

Comparative Analysis of Plastic Resource Circulation Policies in South Korea and Japan

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Abstract

Plastic pollution poses a significant threat to the world today. Efforts to establish effective policies for addressing plastic pollution and promoting resource circulation remain insufficient. In this context, this study compares the plastic recycling and resource circulation policies of South Korea and Japan, and focuses in particular on the Kitakyushu Eco-town model. This study examines how Japan's legal framework, local government cooperation, and industrial integration contribute to a more integrated circulation system through a comparative policy approach. Although South Korea has well-established waste collection and source-separation systems, it continues to face challenges such as contamination of collected plastics, fragmented recycling structures, and insufficient linkages with industrial users (Greenpeace Korea, 2023). Meanwhile, Japan's approach focuses on product design, stakeholder cooperation, and local recycling ecosystems (Ministry of the Environment, Japan, 2022). The 'Kitakyushu Eco-Town' model demonstrates how local governments, private companies, and citizens can collaborate to establish an effective circular economy (Kitakyushu City, n.d.). This comparative study supports the assertion that South Korea should advance beyond waste sorting and develop industrial cooperation at the regional level to build a more integrated circular economy.

Keywords: plastic recycling, resource circulation, South Korea, Japan, Kitakyushu Eco-town, circular economy.

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Introduction

Background and Rationale

The issue with plastic waste extends beyond disposal issues. It reflects the modern systems of production, consumption, and responsibility. With the continual growth of the production and consumption of plastic, more serious costs to the environment are seen in plastic pollution. Marine waste, overflowing landfills, carbon emissions from incineration, and poor recycling practices show that one system to address the issue with plastic waste is insufficient (OECD, 2022; UNEP, 2023). More systems that are interconnected to consumers, local authorities, producers, and the recycling industry are needed.

In East Asia, Korea and Japan present two important examples of how to manage plastic waste. The two countries are highly industrialized, highly urbanized, and highly dependent on packaging materials in their daily lives. Yet their policy structure is different in a meaningful way. Korea has long emphasized citizen participation through mandatory waste separation and volume-based waste fees. Japan, in contrast, has promoted a wide range of legal and industrial strategies around the “Sound Material-Cycle society” and recent plastic resource circulation legislation (Ellen MacArthur Foundation, 2015; Ministry of the Environment, Japan, 2024).

This paper compares the two countries’ plastic resource circulation policies with a focus on the Kitakyushu Eco-Town model as an example of successful circular governance. The Kitakyushu Eco-Town project was selected as the primary case study because it is one of Japan's earliest and most extensively documented Eco-Town projects established under the national Eco-Town Program in 1997. It has been widely recognized as a representative example of industrial symbiosis, public-private collaboration, and regional resource circulation.

Although other Eco-Town projects exist in Japan, Kitakyushu provides comprehensive documentation and long-term operational experience, making it an appropriate case for examining how national circular economy policies can be implemented at the local level. The aim is to understand what structural conditions make recycling work rather than to say who does it best. By examining this model, this paper offers some policy suggestions for South Korea and insights for Asian cities more broadly.

Research Question: *How do the plastic resource circulation policies of South Korea and Japan differ, and what lessons can South Korea learn from the Kitakyushu Eco-Town model?*

Hypothesis: *Japan’s integrated resource circulation framework provides a more comprehensive model for achieving a circular economy than South Korea’s collection-centered approach.*

Methods

This study used a comparative policy analysis based on official government materials, legal documents, and secondary literature on plastic waste management in South Korea and Japan. The focus was on three main areas: waste collection and classification systems, legal and institutional frameworks, and regional circular economy models, with particular attention given to the Kitakyushu Eco-Town project as an example of local industrial symbiosis and public-private cooperation (Kitakyushu City, n.d.).

This study compared how each country approaches plastic resource circulation from the point of product design to final recycling. South Korea's system was examined mainly through its waste separation culture, volume-based waste fee system, and extended producer responsibility framework (Greenpeace Korea, 2023). Japan's system was analyzed based on its sound material-cycle policy, the Act on Promotion of Resource Circulation for Plastics, and the local governance of Kitakyushu. By comparing these systems, the paper identifies both strengths and limitations in each country's approach (Ministry of the Environment, Japan, 2022; METI, 2022).

Results

Table 1. Comparison of Plastic Waste Management Indicators in South Korea and Japan (2022).

Indicator	South Korea	Japan
Plastic Waste Generated	12.6 million tons (2022)	8.23 million tons (2022)
Reported Recycling / Utilization Rate	73%	87%
Material Recycling Share	27%	20%
Thermal Recovery Share	Not included in statistics	67%

In 2022, South Korea generated approximately 12.6 million tons of plastic waste, while Japan generated approximately 8.23 million tons. However, the two countries apply different definitions when reporting recycling performance. South Korea's reported recycling rate mainly refers to recycled waste entering recycling processes, whereas Japan's effective utilization rate includes material recycling, chemical recycling, and thermal recovery (Ministry of the Environment, Japan, 2023). Therefore, these indicators are not directly comparable as performance rankings but provide insight into different resource circulation structures.

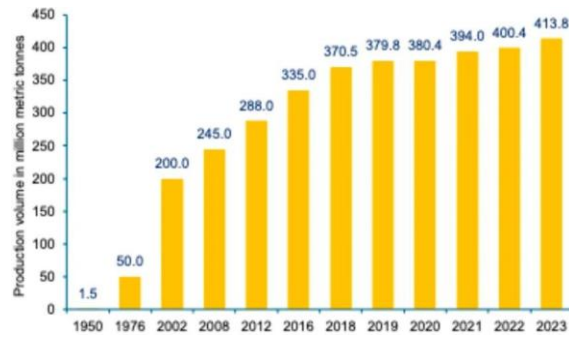


Figure 1: Global Annual Plastic Production, 1950-2023.

Figure 1 illustrates that global production has increased tremendously from 1.5 million metric tons in 1950 to 413.8 million metric tons in 2023 (Statista, 2024). The most rapid growth was seen after the beginning of the 2000s when global production doubled from 200 million tons in 2002 to over 400 million tons in 2022-2023 (Statista, 2024).

Table 2. Comparison of Municipal Waste Treatment Methods in South Korea and Japan.

Treatment Method	South Korea	Japan
Recycling	85.7%	19.3%
Incineration	5.6%	72.7%
Landfill	5.4%	8.0%

Note: In South Korea, the remaining 3.3% was managed through other treatment methods as reported in the national waste statistics.

Table 2 compares municipal waste treatment methods in South Korea and Japan using official national statistics (Ministry of Environment, Republic of Korea, 2024; Ministry of the Environment, Japan, 2024). South Korea recycled 85.7% of its municipal waste in 2024, while 5.6% was incinerated and 5.4% was landfilled (Ministry of Environment, Republic of Korea, 2024). In contrast, Japan reported a municipal recycling rate of 19.3% in 2024 and only 8% of the waste was directly disposed of into landfills without any intermediate treatment. Most remaining waste went through intermediate treatment, which is mainly incineration with energy recovery (Ministry of the Environment, Japan, 2024).

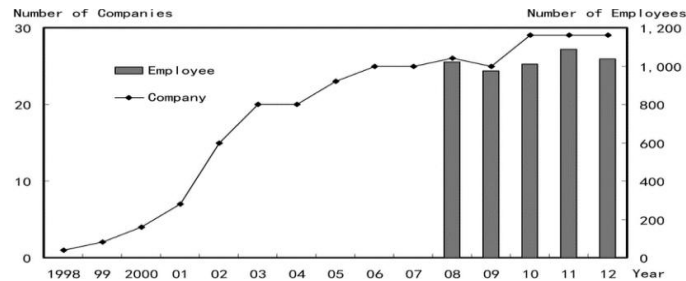


Figure 2: The number of companies and employees in Kitakyushu Eco-Town (1998-2012).

Note: Employee data from 1998 to 2007 are unavailable. The latest publicly available employment statistics for the Kitakyushu Eco-Town project are limited to 2012. Therefore, Figure 2 is used primarily to illustrate the historical development of the Eco-Town rather than its current economic performance. More recent quantitative data were not publicly available at the time of this study, which represents a limitation of the present analysis.

Source: Environment Bureau, Kitakyushu City.

Figure 2 shows that the Kitakyushu Eco-Town project has been expanding rapidly since it began in 1997 (Kitakyushu City, n.d.). In the early stages of development, the number of participating companies was only one company in 1998, but increased to 21 by 2003 (Kitakyushu City, n.d.). By 2012, Eco-Town had attracted 29 companies and created more than 1,000 jobs (Kitakyushu City, n.d.).

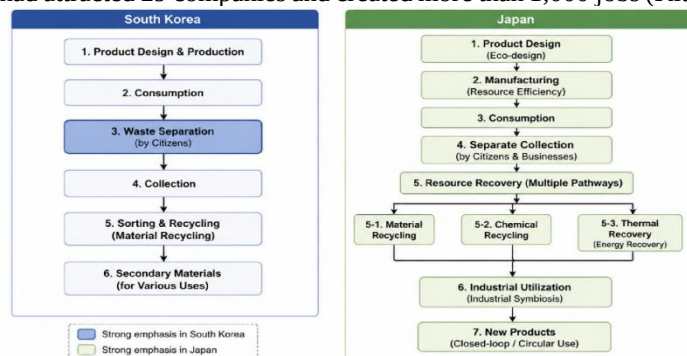


Figure 3: Comparison of Plastic Resource Circulation Frameworks in South Korea and Japan.

Note. Adapted from Ministry of Environment, Republic of Korea, First National Circular Economy Plan (2024-2028), 2024; Ministry of the Environment, Japan, Act of Promotion of Resource Circulation for Plastics, 2022; Ministry of the Environment, Japan, Fundamental Plan for Establishing a Sound Material-Cycle Society, 2024; Environment Bureau, Kitakyushu City.

Figure 3 summarizes the policy frameworks identified in this study. South Korea's resource circulation system is organized around post-consumption waste separation, collection, and recycling (Ministry of Environment, Republic of Korea, 2024). Japan's framework extends resource circulation to earlier and later stages of the product life cycle, including product design, multiple recycling pathways, and industrial utilization (Ministry of the Environment, Japan, 2022; Ministry of the Environment, Japan, 2024). Both systems include waste separation and recycling; however, the Japanese framework incorporates additional processes related to product development and industrial resource circulation.

Discussion

The findings of this study indicate that the difference between South Korea and Japan's plastic resource circulation systems is not simply a difference in recycling performance, but a result of different institutional and governance structures. South Korea's current system has developed primarily around efficient waste collection and citizen participation. The mandatory separation system and volume-based waste fee system were introduced to reduce landfill dependency and improve waste management efficiency (Ministry of Environment, Republic of Korea, 2024). As a result, South Korea has achieved high collection and reported recycling rates. However, this governance structure places greater responsibility on consumers and waste management facilities after plastic products have already entered the waste stream. Therefore, challenges remain in maintaining the quality of collected plastics and connecting recycled materials with industrial demand. Japan's approach developed from a broader concept of establishing a "Sound Material-Cycle Society," which emphasizes resource circulation throughout the entire life cycle of products (Ministry of the Environment, Japan, 2024). Rather than focusing mainly on waste treatment after consumption, Japan's policies encourage cooperation among manufacturers, municipalities, recycling companies, and consumers from the design stage to final resource utilization. This difference in governance structure helps explain why Japan has developed more diverse recycling pathways and stronger connections between recycling systems and industrial users. However, Japan's system also reflects its own economic and geographical conditions, including limited landfill capacity, strong municipal waste management responsibility, and long-term cooperation between local governments and industries. Therefore, its success cannot be explained only by the existence of advanced recycling technologies.

The Kitakyushu Eco-Town model demonstrates the importance of regional industrial networks in achieving circular resource management. Its main contribution is not only the establishment of recycling facilities but also the creation of an ecosystem where government support, private investment, research institutions, and local industries operate together (Kitakyushu City, n.d.). This structure allows recycled materials to have economic value by connecting waste streams with industrial demand. In contrast, South Korea's recycling system has traditionally focused more on collection and sorting infrastructure, while relatively less attention has been given to developing

stable markets for recycled materials. Therefore, the key lesson from Kitakyushu is not simply to copy its recycling facilities, but to strengthen institutional connections between waste generators, recycling industries, and material users.

However, transferring the Kitakyushu model directly to South Korea may face several limitations. First, geographical and industrial differences must be considered. Kitakyushu developed as an industrial city with existing manufacturing infrastructure, which created favorable conditions for industrial symbiosis. Many Korean regions may not have similar industrial clusters or sufficient demand for recycled plastic materials. Second, economic incentives remain a challenge. Recycled plastics often compete with cheaper virgin plastics, meaning that companies may lack motivation to use recycled materials without stronger market-based policies or government support (OECD, 2022). Third, differences in regulatory systems may influence implementation. Japan's long-term local government-industry cooperation has developed through decades of environmental policy development, while South Korea may require additional institutional coordination among national government agencies, municipalities, and private companies.

Therefore, rather than adopting the Kitakyushu model as a complete solution, South Korea should selectively adapt its key principles. These include strengthening regional recycling networks, increasing cooperation between recycling companies and manufacturers, promoting eco-design practices, and creating stable demand for high-quality recycled plastics. Such changes would allow South Korea to move beyond a collection-centered system toward a more integrated circular economy while considering its own industrial and institutional conditions.

This study has several limitations. Because the analysis was based mainly on policy documents and secondary data, it could not fully evaluate the long-term environmental and economic outcomes of each system. Future research should examine specific regional recycling projects in South Korea and compare their performance with international circular economy models to identify more practical strategies for policy implementation.

Conclusion

This study conducted a comparative policy analysis of plastic resource circulation policies in South Korea and Japan and examined the Kitakyushu Eco-Town model as a reference model for regional circular economy governance (Kitakyushu City, n.d.). The results of this study show that although South Korea successfully managed to achieve high rate of waste collection and recycling rates through the mandatory waste separation and the Extended Producer Responsibility (EPR) system, improvements to quality of the recycled plastics and to their utilization value at industrial level still remains as challenges (Ministry of Environment, Republic of Korea, 2023; Korea Environment Corporation, 2023).

In contrast, Japan adopts a life-cycle approach that encompasses eco-design, a variety of recycling technologies, industrial collaboration, and local-government-led governance in its approach to the resource circulation (Ministry of the Environment, Japan, 2022; Ministry of the Environment, Japan,

2024). In the Kitakyushu Eco-Town model, both efficient plastic recycling technologies and cooperation among governments, industries, universities, and local communities are essential for the circular plastic management (Kitakyushu City, n.d.).

In conclusion, this study leads the finding that South Korea has to expand industrial collaboration across regions, develop its promotion strategies for eco-design, and increase the production and industrial use of high-value recycled plastics to improve the circular economy (Ministry of the Environment, Japan, 2022). In response to the continuous increase of plastic production globally, the resource circulation policies will play a significant role in the environment and economy sustainability, and These findings may provide valuable lessons for other rapidly industrializing countries seeking to develop effective plastic resource circulation systems.

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