

Chapter 1

Regionalization of Solid Waste Management in Asia: Benefits and Challenges

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Abstract

In most Asian countries, solid waste management is one of the major responsibilities of local governments. They are mandated to collect municipal solid waste, treat it at composting plants or energy plants, and to dispose of it in landfills. However, most waste is not collected or is improperly disposed of on open dumpsites. Developing Asian countries, such as China, Indonesia, the Philippines, Vietnam, and Thailand, are regarded as a major source of marine plastic debris. To treat and dispose of municipal solid waste properly, local government should invest in good facilities, such as sanitary landfill, or contract with private companies investing in appropriate technology. Such technologies usually have the characteristics of economy of scale. The unit cost of investment in waste treatment and disposal technology is getting cheaper as the capacity of facilities becomes bigger. The necessity of such investment may stimulate regional solid waste management, through inter-municipal cooperation and/or privatization of waste treatment and disposal services. This paper surveys the benefits and challenges of a regional approach to municipal solid waste management in selected Asian countries.

Key Words: Municipal Solid Waste Management, Regionalization, Inter-Municipal Cooperation, Public-Private Partnerships

Introduction

In most Asian countries, solid waste management is one of the major responsibilities of local governments.ⁱ They are mandated to collect municipal solid wasteⁱⁱ and to dispose of it in landfills. Some local government also treat waste at facilities such as composting plants and waste-to-energy plants.

However, most local governments in developing Asian countries do not have

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environmentally sound waste management facilities. A huge amount of municipal solid waste is not collected properly and usually dumped in open dumping sites or public spaces, including rivers. The World Bank (2018) pointed out that the waste collection rate in the East Asia and Pacific Region is 71%, while that in South Asia is 44%. It reports that 135 million tons of waste are not collected in the East Asia and Pacific Region every year, while 187 million tons are not collected in South Asia. Even if waste is collected, 75% of the collected waste in South Asia is dumped in open dumpsites, while 18% is treated in the same way in the East Asia and Pacific Region.

A threat to marine biodiversity, marine debris is receiving global attention, especially marine plastics. Global society has begun to regard marine debris as a global environmental issue. Rapidly growing Asian countries such as China, Indonesia, Philippines and Vietnam are regarded as major sources of marine plastic waste. Jambeck et al. (2015) have roughly estimated the quantity of plastic marine debris generated by the countries of the world. On the basis of data on populations within 50 km of the coast, waste generation per capita, percentage of plastic waste, and percentage of mismanaged waste, they reported that the growing Asian countries are a major source of land-based plastic marine debris. China is regarded as the biggest generator of marine plastics, followed by Indonesia, the Philippines, Vietnam, and Thailand. Mismanaged waste includes uncollected waste and waste disposed of on open dumpsites.

Improper waste management is also one of the sources of Green House Gases (GHGs). The waste sector, including solid waste disposal, accounts for about 1.4% of total GHG emissions (International Panel on Climate Change 2014). The anaerobic congestion of waste generates methane gas, which is one of major GHGs.

The improper design and management of landfill sites can cause the collapse of mountains of garbage. Many cases have been reported in Asia. The Payatas open dumpsite tragedy in the Philippines in July 2000 killed about 200 people. A similar incident occurred in Leuwigajah dumpsite in Bandung, Indonesia, in February 2005, causing 147 deaths, and a collapse in April 2017 at the Meethotamulla dumpsite in Colombo, Sri Lanka, caused more than 30 deaths.

Uncontrolled leachate discharge from landfill contaminates water resources. Air pollution due to the open burning of waste and fire from dumpsites has been observed in many places. Such incidents lead to opposition to existing dumpsites and to the construction of new waste dumping sites.

To tackle such problems, many countries in Asia have made efforts to introduce or revise regulations on solid waste management and to adopt environmentally sound

technologies for waste management. For example, the Ecological Solid Waste Management Act of 2000 (RA 9003) in the Philippines, enacted in 2001, requires governments to close open dumpsites and to use sanitary landfills. Other Asian countries, such as Malaysia and Thailand, are aiming for a move away from open dumping and toward sanitary landfills. In recent years, China, India, Indonesia, Malaysia, the Philippines, and Thailand have also tried to introduce waste-to-energy plants.

To treat and dispose of municipal solid waste properly, local governments should invest in good facilities, such as sanitary landfills, or contract with private companies investing in the appropriate technology. Such technologies usually have the characteristics of economy of scale. The unit cost of investment in waste treatment and disposal technology becomes cheaper as the capacity of the facility increases.

The necessity of such investment in larger facilities may stimulate the regionalization of solid waste management, through inter-municipal cooperation and/or privatization of waste treatment and disposal services.

This paper reviews some of the studies on economies of scale in waste management and the institutional settings for regionalization of municipal waste management. Section 1 surveys theoretical and empirical papers related to economies of scale and the appropriate size of areas for municipal solid waste management. To operate larger-scale waste treatment facilities, the waste is collected from a wider area, which implies an increase in transportation costs. The appropriate size and number of waste treatment facilities in a region can be identified by considering this trade-off. To utilize economies of scale in waste management, smaller local governments need to join schemes to collect waste from a wider area and to treat waste in a centralized treatment or disposal facility. Such a scheme might be described as “regional municipal solid waste management.”

There are two possible interpretations of regionalization: decentralization and centralization. In this report, regionalization means the shift from decentralized waste management in each local government to integrated MSW in the region.ⁱⁱⁱ

Section 2 reviews institutional arrangements on regional inter-municipal cooperation, which has been a major type of joint delivery of public services in regions. There are many studies on inter-municipal cooperation, examining the types of inter-municipal cooperation and the pros and cons of different types of inter-municipal cooperation. Section 3 considers the relationship between the regionalization of MSW management and private sector involvement, including public-private partnerships. An inter-municipal cooperation scheme may ask private companies to engage in full or partial

investment in waste management facilities and related services. Section 4 discusses the drivers for the regionalization of solid waste management. Some initiatives to improve municipal solid waste management, such as the policy of shifting open dumping to sanitary landfills, incentivize inter-municipal cooperation. Section 5 briefly discusses the structure of this report.

1. Economies of Scale and the Appropriate Size of Areas for Municipal Solid Waste Management

Economies of scale have been observed in various production processes, such as steel production and oil refineries (Silberston 1972). Waste treatment and disposal facilities also have such characteristics.

Fujii (2005) pointed out the theoretical advantages of regional cooperation in waste management. The capacity of a waste treatment facility is basically proportional to its volume. The capacity, in terms of volume, is proportional to cube of length of the facility. On the other hand, the construction cost is proportional to the square of its length. The larger the scale of the capacity of waste treatment, the lower the cost. Inter-municipal cooperation can save waste treatment and disposal costs if such economies of scale work for waste treatment facilities such as sanitary landfills, waste-to-energy plants, composting plants, and others.

India's Ministry of Urban Development (2011) has illustrated the economies of scale in landfills, on the basis of a number of assumptions, such as degree of slope, depth from ground level, and a square landfill site. Table 1-1 shows the hypothetical cases in the Ministry's report, which said,

Given a fixed side slope, a greater height can be achieved with a larger base area. Therefore, more waste can be placed per unit area of larger landfill sites, resulting in a lower per ton cost of land filling.

Table 1-1. Hypothetical Example of Economy of Scale on Landfills

x= (m)	Land Area(m ²)	Limit of height from ground level	Air Space (m ³)	Factor	
				Area	Air Space
100	10,000	10	82,000	-	-
300	90,000	15	1,302,667	9	17.5
500	250,000	20	4,771,333	25	67.3

Source: Ministry of Urban Development, India (2011).

However, as Fujii (2005) has pointed out, a larger facility needs a larger waste collection area, which means increased transportation costs. The optimal waste collection area and optimal size of waste treatment facility are determined by a balance between the treatment costs and the transportation costs.

Gujarat State in India, provides a good example of inter-municipal cooperation in solid waste management in India. Around the year 2005, the state government of Gujarat asked the Gujarat Urban Development Company Limited (GUDCL) to develop a state-wide municipal solid waste management program, covering 159 urban local bodies. GUDCL estimated that if each urban local body (ULB) developed its own treatment and disposal facilities, the cost of waste management would be 25 USD/ton. On the other hand, the decentralized treatment at ULBs and 36 regional landfill sites could reduce the waste management costs to 9.4 USD/ton. By 2015, 93 vermicomposting plants for 159 ULBs, and 7 regional landfills for 37 ULBs had been constructed (UNEP 2015).

In 1997, the Japanese Ministry of Health and Welfare issued a “Notice on the Regionalization of Municipal Solid Waste.” The notice stated that the capacity of waste incineration plants should be more than 100 tons per day in order to reduce dioxins and should be more than 300 tons per day from the perspective of energy use. The notice was formulated using the data from existing waste incineration plants in Japan.

There are also many empirical studies on costs saved by inter-municipal cooperation in Europe. Bel and Warner (2014) reviewed recent multivariate econometric studies on inter-municipal cooperation and costs in Europe. Of eight studies, seven dealt only with solid waste management, while the other one studied water, electricity, gas, and waste. Of the seven studies on waste, five found that inter-municipal cooperation made significant cost savings, while one study showed cost savings that were not statistically significant. All of the studies dealt with European cases. Only one study, targeting Norway,

showed that inter-municipal cooperation increased the cost of solid waste.

However, the dependent variables of these studies were “total cost of solid waste management for a municipality” or “cost per capita/fees per household.” The studies did not distinguish the economies of scale of treatment and disposal facilities or diseconomies of scale of collection areas. The optimal areas for solid waste collection and for the size of facility may be affected by transportation costs, construction costs of the waste treatment facility, and other factors.

2. Inter-municipal Cooperation

On the basis of various studies in Europe, the Council of Europe et al. (2010) listed the possible objectives of inter-municipal cooperation in the field of waste management, which included finding adequate locations for landfills and sharing their use, acquiring trucks, building central waste disposal/treatment plants, developing joint policies for solid waste management, and recycling to achieve better environmental protection.

On the basis of case studies in India and other countries, the Indian Ministry of Urban Development made a guidance note for municipal solid waste management on a regional basis (Ministry of Urban Development 2011). The guidance note pointed out that there are three structures for a regional municipal solid waste project, namely, the “State Government Concession Agreement Structure,” “Authority Concession Agreement Structure,” and “Structure When a Private Party Provides the Land.” Basically, the landowners are different in these three structures. In the State Government Concession Agreement Structure, land for the facility is owned by the state government. In the “Authority Concession Agreement Structure,” the land for the facility is owned by a specific authority. In the third case, as indicated by the name, the land is owned by a private party. Thus, the leading actors are different in each structure.

In Southeast Asia, similar cases are observed. A waste-to-energy plant in Phuket municipality in Thailand is operated in a scheme similar to that of the Authority Concession Agreement Structure. Phuket municipality has contracts with 17 surrounding local governments to accept waste from them. The agreement was made by a committee chaired by the Phuket Provincial Governor. Phuket municipality has contacted a private company that operates the waste-to-energy plant in the municipality. Thus, the main or leading municipality, where the waste management facility—such as the landfill site and/or waste-to-energy plant—is located, makes contracts with other municipalities. In this paper, such cooperation is called the “Leading Municipality Scheme” of regional

solid waste management.

The scheme of a waste-to-energy plant in West Jawa, Indonesia, is similar to the “State Government Concession Agreement Structure” in India. West Jawa is trying to construct a waste-to-energy plant that will treat waste generated from Legok Nangka. The plan is for the facility to treat waste from six local governments, namely, Bandung City, Cimahi City, West Bandung Regency, Bandung Regency, Sumedang Regency and Garut Regency; the West Jawa Provincial Government has signed contracts with these. This type of scheme sees a higher-level local government, such as a provincial or prefectural government, make contracts with lower-level cities or towns. Such an arrangement can be called a “Regional Government Scheme” of regional solid waste management.

Some landfills in Thailand and the Philippines have been constructed by private companies and have accepted waste from various local governments. Such an arrangement is similar to the “Structure When a Private Party Provides the Land” in India. In this paper, such a scheme is referred to as a “Private Companies Leading Scheme.”

This typology of regional arrangement is incomplete, however. Another approach to inter-municipal cooperation involves local governments forming an association, union, or enterprise. Such an approach is very popular in Japan. The Local Autonomy Act, enacted in 1947, contains an article to allow local governments to formulate a “Partial Affairs Association” (Article 284). Some or all of the obligations of local government, including solid waste management, can be transferred to a Partial Affairs Association. The number of Partial Affairs Associations dealing with waste was less than 100 at the end of 1950s, however, its popularity rose to the extent that there were more than 100 associations established in 1970–71 alone. The reason behind the increase in the number of partial associations was the introduction of waste incineration plants around 1970 (Yatsuki 2004).

The Local Autonomy Act was revised in 1994, the revisions entering into force in 1995. In the revision, a “Wide Area Union” was newly defined, in addition to the Partial Affairs Association. The power of authority of a Wide Area Union is stronger than that of a Partial Affairs Association. The national government can also transfer some tasks to a Wide Area Union, while a Partial Affairs Association only implement tasks assigned by local government. Many Partial Affairs Associations and Wide Area Unions are conducting waste treatment.

Table 1-2 shows the types of regional solid waste management schemes. The kind of scheme led by private companies will be discussed in the following section, along with other types of private sector involvement.

Table 1-2. Types of Regional Municipal Solid Waste Management

	Types	Example	Explanation
Inter-municipal cooperation	Regional Government Scheme	Waste-To-Energy plant planed in West Jawa, Indonesia.	Regional government make agreement with local governments in the region and accept waste from them.
	Leading Municipality Scheme	Waste to Energy Plant in Phuket.	A municipality hosting waste treatment or disposal facility make agreement with and receive waste from other municipalities.
	Municipalities' Association Scheme	Partial Affairs Association in Japan	Local governments formulate association to treat and/or dispose waste jointly.
	Private Sector Leading Scheme	Some private landfills accepting ashes from Waste-to-Energy plants in Japan. Some private landfills in Thailand.	Private sector operates waste treatment and disposal facility which accept waste from multiple local government.

Source: Compiled by the Author.

3. Inter-municipal Cooperation and Private Sector

Local government and inter-municipal cooperation schemes can outsource all or part of their waste management processes to the private sector. They can invite the private sector to invest in the waste management infrastructure in a Build, Operation, and Transfer scheme or some other scheme. There are many varieties of public-private partnerships in waste management.

In some countries, public-private partnerships in waste management are very common. Grossi and Reichard (2016) reviewed the dominant modes of public service delivery in several European countries. They found that cooperation, public-private partnerships, and contracting out have become popular. In Italy, the contracting out of waste disposal services has increased considerably. Moreover, contracting out is the dominant approach in waste collection and treatment in Germany. With regard to waste

collection in Finland, contracting out is the most common approach.

There are a few companies that deliver waste collection and treatment services in many counties and cities, such as Veolia, SUEZ, and Waste Management. By contracting out or through public-private partnership programs, private companies and local government may be able to capture economies of scale.

Some studies have pointed out the difficulty faced by municipalities in rural areas in finding private service providers. Using data for multiple public service deliveries, Warner and Hefetz (2003) have pointed out that in the United States, rural governments exhibit a higher relative use of inter-municipal cooperation, while suburban local governments favor the use of for-profit firms. Metropolitan-core governments show the highest use of non-profit organizations. Both rural governments and metropolitan-core governments show a tendency for lower incomes and higher poverty levels among their populations.

There are reasons for such differences. The first is a lower level of professional capacity among rural governments to develop and manage contracts with private alternatives. Second, it may be difficult to find a number of qualified private sector companies. If there are only one or a few private companies, the achievement of efficiency through competition may not be achieved.

In some Asian countries, such as Thailand and the Philippines, the private sector is very active in constructing and operating dumpsites. Many landfills have been developed by the private sector. Some local governments contract with private sector companies for waste disposal. This implies that the benefits of the economies of scale in landfills are captured through the privatization of disposal services.

4. Drivers to Regional Waste Management

There are some economic, social, and environmental circumstances that stimulate regional waste management. Hulst et al. (2009) have shown that inter-municipal service delivery is affected by the national institutional context, such as the formal state structures, legislation, incentives for cooperation, and administrative culture, and by environmental factors such as social, economic, political, demographic, and technological features. Emerging environmental concerns and stricter environmental regulations, which are both environmental factors, are likely to force local governments to form inter-municipal corporations.

In Japan in the late 1990s, dioxins generated from waste incinerators became a public concern. In 1997, the Ministry of Health and Welfare revised the Guidelines for

the Prevention of Dioxin Formulation Relating to Waste Treatment. It recommended that the capacity of waste incineration plants should be at least 100 tons per day and ideally more than 300 tons per day. The notification on the Plan for Treating Waste over a Wider Area was also issued in 1997, which stressed the need to treat waste over a wider area, because bigger incineration plants emit fewer dioxins. In 1999, the Air Pollution Control Act was also amended. Stricter emission standards for dioxins were introduced. Yatsuki (2004) has pointed out that until the mid-1990s, cities were less likely to join Partial Affairs Associations and Wide Area Unions than were towns and villages. However, because of the policies changes on dioxins, most of cities formulated Partial Affairs Associations or Wide Area Unions with neighboring towns and villages. Such inter-municipal cooperation was also financially supported by central government with budget allocations or low-interest loans.

Japan's Mitsubishi Research Institute (2012) conducted a questionnaire survey and case studies on the notification of the Ministry of Health and Welfare. They obtained answers from 38 prefectural governments stating that all of them had already made plans for treating waste over a wider area. Many facilities achieved their targets in their plan (Table 1-3). The average capacity of waste incinerators and landfills satisfying the target is larger than that of those not satisfying the targets in their plan.

Table 1-3. Capacity of facilities by Achievement of Plan

	Waste Incinerator		Landfill		Sorting Facility for Recycling	
	Average Capacity t/day	Number of facilities	Average Capacity 1,000m3	Number of facilities	Average Capacity t/day	Number of facilities
Total	183.47	247	1873.57	54	46.50	5
Achieved as planned	197.42	123	2202.88	45	37.93	36
Partially Achieved	181.96	51	387.33	3	55.97	11
Not at all	161.00	71	146.83	6	75.71	7

Source: Mitsubishi Research Institute (2012)

Transportation costs also affect regional solid waste management. If unit transportation costs became cheaper due to a reduction in traffic jams or lower fuel costs, the number of municipalities joining inter-municipal cooperation schemes would increase.

In addition, if environmental regulations of waste management facilities were stricter, and if economies of scale worked for environmentally sound technologies, the number of local governments joining inter-municipal cooperation would increase.

In an institutional context, the most important action is to define the legal status of the associations formulated by municipalities. In Japan, it is very popular to create associations or unions to deliver public services. The number of Partial Affairs Associations, Wide Area Unions, and the like dealing with municipal solid waste and/or human waste in Japan had reached 459 by the end of 2016. Of 1320 Partial Affairs Associations and the like in Japan, 34.8% are dealing with solid waste and/or human waste. The Japanese government provides the legal bases for such associations.

One example is the *Joso Chiho Koiki Shichouson Jimu Rengo* (Joso Area Partial Affairs Association), which was established in March 1972, when the construction of a waste incinerator and crushing facility was started. The daily capacity of the first waste incineration plant was 150 tons per day. A second waste incinerator was built in 2000, with a capacity of 351 tons per day. After the emission controls on dioxins were revised in 1999, a third waste incinerator (259 tons per day) and a sorting plant for recycling (127 tons per day) were developed in 2000. Until 1975, the final disposal site was in the area, but it was closed due to tighter environmental regulations on landfills. Since 1975, the association has sent its waste, such as ash from the incinerators, to landfill outside the area.

Many developing Asian countries are trying to upgrade their waste management facilities. In most developing countries, open landfills have been closed and shifted to sanitary landfills. In higher middle-income countries, they are trying to introduce waste-to-energy plants. There are so many cost-saving opportunities in the field of solid waste management from facilitating inter-municipal cooperation.

In Japan, inter-municipal cooperation is very popular, especially in the form of Municipalities Association Schemes. One of the reasons is the existence of legislation defining municipalities associations such as the Partial Affairs Associations and Wide Area Unions.

Southeast Asian countries should define the legal status of inter-municipal associations. There are several examples of inter-municipal cooperation formulated through agreements between states/provinces and cities/municipalities, or agreements among cities/municipalities, but associations similar to the Partial Affairs Associations and Wide Area Unions established in Japan have not been observed in Southeast Asia.

In addition, the conditions for subsidizing local government should favor inter-

municipal cooperation. In cases where the central government supports the construction of waste management facilities, the benefits of the cost savings from inter-municipal cooperation should be shared by local governments and central government. Such financial incentives should stimulate local governments to undertake inter-municipal cooperation.

6. Structure of the Report

Following this chapter, Chapter 2 shows the economies of scale in waste management in Japan. It also discusses the trade-off between advantages in the scale of treatment facilities and the transportation costs of waste. Transportation costs can be saved by investment in transfer stations. Chapter 3 surveys inter-municipal cooperation in Southeast Asia, especially Thailand, Indonesia, and the Philippines. It points out the importance of legal arrangements for inter-municipal cooperation. The differences in the level of inter-municipal cooperation among these countries can be explained by the experiences of local autonomy in the past. Chapter 4 describes Thailand's efforts to upgrade waste management in recent years. The central government is trying to create a cluster of local governments to cooperate on solid waste management. Although it is still in its initial stage, several cases of inter-municipal cooperation are reported. Chapter 5 reviews the development of waste management in the Philippines. Chapter 6 illustrates the improvements in public access to drinking water and sanitation services in Indonesia. Chapter 7 conducts case studies on inter-municipal cooperation in Indonesia. Chapter 8 reviews international cooperation between cities from Japan and other organizations. While there are many cases of international city-to-city cooperation in the field of environmental management, there are a few cases in which Japanese inter-municipal cooperation bodies cooperate with the inter-municipal cooperation bodies of developing countries.

Conclusion

To achieve the environmentally sound management of municipal solid waste, local governments should engage in the proper treatment and disposal of waste. Technologies such as waste-to-energy plants and sanitary landfills are often too costly for small municipalities. Inter-municipal cooperation may be able to save some costs because of economies of scale at some facilities.

A few countries in Asia, such as Japan and India, have taken the initiative in establishing regional waste management systems through inter-municipal cooperation,

with or without privatization. Privatization in landfill services in Thailand and the Philippines can be regarded as a type of regionalization of waste management. In rural areas, however, such a privatization approach may not be of use in improving waste management because of insufficient financial and human resources and insufficient service providers. For rural areas in Asian countries, legal arrangements to formulate inter-municipal cooperation in waste management should be established. It may be advantageous to share experiences within the region.

ⁱ The exceptions are Singapore and Malaysia. Singapore is small enough for its national government to collect, treat, and dispose of municipal waste. Malaysia enacted the Solid Waste & Public Cleansing Management Act in 2007, which tried to federalize municipal solid waste management in the Malay Peninsula, although some states, such as Selangor and Penang, have not participated in the scheme. In other Asian countries, local governments are basically responsible for waste management.

ⁱⁱ In this report, “Municipal Solid Waste” refers to the waste generated from daily life and not limited to waste from urban areas. The US Environmental Protection Agency defines “Municipal Solid Waste” as waste “consisting of everyday items such as product packaging, grass clippings, furniture, clothing, bottles and cans, food scraps, newspapers, appliances, consumer electronics, and batteries.” It also states that such waste comes from homes, institutions such as schools and hospitals, and commercial sources such as restaurants and small businesses.

https://cfpub.epa.gov/roe/indicator_pdf.cfm?i=53

ⁱⁱⁱ The Ministry of Urban Development (2011) defined a regional municipal solid waste facility as a waste management facility or system of any kind (whether in relation to collection, transportation, treatment, or disposal of municipal solid waste or a combination of any or all of these) that collects, manages, receives, or disposes of municipal solid waste from more than one authority.

<References>

- Bel, Germa and Mildred E. Warner (2015). “Inter-municipal Cooperation and Costs: Expectations and Evidence” *Public Administration* Vol.93, No.1, pp.52-67.
- BEL, GERMÀ and ANTÓN COSTAS (2006) “Do Public Sector Reforms Get Rusty? Local Privatization in Spain” *The Journal of Policy Reform* Vol. 9, No. 1, 1–24.
- BEL, GERMÀ and Melania Mur (2006) “Intermunicipal Cooperation, Privatization and Waste Management Costs: Evidence from rural Municipalities” *Waste Management* Vol.29, pp.2772-2778.
- Council of Europe, United Nations Development Programme and the Local Government Initiative of the Open Society (2010). *Inter-Municipal Cooperation Toolkit Manual*.
- Fujii, Minoru (2005) “Advantage and Disadvantage in Regional Waste Management” *Waste Management Research* Vol.16, No.6. pp. 328-333. (in Japanese with English abstract: 藤井実「廃棄物処理・リサイクルの広域化のトレードオフについて」『廃棄物学会誌』 Vol.16, No.6, 2005 年)。
- Grossi, Giuseppe and Christoph Reichard (2016) “Variance in the Institutions of Local Utility Services: Evidence from Several European Counties” in H. Wollmann, I. Koprić,

- G. Marcou (ed.) *Public and Social Services in Europe – From Public and Municipal to Private Sector Provision*, Palgrave Macmillan.
- Hirayama, Shuichi, Fumio Nagai and Yoichiro Kimata(2016). *Nation Building from Local – 15 Years Cooperation on Inter-Municipal Cooperation between Japan and Thailand* (in Japanese: 平山修一・永井史男・木全洋一郎(2016)『地方からの国づくり—自治体間協力にかけた日本とタイの15年間の挑戦』佐伯印刷).
- Inaba, Rokuta, Tomohiro Tasaki and Kousuke Kawai (2018) 「ごみの広域化と集約化～将来の社会変化に対応して」『都市清掃』Vol.71, No.342, pp7-13
- International Panel on Climate Change (2014) *Climate Change 2014: Mitigation of Climate Change*.
- Kamo, Tosiho, Hiroaki Inatsugu, Fumio Nagai(2010) *International Comparison of Inter-Municipal Cooperation - Beyond Integration of Municipalities*, Minerva (Japanese: 加茂利男・稲継裕昭・永井史男編著『自治体間連携の国際比較—市町村合併を超えて』ミネルヴァ書房).
- Kimura, Shunsuke (2017) 木村俊介『グローバル化時代の広域連携—仏米の広域制度からの示唆』第一法規。
- Kimura, Shunsuke(2017) *Regional Administration in Japan: Departure from Uniformity*, Routledge.
- Ministry of Urban Development (2011). *Municipal Solid Waste Management on a Regional Basis*, India.
- Mitsubishi Research Institute (2012). *Report on the Project of Supporting Transformation of Waste Treatment for 3R and Low Carbon* (in Japanese: 三菱総合研究所『平成23年度 廃棄物処理の3R化・低炭素化改革支援事業委託業務報告書』)
- UNEP(2015). *Global Waste Management Outlook*.
- Silverston, Aubrey (1972) “Economics of Scale in Theory and Practices” *The Economic Journal*, Vol.82, No.325, pp.369-391.
- World Bank (2018). *What a Waste 2.0 – A Global Snapshot of Solid Waste Management to 2050*.
- Yatsuki, Shin-ichi (2004). *Administrative and Financial System of Wastes* (in Japanese: 八木信一(2004)『廃棄物の行政システム』有斐閣。)
- Warner, M.E. and Heftz, A, (2003) “Rural-Urban Differences in Privatization: Limits to the Competitive State” *Environment and Planning C: Government and Policy* Vol.21. pp.703-718.