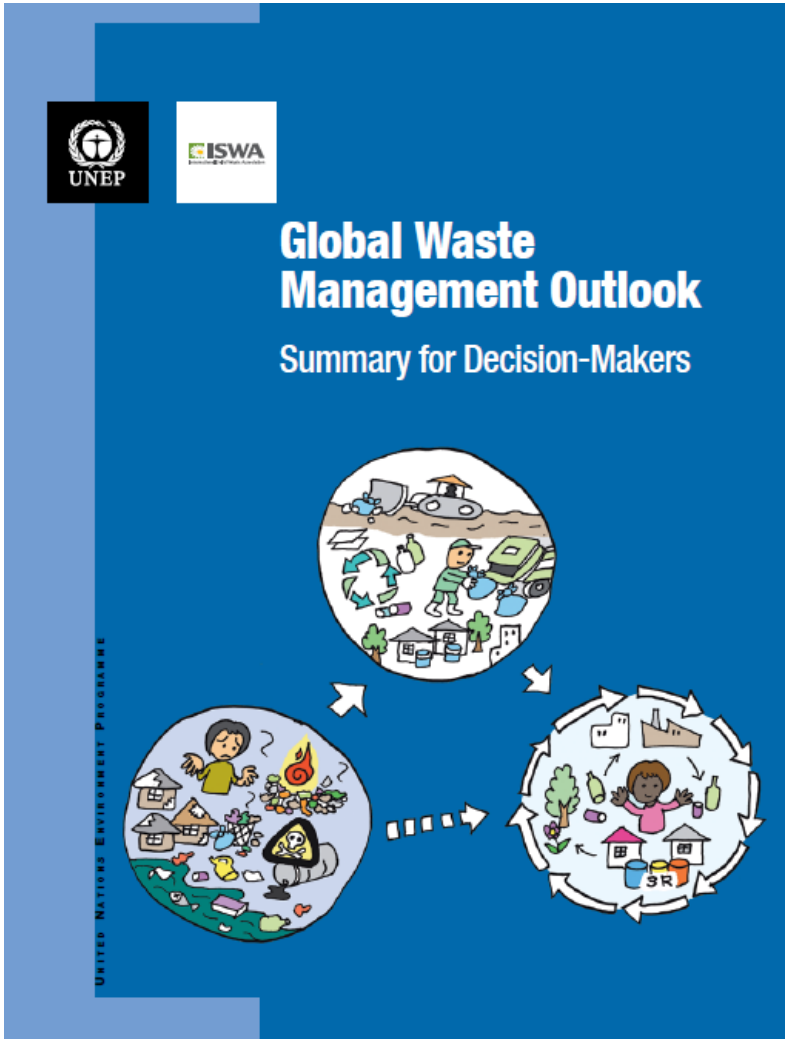

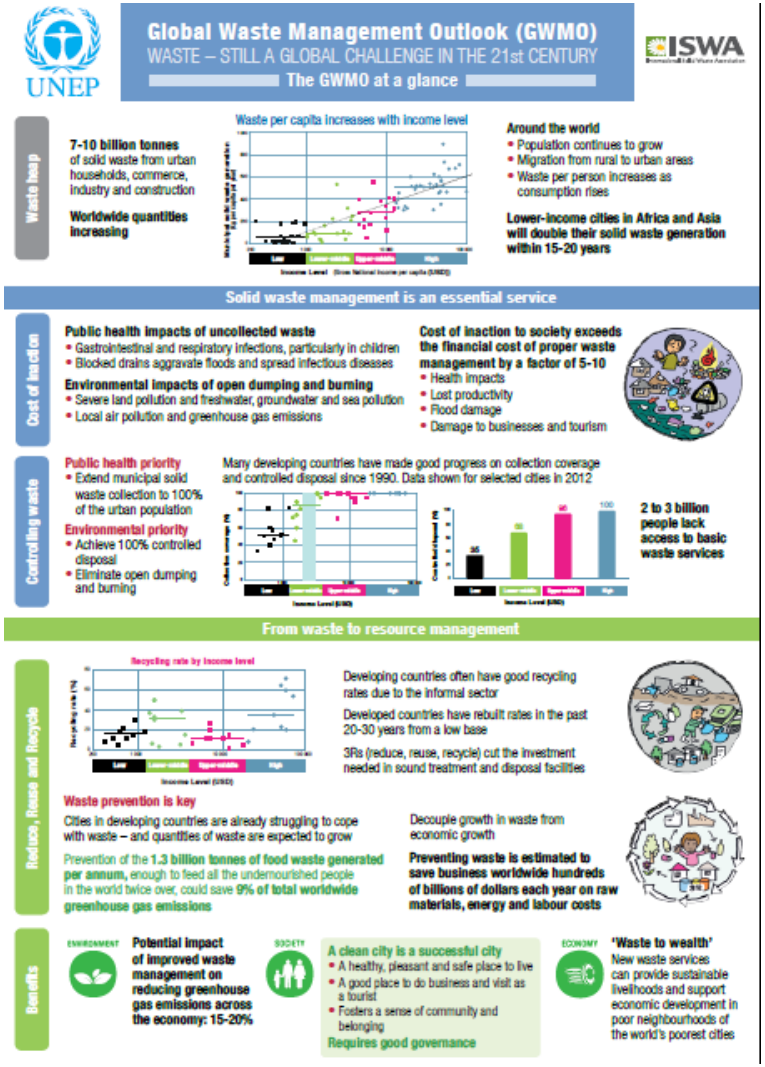

GWMO: Wasteaware city-level data

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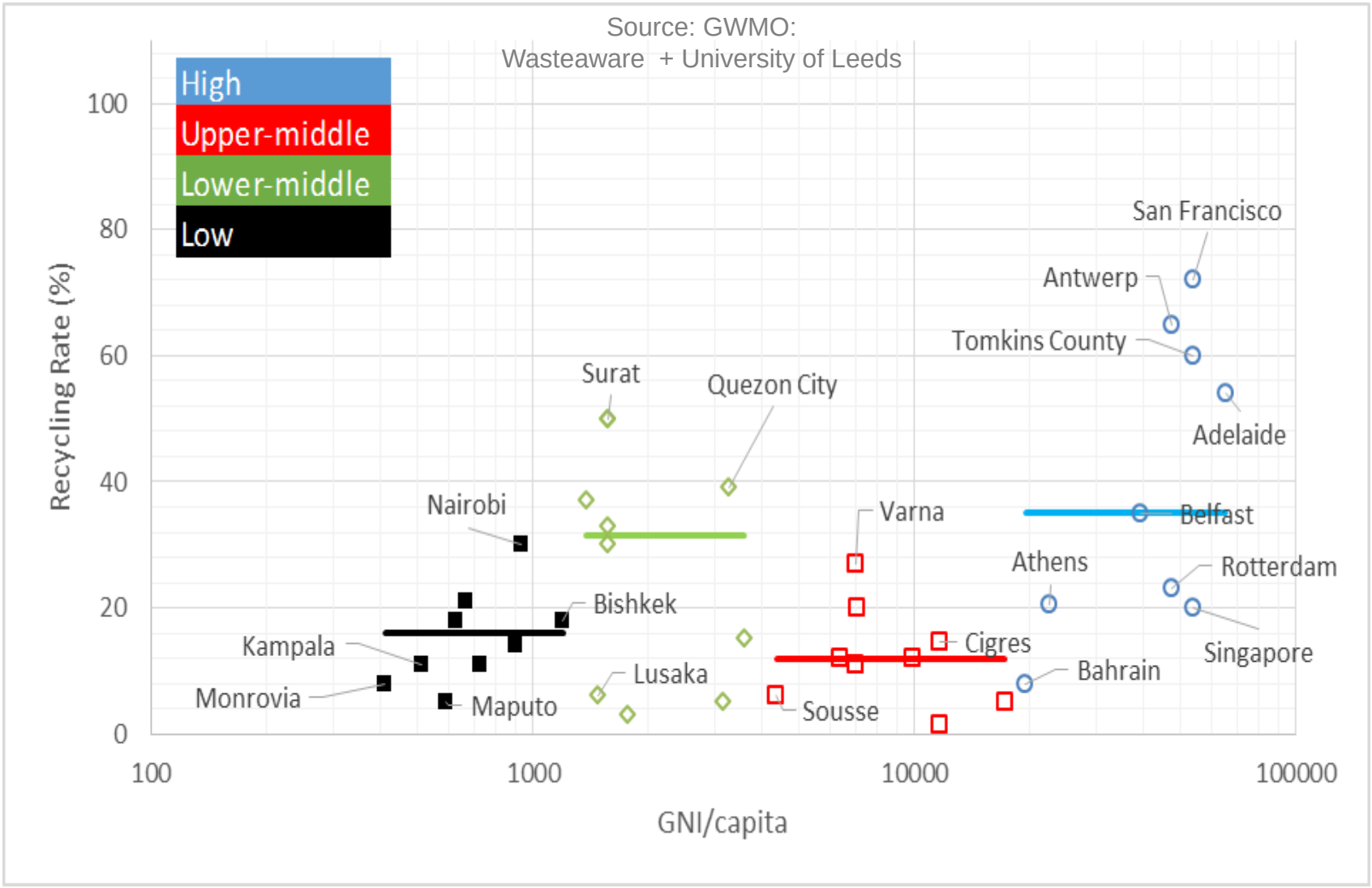

Wasteaware: Recycling – Cultural clusters

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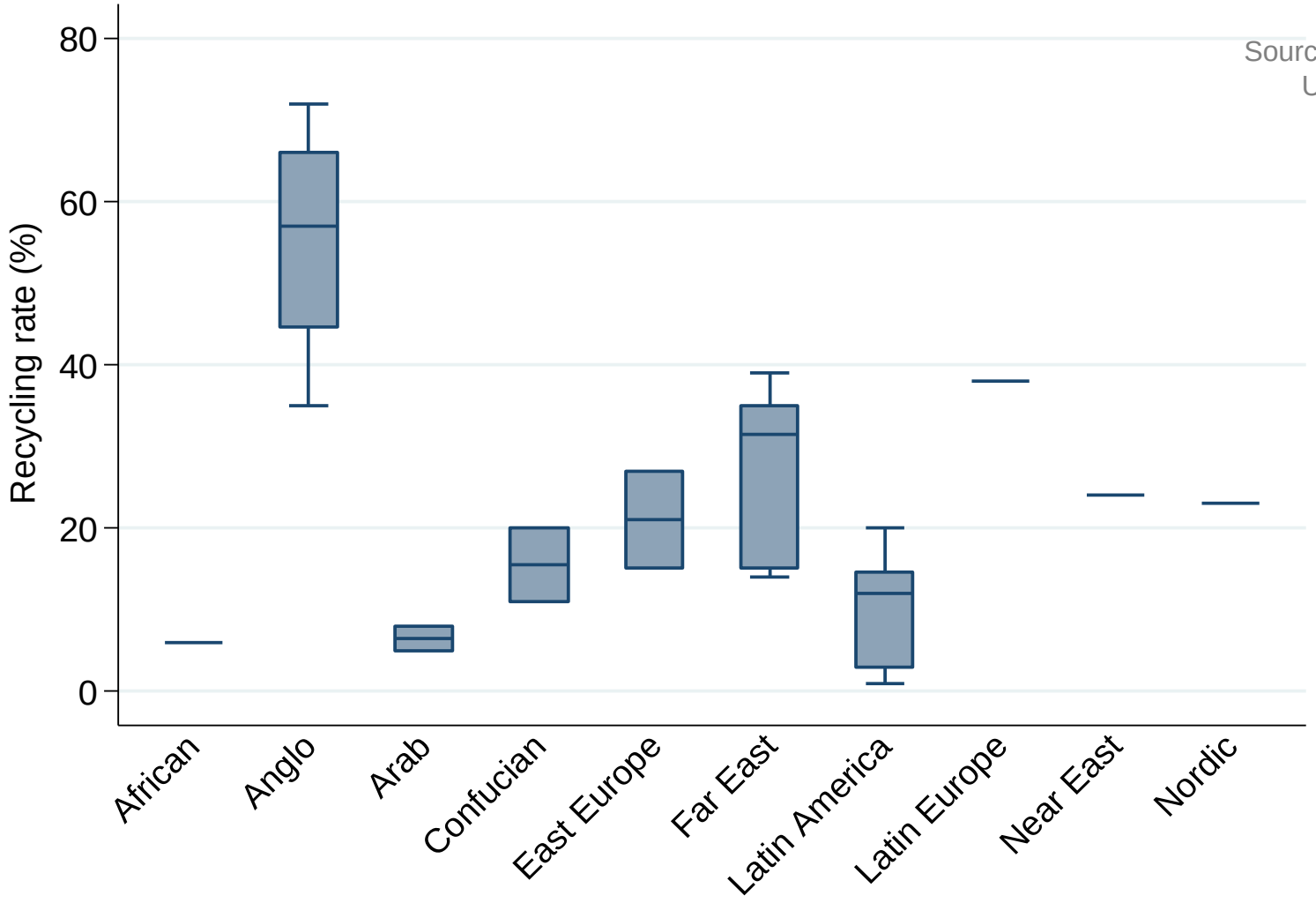

Source: Fargier et al., Unpublished

10 Challenging ideas

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1. IRS can be found all over the world – even in the most affluent countries
2. Politicisation of IRS is local feature in LAC and is not helping to achieve win-win solutions
3. Focusing only on inclusion/ livelihood preservation is not a sustainable strategy: new ‘circular economy’ framework
4. There are limits to what it can achieve regarding recycling rates
5. The “west” has already gone though this process during 1800-1900

Wasteaware: formal recycling

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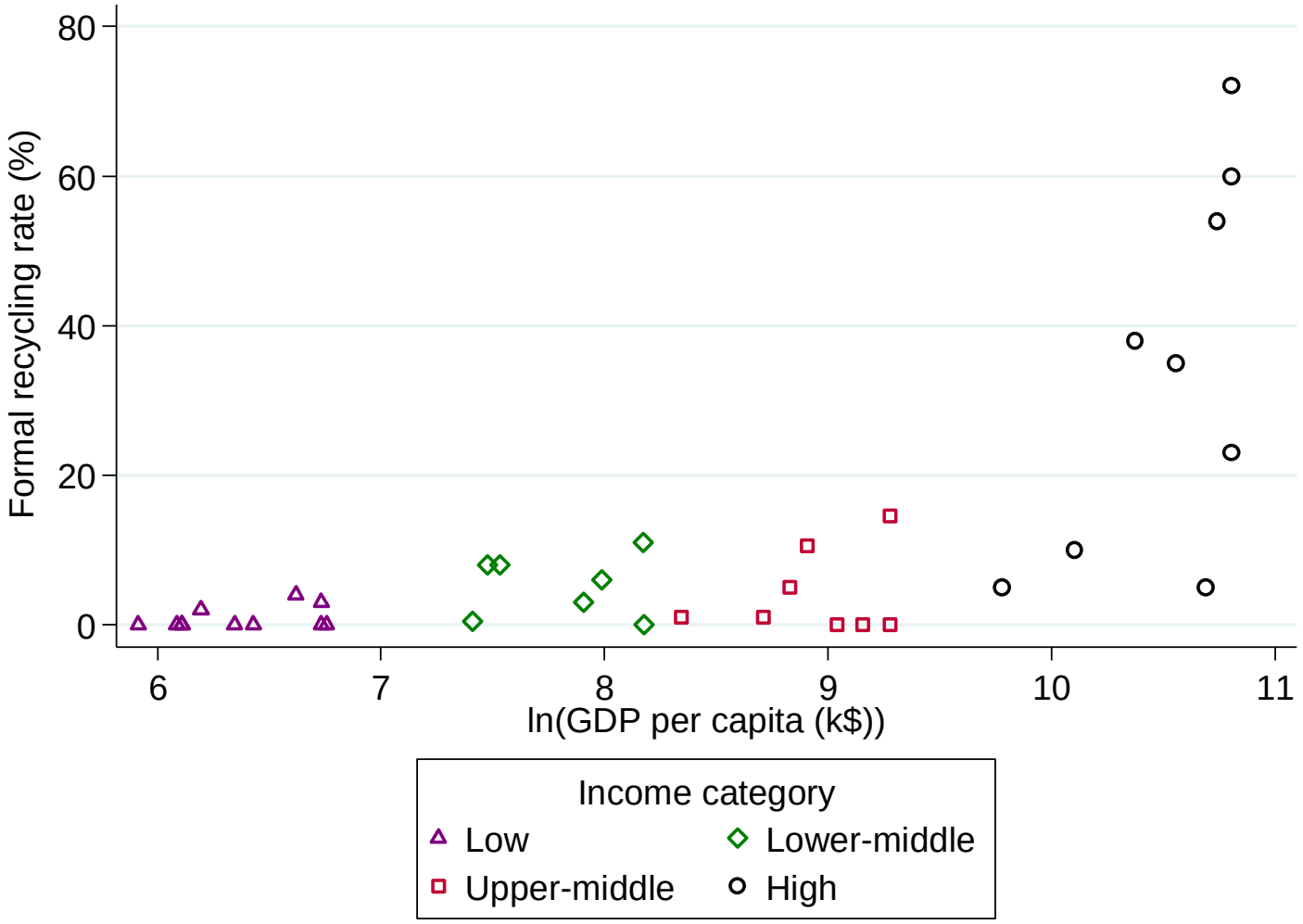

Source: Fargier et al., Unpublished

3 necessary conditions for waste picking

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Wasteaware: informal recycling dominates around the world…

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Total recycling rate (%)

80
70
60
50
40
30
20
10
0

Monrovia
Kampala
Maputo
Moshi
Ghorahi
Dar-es-Salaam
Bamako
Lusaka
Bishkek
Dhaka
Nairobi
Managua
Lahore
Quezon City
Qena
Delhi
Kunming
Bangalore
Sousse
Canete
Varna
Sofia
Castries
Curepipe
Jakarta
Buenos Aires
Guadalajara
Belo Horizonte
Cigres
Bahrain
Athens (GAA)
Vitoria-Gasteiz
Belfast
Singapore
Adelaide
Rotterdam
San Francisco
Tompkins County

% of total waste recovered by informal sector
% of total waste recovered by formal sector

Source: Fargier et al., Unpublished

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Not just about waste!

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Some key aspects to consider

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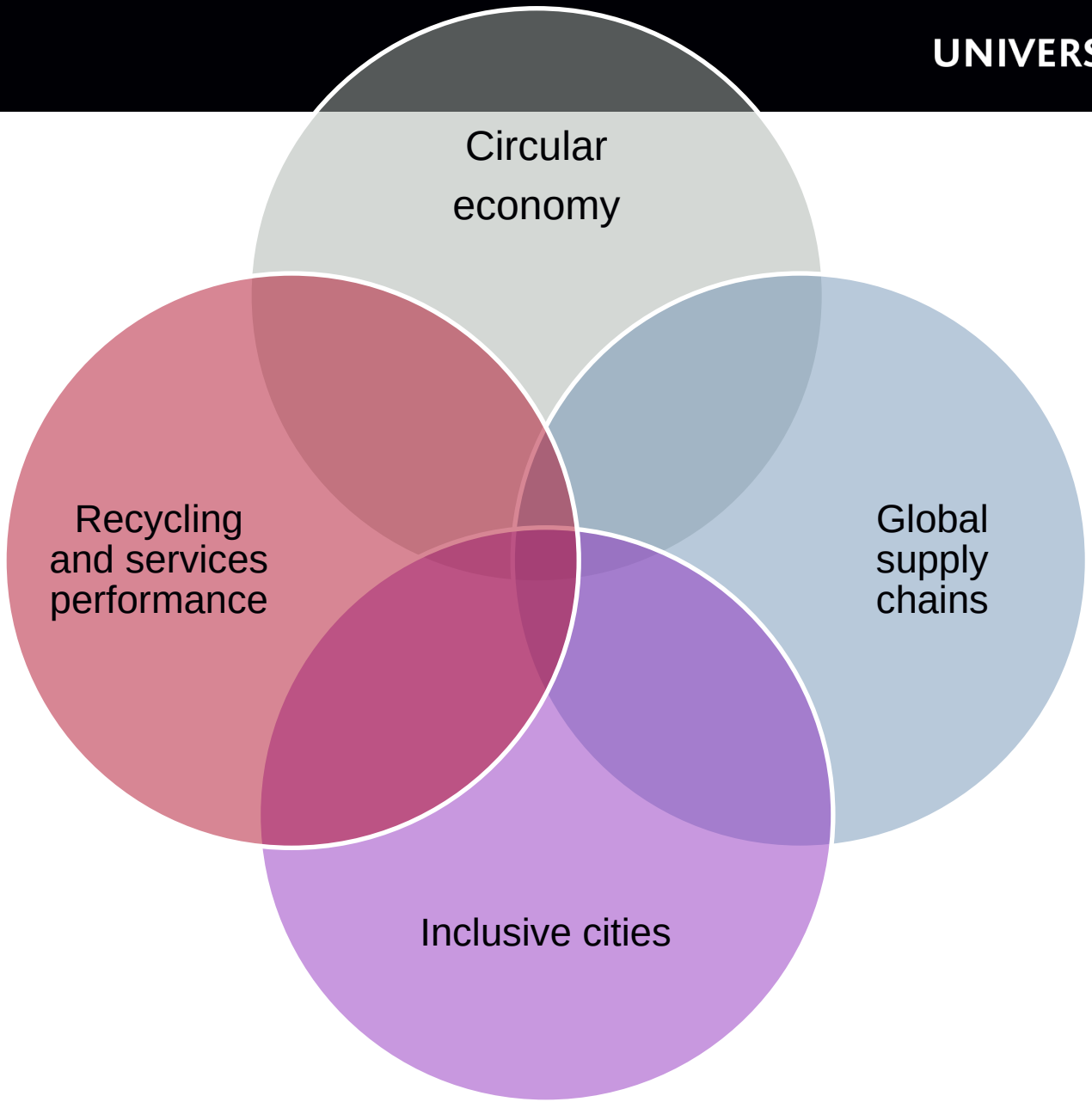

Circular economy vision: limits of recycling

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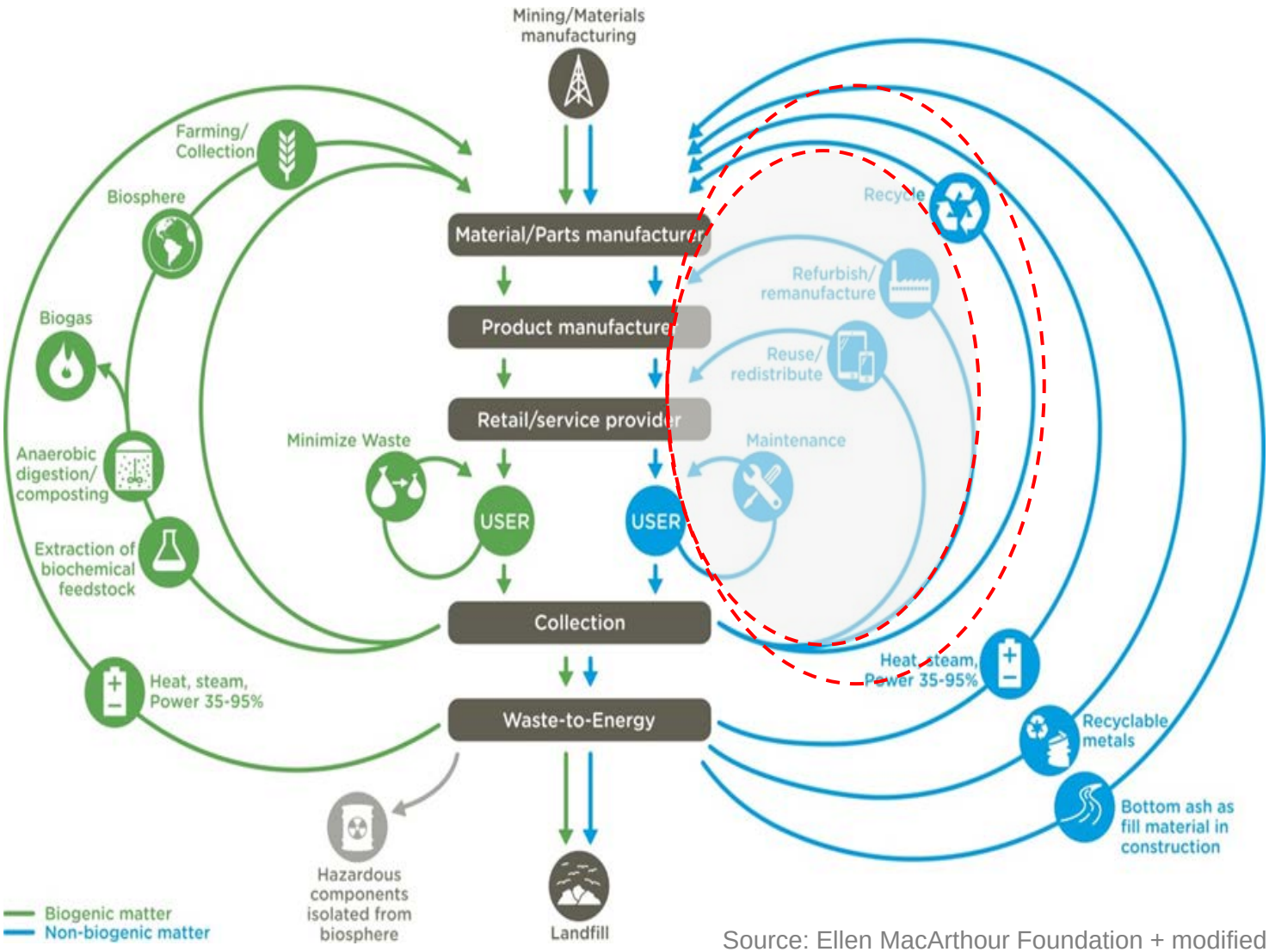

Source: Ellen MacArthour Foundation + modified by Ramboll

Circular + green economy? Any dilemas?

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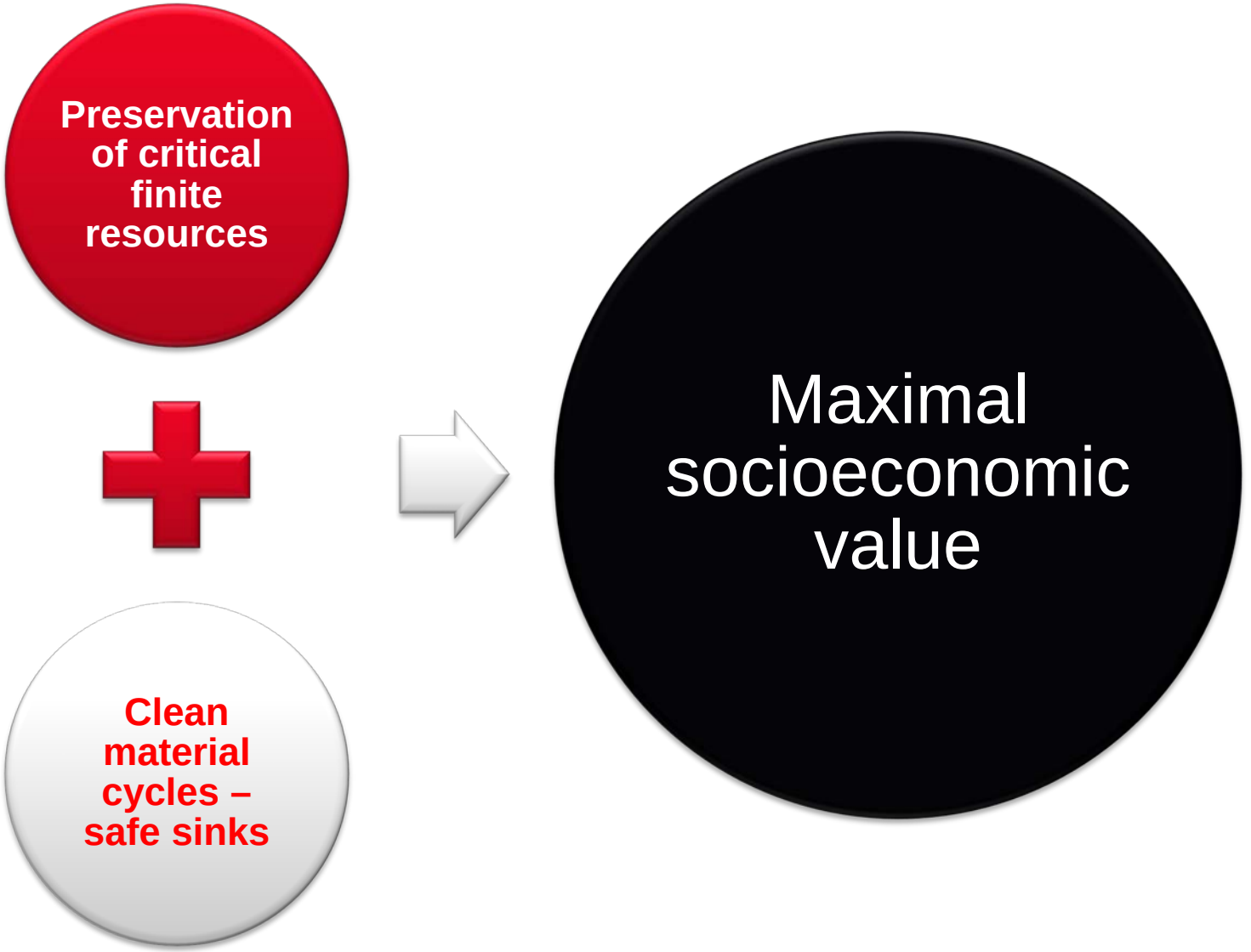

Benefit and cost for whom? The Paracommons…

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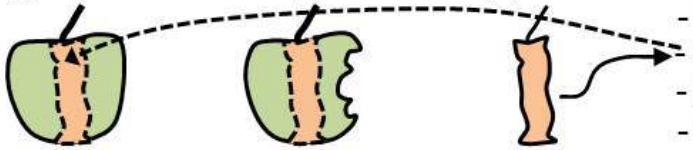
An apple-eater leaves quite a bit of apple flesh on the core which goes to waste:

A



Apple on tree; core inside | Apple being eaten at home | Apple core is discarded

- Householder (proprietor system)
- City dump picker (neighbour system)
- Compost to apple trees (common pool)
- Electricity generation (wider economy)

The city dump picker 'sees' his core further up the chain but has no control

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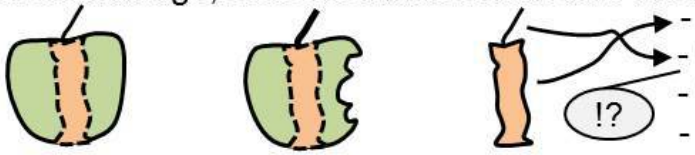
In the future, perhaps the apple is more expensive, or her new partner has different views on wastage; here the householder eats the whole apple minus the stalk:

B



- Householder (proprietor system)
- City dump picker (neighbour system)
- Compost to apple trees (common pool)
- Electricity generation (wider economy)

In the future, perhaps due to a recycling or composting scheme, householder keeps the apple core as organic composting waste. The seeds germinate into new apple trees.

C

- Householder (proprietor system)
- City dump picker (neighbour system)
- Compost to apple trees (common pool)
- Electricity generation (wider economy)

In the future, a new household-waste electricity generator is built. The garbage is sorted, collected and the apple core is turned into electricity for the wider economy:

D

- Householder (proprietor system)
- City dump picker (neighbour system)
- Compost to apple trees (common pool)
- Electricity generation (wider economy)

Source: Bruce Lankford http://brucelankford.org.uk/research/paracommons/

ISWA Globalisation and Waste Management: local actions – global implications

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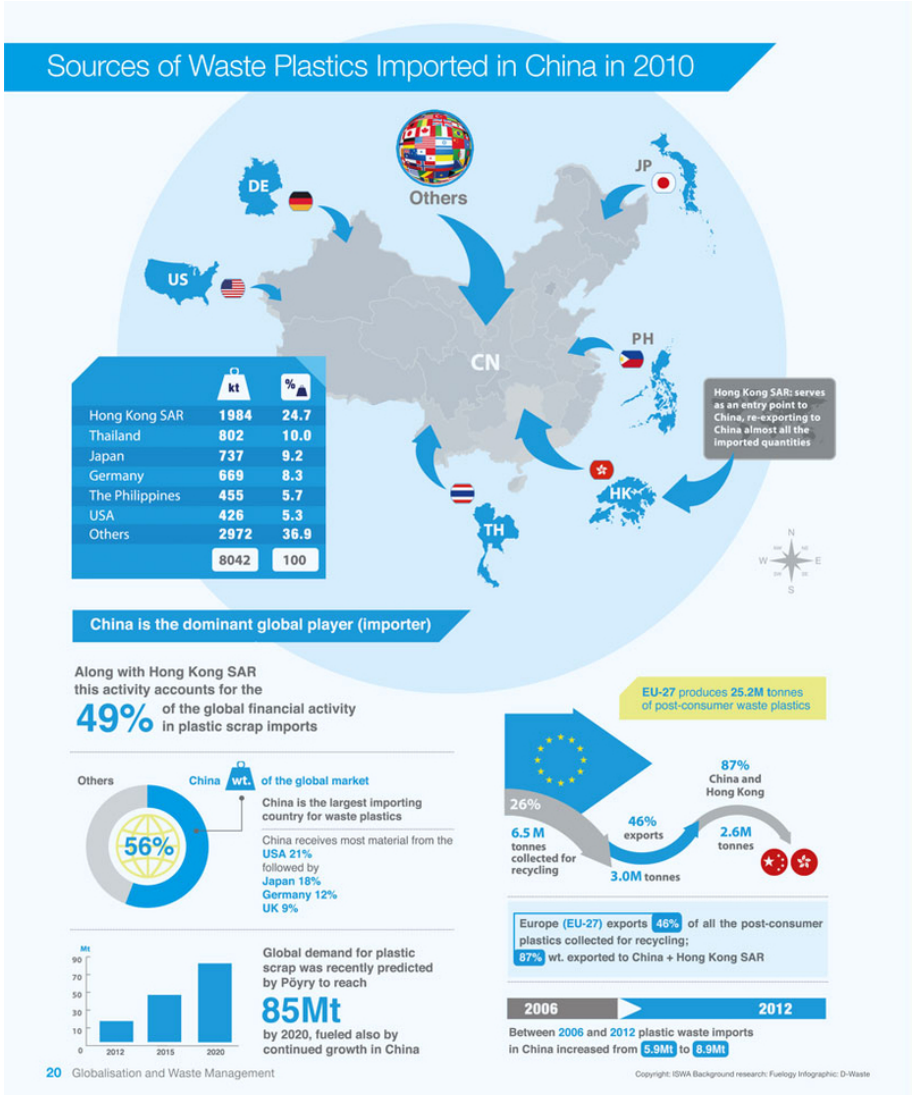

Complex and volatile globalised markets

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Documentary on past reprocessing plastic scrap imports “Deadly waste in China”

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See at 2DF:http://www.zdf.de/ZDFmediathek#/beitrag/video/1993090/Die-Doku:-Tödlicher-Müll-in-China

C-VORR: multiple-value dimensions systems and concurrent approach

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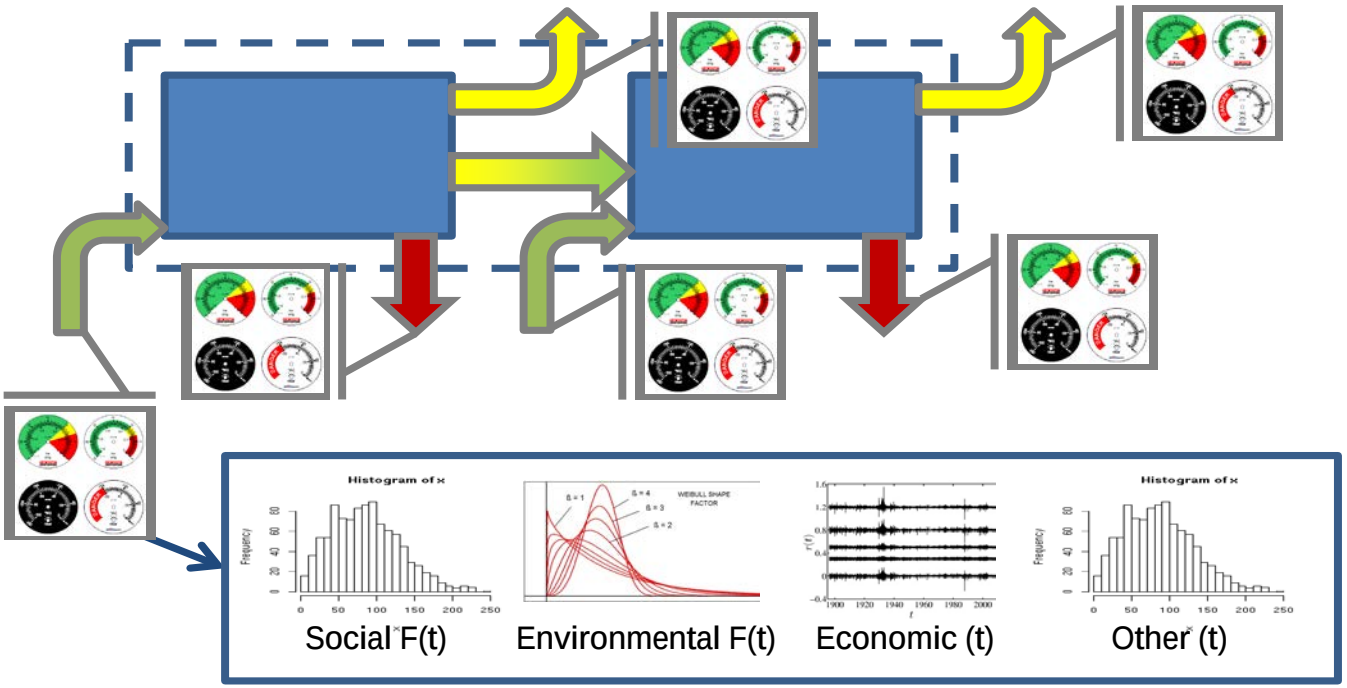

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10 Challenging ideas

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Recycling: There is a cap depending on recyclability of materials and organics separate collection

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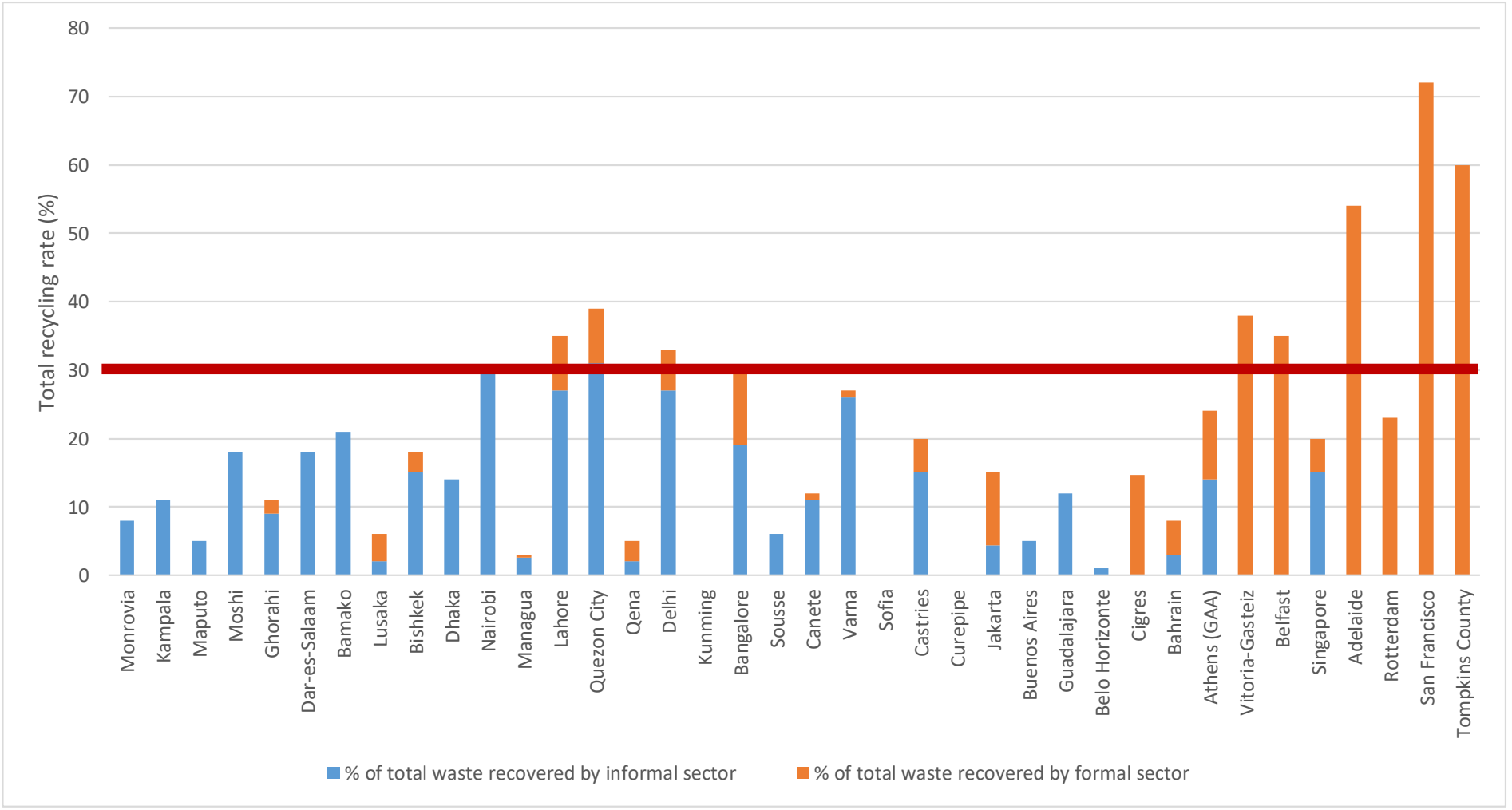

Source: Fargier et al., Unpublished

A key question

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25% of global plastics production is polypropylene (PP)

Why PP is one of the least recycled polymers?

ISWA Task Force Resource Management
Report No.3

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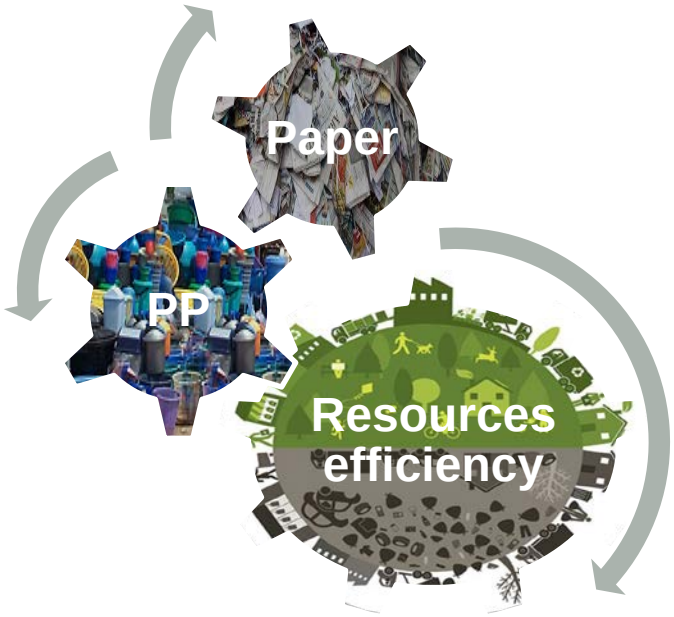
CIRCULAR ECONOMY:
CLOSING THE LOOPS

Costas Velis
Maria Coronado
David Lerpiniere

3

ISWA
International Solid Waste Association



Technical challenges for closing the PP loops

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- Variability: materials – products – sectors
- Ineffective collection for recycling
- Material and Mechanical recycling limitations
- Sorting out pure PP + grades + miscibility
- Processing output / rPP standards
- Global supply chains – Outlets / prices?
- Environmental performance – Inputs & losses

Variability: materials – products – sectors – lifespans

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Materials Grades

- Homo-polymer
  - Co-polymer
  - Multi-layer
  - Wood-plastic composites
- Additives:
  - Fillers
  - Stabilisers
  - Inks
  - Flame retardants
- Food / non-food grade
- Colour: Black / clear PP

Products

- Bottles
- Non-Bottles
- PTTs: Pots Tubes Trays
- Rigid / films

Sectors

- Packaging
- Electrical and electronic
- Automotive
- Construction
- Agriculture

Lifespans

- Pack.: < 1 y
- WEEE: e.g. 2-10 y
- ELVs:12-15 y
- Const.: ca. 35 y

10 Challenging ideas

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Waste sorting 200 y ago in London
Then sanitation era arrived

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Demand for soil improver

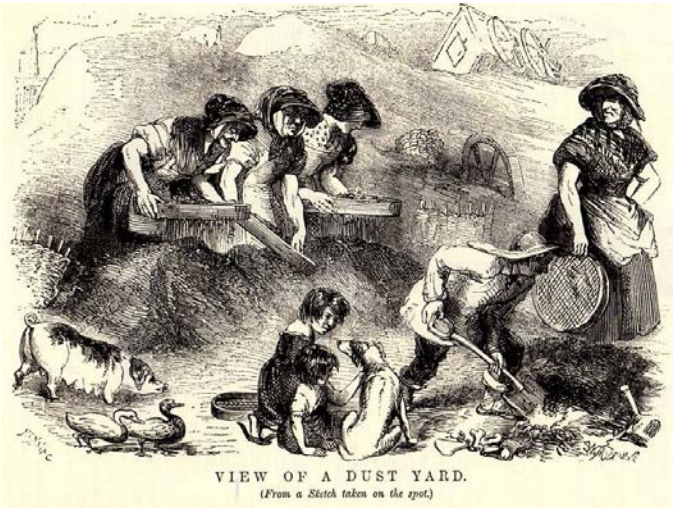
Chadwick's sanitary report

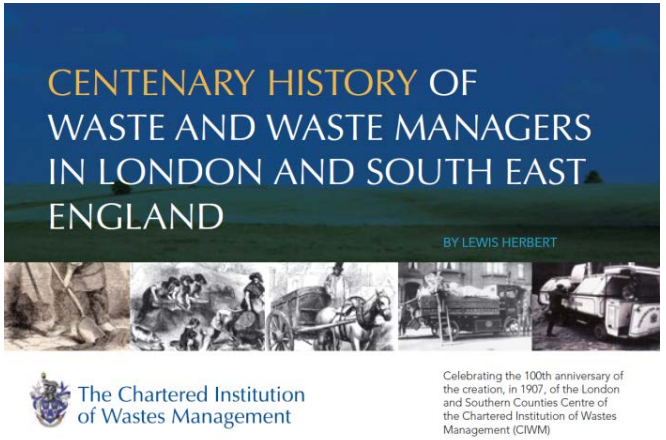
Mechanisation of dust-yards (first Material Recycling Factories)

1750s 1820s 1842 1850s 1890s

Dust-yards: Peak of "dust" value

Waste management cost exceeds dust trade profits





(Velis *et al.*, 2009, *Waste Management*)

But today we have different technologies and ideological framework

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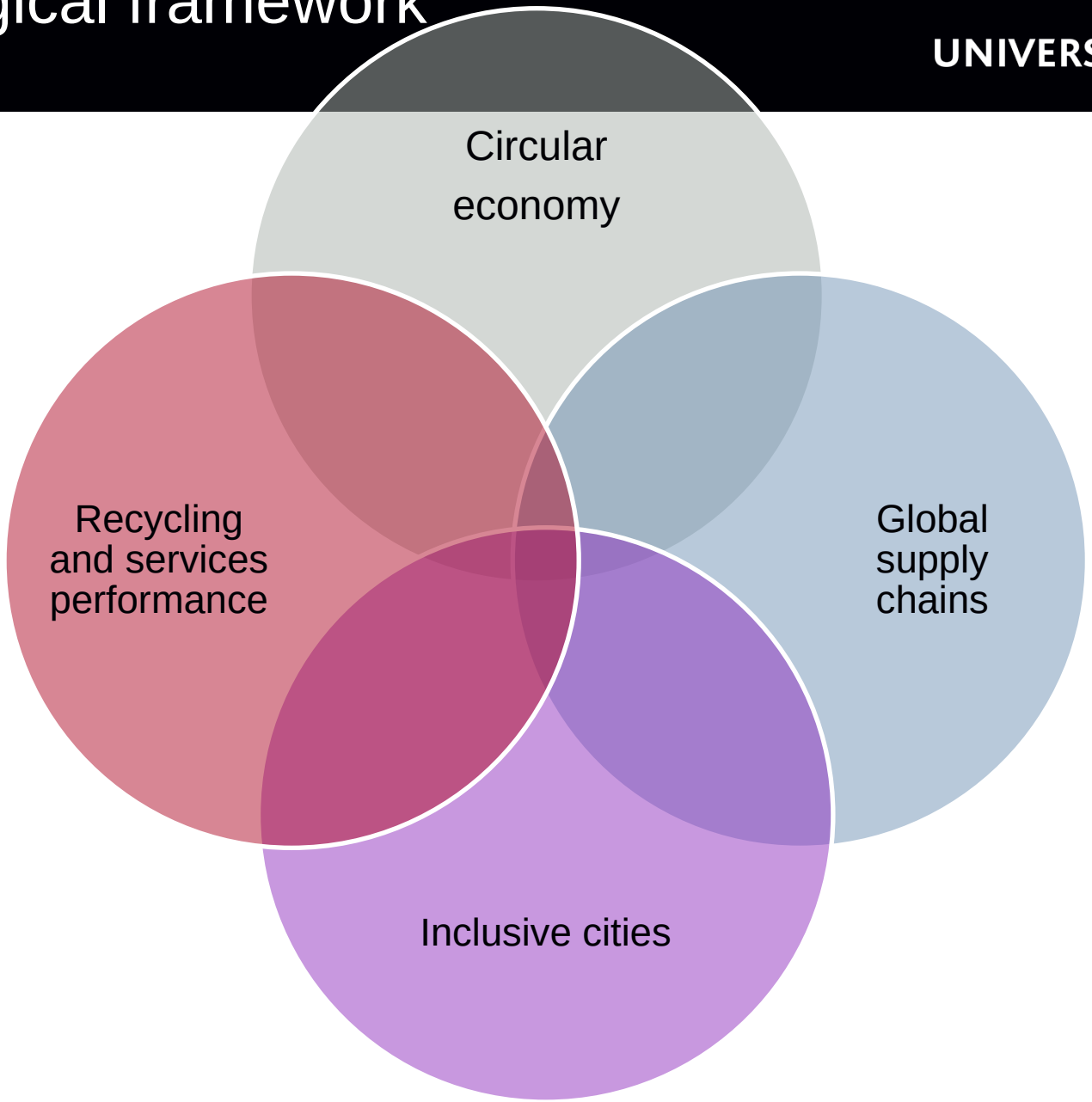

High-tech, mechanised Materials recycling facility (MRF)

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10 Challenging ideas

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6. Waste pickers cannot be empowered without understanding material properties, secondary material supply chains
7. Recycling is vulnerable: no effective ‘safety networks’ for formal recycling business: how IRS will be more competitive?
8. Waste is a negative economy – one could ask: ‘if waste pickers get the best materials, who will pay the increased cost’?
9. The cost of externalities is largely unknown
10. What about those not willing to enter cooperatives? Long-term poverty eradication

England UK – collection of plastics for recycling

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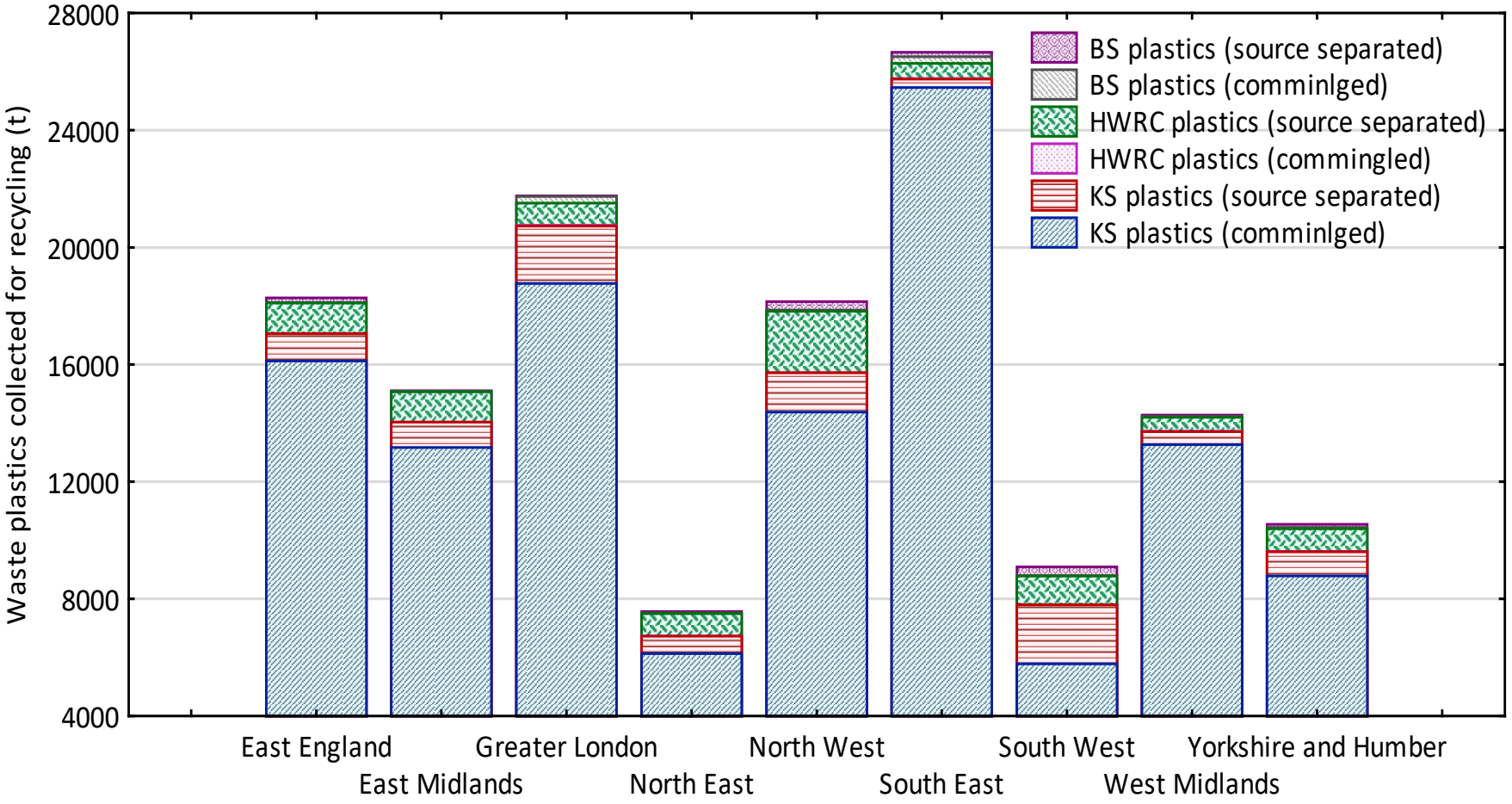

Source: University of Leeds

England UK – collection of plastics for recycling

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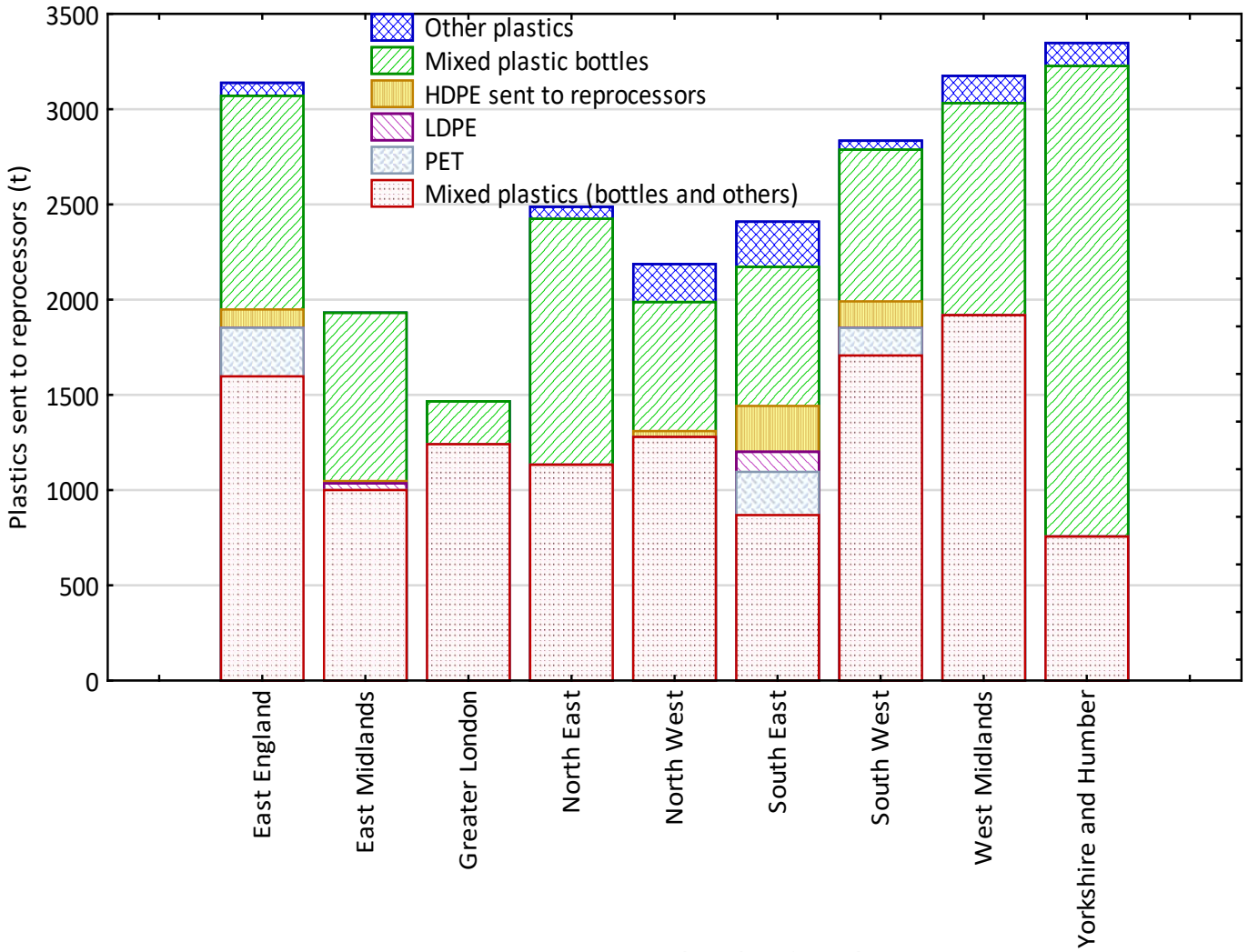

Source: University of Leeds

Operational interfaces for the inclusive recycling

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Original Article

wm&r

An analytical framework and tool ('*InteRa*') for integrating the informal recycling sector in waste and resource management systems in developing countries

Waste Management & Research
30(9) Supplement 43–66

DOI: 10.1177/0734242X12454934
wmr.sagepub.com
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Costas A Velis[1,2], David C Wilson[2], Ondina Rocca[2], Stephen R Smith[2], Antonis Mavropoulos[3] and Chris R Cheeseman[2]

In India: adapted and applied by

CHINTAN
ENVIRONMENTAL RESEARCH AND ACTION GROUP

Waste Management & Research:
Florence Congress Issue
Obtain from: http://wmr.sagepub.com/
Or e-mail: c.velis@leeds.ac.uk

Systems description of informal recycling sector

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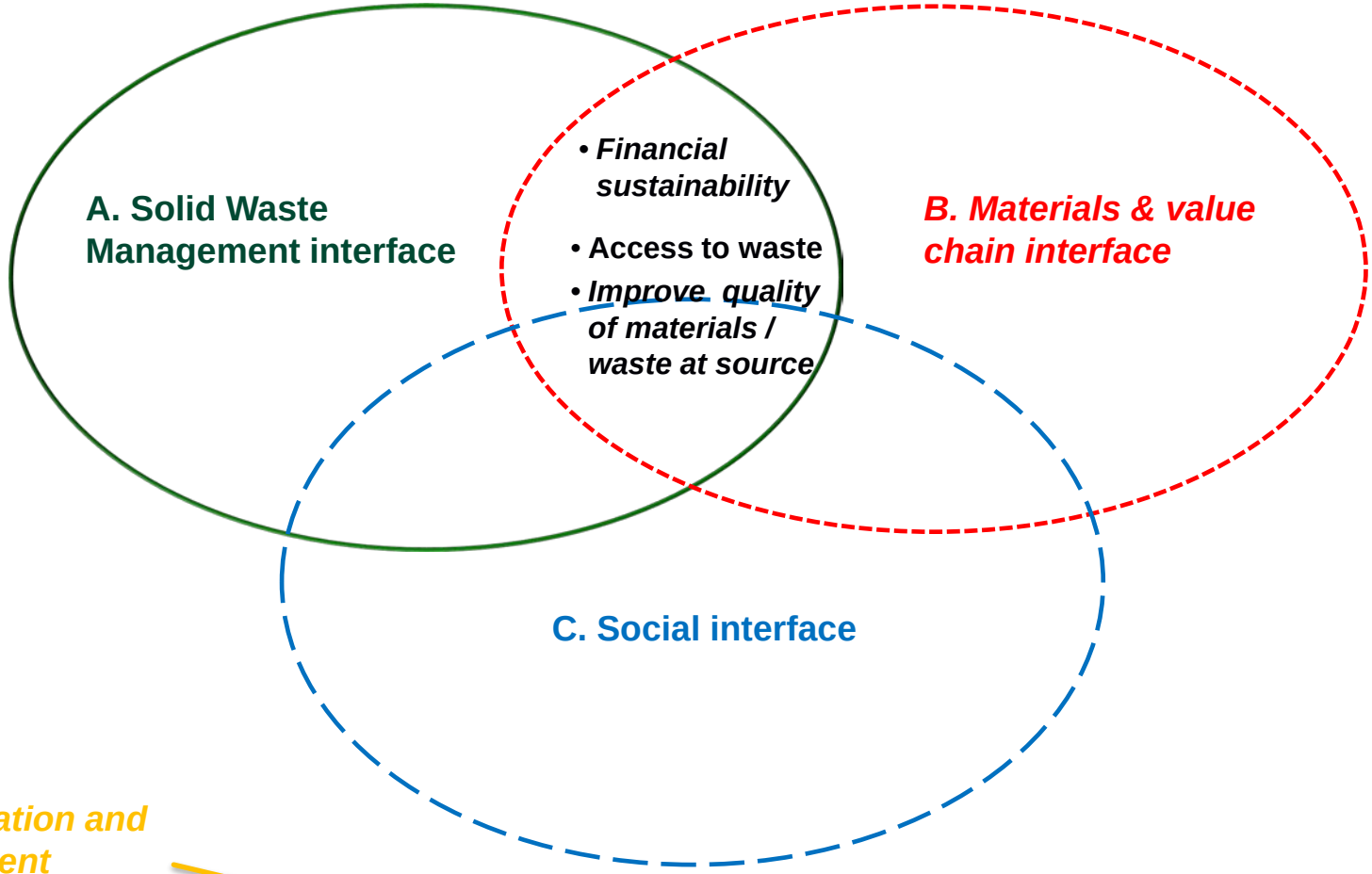

Visualisation tool for inclusive recycling initiatives

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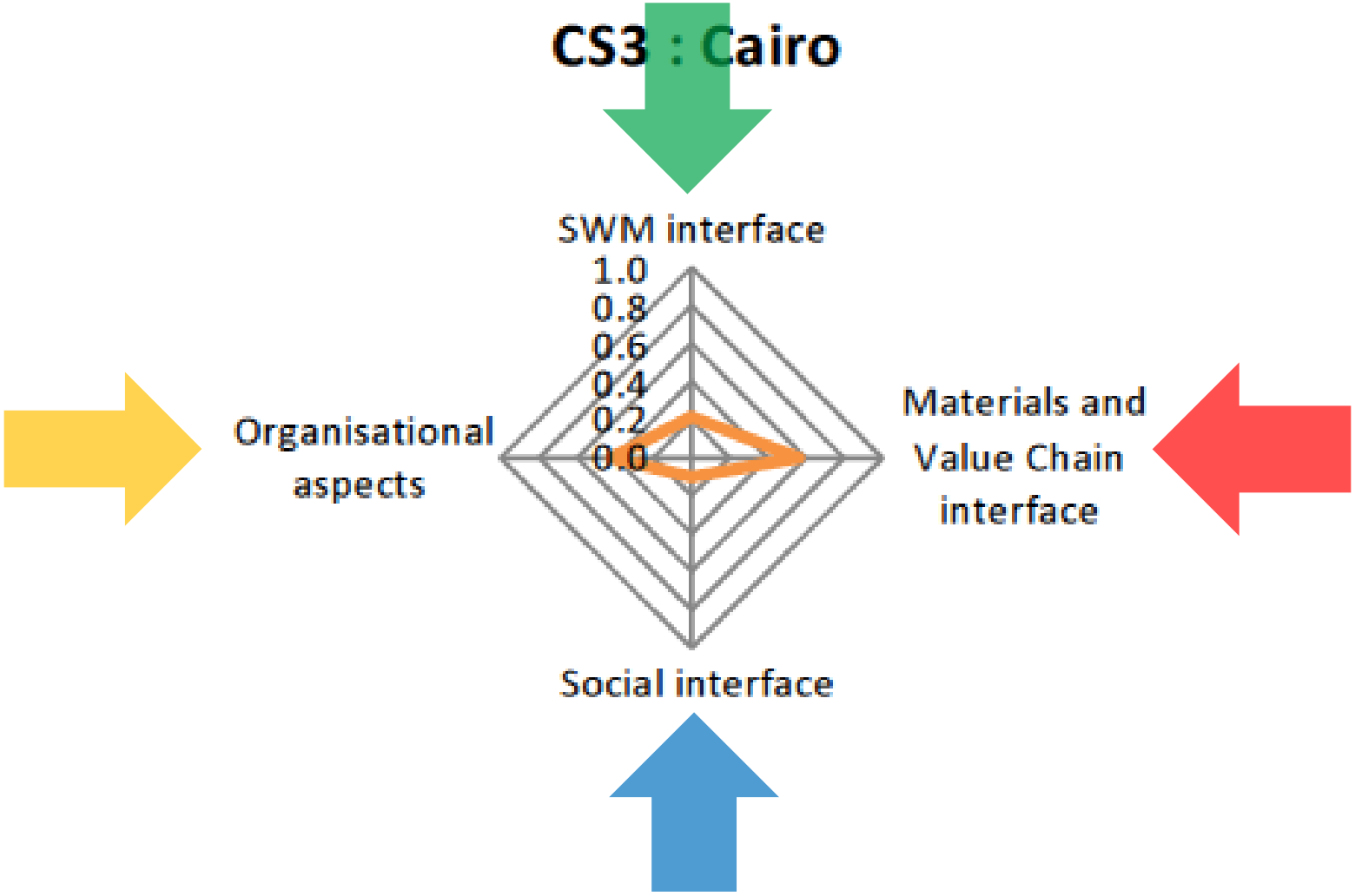

Source: Velis et al, 2012

SWM only one part of a circular economy…

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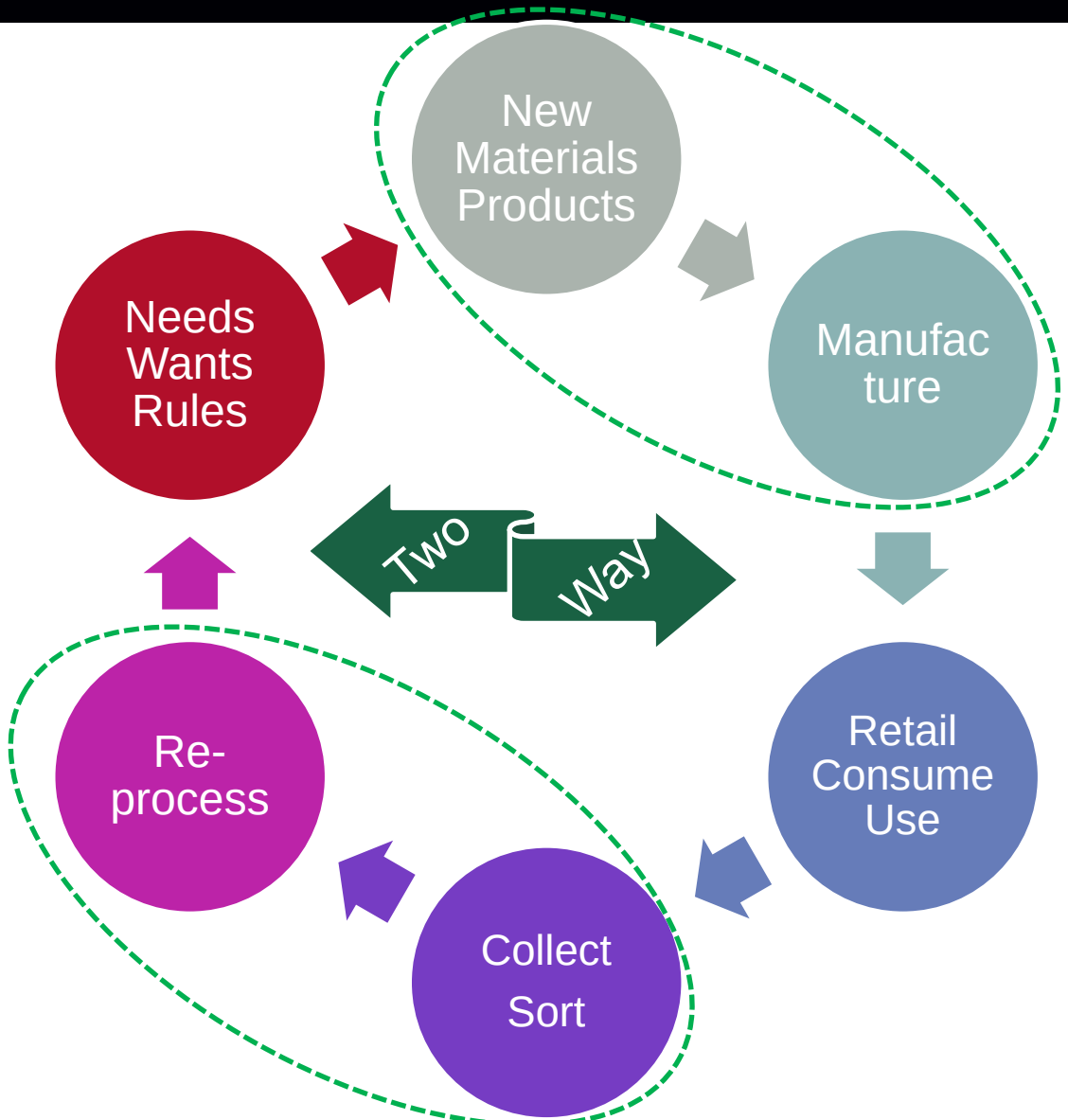

Meaning / role of “recycling”: Recycling *vs.* primary raw material substtuton

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Goal

Basis - NOT Goal

Collection for recycling = “recycling”

Separation
(At source – MRFs – post EfW)
(Manual vs. mechanised)

Specialised reprocessing (mechanical – thermal – chemical)

Substitution of primary raw material – equivalent functionality

Least consid ered

Focus to date

ISWA Globalisation and Waste Management: local actions – global implications

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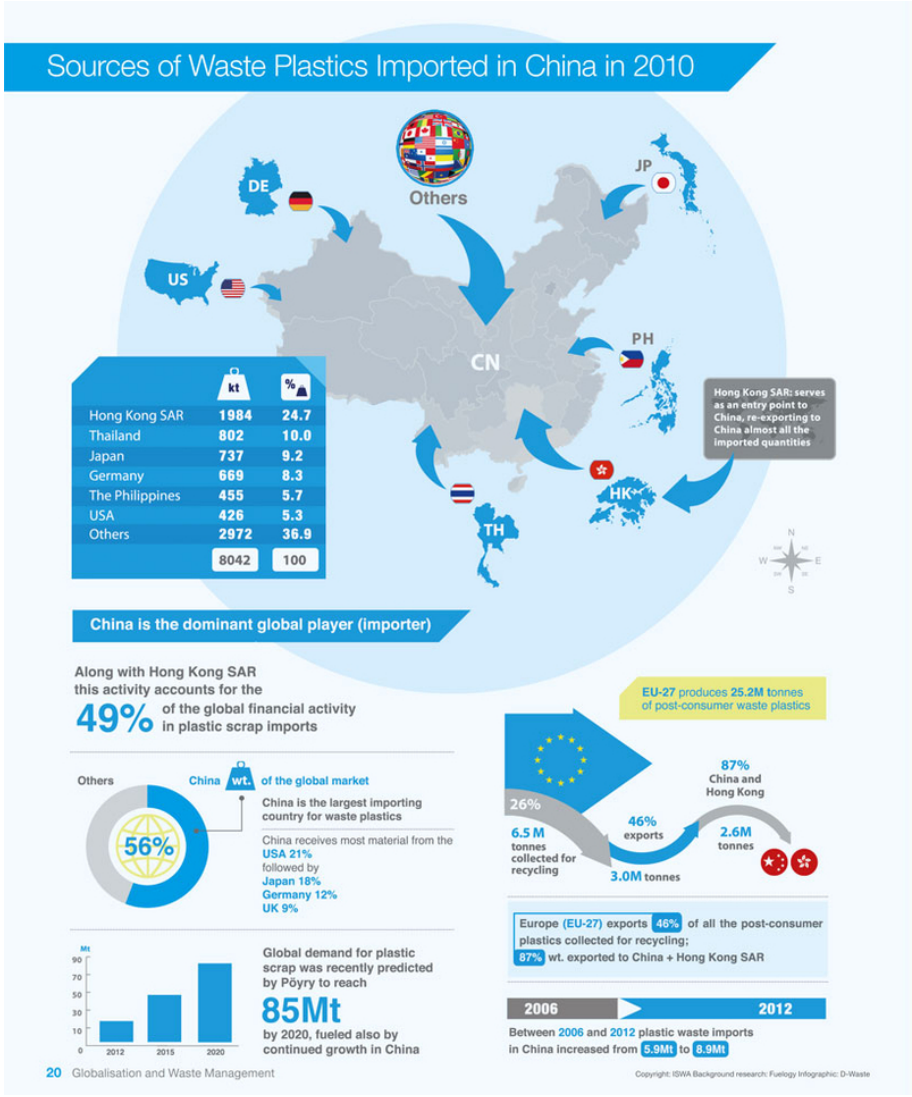

10 Challenging ideas

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6. Waste pickers cannot be empowered without understanding material properties, secondary material supply chains
7. Recycling is vulnerable: no effective ‘safety networks’ for formal recycling business: how IRS will be more competitive?
8. Waste is a negative economy – one could ask: ‘if waste pickers get the best materials, who will pay the increased cost’?
9. The cost of externalities is largely unknown
10. What about those not willing to enter cooperatives? Long-term poverty eradication

Barriers to recycling in global North/West

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- High cost of infrastructure
- High cost of collection / separation systems for recyclable materials
- Lack of public participation
- Unstable prices for materials (particularly internationally traded materials)
- Quality of materials
- Quantity of recovered material

How about EPR (Extended producer responsibility)?

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Editorial

WM&R

Which material ownership and responsibility in a circular economy?

Waste Management & Research
2015, Vol. 33(9) 773–774

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GWMO:
Typical net cost for key systems parts

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PART A: WORLD BANK PROJECT DATA (NOMINAL DATE 2006)[11]	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME	UPPER MIDDLE INCOME	HIGH INCOME COUNTRIES
Income (GNI/capita) 2006	< 876 USD	876-3 465 USD	3 466-10 725 USD	> 10 725 USD
Waste generation (kg/cap/yr)	220	290	420	780
Collection coverage[12] (percent of households served)	43%	68%	85%	98%
	Cost of Collection and Disposal (USD/tonne)			
Collection	20-50	30-75	40-90	85-250
Sanitary landfill	10-30	15-40	25-65	40-100
Open dumping	2-8	3-10	NA	NA
Composting	5-30	10-40	20-75	35-90
Waste-to-energy incineration	NA	40-100	60-150	70-200
Anaerobic digestion	NA	20-80	50-100	65-150

Collection: **Up to 30% of total net costs** for high income –
BUT: assuming high level of treatment and disposal

GWMO: SWM: Affordability

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- **Combined net costs for unit operations**: icl. investment and operating costs, minus: resource recovery revenues
- **Unit costs increase with income level** (higher costs of personnel and compliance + more stringent environmental regulations)
- **As income levels rise, more sophisticated technologies generally become more affordable**
- **Upper limit on affordability of 1% of the GDP/GNI per capita**

PART B: RESEARCH STUDY COMPARING ALTERNATIVE TECHNOLOGIES (2012 DATA)[13]	LOW INCOME COUNTRIES	LOWER MIDDLE INCOME	UPPER MIDDLE INCOME	HIGH INCOME COUNTRIES
GDP [USD/capita/year]	< 2 700	2 700-5 400	5 400-8 100	34 000-41 000

PART C: CALCULATED FOR GWMO[16]	UPPER LIMIT ON AFFORDABILITY CALCULATED AT 1% OF GNI[17] (USD/TONNE)			
Affordability limit for total cost of solid waste management	< 40	40-120	120-255	> 255

10 Challenging ideas

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Some ongoing research…

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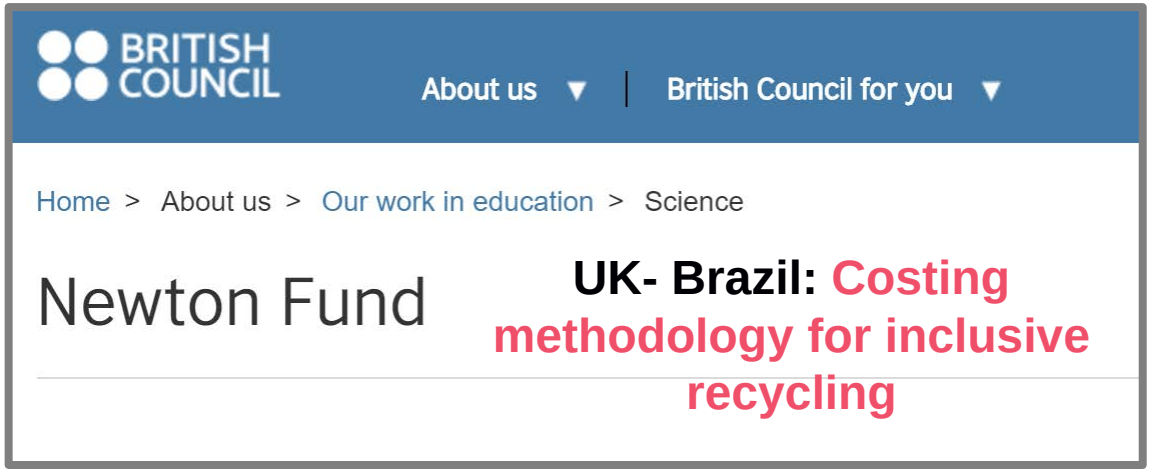
Buenos Aires Argentina:

Following the informal sector plastic scrap supply chain formal to global



UK- Brazil: Costing methodology for inclusive recycling

10 Challenging ideas

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3 necessary conditions for waste picking

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Waste and children...

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Dandora dumpsite, Nairobi

Photo: Lameck Nyagudi
Web:
http://www.africanews.com/site/Van_Nistelrooy_at_Nairobi_dump_site/list_messages/17449

Payatas Philippines, young boys working

Copywrite: David Paul Morris
Web:
http://davidpaulmorris.com/#/portfolio/stories/payatas-dumpsite-child-labor/PAYATAS017DPM

Image by: Paul Jeffrey
Source: New World Outlook
Web: http://gbgm-umc.org/global_news/full_article.cfm?articleid=3470

"New site has opened nearby Smokey Mountain after it has been discontinued as a dump site"

Africa-EU research collaboration. Can basic services combined with resoruce recovery?

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Waste picking and processing of WEEE and health

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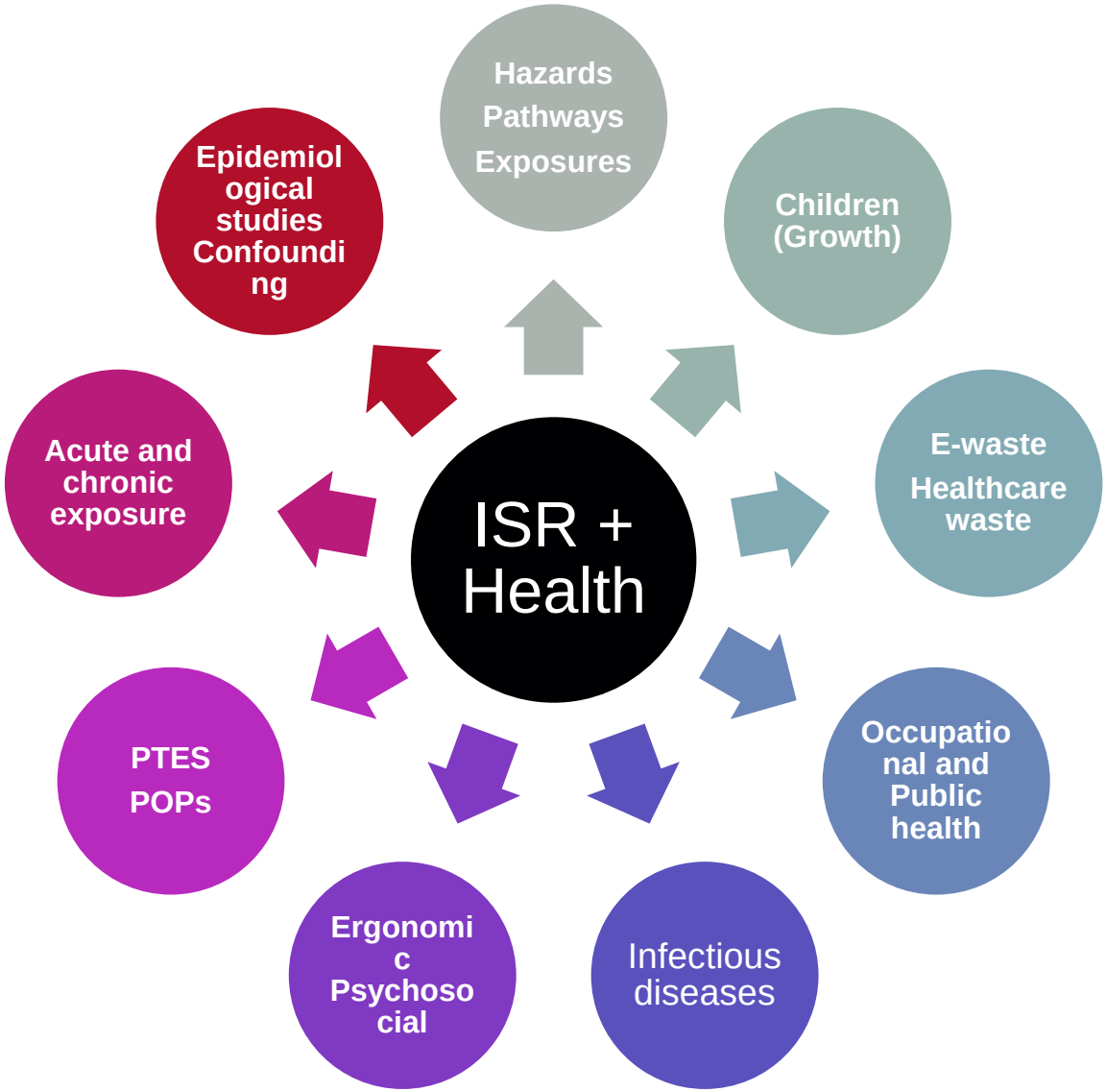

E-waste toolkit: Knowlwgde Base (KB: TU Vienna – Website: UoL)

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A data set for each region	Stage in the (W)EEE-Cycle					
	Consumption	Collection	Recovery of Function	Recovery of Materials	Disposal	Total system
Field of Information: Goals of WEEE-Management						
(W)EEE-characteristics						
Treatment options						
Secondary resources						
Environment & Health						
Regional characteristics						
Costs						
% GDP						
Stakeholder issues						
Other issues						

Waste, recycling and governance…

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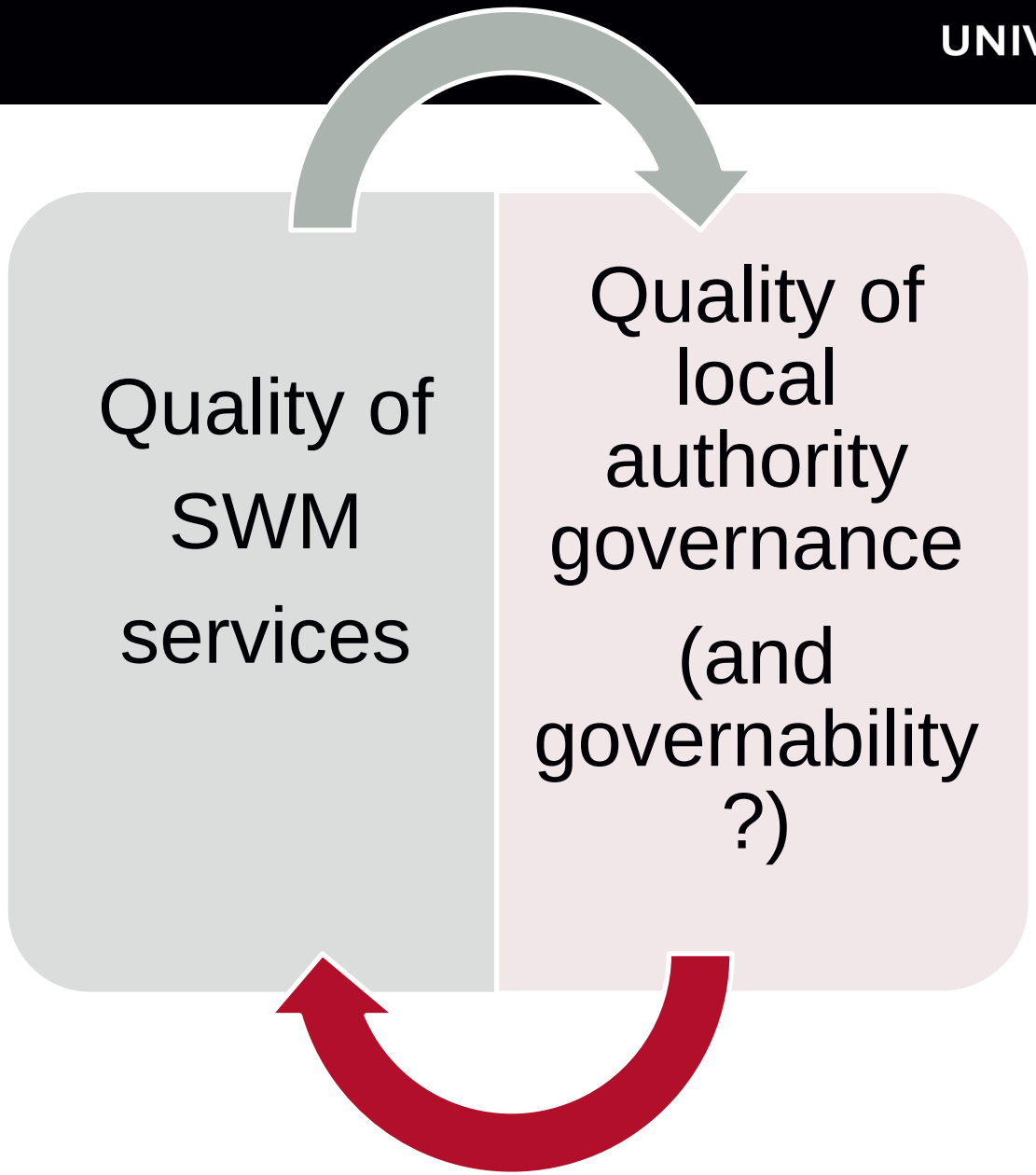

The practical way forward…

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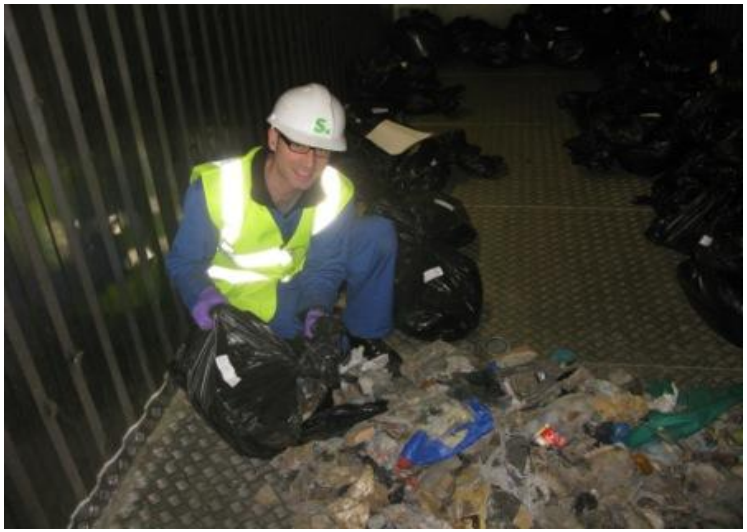
Thank you for listening!!

Muito Obrigado!!



With many thanks to my research team, students, collaborators and ORIS

Dr Costas Velis

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RESILIENT SUSTAINABLE SOCIETIES & INFRASTRUCTURE Cities