A Comparative Study on Economic Policies for Construction and Demolition Waste Minimisation

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• Introduction to Economic Policies for C&D Waste
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Current C&D Waste

- Construction waste is a major source of urban wastes in HK, with daily generation of 57,547 tonnes in 2014 (3,942 tonnes to landfill per day).

25%
• Construction waste is a major source of urban wastes in HK, with daily generation of 65,971 tonnes in 2013 (3,591 tonnes to landfill per day).
Research Background

• Appropriate economic policies can motivate the construction industry to minimise C&D waste (Li, 2013).

• There are differences in economic policies adopted by various countries and cities.

→ Lack of comparative studies on economic policies
Research Objectives

• To compare the economic policies implemented for C&D waste minimization
  • Three regions: Asia Pacific, North American, and European regions (largest construction markets (IHS, 2013))
    • Hong Kong, South Korea, the US, the UK, Ireland, and the Netherlands
    • Economic policies and statistical data are officially provided
    • Establishment and modification years of economic policies, waste disposal facilities, classification of waste types, and charges for each waste type.

• To understand the impacts of the economic policies on C&D waste minimization
  • Solid waste generated per capita
  • C&D waste generated per capita
  • C&D waste generation rates
Introduction to Economic Policies for C&D Waste

- Deposit-refunded scheme
- Fines scheme
- Charging scheme (or landfill levy)
- Tax on raw materials
Introduction to Economic Policies for C&D Waste

• Deposit-refunded scheme
  • The deposit is refunded when the specific requirements are fulfilled. The scheme reduces the incentive to illegal dumping and stimulates reuse and recycling of waste streams.
Introduction to Economic Policies for C&D Waste

• Deposit-refunded scheme

• Fines scheme
  • Fines are charged for non-compliance such as illegal dumping and low recycling rates.
Introduction to Economic Policies for C&D Waste

• Deposit-refunded scheme

• Fines scheme

• Charging scheme (or landfill levy)
  • The charging scheme charges construction waste generation in order to reduce the amount of C&D waste disposed of at landfills.
Introduction to Economic Policies for C&D Waste

• Deposit-refunded scheme
• Fines scheme
• Charging scheme (or landfill levy)
• Tax on raw materials
  • Tax on raw materials is a financial measure by shifting the price differential against raw materials and in favour of secondary materials, in order to reduce resource extraction, to increase recycling rates, and to make full use of secondary materials.
Comparison of Economics Policies

<table>
<thead>
<tr>
<th>Region (reference)</th>
<th>Economic policies (year)</th>
<th>Deposit-refunded scheme</th>
<th>Tax on raw materials</th>
<th>Fines scheme</th>
<th>Charging scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong (HKEPD, 2012)</td>
<td></td>
<td>-</td>
<td>2001</td>
<td>-</td>
<td>2006</td>
</tr>
<tr>
<td>South Korea (KECO, 2016)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1993&lt;sup&gt;a)&lt;/sup&gt; (2008&lt;sup&gt;a)&lt;sub&gt;b&lt;/sub&gt;&lt;/sup&gt;)</td>
</tr>
<tr>
<td>UK (EIONET, 2009)</td>
<td></td>
<td>-</td>
<td>2002</td>
<td>-</td>
<td>1996</td>
</tr>
<tr>
<td>Ireland (EIONET, 2009)</td>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2002&lt;sup&gt;b)&lt;/sup&gt;</td>
</tr>
<tr>
<td>Netherlands (Oosterhuis et al., 2009, EIONET, 2009)</td>
<td></td>
<td>-</td>
<td>1997</td>
<td>-</td>
<td>1996</td>
</tr>
</tbody>
</table>

<sup>a)</sup> denotes the establishment or modification year for solid waste
<sup>b)</sup> denotes the modification year
# Comparison of C&D Waste Charging Schemes

<table>
<thead>
<tr>
<th>Country (Reference)</th>
<th>C&amp;D waste type</th>
<th>Facility type</th>
<th>Charing fee (USD/tonne)</th>
<th>Ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong (HKEPD, 2012)</td>
<td>Less than 50% inert waste</td>
<td>Landfill</td>
<td>16.4</td>
<td>15.2</td>
</tr>
<tr>
<td></td>
<td>Inert waste</td>
<td>Public fill</td>
<td>3.5</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>More than 50% inert waste</td>
<td>Sorting facilities</td>
<td>12.9</td>
<td>12.0</td>
</tr>
<tr>
<td>South Korea (Lee and Dong, 2016)</td>
<td>Mixed waste</td>
<td>Landfill</td>
<td>46.1</td>
<td>42.8</td>
</tr>
<tr>
<td></td>
<td>Recyclable waste</td>
<td>Sorting facilities</td>
<td>67.3*</td>
<td>62.4</td>
</tr>
<tr>
<td></td>
<td>Combustible</td>
<td>Incineration</td>
<td>134.5*</td>
<td>124.9</td>
</tr>
<tr>
<td>US (ESD, 2012)</td>
<td>Mixed waste</td>
<td>Landfill</td>
<td>74.0</td>
<td>68.7</td>
</tr>
<tr>
<td></td>
<td>Recyclable concrete</td>
<td>-</td>
<td>10.0</td>
<td>9.3</td>
</tr>
<tr>
<td>UK (UKGov, 2006)</td>
<td>Mixed waste</td>
<td>Landfill</td>
<td>107.7</td>
<td>100.0</td>
</tr>
<tr>
<td></td>
<td>Sorted waste (rock or soil)</td>
<td>Public fill</td>
<td>3.2</td>
<td>3.0</td>
</tr>
<tr>
<td>Ireland (Li, 2013)</td>
<td>-</td>
<td>-</td>
<td>24.1</td>
<td>24.1</td>
</tr>
<tr>
<td>Netherlands (Van Dijk et al., 2001)</td>
<td>Non-combustible</td>
<td>-</td>
<td>70.8</td>
<td>65.7</td>
</tr>
<tr>
<td></td>
<td>Combustible</td>
<td>-</td>
<td>70.8</td>
<td>65.7</td>
</tr>
</tbody>
</table>

* is the average value of charging fee

**Most expensive (incineration)**

**Most expensive (landfill)**
Analysis of C&D Waste Statistics

• Solid waste generated per capita
• C&D waste generated per capita
• C&D waste generation rates
## Analysis of C&D Waste Statistics

- Data collection

<table>
<thead>
<tr>
<th>Country</th>
<th>Solid and C&amp;D waste</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hong Kong</td>
<td>HKEPD (2015)</td>
<td>HKCSD, 2016</td>
</tr>
<tr>
<td>South Korea</td>
<td>ME and KECO (2014)</td>
<td>OECD STAN</td>
</tr>
<tr>
<td>UK</td>
<td>Eurostat (2016)</td>
<td>OECD STAN</td>
</tr>
<tr>
<td>Ireland</td>
<td>Eurostat (2016)</td>
<td>OECD STAN</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Eurostat (2016)</td>
<td>OECD STAN</td>
</tr>
<tr>
<td>US</td>
<td>Data were not collected.</td>
<td></td>
</tr>
</tbody>
</table>
Analysis of C&D Waste Statistics

• Solid waste generated per capita

[Graph showing the trend of generated solid waste per capita from 2004 to 2012 for Korea, UK, Hong Kong, Ireland, and Netherlands. The graph indicates a decrease in waste generation over the years.]
Analysis of C&D Waste Statistics

- C&D waste generated per capita
Analysis of C&D Waste Statistics

- C&D waste generation rates
Discussion

• Appropriate adjustment of disposal cost of C&D waste can motivate practitioners to efficiently minimise and manage C&D waste.

• In Hong Kong, the charges for C&D waste disposal has been recently increased (April 2017)
  • Public fill charge: USD 9.2 (HKD 71)
  • Sorting charge: USD 22.6 (HKD 175)
  • Landfill charge: USD 25.8 (HKD 200)

• Quantified goals, such as setting limits on the amount of total C&D waste being sent to landfills, setting recycling rates for C&D waste, etc., are additionally required.
Conclusions

• To quantitatively and qualitatively compare the economic policies for C&D waste minimisation in Hong Kong, South Korea, the US, the UK, Ireland, and the Netherlands
  • Deposit-refunded scheme, fines scheme, charging scheme (or landfill levy), and tax on raw materials.
• To compare results of C&D waste statistics in countries
  • C&D waste charging schemes have positive impacts on C&D waste minimisation.

Limitations

• Relationships between the economic policies and the amount of C&D waste were not analysed quantitatively
• Other factors can affect the C&D waste statistics as well
Further Thoughts

- **Soft** side: *policies*, incentives
- **Hard** side: technologies

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**Avoid**
- Avoid generated of C&D waste by design or project operation.

**Minimise**
- Minimise generated of C&D waste by design or project operation.
- The C&D material producer has the responsibility sorting, reuse and recycle of C&D waste.

**Recycle**
- Appropriate facility to increase the value and reuse of C&D material.

**Treat**
- Waste cannot be reuse or recycle, disposed by landfill or incinerator.

**Dispose**
Thank you

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