REPLAST: Driving Manufacturing Using Recycled Plastics

Wednesday 6th November 2013

Findings of Report on Global Plastics Scrap Market

Jeff Cooper, ISWA
Dependence of Plastics Recycling on Global Markets

Based on research by Dr Costas Velis

Presented by Jeff Cooper

ISWA Globalisation and Waste Management Task Force
Project Coordinator: A. Mavropoulos, ISWA STC Chair  
Scientific co-ordinator: Prof D. Wilson  
Members: J. Cooper, B. Appelqvist, C. Velis

Examine and make recommendations on issues arising from the interaction between globalisation and waste management

Contributing: more than 60 scientists and countless practitioners

<table>
<thead>
<tr>
<th>Megacities</th>
<th>Informal Sector</th>
<th>Global Recycling Markets</th>
<th>International Collaboration and Aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beacon conference - Singapore July 2012</td>
<td>International expert workshop - Buenos Aires 2011</td>
<td>ISWA report: Global plastic recycling markets</td>
<td>PhD research partly supported by ISWA</td>
</tr>
<tr>
<td>ISWA Report on Underground SWM solutions - in most read of Knowledge base</td>
<td>‘InteRa’ framework and tool : WM&amp;R paper and CGI keynote presentation</td>
<td>Vienna ISWA Congress Special Session (1) Paper markets and (2) Trafficking</td>
<td>‘International Development aid for waste management in low and middle income countries’</td>
</tr>
<tr>
<td>‘Globalising MFA’ decision support tool + publication</td>
<td>ISWA publication Award 2013 – in most read of WM&amp;R</td>
<td>Pre-view today Generated already press interest (2 Guardian articles)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
European waste plastics management

- EU-27 generates 25 Mt waste plastics
- Almost stable since 2006 (Plastics Europe, 2012 based on 2011 data)
  - 6.3Mt (25.1% wt.) was sent for recycling
  - 8.6Mt was sent for energy recovery
  - Remaining was disposed of (landfill)
- Collection for recycling ranges from 15-30% and energy recovery levels vary from 0-75% EU-27
  - From the 6.4Mt collected for recycling (BIR’s 2011 data):
    - 3Mt was handled within Europe
    - **3.4Mt exported outside Europe - worth of €1.7 Billion (Extra-EU trade)**
European Waste plastics value recovery

Adopted from: Consultic, as cited by Plastics Europe, 2012

Figure 12: Total Recovery Rate by Country 2011
(Referring to Post-Consumer Plastic Waste)
Source: Consultic
Top Trading Countries

Top Importers in the selection

<table>
<thead>
<tr>
<th>Reporter Title</th>
<th>Trade Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>$6,109,315,386</td>
</tr>
<tr>
<td>China, Hong Kong SAR</td>
<td>$1,648,137,359</td>
</tr>
<tr>
<td>USA</td>
<td>$217,866,559</td>
</tr>
<tr>
<td>Netherlands</td>
<td>$204,638,745</td>
</tr>
<tr>
<td>Belgium</td>
<td>$179,136,063</td>
</tr>
</tbody>
</table>

Total Import: $8,359,094,112

Top Exporters in the selection

<table>
<thead>
<tr>
<th>Reporter Title</th>
<th>Trade Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>China, Hong Kong SAR</td>
<td>$1,105,843,904</td>
</tr>
<tr>
<td>USA</td>
<td>$1,052,355,271</td>
</tr>
<tr>
<td>Japan</td>
<td>$944,978,707</td>
</tr>
<tr>
<td>Germany</td>
<td>$697,069,415</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>$304,747,504</td>
</tr>
</tbody>
</table>

Total Export: $4,104,994,801

Code 3915: “waste, parings and scraps of plastics”

Data source: (UN Comtrade)
Global map of export transactions - waste plastics ‘11

Code 3915: “waste, parings and scraps of plastics”

Data source: (UN Comtrade)
Europe depends on exporting to China (87% wt. of exports)

More than half of the plastic waste collected for recycling in Europe is directed to international markets

• Trade is relatively stable: 2010: 3.373Mt; 2011: 3.365Mt; 2012: 3.358Mt
• Destination (target countries) mainly Asia (South, South East, East)
• 87% wt. to China + Hong Kong SAR
• Rising trend of direct exports to China, and also to India
• Exports of Europe to South-East Asian countries to a great extent finally find their way towards China!

Overall dependence on Chinese market demand is even greater!

EU-27 imports: 0.4 Mt (vs.3.4Mt exports)

• Countries from outside Europe make a negligible contribution
• Norway and Switzerland being most important EU-27 suppliers
Global map of import transactions in waste plastic – 2011: China rules!
Waste plastics flows in the UK and... beyond - Processed for export?

Source: Zhou, 2012
UK Exports per polymer type to China and Hong Kong

![Bar chart showing UK exports per polymer type to China and Hong Kong from 2003 to 2011. The chart includes data for PP, PVC, PS, and PE polymers.](https://example.com/chart.png)
Prices of reprocessed waste plastics in the UK market

Collapse in prices corresponded to the financial crisis which resulted in a fall in the production index of primary plastics

*Plastics Europe, 2012.*

Adapted from *WRAP, 2012*
World exports of recovered plastics to China, including HK, in 2011

- Others: 35%
- USA: 21%
- Japan: 18%
- UK: 9%
- Thailand: 2%
- Germany: 12%
- Belgium: 3%
What happens within China?

- There is insufficient understanding on the fate of the waste plastics after entering China
  - Implications for local and global human health and environment?
- China in top consumers of plastics: plastic products consumption grew rapidly from 22kg per capita (kg per-1) in 2005 to 46kg per-1 in 2010 (Liao, 2011).
- Sufficient supply of plastic resources?
China: high demand for (waste) plastics

• Long term demand for waste plastics in China is closely related to the gap between the supply and demand of primary plastics. **Chinese domestic supply is inadequate to meet the demand** - BUT capacity of the domestic petro-chemical industry develops dramatically. The production of synthetic resins doubled in the past six years, reaching at around 48Mt in 2011.

• **Almost half of the primary material is imported.** The total yearly imports of primary plastics in 2011 were 23Mt, covering just less than 50% of total demand.

• Chinese government regards that the **dependency on imports of one commodity should not exceed 50%**, and the utilisation of recycled plastics can effectively reduce Chinese dependency on imports of primary plastics.

• Poyry, based on CBI China projections, predicts that the Chinese (including Hong Kong) **demand for recovered plastics could reach 29Mt by 2015**
Data-sets not fully mutually consistent (use of recycled plastics and total recovered plastics)

2006 and 2007: use of recycled plastics were lower than imports of waste plastics (can be partly attributed to disorder of the waste plastics industry. + Chinese importers maintain stock to purchase waste plastics at low market prices; Imported waste plastics not all incorporated into products due to impurities, water content and a range of other factors).

Recycling of domestic waste plastics is still very low, although domestic recovered plastics were almost twice the imports in 2011
• Import also due to quality being better than domestic Chinese sources

• HYPOTHESIS: **domestic waste plastics go mainly to EfW?**

• But also often thin line with waste trafficking – WEEE plastic casing?

• Wide spectrum of reprocessing industry

• **But**: some importers re-sell to “3-non-enterprises”

• (no rules for operation – no quality standards – no inspection)
Implications for resource recovery?

Around 70% wt. of “recycled” UK plastics are exported: IMPLICATIONS?

“A Chinese woman holds her baby as she strips labels from plastic soda bottles so they can be recycled.” Copyright: Peter Ford/The Christian Science Monitor. After (Ford, 2013)

“Coal fired extruder in a small recycling plant in China.” After (Jefferson 2010)

“Children sorting out tiny specks of wrong coloured plastic chips. Many hundreds of bags await their eyes and fingers.” © BAN. After (Pucket et al., 2002)

• High use of additives + low quality products = down-cycling

• Poor worker health and safety and variable manufacturing practices

• Environmental protection not a priority (Wastewater treatment? Melting?)
‘Green Fence Operation’ is rapidly changing import facts

• So called “Green fence operation”: enhanced enforcement campaign implemented at Chinese customs
  • Since February 2013, and has been announced to last for 10 months.
  • It implements legislation on quality of imported waste-derived secondary raw materials.
  • 2009 Chinese regulations allow up only 1.5% wt. physical contamination.

Photo by Dan Kitwood/Getty Images – Web source: WONGBLOG (Plumer, 2013)
Key Global Recycling Market Factors

International recycling markets for plastics scrap - complex interplay of:

(1) National (domestic) solid waste collection capabilities (formal and informal), reprocessing capabilities and needs, and export /transport laws and controls.

(2) Market demand and import controls at the major destination countries (e.g. China) and investment in raw material production elsewhere (e.g. Chinese investments in Africa).

(3) Global supply chain networks: transport logistics and costs (westbound freight rates, number of empty containers returning to Asia (“reverse haulage”), customs).

(4) Cost of primary resins, dependent on oil and natural gas prices (prime determinant of the price of recycled plastics)

(5) Technological innovation: (new resins, composites, oxo-degradable and compostable plastics, sensor-based sorting, chemical recycling).

(6) International and domestic politics (price dumping – economic growth and employment generation – “green economy”)
Beyond mainstream economics and value chain: Recycling market’s challenges

- Resource efficiency + effectiveness
- Sustainable consumption and production
- Final storage quality landfill
- Circular economy
- Low carbon footprint
- Resilient and adaptable infrastructure
- Materials criticality
- Cradle to cradle
- Zero waste
BUT: ‘When applying the waste hierarchy, Member States shall take measures to encourage the **options that deliver the best overall environmental outcome**. This may require **specific waste streams departing from the hierarchy** where this is justified by **life-cycle thinking** on the overall impacts of the generation and management of such waste’
European Waste plastics value recovery

Adopted from: Consultic, as cited by (Plastics Europe, 2012)
Some key challenges for our recycling systems

- What will the EU do if China did not receive their recyclables?
- Why does the EU (and USA and Japan) have to export so much? A starting point to rethink the sustainability of the current practices?
- Environmentally, a lot depends on the local (mostly Chinese) management of recyclables - which is not 100% known to us
- Need to consider the global dimensions of waste management and introduce better international cooperation
- In the long-term Chinese oligopoly in recyclables creates need for a strong, more regional waste management and recycling markets
- (Cost-) Effective single stream collection + local reprocessing systems need to be developed: e.g. closed-loop PET + HDPE in the UK
More on optimising value from recycling

• WM&R editorial [31 (6), 539-540] Velis and Brunner: ‘Recycling and resource efficiency: it is time for a change from quantity to quality’


• University of Leeds C-VORR cross-disciplinary research project:
  • framework and tool for optimizing resource efficiency beyond just SWM
Thank You……..

c.velis@leeds.ac.uk
jeffcooper@btinternet.com

ISWA Globalisation and Waste Management Task Force