

Circular Economy and Material Flow Analysis

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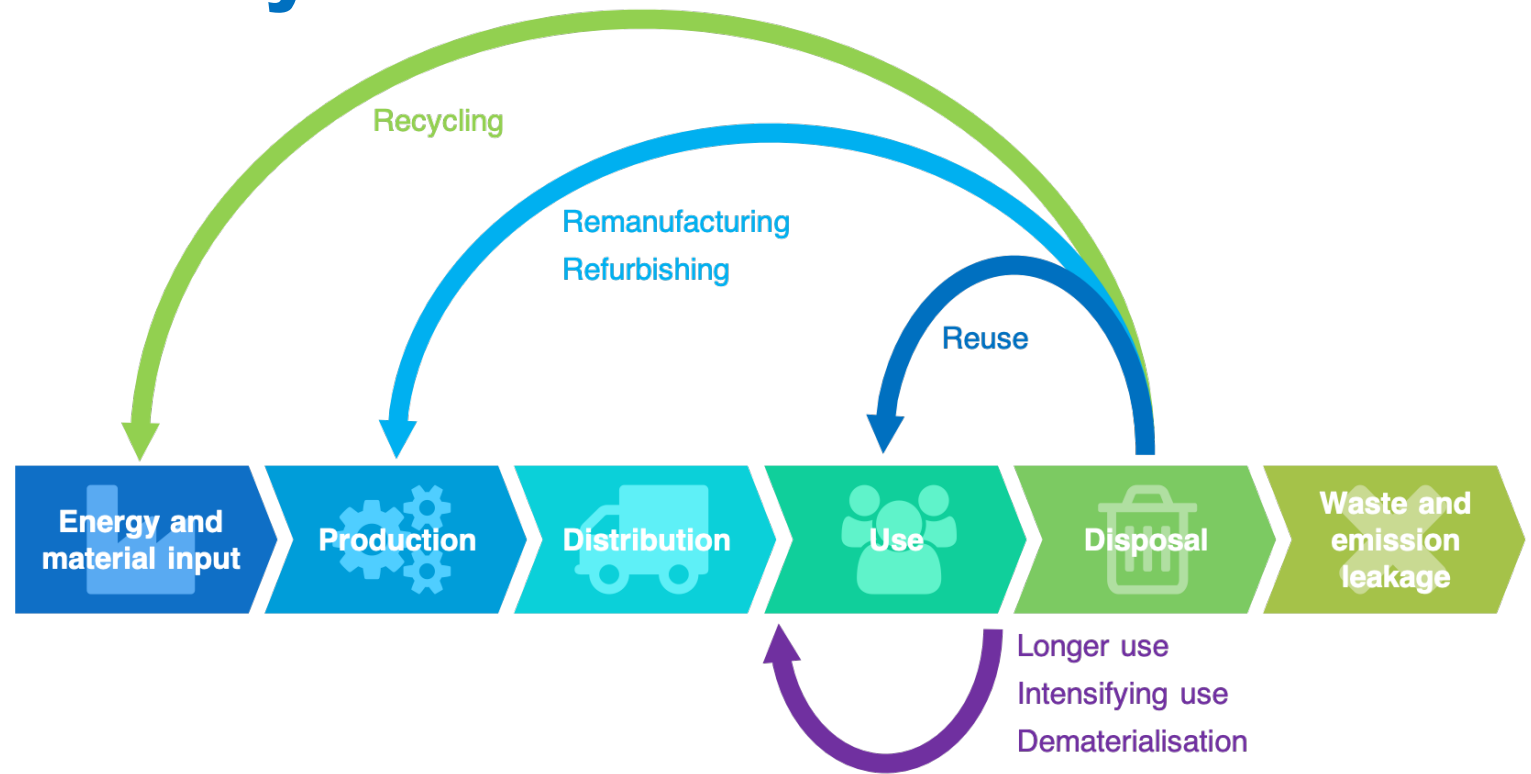
September 6, 2023

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Circular economy



Circular Economy: Is it profitable?

- ▼ That's the hope.
- ▼ Evidence: ad hoc cases, unclear how much circularity can happen at how much profit.
- ▼ Economist might argue: if profitable, market forces would have made CE happen already.
- ▼ Entrepreneur/technology developer says markets/products are dynamic, NOT in equilibrium

Market failures and Circular Economy

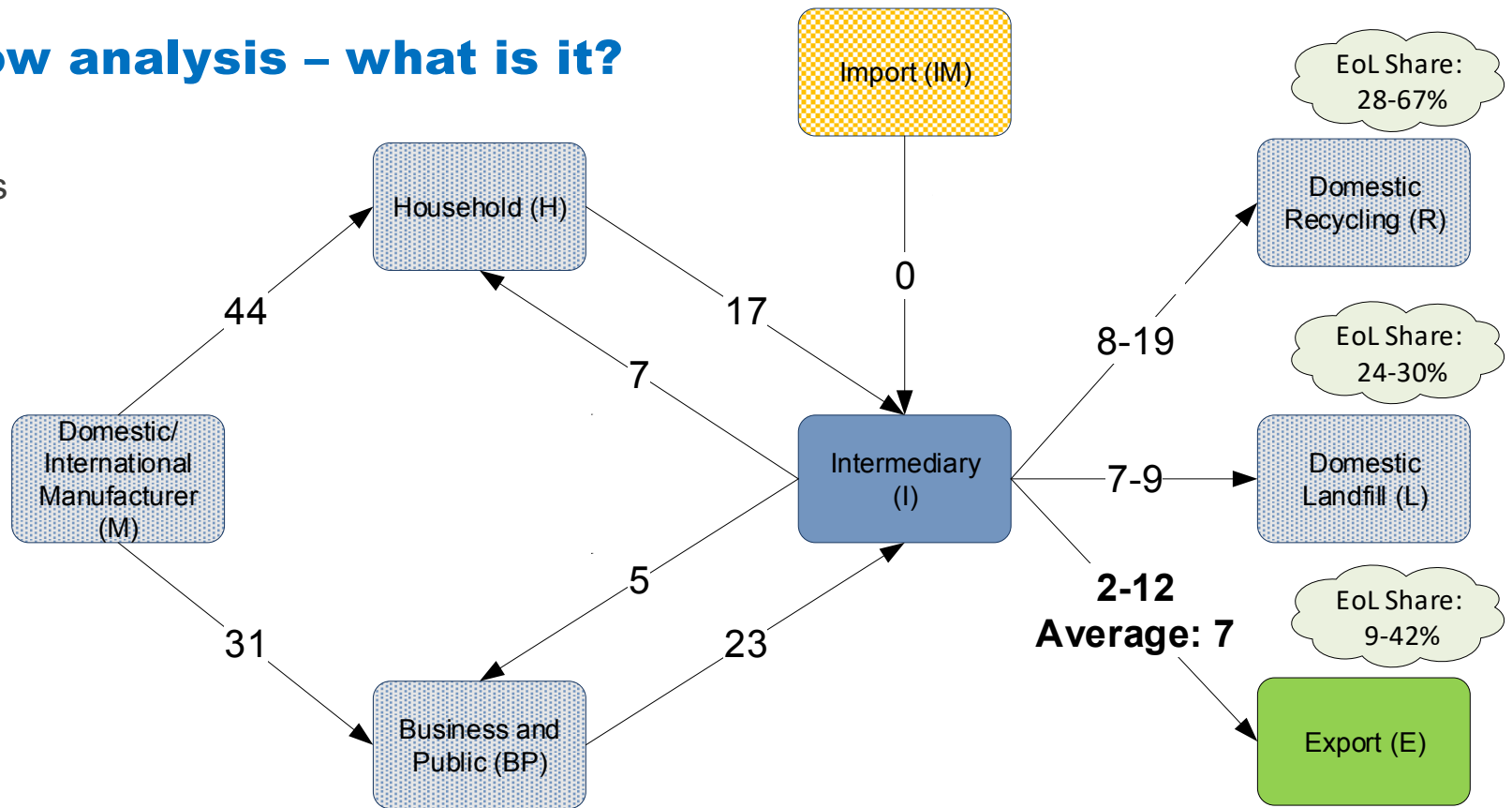
- ▼ Externalities – environment can often be damaged without cost.
- ▼ If cost of environmental damages would be included, more CE would happen.
- ▼ Incomplete information: producers and potential users of waste don't know about each other, what are opportunities?
- ▼ Material Flow Analysis can help address knowledge gaps.

Material flow analysis – what is it?

Example quantifies
2010 flows of new,
used and waste
computers in the
U.S.
(millions of units)

Clarifies scale of
reuse, recycling,
waste and exports

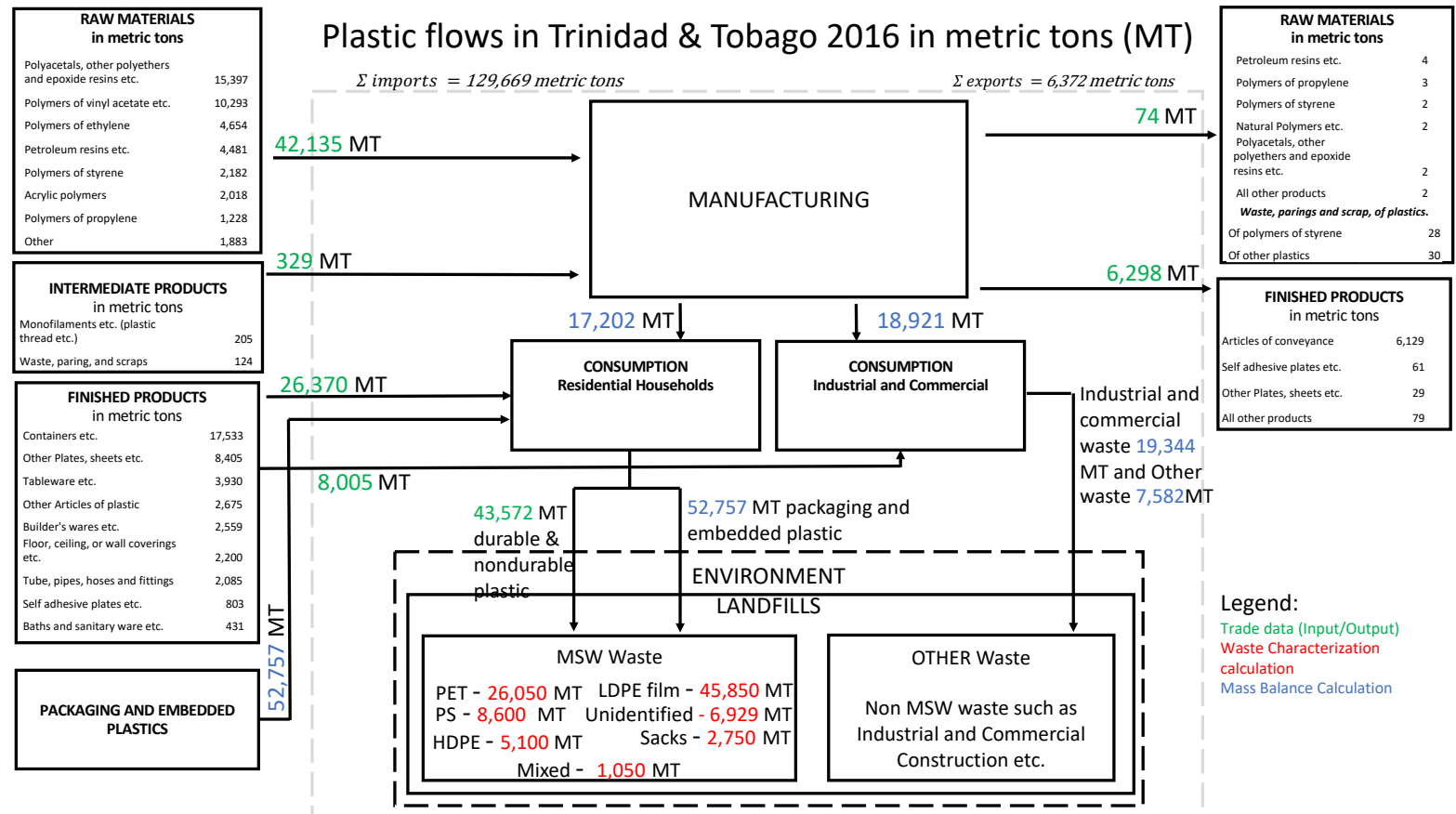
Source: Kahhat
and Williams
(2012)



Material flow analysis – finding CE opportunities

National flows of plastics in Trinidad and Tobago

Source: Millette, Williams and Hull (2019)



Material flow analysis – finding CE opportunities: Lessons from Trinidad and Tobago

1. There is enough PET plastic bottle waste to justify a dedicated recycling facility in Trinidad and Tobago (~ 11,000 metric tons/year)
2. There is more PET bottle waste generated than consumed domestically (PET bottles are imported as part of product), so PET needs to be exported to recycle fully.
3. There is a cement kiln with capacity that could take 32,000 tons of plastic film waste as input instead of fossil fuels.

Material Flow Analysis – next steps

- ▼ **What:** Specific case studies to help plan circular economy at different scales (industrial park, city, nation, international)
- ▼ Studies should be linked with planning/efforts of private sector or government.
- ▼ Connect with economics/ entrepreneurship
- ▼ **Who does?** Expertise mainly in academia, some consultants (assuming outsourced).
- ▼ **Who pays?** Market failure in place, so governments?

Material Flow Analysis – is it hard to do/expensive?

- ▼ How is it done?
- ▼ **Combine** existing data sources with primary data collection, using mass balance.
- ▼ Primary data collection usually surveys of sector (e.g. private consumers, industry sector)

Data	Source
Product sales & production	Government, Consultants
Product imports and exports	Trade ministry
Waste in landfills	Composition studies
Process input/outputs	Academia/industry/consultants
Product lifetime	Consumer survey

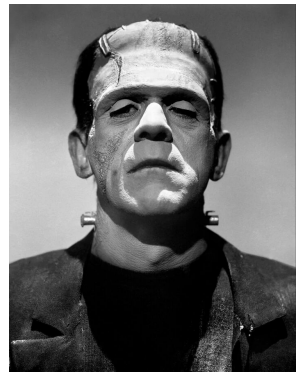
Material Flow Analysis – is it hard to do/ expensive?

Hard to do?

- ▼ Technical, but not rocket science.
- ▼ Needs perspectives of multiple disciplines: engineering, social science, industrial ecology.
- ▼ Lack of trained specialists

Expensive?

- ▼ If trying to brute force difficult question, yes (need lots of primary data collection)
- ▼ If leveraging existing data (e.g. trade), quite reasonably priced.



Return to start: Promoting Circular Economy

- ▼ The **Information** market failure needs to be addressed: material flow analysis can help.
- ▼ Economic analyses also needed (and neglected)

Also:

- ▼ **Externalities:** Environmental regulation can make CE solutions preferred.
- ▼ Other barriers, e.g. regulations set up in linear economy.

Thank you for your attention!

This work was partially supported by the US Department of State



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December 21, 2018

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Eric Williams, [Rochester Institute of Technology](#); [Ashok Sekar](#), [University of Texas at Austin](#), and [Eric Hittinger](#), [Rochester Institute of Technology](#)

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