

Evaluating the impact of China waste ban on the dynamics system of the EU's packaging waste management supply chain

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INTRODUCTION

- In an effort to improve the domestic environment as well as target more sustainable economic growth, China has notified during mid July 2017 that 24 kinds of solid waste including plastic, metal, steel and other types of unsorted waste are banned from being imported starting from January 2018 (World Trade Organization, 2017).
- The China waste ban has impacted not only its domestic manufacturing industry, but many exporters who heavily rely on China in dealing with the recyclable materials. The effect can already be seen in several western countries including Canada, UK, and many EU members, where waste is piling up without any exit routes.
- Alternative solutions have been considered, one of which is to reallocate the exporting destination to other third countries in Southeast Asia, India or the Middle East. Even so, China's recycling capacity was simply just too significant to be replaced. Meanwhile, some of the last resorts – incineration and landfilling encounter huge barriers from legislation and environmentalists.
- Given the impactful of the issue on hand, the focus of our paper is first to develop an overview of the dynamic structure of the current EU packaging waste recycling system. Based on these understandings, the impacts as well as ripple effects that the China Waste Ban has on the system developed is also evaluated.
- Subsequently, certain government policies are simulated over a long-term period to provide policy makers with more insights to help them with their decision making.

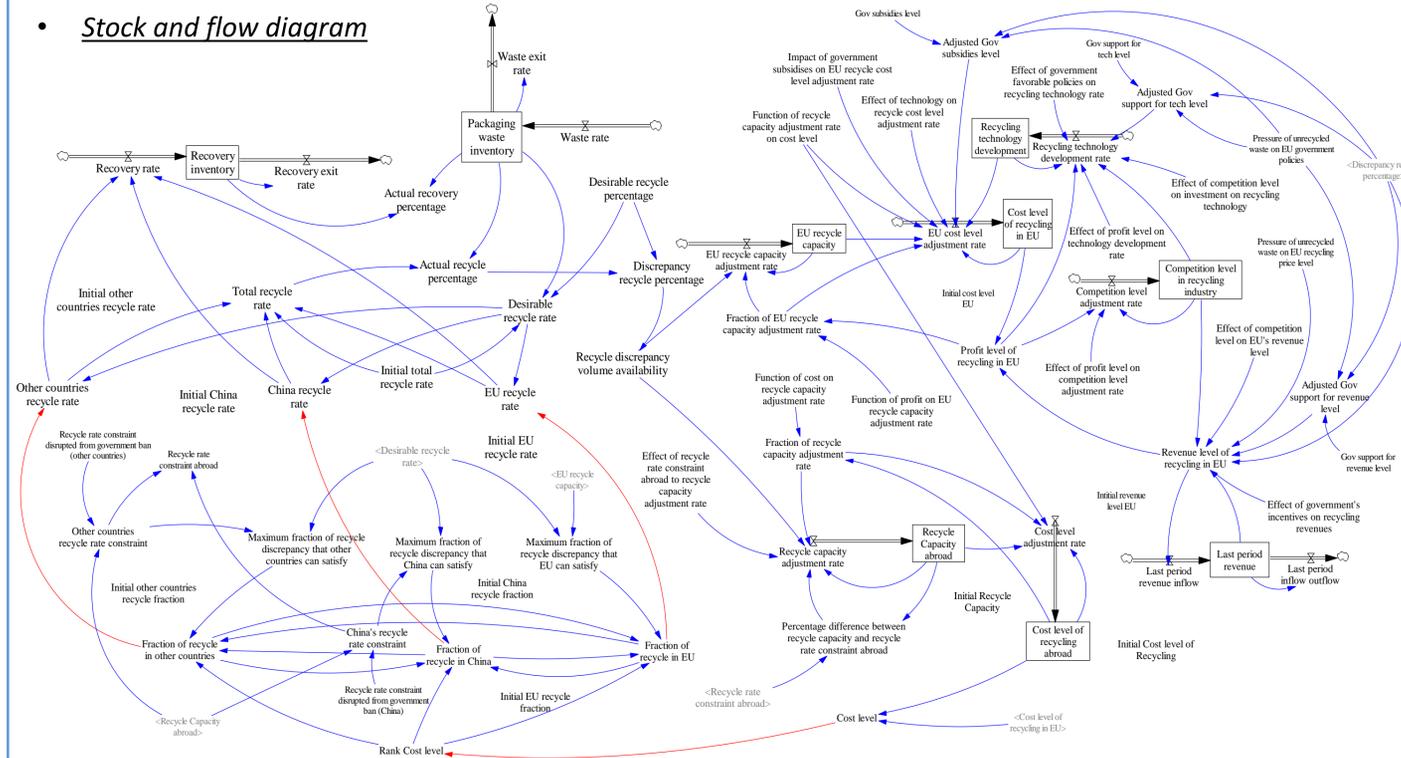
OBJECTIVES

METHODOLOGY

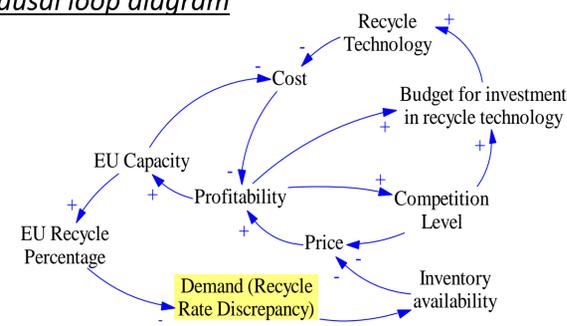
- System dynamics (SD) (Sterman, 2000; Forrester, 1958) is one of the most popular modelling tool in waste management system policy design (Hjorth and Bagheri, 2006; Vizayakumar, 1995) due to its ability to model complex dynamic systems which exhibit unique characteristics such as accumulations over time, non-linear feedback mechanisms.
- The Packaging waste recycling system in EU was built in Vensim software environment. The system created generalise the packaging waste recycling system of 27 members of European union.
- Some of the important assumptions of the dynamic system include: over 70% of the packaging recycled waste from EU is exported to China for recycling before being sent back; EU always utilise its domestic recycling facilities to full capacity; the government has limited budget to allocate to different policies, influence the whole system.
- Several tests were carried out to validate the model, including structure verification test, behavioural reproduction test, test under extreme conditions, and dimensional consistency test.
- The simulation will be run for 10 years and 20 years after the ban.

RESULTS

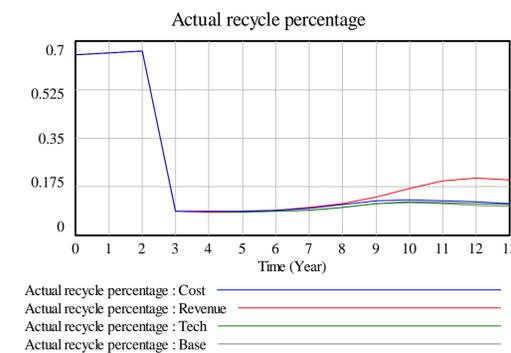
Stock and flow diagram



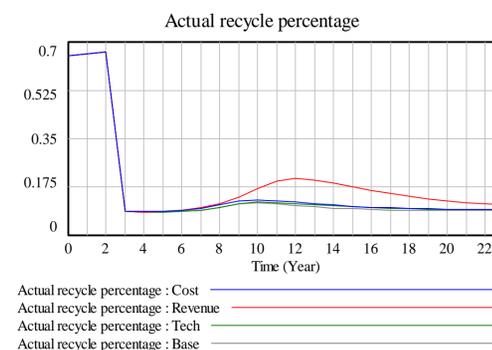
Causal loop diagram



10 years simulation



20 years simulation



DISCUSSION

- Technology can only influence cost
- Capacity is directly influenced by profit level
 - Cost is constrained by 0 so can only be minimised to limited extent
 - Revenue can go as high as the competition allow and by high demand
- Increasing revenue would be most effective way to expand the capacity faster

CONTRIBUTION

- Practical contribution:
 - Help regulators to come up with most effective policies by providing:
 - Holistic picture of the EU's packaging waste management system
 - Insights on how CWB impact both EU's packaging waste management system and global packaging waste management system
 - Make scientific-proven recommended policies for regulators
- Theoretical contribution:
 - Contribute to under-developed reverse logistic, closed loop supply chain literature

LIMITATIONS

- Lack of data to fully validate the model
- The recommendations are somewhat generic, lack of details

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