Circular Economy Practices for Plastic Pollution: UNIDO’s Approach

Sooksiri Chamsuk
UNIDO Regional Hub Office in Thailand

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Our HQ is in Vienna.
Main Activity Lines

Advancing economic competitiveness

- Investment, technology and SME development
- Competitive trade capacities and corporate responsibility
- Entrepreneurship development

Creating shared prosperity

- Agribusiness and rural development
- Women and youth in productive activities
- Human security and post-crisis rehabilitation

Safeguarding the environment

- Resource-efficient and low-carbon industrial production
- Clean energy access for productive use
- Implementation of multilateral environmental agreements (MEA)

Includes

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- Women and youth in productive activities
- Human security and post-crisis rehabilitation

Includes

- Resource-efficient and low-carbon industrial production
- Clean energy access for productive use
- Implementation of multilateral environmental agreements (MEA)
Regional Hub Office in Thailand

• Iran, Malaysia,

• Cambodia, Myanmar, Pakistan, Philippines, Thailand, Viet Nam.

• Lao PDR & Myanmar,

• Fiji, Kiribati, Samoa, Tonga, Tuvalu, Vanuatu.
Circular Economy Practices for Plastic Pollution:

UNIDO’s Approach
Linear supply chain
Circular economy practices

Material supply ➔ Design and manufacturing ➔ Distribution and use ➔ End-of-first life ➔ Waste-to-energy

Reduce / Replace ➔ Recycle / Regenerate ➔ Remanufacture ➔ Repair / Reuse ➔ Intensify
Circular economy practices

Material supply → Reduce/replace → Design and manufacturing → Distribution and use → End of first life → Chemical leasing → Disposal

New use models

Recycle/industrial symbiosis

Eco-Industrial Parks (EIP) sustainable cities and infrastructure

Global Forum and Partnerships

Greening design, circular economy business practices by RECP, TEST, green chemistry, water stewardship
Practices of Circular Economy concept in:

- Design of Green product
- Replace material
- Resource efficient and cleaner production Extend lifespan of plastic products by reuse, repair
- Product use
- Extended Producer Responsibility
- Recycling and upcycling
- Detoxification of hazardous additives/
- Safe disposal of these contaminated additives.
- Waste to energy- where possible.
<table>
<thead>
<tr>
<th>Plastic use sector</th>
<th>Primary production (% of total)</th>
<th>Waste generation (% of production)</th>
<th>Waste generation (% of total waste)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packaging</td>
<td>36%</td>
<td>97%</td>
<td>47%</td>
</tr>
<tr>
<td>Transportation</td>
<td>7%</td>
<td>63%</td>
<td>6%</td>
</tr>
<tr>
<td>Building and construction</td>
<td>16%</td>
<td>20%</td>
<td>4%</td>
</tr>
<tr>
<td>Electrical/Electronic products</td>
<td>4%</td>
<td>72%</td>
<td>4%</td>
</tr>
<tr>
<td>Consumer &amp; institutional products</td>
<td>10%</td>
<td>88%</td>
<td>12%</td>
</tr>
<tr>
<td>Industrial machinery</td>
<td>1%</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td>Textiles</td>
<td>14%</td>
<td>71%</td>
<td>14%</td>
</tr>
<tr>
<td>Other</td>
<td>12%</td>
<td>81%</td>
<td>13%</td>
</tr>
</tbody>
</table>

*Table 1. Importance of plastics use sectors in production and waste generation, 2015
There are basically two types of products that we use with respect to their lifetime

• Short-lived, fast-moving products

• Long-lived, more durable products

What are some examples?
Short-lived products (that lose value immediately or rapidly)

- Packaging

- Single-use items

- Short-lived consumer products
Long-lived (durable) products

Loop: https://loopstore.com/
Eco-design strategies

Product System Level

7. Optimization of end-of-life system
   - Reuse of product
   - Remanufacturing/refurbishing
   - Recycling of materials
   - Safer incineration

6. Optimization of initial lifetime
   - Reliability and durability
   - Easier maintenance and repair
   - Modular product structure
   - Classic design
   - Strong product-user relation

5. Reduction of impact during use
   - Lower energy consumption
   - Cleaner energy source
   - Fewer consumables needed
   - Cleaner consumables
   - No waste of energy/consumables

4. Optimization of distribution system
   - Less/cleaner/reusable packaging
   - Energy-efficient transport mode
   - Energy-efficient logistics

3. Optimization of production techniques
   - Alternative production techniques
   - Fewer production steps
   - Lower/cleaner energy consumption
   - Less production waste
   - Fewer/cleaner production consumables

2. Reduction of materials usage
   - Reduction in weight
   - Reduction in (transport) volume

1. Selection of low-impact materials
   - Cleaner materials
   - Renewable materials
   - Lower energy content materials
   - Recycled materials
   - Recyclable materials
For consideration:

Design questions for **plastic packaging** such as the following need to be answered:

- Is it possible to replace plastic packaging with alternative (e.g. renewable or more easily recyclable) packaging and offers similar functionality? This alternative packaging should both likely reduce the amount of plastic waste in oceans and, ideally, have no other (significant) environmental disadvantages;
- Can the manufacturer reduce the amount of plastic packaging used (light-weighting)?
- Can the packaging be replaced with reusable and more durable plastic packaging to render it suitable for multiple uses and a longer lifetime? Could this also result in a new business model?
- Can this packaging be made from one polymer rather than different polymers in the same product, e.g., caps and lids made from different polymers when beverage containers and bottles are made of PET?
- Is it possible to eliminate multilayer packaging or use an easier to recycle multilayer packaging?
- Is there a mechanism to manage the plastic packaging after its use to maintain some economic value?
- Is it possible to totally eliminate packaging for a product?
Short-lives plastic consumer products—additives

In the case of *short-lived plastic consumer products*, in addition to the above design considerations such as maintaining the value of plastic materials at the product’s end of first life, additional questions on how the product behaves in the use phase would be justified:

- Is it possible to reduce impacts during use by reducing or eliminating microplastics emitted when clothing is laundered?
- Is it possible to eliminate microbeads in cleaning and personal care products and maintain a similar functionality?
- Can single-use plastic products be replaced with durable, recyclable or renewable alternatives?
- Is it possible to use no/fewer and less harmful additives in this product?
- Is it possible to use recycled plastics in this product?
- Can it be avoided to mix bio-based plastics with fossil-fuel-based plastics in the same product which renders them not easily recyclable to high quality secondary materials?
- Is it possible to have synthetic fibers in textiles and clothing that reduce microfiber formation during use?
- Can fossil-fuel-based plastics in this product be replaced with bio-based plastics, subject to the latter having more favorable life cycle impacts compared to the former?
Additives used in Plastics

- Plasticizers, 34%
- Fillers, 28%
- Flame retardants, 13%
- Antioxidants, 6%
- Heat stabilizers, 5%
- Impact modifiers, 5%
- Colorants, 2%
- Lubricants, 2%
- Light stabilizers, 1%
- Other, 4%

Figure 5. Commonly used additives in plastics, by function
Source: Geyer, et al. 2017
Substitute critical or hazardous materials
Sound Chemicals Management

Multilateral on Environmental Agreements
- Pesticides, Unintendeded, Chemicals in products, and hazardous wastes (containing these chemicals)
Stockholm Convention on Persistent Organic Pollutants

http://www.pops.int/
Durable packaging
Where can manufacturers “do more and better with less?”
In manufacturing, use RECP* solutions

*RECP=Resource Efficient Cleaner Production
Service sectors & product use

- Service sector: replace single use packaging with durable & resusable package
- Consumers: economic tools to discourage the use of single use plastic
  - Taxing single use plastic & subsidizing its- eco alternative
  - Discouage Fast fashion & consumerism culture
  - Extended Producer Responsibility

- End of first life:
  - considering to repair

- Waste segregation at source is the key!
Recycling/upcycling

- Know your plastic before recycle
- Mechanical recycling
- Chemical recycling
- Thermal recycling – waste to energy
- Upcycling
Safe disposal:

• Detoxification of hazardous additives/
• Safe disposal of these contaminated additives.
• Waste to energy- where possible.
Product-as-service

• iTunes & Apple Music - renting out music without owning a CD/tape casset

• Laundry service

• Food Apps – reduce carbon emissions but more packaging waste
Bike sharing, with mobile phones and apps

Both are billion dollar investments, expanding internationally out of China

Mobike

Ofo
Lastly, getting the price right $$
• In most cases low waste tipping fees for landfills discourage the more expensive collection, sorting and recycling operations;

• A level playing field exists where recycled (secondary) raw materials are not disadvantaged vis-à-vis virgin material; the latter for example benefitting from fossil-fuel subsidies;

• An economy of scale influenced by cooperation of users and existence of collection and separation systems and infrastructure for mechanical, chemical or thermal recycling.
A UNIDO-UNEP initiative since 1994

65 independent Resource Efficient Cleaner Production centers in 50 countries

www.recpnet.org
Greening the scrap metal value chain through promotion of BAT/BEP to reduce u-POPs releases from recycling facilities
GEF-UNIDO Global Cleantech Innovation Programme

Green building materials
GEF-UNIDO Global Cleantech Innovation Programme
PFAN- Private Finance Advisory Network (pfan.net)
Eco-Industrial Parks (EIP)

Firm level

Individual RECP solutions

Resource Efficient Cleaner Production (RECP):
- Materials efficiency
- Water efficiency
- Energy efficiency

Industrial Park level

Collective RECP solutions

Operation & Management of:
- Common Infrastructures
- Resource Supply (Water, Energy, Materials)
- Environmental & Social Services

City level

Urban Symbiosis

- Waste Management
- Recycling industries
- Corporate Social Responsibility

EIPs to promote “circular business practices, including “green design”
UNIDO’s Global Eco-Industrial Parks Programme

- **Bir Mcherga industrial park, Tunisia:**
  - Cement industry symbiosis:
    - Energy co-processing (waste to energy)
    - Materials co-processing (Reuse of slag, and refractory materials as substitutes for raw materials)

- **Morocco:**
  - 1 Industrial park
  - 10 Companies

- **Colombia:**
  - 1 Industrial park
  - 20 Companies

- **Peru:**
  - 2 Industrial parks
  - 20 Companies

- **India:**
  - 4 Industrial parks
  - 40 Companies

- **South Africa:**
  - 2 Industrial parks
  - 40 Companies

- **Viet Nam:**
  - 4 Industrial parks
  - 60 Companies

- **Ankleshwar industrial park, Gujarat, India:**
  - Common facility of spent sulfuric acid recovery for 46 companies

Target beneficiaries:
- 15 industrial parks
- Over 200 companies

An effective means of scaling up Circular Economy!
An international framework for Eco-Industrial Parks

https://openknowledge.worldbank.org/handle/10986/29110
https://openknowledge.worldbank.org/handle/10986/30458

With support of and inputs from

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An International Framework For
Eco-Industrial Parks

December 2017

A Practitioner's Handbook For
Eco-Industrial Parks
Implementing the International EP Framework

September 2018
Eco-industrial park pilots

- Colombia: 2 Industrial parks
- India: 4 Industrial parks
- South Africa: 2 Industrial parks
- Mauritania: 1 Industrial park
- Senegal: 1 Industrial park
- Peru: 2 Industrial parks
- Morocco: 2 Industrial parks
- Bangladesh: 1 Industrial park
- Ethiopia: 4 Industrial parks
- Vietnam (joint): 4 Industrial parks
- Turkey: 4 Industrial parks
- Thailand: 3 Industrial parks
- Turkey: 4 Industrial parks
- Senegal: 1 Industrial park
- Mauritania: 1 Industrial park
- Bangladesh: 1 Industrial park
- Ethiopia: 3 Industrial parks
- Turkey: 3 Industrial parks
- Vietnam: 3 Industrial parks

UNIDO

WBG

33 IPs
Detoxify waste for reuse of recovered materials

• Following e-waste programmes in Cambodia, Ethiopia, Uganda, Vietnam in partnership with Dell and Microsoft

• Environmentally sound management of POPs in waste of electronic and electrical equipment (WEEE)

• Regional WEEE programme 13 Latin American countries: Argentina, Bolivia, Chile, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Peru, Uruguay and Venezuela
Pay for performance or product-as-service

An innovative industrial product-as-service model launched first by UNIDO in 2004

http://www.chemicalleasing.com
Before:

• Badawi sold HC solvent to GM for cleaning metal parts
• After use, GM had to dispose of the waste solvent

After:

• Badawi “leases” HC solvent and supervises its use in the factory. After use, Badawi takes the solvent back to its factory for recycling.

Economic benefits:

• Badawi has increased efficiency of solvent use, and GM has reduced costs linked to solvent use by 15%. Proper solvent recycling has reduced GM’s liability from solvent waste. Badawi now has a long-term relationship with GM (much less chance that GM will purchase solvent from another company).

Environmental benefits:

• Less solvent is used, and it is properly recycled.
Chemical leasing

**Powder coating**
- Classical business model: payment per t of powder coating
  - Payment per m² of coated surface

**Agrochemicals**
- Classical business model: payment per kg pesticides
  - Payment per ha agriculture area with controlled pest

**Water treatment**
- Classical business model: payment per t of treatment chemical
  - Payment per m³ of purified water

**Labelling glues**
- Classical business model: payment per kg of glue
  - Payment per labelled bottle
Circular Economy

Thank you