Typology of Operational Models within Informal Waste Management and Recycling Sector

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CERRY: Circular Economy & Resource Recovery

- Material Properties
- MFA/Cascades
- Technology
- Infrastructure
- Design

- Impact Assessment
- Embodied Carbon
- LCA
- Resource Depletion

- Markets
- CBA
- Value loss/creation
- Business Case
- Abatement costs

- Education
- Legislation
- Employment
- Informal Sector

Technical

Economic

Environment

Social
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

Majority
- e.g. Completely uncontrolled autonomous activities at dumpsites

Minority
- e.g. Legal and tax-paying formal organisations (co-operatives, associations)
IRS analytical and decision support tools
SoCo: Solidary Selective Collection and Inclusive Recycling Analysis Tool

Actor Spreadsheets

Master Spreadsheet

Basic information

Material flows

Costs and revenues

Social and environmental

Financial summary

Actor information

Combined material flows

Combined metrics
Method

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

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

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

<table>
<thead>
<tr>
<th>Primary focus is:</th>
<th>Type</th>
<th>Activities</th>
<th>Primary purpose is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removing waste</td>
<td>I</td>
<td>Waste collection service</td>
<td>Service provision</td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>Waste collection service</td>
<td>Service provision and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recyclables are separated</td>
<td>valorisation</td>
</tr>
<tr>
<td>Collecting recyclables</td>
<td>III</td>
<td>Recyclables collected</td>
<td>Valorisation</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td>Recyclables collection service</td>
<td>Service provision and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rejects are separated</td>
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Ten common configurations identified from literature review and case studies
### Results - Typology

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<tr>
<td>Ia</td>
<td>Collect Waste → Dispose Waste</td>
<td>Waste collection service – waste is collected directly from households and disposed (either at a landfill or open dumpsite) by the IWMRS.</td>
<td>Carroceiros, Belo Horizonte, Brazil, prior to intervention [1]</td>
</tr>
<tr>
<td>Ib</td>
<td>Collect Waste → Dispose Waste</td>
<td>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.</td>
<td>Carroceiros, Belo Horizonte, Brazil [1]</td>
</tr>
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<tr>
<td>Ila</td>
<td>Collect Waste → Separate Recyclables → Sell Recyclables → Dispose Rejects</td>
<td>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.</td>
<td>Recyclers in Laredo / Nuevo Laredo, USA/Mexico [2]</td>
</tr>
<tr>
<td>IIb</td>
<td>Collect Waste → Separate Recyclables → Sell Recyclables → Dispose Rejects</td>
<td>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.</td>
<td>Micro-enterprises, Quito, Ecuador [3] Manos Unidas, Managua, Nicaragua [4]</td>
</tr>
<tr>
<td>IIC</td>
<td>Collect Waste → Separate Recyclables → Sell Recyclables → Dispose Rejects</td>
<td>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.</td>
<td>Medina and Scheinberg et al. [5, 6] discuss the separation of recyclables during municipal solid waste collection rounds</td>
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<td>IIIa</td>
<td><img src="#" alt="Flowchart" /></td>
<td>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.</td>
<td>Recyclers in Laredo / Nuevo Laredo, USA/Mexico [2]</td>
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<td>IIIb</td>
<td><img src="#" alt="Flowchart" /></td>
<td>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).</td>
<td>Coopesol Leste, Belo Horizonte, Brazil [7] Coopert, Itauna, Brazil [8]</td>
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<td>IVa</td>
<td>Collect Recyclables → Sort Recyclables → Sell Recyclables → Dispose Rejects</td>
<td>Recyclables collection service – comingled recyclables are collected by the IWMRS directly from households, sorted and sold, and rejected material is disposed.</td>
<td>Cooperpires, Ribeirão Pires, Brazil [9, 10]</td>
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<tr>
<td></td>
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<td>Coopert, Itauna, Brazil; Cocamar, Natal, Brazil; CooperRegião, Londrina, Brazil [8]</td>
</tr>
<tr>
<td>IVb</td>
<td>Collect Recyclables → Sort Recyclables → Sell Recyclables → Dispose Rejects</td>
<td>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.</td>
<td>Coopesol Leste, Belo Horizonte, Brazil [7]</td>
</tr>
<tr>
<td>IVc</td>
<td>Collect Recyclables → Sort Recyclables → Sell Recyclables → Dispose Rejects</td>
<td>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.</td>
<td>Private Company and Recyclers, La Reina, Chile [11]</td>
</tr>
</tbody>
</table>
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**


**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.
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Thank you for listening!

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