

UNDERSTANDING THE ROLE OF PLASTIC RECYCLERS IN PLASTIC WASTE'S CIRCULAR SUPPLY CHAIN GOVERNANCE IN INDONESIA

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Abstract: *This study aims to examine the role of plastic recyclers in managing the plastic waste's circular supply chain governance in Indonesia. The data was gathered through interviews and on-site visits to plastic waste stakeholders five plastic recycling plants in Indonesia. The findings reveal that the plastic waste's circular supply chain governance shows a combination of approaches, particularly in the relationship between recyclers and junk shops based on seven aspects of relational-contractual analysis. The governance structure of the plastic waste's circular economy supply chain tends to be relational, considering historical relationships, environmental uncertainties, power imbalances, and fairness perceptions. On the other hand, recycling factories strictly adhere to a contractual governance pattern concerning risk perception. This research provides valuable insights into circular economy governance in a developing economy and offers policy implications for the governance of the plastic circular economy supply chain in Indonesia.*

Keywords: plastic waste; recycler; junk shop; circular economy; circular supply chain governance; relational; contractual; relationship history; environmental uncertainty; perceived risk; interdependence; power asymmetry; perceived justice; specific asset

1. Introduction

Indonesia is a country that arguably contributes to significant plastic waste pollution to the environment. Indonesian Association of Plastic Industry and Indonesian Center Bureau of Statistics claim that Indonesia contributes 64 million ton of plastic wastes and 3.2 million out of those leaked to the ocean body¹. If there is an effective plastic waste's circular supply chain governance (plastic CSCG), recycling capacity can reach up to 2 million ton per annum², empower 3.6 million workers of informal sectors (to provide plastic wastes supply to recyclers), and potentially get economic impact of Rp10.5T (around \$66M) per annum³.

¹ [Indonesia.go.id](https://indonesia.go.id) - Menenggellamkan Pembuang Sampah Plastik di Laut

² [Kompas.com](https://kompas.com) - Indonesia Punya Potensi Ekspor Plastik hingga 9 Juta Ton

³ [Kemenperin](https://kemenperin.go.id) - Dukung Circular Economy, Kemenperin Apresiasi Coca-Cola dalam Pembangunan Fasilitas Daur Ulang Botol Plastik

This study aims to determine the strategic role of plastic recyclers on sustainability of plastic CSCG in Indonesia. We scrutinize the role of plastic recyclers in managing the plastic CSCG relationship in Indonesia, especially the relationship between suppliers (junk shops, scrap dealers, and traders) and buyers (recyclers). To answer these questions, we use contextual factors developed by Bonatto et al. (2022) to identify the factors of contractual and relational governance.

This research answers the research call of Boström et al. (2015) who put concerns on the sustainability and responsibility challenges faced by supply chain governance. Specifically, this study identifies three strategic requirements by Schultz et al. (2021): development of environment in circular economy implementation, innovation on circular business model, and establishment of strategic alliance of partnerships specialized within and outside the industry. These three requirements are vital to develop the vertical and horizontal relationship in European circular supply chain management (CSCM) of one type of plastic thermoset: polyurethane.

2. Methodology

Multiple case studies with interviews and on-site visits (if granted permissions) are conducted to the research subjects of plastic recyclers. Appendix A describes the types of plastic recyclers of the research subject. This method follows Schultz et al. (2021) interviewing the key stakeholders in the supply chain.

We employ in-depth semi-structured interviews. Aspects of information that we identify from plastic recyclers are value chain, business model, operational/manufacturing processes and methods, business unit further development, and contextual factors in developing the value chains. Appendix B describes the typical questions as guidance to open in-depth semi-structured interviews of this research.

3. Results

3.1. Relationship History

In the aspect of relationship history, the pattern tends to be relational. In Indonesia, plastic CSCG and relationship between junk shops and plastic recyclers have been established since 1980s. This phenomenon is like other countries, especially in the developing nations with minimum waste management infrastructures. Winans et al. (2017) argued that this value chain was established following the issues of unsustainable and environmentally unfriendly products.

Unfortunately, Indonesian government was considered failed in integrating Indonesian plastic CSCG. The main reason is that Indonesian plastic CSCG was not developed in a formal business corridor, instead the development was informal. The key supply chain players such as scavengers, waste pickers, junk shops, scrap dealers, and traders are not institutionalized. Institutionalization does not intend to kill free and open market of plastic waste supply chain, rather to better administer the issues in the supply chain by the related government agencies. One crucial example is financial administration of value added tax (VAT) that the suppliers cannot provide. This is a challenge that the recyclers in Indonesia could work with initially, until recently the government has a program to manage taxes more properly into sectors that have inherent tax problem such as recycling industry.

3.2. Environmental uncertainty

For the aspect of environmental uncertainty, plastic CSCG pattern tends to be relational as well. However, it is noted that the contractual pattern is currently explored due to the perception of more surplus gained by the supply chain rather than by the recyclers. There are significant number of uncertainties in plastic CSCG. Transitional process from linear to partial and fully circular economic model of doing businesses generates a strategic control issue on uncertainties (Esbensen & Velis, 2016).

First, the business model of plastic recycling has a huge uncertainty risk, especially in the supply chain. The traditional supply chain can endanger the feedstock needed by recyclers who have committed to recycling plastic wastes by putting investment in recycling capacity. They face two uncertainties regarding feedstock: quantity and quality. There are cases when junk shops have been closed/bankrupt because they do not improve their business model to be economically sustainable. Second, there is a risk of bans forbidding uses of certain type(s) of plastics products/materials in public. Recyclers argue that this orientation of banning is more towards gaining political interests rather solving the real issues since (1) there is no alternative of plastic materials discovered that can scale and be costly efficient and (2) the government can dodge the problematic issues on municipal solid waste management that can take substantial amount of time, resource, and budget to solve. Third, plastic packaging standardization to be more recyclable is not currently in place. The only objectives of plastic packaging design are to (1) safely secure the product inside the packaging until use by customers and (2) cost efficiency. By these two objectives and absence of regulation on packaging design, product manufacturers can freely develop many options of plastic packaging that are more difficult to recycle. Fourth, since there is no regulation on mandatory recycling content, the price of recycled plastic resin is highly related to virgin plastic resin and oil price because recycled resin is considered substitution product of the virgin ones.

3.3. Perceived Risk

For the aspect of perceived risk, the pattern of CSCG is developed towards contractual, rather than relational. Due to the high-risk exposure, recyclers cannot tolerate the material quality. Recyclers force quality requirement through strict quality check in recycler's site in every supply batch from junk shops. The low quality of recyclables from junk shops is not intended, rather it is because the scavenging activity (especially for plastic bags recyclables collected from landfill sites) is not standardized and sustainable. Recyclers prefer to cut down business relations if the quality is not met, and even change the business model direction to process post-industrial recyclables (not processing post-consumer recyclables) because of the high certainty of quality.

3.4. Interdependence

In interdependence aspect, we argue that the CSCG pattern tends to be balanced relational-contractual. There is high interdependency between supply chain and recyclers. The capital investment by recyclers is costly, therefore they depend on the recyclables material supply from informal sector. Even when recyclers have put quality requirements, there are several steps before cutting down business relation to informal sector such as continue educating the junk shop on the quality requirement or putting training staff on junk shop's site to teach how to sort materials as required. If these steps have been conducted and the junk shop cannot deliver the quality, then they will cut down relation. Most junk shops obey this condition meaning that recyclers succeed in adjusting the business process of the junk shops. This is aligned with the recycler's calculations so they can achieve the targeted ROI of their investments.

3.5. Power Asymmetry

In the perspective of power asymmetry, the plastic CSCG pattern is engineered to be more relational. The power is not balanced between junk shops and recyclers because recyclers have put significant amount of investment in fixed asset of recycling factory while junk shops (due to the informality of the business) do not put and have capacity in collection infrastructure in place. Due to higher power on the supply chain gained by junk shops, recyclers introduce various incentives and tempting offers. And junk shops can ignore the incentives because there is no substantial effect to their profitability. Junk shops can simply choose which buyer that they want to sell their recyclables materials with three factors considered: price, quality, and service. The commodity of recyclables has highly sensitive price elasticity that even as little as Rp100/kg (\$0.01/kg) price difference can affect the buyer decisions.

3.6. Perceived Justice

In the perspective of perceived justice, plastic CSCG pattern is more towards relational. Due to price sensitivity of the recyclables from junk shops, recyclers contend that they can only receive “justice” (receiving recyclables materials) if they provide good price list. There are considerations that recyclers can win competition on receiving materials when they have the top price amongst the competitors. Especially for those junk shops who can optimize collection capacity, they are in the upper hand when negotiating prices and letting big recyclers (who have bigger investment opportunity to lose) win the material bid.

3.7. Specific Asset

For the specific asset aspect, the pattern of plastic CSCG is mixed between contractual and relational. In one hand, supply chain asset specificity is either absent or low. The asset is more on social asset with collegued and familial relationships are common to find between junk shop owners and their scavengers/waste pickers. This “asset” is crucial for junk shops to reach out post-consumer recyclables more timely, efficient, and reliable. If only there is asset needed to increase logistical efficiency, they are balers machines to make the recyclables denser to transport from junk shop warehouse to the recycling site. In the other hand, the need for more sustainable supply chain for recyclables supply increases the likelihood for better partnership and collaboration between recyclers and junk shops. Through this upscaling processes in the supply chain, several asset types (e.g., conveyor belt, loading dock, standard warehouse, weigh bridge, and higher-density baller machine), are introduced to further increase the collection rate, business efficiency, and less logistical costs.

4. Conclusion

This study aims to analyze the strategic role of recyclers in plastic CSCG in Indonesia. We identify each of contextual factor developed by Bonatto et al. (2022) to analyze on how recyclers manage the plastic CSCG in Indonesia. The general result of this study is that there are multiple patterns of plastic CSCG that recyclers have developed towards their supply chain: (1) relational, (2) contractual, and (2) balanced of contractual-relational.

Plastic CSCG patterns that have been developed to be relational by recyclers are (1) relationship history, (2) environmental uncertainty, (3) power asymmetry, and (4) perceived justice. Meanwhile, the only contractual plastic CSCG pattern is perceived risk. Finally, there are balanced of contractual-relational plastic CSCG developed by recyclers for two factors: (1) interdependence and (2) specific asset. This research provides valuable insights into contributes

to the literature of circular economy governance in a developing economy and provides policy implications for the governance of the plastic circular economy supply chain in Indonesia.






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Appendix A

Types of recyclers that are the subject of this research and the plastic material they process

No	Types of recycler	Plastic waste material that they process
1	PET bottles recycler	
2	Multilayered plastic recycler (e.g., sachets)	
3	HDPE plastic bag recycler	
4	Styrofoam recycler	
5	PS plastic container recycler	

Appendix B

Questions to open interviews with the subject of this research

No	Contextual Factor	Interview Question
1	Relationship history	<ul style="list-style-type: none"> - How extensive are transactions conducted with junk shops? - How frequently are transactions carried out with junk shops? - How long has the relationship been established with junk shops? - What experiences/stories have emerged from the business relationship with the junk shops?
2	Environmental uncertainty	<ul style="list-style-type: none"> - Is there a fluctuation in the capacity of supply you need from junk shops? - Do junk shops tend to be uncertain in providing quantity-quality information and delivery schedules? - Is there potential for technological development in the factory? - Are there internal and external factors that are uncertain in the recycling factory business?
3	Perceived risk	<ul style="list-style-type: none"> - How can your behavior (requirements) affect the relationship with junk shops? - Is there opportunistic behavior by junk shops?
4	Interdependence	<ul style="list-style-type: none"> - Is the pattern of the relationship with junk shops sufficiently mutually balanced or tends to be relative? - To what extent does the factory rely on junk shops and their supply chain compared to the other way around?
5	Power asymmetry	<ul style="list-style-type: none"> - To what extent can the factory negotiate prices? - What factors contribute to junk shops' bargaining power in supply negotiations and vice versa?
6	Perceived justice	<ul style="list-style-type: none"> - How do you perceive the distribution justice from the relationship with junk shops? - How do you perceive the interaction justice from the relationship with junk shops? - How do you perceive the procedural justice from the relationship with junk shops?
7	Specific asset	<ul style="list-style-type: none"> - Is there any investment made to improve your relationship with junk shops? - Are there ongoing investments that junk shops

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- need to meet your supply requirements?
 - How are the current assets of junk shops? Are they capable of producing adequate products?
-