Waste pickers as an unappreciated link in municipal solid waste management system: A social survey in Nanjing, China

Reporter: Zhanbin Luo

Co-authors: Fu Chen, Yongjun Yang, Gang-Jun Liu, Jing Ma

21–24, June 2017, Athens

China University of Mining & Technology
OUTLINE

INTRODUCTION

- CURRENT DEBATES OF WASTE PICKERS IN CHINA

METHODOLOGY AND DATA COLLECTION

- Study area
- Methodology
- Data collection

RESULTS AND DISCUSSION

- Mapping a socio-economic profile of MSW recycling in Nanjing, China
- Estimation of the economic value of the informal waste recycling sector through pickers
- Influence of waste pickers on the MSW recovery rate

PROPOSED OPTIONS OF MSW MANAGEMENT IMPROVEMENT AND POLICY IMPLEMENTATION IN NANJING

- Establishment of a community-based semi-official picker organizational framework to improve resource recovery rate and pickers’ income
- Policy implementation

CONCLUSIONS
The land use map of Nanjing 2008 and 2011

“Garbage siege” in China
CURRENT DEBATES OF WASTE PICKERS IN CHINA

Waste Pickers?

- Street waste pickers
- Municipal street cleaners/garbage collectors

HOW?

- Street hawkers
METHODOLOGY AND DATA COLLECTION

- Study area

Table 1 The municipal solid waste composition in Nanjing City, China (%)

<table>
<thead>
<tr>
<th>Waste classification</th>
<th>Food</th>
<th>Wood</th>
<th>Paper and cardboard</th>
<th>Plastics</th>
<th>Textile</th>
<th>Glass</th>
<th>Metal</th>
<th>Fines</th>
<th>Stones and brick</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet weight fraction (%)</td>
<td>46.2</td>
<td>2.3</td>
<td>12.6</td>
<td>7.2</td>
<td>6.4</td>
<td>1.6</td>
<td>1.1</td>
<td>21.7</td>
<td>3.2</td>
<td>100</td>
</tr>
<tr>
<td>Moisture content (%)</td>
<td>64.2</td>
<td>44.3</td>
<td>27.8</td>
<td>34.2</td>
<td>37.2</td>
<td>7.8</td>
<td>6.4</td>
<td>14.3</td>
<td>9.4</td>
<td>40.4</td>
</tr>
<tr>
<td>Dry weight fraction (%)</td>
<td>16.5</td>
<td>1.3</td>
<td>9.1</td>
<td>4.7</td>
<td>4.0</td>
<td>1.5</td>
<td>1.0</td>
<td>18.6</td>
<td>2.9</td>
<td>59.6</td>
</tr>
</tbody>
</table>

Figure 1. Evolution of MSW generation in Nanjing in 1984-2016 (a) and MSW correlation with GDP and urban population (b)

Forecast by NEPB: 4.85 million tons in 2030
METHODOLOGY AND DATA COLLECTION

- Methodology

**Step I:** Social survey of MSW management
- Decision-makers
- Ordinary citizens
- Recyclables’ dealers
- Waste pickers
- Extraction
- Current management system
- Problems and suggestions
- Livelihood and aspirations

**Step II:** Mapping a profile of MSW recycling
- Formal sector:
  - City collector
  - Commercial collector
  - Treatment center
  - Recycling system
- Informal sector:
  - Street picker
  - Itinerant buyer
  - Dealer
  - Dump picker

**Step III:** Assess the impact of pickers on MSW recycling
- Composition of informal waste recycling sector
- Estimation of recycled material flow through waste pickers
- Role of the informal waste recycling sector

**Step IV:** Enhanced MSW recycling system
- Established a community-based waste picker management model for improving the waste recycling
- Policy implementation

Figure 2. Research framework for waste recycling through pickers in this study

\[ Y = \sum_{i=1}^{n} m_{i,x} \cdot p_i \]
METHODOLOGY AND DATA COLLECTION

- Data collection

Figure 3. The city districts covered by the field investigation in this research
RESULTS AND DISCUSSION

- Mapping a socio-economic profile of MSW recycling in Nanjing, China

Figure 5. Formal and informal MSW recycling sectors in Nanjing, China
### RESULTS AND DISCUSSION

- Estimation of the economic value of the informal waste recycling sector through pickers

Table 2 Break-down of collected recycling materials monitored in the field survey of waste pickers in Nanjing

<table>
<thead>
<tr>
<th>Waste break-down</th>
<th>Itinerant buyers</th>
<th>Street picker</th>
<th>Dump scavenger</th>
<th>Municipal cleaner</th>
<th>Junk shopper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample size</td>
<td>58</td>
<td>185</td>
<td>89</td>
<td>79</td>
<td>11</td>
</tr>
<tr>
<td>Source generation</td>
<td>Households and small business</td>
<td>Streets and public facilities</td>
<td>dump</td>
<td>Streets and temporary storage site</td>
<td>all waste pickers</td>
</tr>
<tr>
<td>Paper and cardboard (kg d⁻¹)</td>
<td>65.4 ± 19.3</td>
<td>16.9 ± 5.8</td>
<td>14.4 ± 4.5</td>
<td>16.3 ± 5.2</td>
<td>843.8 ± 192.4</td>
</tr>
<tr>
<td>Metal (kg d⁻¹)</td>
<td>6.5 ± 1.8</td>
<td>1.7 ± 1.1</td>
<td>0.9 ± 0.5</td>
<td>1.3 ± 0.5</td>
<td>63.5 ± 31.6</td>
</tr>
<tr>
<td>Plastic (kg d⁻¹)</td>
<td>15.7 ± 5.7</td>
<td>11.6 ± 4.3</td>
<td>10.4 ± 2.9</td>
<td>12.2 ± 3.9</td>
<td>426.7 ± 109.3</td>
</tr>
<tr>
<td>Grass (kg d⁻¹)</td>
<td>4.4 ± 2.9</td>
<td>3.1 ± 2.0</td>
<td>2.9 ± 1.2</td>
<td>2.3 ± 1.5</td>
<td>108.8 ± 30.8</td>
</tr>
<tr>
<td>Woods (kg d⁻¹)</td>
<td>2.3 ± 1.3</td>
<td>6.8 ± 3.7</td>
<td>1.7 ± 0.7</td>
<td>37.9 ± 10.4</td>
<td></td>
</tr>
<tr>
<td>Textile (kg d⁻¹)</td>
<td>2.7 ± 1.1</td>
<td>4.9 ± 2.3</td>
<td>2.1 ± 0.9</td>
<td>44.7 ± 7.8</td>
<td></td>
</tr>
<tr>
<td>Total (kg d⁻¹)</td>
<td>92.0 ± 23.9</td>
<td>38.3 ± 10.2</td>
<td>40.3 ± 9.7</td>
<td>35.9 ± 7.8</td>
<td>1525.4 ± 237.5</td>
</tr>
</tbody>
</table>

Note: d⁻¹ means per day
RESULTS AND DISCUSSION

- Influence of waste pickers on the MSW recovery rate

Table 4. The potential contribution of pickers to the MSW recycling ratio in Nanjing

<table>
<thead>
<tr>
<th>Recyclable materials (kg d⁻¹)</th>
<th>Potential availability of recyclable material in MSW (kg d⁻¹)</th>
<th>Actual recyclable materials captured by recycling industries (kg d⁻¹)</th>
<th>Total recovery rate</th>
<th>Recovery rate of Singapore-Nanjing Eco-tech islandᵃ</th>
<th>Contribution of waste pickers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper and cardboard</td>
<td>395514</td>
<td>337211.4</td>
<td>85.3%</td>
<td>77.3%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Metal</td>
<td>34529</td>
<td>30144.5</td>
<td>87.3%</td>
<td>85.4%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Plastic</td>
<td>226008</td>
<td>174010.3</td>
<td>77.0%</td>
<td>72.5%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Glass</td>
<td>50224</td>
<td>45987.4</td>
<td>91.6%</td>
<td>88.1%</td>
<td>3.5%</td>
</tr>
<tr>
<td>Wood</td>
<td>72197</td>
<td>24356.8</td>
<td>33.7%</td>
<td>43.8%</td>
<td>Data is not validᵇ</td>
</tr>
<tr>
<td>Textile</td>
<td>200896</td>
<td>128875.9</td>
<td>64.2%</td>
<td>59.6%</td>
<td>4.6%</td>
</tr>
</tbody>
</table>

ᵃCalculation is based on the data of Super-Energy Resources Recycling Corporation, Ltd. and Table 1.
ᵇThe calculated value is invalid, due to the same reasons as described in Table 3
RESULTS AND DISCUSSION

- Establishment of a community-based semi-official picker organizational framework to improve resource recovery rate and pickers’ income

Figure 6. Proposed community-based pickers’ organizational framework linked with public service of the MSW management in Nanjing
RESULTS AND DISCUSSION

- Policy implementation

**NO.1 COMMUNITY & ORGANIZATION**

Implement the semi-official picker organizational mode based on community as a pilot project and delegate the dispersed resource, financial ability, and right to grassroots community organizations.

**NO.2 LAWS & REGULATIONS**

Such as:

1. Law of waste disposal
2. Law on recycling economy and waste utilization
3. Technical guide for waste classification and disposal in residential area
4. Technical guidelines for special disposal and storage of waste

**NO.3 CHAIN & HEALTHY**

① Ensure a better balance the value chain of MSW recycling and promote the healthy development of MSW recycling.
② A financial support for the purchase of recyclable raw materials.
The informal sector of waste recycling through classified by waste pickers.

In Nanjing, waste pickers annually collect about 505,000 tons of recyclable materials and create about 541.9-583.7 million CNY (78.6-84.7 USD) of the annual economic value, but account only for 6.8-7.3% of the entire recycling industry chain.

The pickers in Nanjing are able to save the MSW disposal cost of approximately 121.2-151.5 million CNY (17.6-22.0 million USD). The resource recovery rate is also increased by 1.9-8.0%.

The available management modes for pickers’ are shown to be inefficient.

The survey results support the expedience of establishing a community-based semi-official picker organizational framework, accompanied with relevant laws, regulations and preferential policies that would improve resources’ recovery rate and pickers’ living and work conditions.
ACKNOWLEDGEMENTS

Organizers and Presiders of This Conference

Nanjing Environmental Protection Bureau

Bureau of Land and Resources of Nanjing City

Financial support: Fundamental Research Funds for the Central Universities (2017XKQY070).
THANKS

*Correspondence:
E-mail: jingma2013@cumt.edu.cn;
Tel.: +86051683883501;
Fax: +86051683883501