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Institute for Resilient Infrastructure (iRI)

Institute for Public Health & Environmental Engineering (iPHEE)



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Typology of Operational Models within Informal Waste Management and Recycling Sector

Dr Costas Velis

c.velis@leeds.ac.uk

Co-authors: Heather Purshouse¹, Jacqueline Rutkowski², Emilia Rutkowski³, David Lerpiniere¹

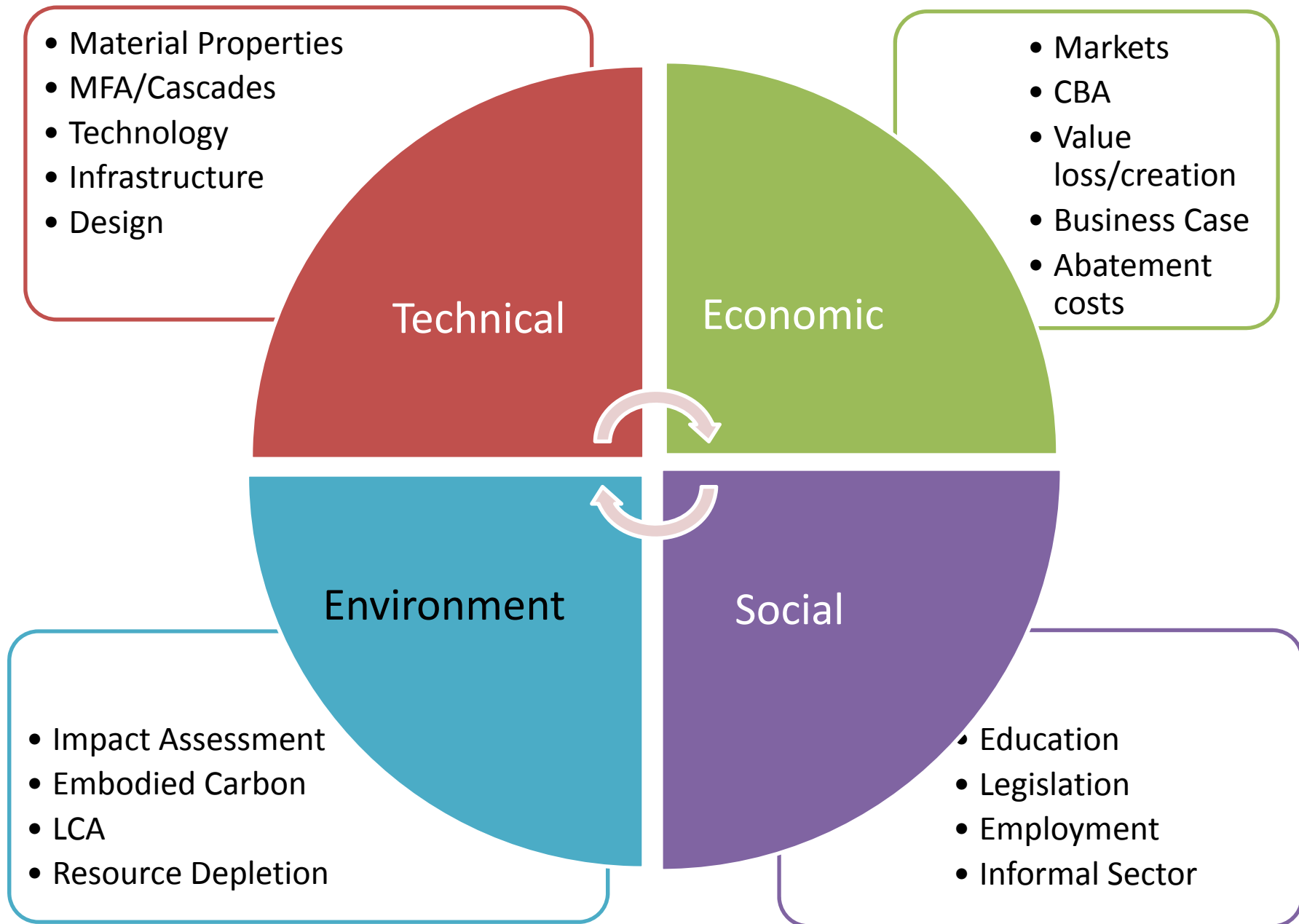
¹ School of Civil Engineering, University of Leeds, Leeds, West Yorkshire, LS2 9JT, UK² SUSTENTAR Institute for Sustainability Studies and Research, Belo Horizonte, Minas Gerais, Brazil

³ FLUXUS Laboratory, School of Civil Engineering, Architecture, and Urban Design, UNICAMP, Campinas, São Paulo, Brazil

ATHENS2017

5th International Conference on Sustainable Solid Waste Management Athens; 23-25 June 2017

CERRY: Circular Economy & Resource Recovery





Informal Recycling Sector (IRS)

- Solid waste management (SWM) - essential service
- Materials recycling/reuse valuable for environment and society
- Informal sector is diverse and innovative
- Need to understand 'ecosystem' of actors and how they interact



IRS analytical and decision support tools



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Wasteaware Cities Indicators

Benchmarking for Integrated Sustainable Waste Management in Cities

CHALLENGE

- Lack of data to inform problem interventions, solid waste management, and resource recovery
- Indicator is compounded by increasing baseline (waste data, recycling, composting) across time periods
- Any inter-city comparative benchmarking across full range of social income levels, both physical and governance systems, and in wider Africa

AIMS

- Develop and test indicator set for integrated sustainable waste management in cities both North and South to allow benchmarking, comparison, and monitoring of developments over time
- Explicitly consider waste-poor contribution to recycling

WORLD VIEW

Map showing high income countries (green), middle income countries (yellow), and low income countries (red). Key cities highlighted include Kampala, Uganda; Lagos, Nigeria; and Cape Town, South Africa.

ISWM Framework

DELIVERABLES

- Indicator set developed based on integrated sustainable waste management (ISWM) framework, and applied to 40 city case studies
- Academic paper and supporting online user manual: 'Wasteaware' benchmark indicator to measure the performance of a city's ISWM systems in low-income cities
- Online tool and database under construction: wasteaware.org.uk

CASE STUDY RESULTS

- Four city volumes used to rise and manage income levels
- Many cities in low-income countries have exceeded collection coverage, full lag in collection disposal
- Recycling rates remain relatively high levels in some low-income countries, but are relatively low in informal recycling networks

OUTCOMES

- Adopted by Global Waste Management Outlook and World Publication Award and CIWM 2014-15 James Jackson Model for major contributors to solid waste management
- Most comprehensive and inclusive benchmarking system to date

RESILIENT CITIES SOCIETIES & RESOURCES

Contact: Dr Colette Vella, c.vella@leeds.ac.uk, Prof David Wilson, d.wilson@leeds.ac.uk

Wasteaware Team

Project funders: EPSRC, giz, UNOHABITAT FOR A BETTER URBAN FUTURE, UNIVERSITY OF LEEDS

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CVORR

Complex Value Optimisation for Resource Recovery from Waste

CHALLENGE

- Waste-poor recover value from waste, but to measure this value as a complex variable of environmental, economic, social and technical domains
- Enable optimal resource economy pathway using whole-systems approach, preventing degradation of value into waste and maximising resource recovery

AIM

- CVORR novel methodology for systems analysis of resource recovery from waste systems
- Combine micro and macro flow measurements with assessment of multi-dimensional flow values
- Produce books for analysing resource recovery processes and optimisation of value system complex value

IMPACT

- CVORR multi-dimensional analysis can assess informal recycling contribution to the circular economy
- Help policy-makers make more informed decisions that measure multidimensional benefits
- Lowest 'hidden value' currency being designed to wider systems, supporting low-income recovery and opportunities

Informal recycling sector plastic waste flow - case study of Buenos Aires

DELIVERABLE

- CVORR framework and books for evidence-based contribution of Informal Recycling Sector to circular economy
- Key stages in tool application:
 - Material selection and scenario development
 - Identification of stocks and flows of wastes and values
 - Assessment and evaluation of value saved and lost

CASE STUDY

Buenos Aires, Argentina

- Over 5,000 containers required, with further 5,000 estimated containers
- Containers significantly contribute to plastic waste used to make 60% of total plastic value generated by households and businesses

OUTCOMES

- Development of holistic plastic material and value flow model, applicable to all socio-economic contexts, including circular economy models in Global South
- CVORR concept and books disseminated through ISWA International Knowledge Exchange Workshops

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Contact: Dr Colette Vella, c.vella@leeds.ac.uk, Prof Paul Furness, p.furness@leeds.ac.uk

CVORR Team

Project funders: NERC, EPSRC, RAMBOLL, ARUP, NFU, ECOVER, link, energy, WASTE, CIWM, ISWA

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EWIT

E-Waste Web-based Implementation Toolkit

CHALLENGE

- Increase uptake of electrical and electronic products (e-waste) from waste and as part of a global environment
- Demands for products creates increasing demand of production and other hazardous E-waste
- Industry often reluctant to change recovery initiatives due to change in pricing, but may accept preferential priority of resource-recovery activities

AIM

- Develop E-waste Implementation Toolkit (EWIT) to identify conditions necessary to implement effective E-waste management systems in urban Africa
- Establish online Knowledge Base to inform and support stakeholder interventions as communities adapt to the requirements of E-waste management

PROJECT STRUCTURE

- Formation of international partnership - international authorities from Kenya, City of Cape Town and South Africa teamed with European cities in Austria, Portugal, France and Italy
- Supported by specialists from elsewhere, the value added technical networks, EWIT project facilitates knowledge transfer and resource locally tailored initiatives

DELIVERABLES

- EWIT web portal ewit.org.uk
- Free online resources available in English and French
- 'Wizard' feature provides fast-track introduction to E-waste priority issues, tailored to local context
- Knowledge Base - in-depth library of information, guidance, and resources on issues relevant to management of E-waste

CASE STUDY

Kenya Country, Kenya

- Provision and test steps established with City Council and key stakeholders
- Action Plan for Ken E-waste developed
- Establishment of Kenya's first E-waste recycling collection facility

OUTCOMES

- Comprehensive baseline dataset of E-waste management in African metropolitan areas developed
- Dynamic, free, easy-to-use online portal provided to organisations across Africa
- Four cities involved in EWIT established Action Plans and will act as flagship projects for E-waste management within Africa

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- Four city volumes used to rise with increasing income levels
- Many cities in low-income countries have exceeded collection coverage, full lag in collection disposal
- Recycling rates remain relatively high levels in some low-income countries, often exclusively due to informal recycling networks

OUTCOMES

- Adopted by UNEP and ISWA's Global Waste Management Outlook (2015) and World Population Review (2016) to give worldwide waste coverage
- Academic paper won 2015 ISWA Publication Award and CIWM 2014-15 James Jackson Model for major contributors to ISWA
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SoCo: Solidary Selective Collection and Inclusive Recycling Analysis Tool



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Actor Spreadsheets

**SOLIDARY SELECTIVE COLLECTION (SOCO) ASSESSMENT TOOL
ACTOR SPREADSHEET**

Tool for assessing the impacts/benefits and costs/revenues of solid waste management systems operated by the informal, public and private sector.

Developed and financed by:

**SOLIDARY SELECTIVE COLLECTION (SOCO) ASSESSMENT TOOL
MASTER SPREADSHEET**

Tool for assessing the impacts/benefits and costs/revenues of solid waste management systems operated by the informal, public and private sector.

Developed and financed by:

Basic information

Costs and revenues

Financial summary

Material flows

Actor information

Social and environmental

Combined material flows

Combined metrics

Master Spreadsheet



Method

- Systematic literature review
- Screening of literature
- Extraction of information
- Analysis

Typology of Operator Models in the Informal Sector

Core Elements

STRUCTURE AND MANAGEMENT (AFFILIATION)
 Informal or covered?
 Decision making and responsibility?
 Power base?

WORKFORCE
 Formal / contract based?
 Employer / Employer?
 Payment methods?
 Skills and educational level?

SERVICE (MEANS)
 Activities
 Services

DEDICATION
 Formal (paid)?
 Informal? (Management contract, service contract, concession, franchise or licensed)
 Is it?
 Is of organization determined whether VAT (or other) is paid.

g Elements

Search Terms	Databases and Websites Searched	Results
Informal recycl* OR waste pick* OR (waste AND informal) AND [Individual Latin American country names] OR Latin America OR Caribbean	Web of Science Scopus ScienceDirect Websites of relevant organisations: WIEGO, GIZ, World Bank, Inter-American Development Bank Google	403 abstracts retrieved from journal databases. 103 sources retrieved after removing irrelevant, duplicated, or inaccessible results. 28 case studies extracted after screening for sufficient detail.

Results – Literature Review



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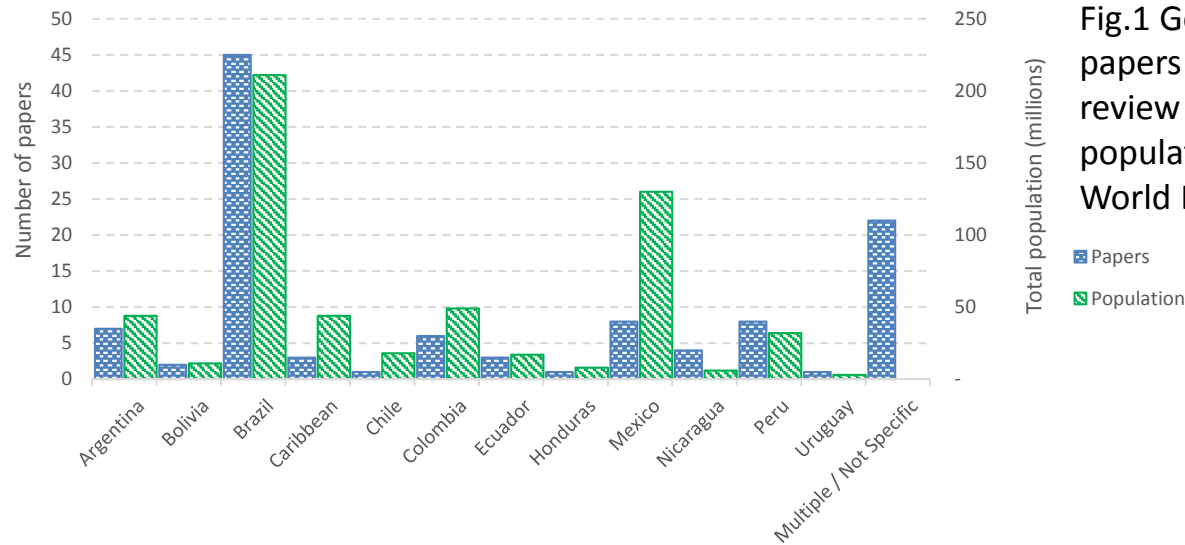


Fig.1 Geographical focus of papers retrieved from literature review and country population; population data taken from the World Bank data base

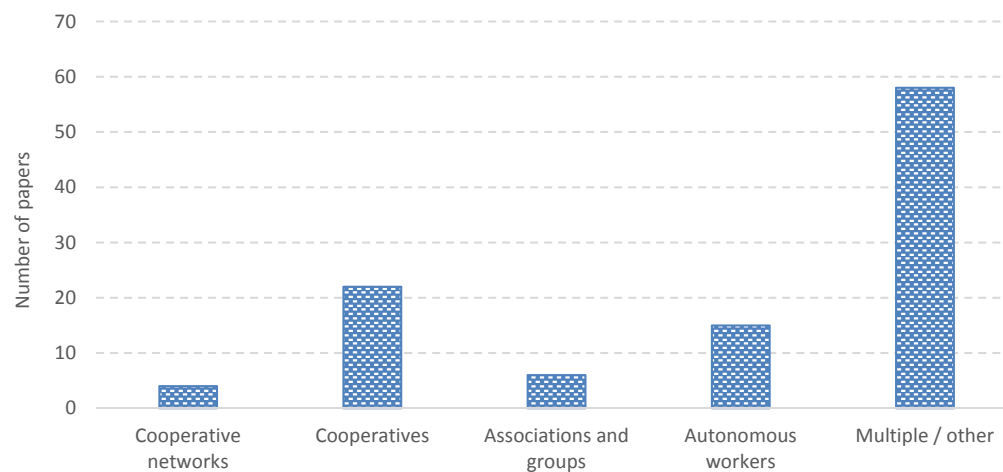


Fig. 2 Organisational models mentioned and discussed in the papers retrieved from literature review

Results - Typology



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Primary focus is:	Type	Activities	Primary purpose is:
Removing waste	I	Waste collection service	Service provision
	II	Waste collection service Recyclables are separated	Service provision and valorisation
Collecting recyclables	III	Recyclables collected	Valorisation
	IV	Recyclables collection service Rejects are separated	Service provision and valorisation

Ten common configurations identified from literature review and case studies

Results - Typology



Typ e	Configuration	Description	Example
la		Waste collection service – waste is collected directly from households and disposed (either at a landfill or open dumpsite) by the IWMRS.	Carroceiros, Belo Horizonte, Brazil, prior to intervention [1]
lb		Waste collection service – waste is collected directly from households by the IWMRS and deposited at a transfer station. Waste is then collected and disposed by the LA.	Carroceiros, Belo Horizonte, Brazil [1]

- Informal Recycling Sector
- Local Authority
- Private Industry

[1] Dias, S.: Recycling in Belo Horizonte , Brazil – An Overview of Inclusive Programming Recycling of Materials from Domestic Waste. WIEGO Policy Br. (Urban Policies) No 3. 1, 1–8 (2011)

[2] Medina, M.: Border scavenging: A case study of aluminum recycling in Laredo, TX and Nuevo Laredo, Mexico. Resour. Conserv. Recycl. 23, 107–126 (1998). doi:10.1016/S0921-3449(98)00019-6

[3] Hernandez, O., Rawlins, B., Schwartz, R.: Voluntary recycling in Quito: factors associated with participation in a pilot programme. Environ. Urban. 11, 145–160 (1999). doi:10.1177/095624789901100213

[4] Campos, M.J.Z., Zapata, P.: Switching Managua on! Connecting informal settlements to the formal city through household waste collection. Environ. Urban. 25, 225–242 (2013). doi:10.1177/0956247812468404

[5] Scheinberg, A., Simpson, M., Gupt, Y., Anschütz, J., Haenen, I., Tasheva, E., Hecke, J., Soos, R., Bharati, C., Garcia-Cortes, S., Gunsilius, E.: Economic Aspects of the Informal Sector in Solid Waste Management. , Eschborn, Germany (2010)

[6] Medina, M.: Waste Picker Cooperatives in Developing Countries. WIEGO/Cornell/SEWA Conf. Membership-Based Organ. Poor, Ahmedabad, India, January 2005. 1–36 (2005). doi:10.4324/9780203934074

[7] Purshouse, H., Rutkowski, J.E., Velis, C.A., Rutkowski, E.W., Da Silva Estevam, V., Soares, A.: Social Technology in Brazilian Informal Material Recycling Facilities. 15th International Conference on Environmental Science And Technology. 31st August - 2nd September. Rhodes, Greece (2017)

[8] Rutkowski, J.E., Rutkowski, E.W.: Expanding worldwide urban solid waste recycling : The Brazilian social technology in waste pickers inclusion. Waste Manag. Res. 33, (2015).

[9] King, M.F., Gutberlet, J.: Contribution of cooperative sector recycling to greenhouse gas emissions reduction: A case study of Ribeiro Pires, Brazil. Waste Manag. 33, 2771–2780 (2013). doi:10.1016/j.wasman.2013.07.031

[10] Gutberlet, J.: Empowering collective recycling initiatives: Video documentation and action research with a recycling co-op in Brazil. Resour. Conserv. Recycl. 52, 659–670 (2008). doi:10.1016/j.resconrec.2007.08.006

[11] Inter-American Development Bank: Regional policy dialogue 1. <http://brik.iadb.org/handle/iadb/80838>. (2002). Accessed 1 December 2016

Results - Typology



Type	Configuration	Description	Example
IIa		Waste collection service with recyclables diversion – waste is collected directly from households, recyclables are separated and sold, and remaining waste is disposed (either at a landfill or open dumpsite) by the IWMRS.	Recyclers in Laredo / Nuevo Laredo, USA/Mexico [2]
IIb		Waste collection service with recyclables diversion – waste is collected directly from households and recyclables separated and sold by the IWMRS. Remaining waste is deposited at a transfer station, and disposed by the LA.	Micro-enterprises, Quito, Ecuador [3] Manos Unidas, Managua, Nicaragua [4]
IIc		Waste collection service with recyclables diversion – waste is collected directly from households by formal municipal solid waste workers. Recyclables are informally retrieved from the waste during their collection rounds, and are diverted to material buyers.	Medina and Scheinberg et al. [5, 6] discuss the separation of recyclables during municipal solid waste collection rounds

Informal Recycling Sector 
 Local Authority 
 Private Industry 

Results - Typology



Type	Configuration	Description	Example
IIIa		<p>Recyclables collection - separated recyclables are collected by the IWMRS (picking from the street, collecting directly from households, or picking from landfills), then sorted and sold.</p>	<p>Recyclers in Laredo / Nuevo Laredo, USA/Mexico [2]</p>
IIIb		<p>Recyclables collection - separated recyclables are collected by the IWMRS (picking from the street, collecting directly from households, or picking from landfills) and sold to another informal actor (e.g. cooperative group) who may perform further segregation and aggregation. The recyclables then may be sold directly, or sold through another IWMRS actor (e.g. cooperative network).</p>	<p>Coopesol Leste, Belo Horizonte, Brazil [7] Coopert, Itauna, Brazil [8]</p>

- Informal Recycling Sector
- Local Authority
- Private Industry

Results - Typology



Type	Configuration	Description	Example
IVa		<p>Recyclables collection service – comingled recyclables are collected by the IWMRS directly from households, sorted and sold, and rejected material is disposed.</p>	<p>Cooperpires, Ribeirão Pires, Brazil [9, 10] Coopert, Itauna, Brazil; Cocamar, Natal, Brazil; CooperRegião, Londrina, Brazil [8]</p>
IVb		<p>Recyclables collection service – comingled recyclables are collected by the LA directly from households, delivered to the informal actor, then sorted and sold. Rejected material is collected and disposed by the LA.</p>	<p>Coopesol Leste, Belo Horizonte, Brazil [7]</p>
IVc		<p>Recyclables collection service - comingled recyclables are collected by the LA directly from households, delivered to the IWMRS, then sorted and sold directly to a private company, who might be a reprocessor. Rejected material is collected and disposed by the LA.</p>	<p>Private Company and Recyclers, La Reina, Chile [11]</p>





Conclusions

- Deficiency of detail in case studies
- Diversity in activities, workforce and employment characteristics, affiliation, motivations, contractual arrangements, commercial and political environments.
- 4 basic operational models and 10 commonly realised configurations identified and elaborated.
- Type IV operational model most common in case studies, with LAs formalising services around this.
- Autonomous recyclers would benefit from more attention in the literature, as they represent greater proportion.

Other IRS tools

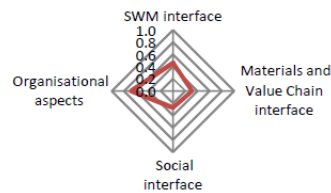


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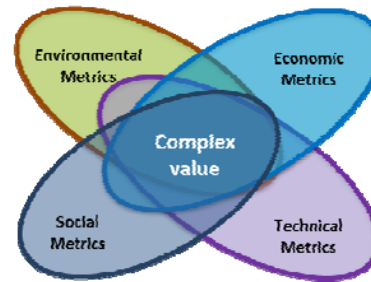
Wilson, D.C. et al. 2015. 'Wasteaware' benchmark indicators for integrated sustainable waste management in cities. *Waste Management*. 35, pp.329-342.

CS2 : Belo Horizonte



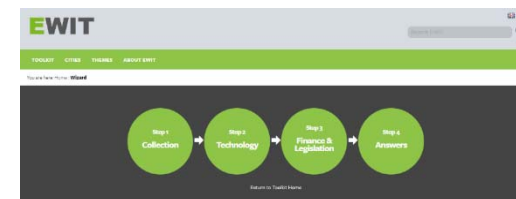
Velis, C.A. et al. 2012. An analytical framework and tool ('InteRa') for integrating the informal recycling sector in waste and resource management systems in developing countries. *Waste Management & Research*. 30(9), pp.43-66.

Solidary Selective Collection of Waste (SoCo) – analysis tool for holistic review of impacts and benefits from informal and formal recycling. British Council / Newton Fund institutional links funding.



Complex Value Optimisation for Resource Recovery from Waste (CVORR) – toolkit for optimising potential to recover value from waste. NERC, ESRC and Defra funded.

EWIT – web portal of expert guidance addressing challenges of e-waste in Africa. EU Horizon 2020 funded.



Funding and Project partners



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INSTITUTIONAL
LINKS



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Thank you for listening!

Costas Velis

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