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Bridging Cultures: Lessons from Japan for Improving Rural Household Waste Management in Bangladesh

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Abstract: *Research on rural solid waste management (SWM) in Bangladesh is limited. This study aims to provide a comprehensive understanding of SWM practices in rural areas of Bangladesh, focusing on the best practices used in Japan. By adopting these teachings developing countries may make substantial progress in enhancing their SWM systems, promoting sustainable development, and protecting public health and the environment. The research was conducted using questionnaires and interviews with one hundred and thirty-one citizens and service providers from representative rural areas of Bangladesh and Japan. Qualitative data were analyzed thematically and quantitative data were analyzed by using basic statistical tools such as frequency, correlation analysis, and t-statistic approaches. The results show that citizens in rural Bangladesh perform SWM on a personal basis, using individual judgment, personal knowledge, and voluntary adherence. In contrast, in Japan, waste disposal is uniformly guided by law and city rules. In rural Bangladesh, citizens usually dump waste in open spaces without any schedule, and sometimes bury or burn rubbish. Japanese individuals dispose of waste by following a specific day and time for waste dumping in designated places. Composting and informal sectors are characteristic of Bangladesh's rural SWM, where active voluntary citizen participation is a unique feature of Japan. Timeliness of relevant rules, prioritizing, ensuring stakeholders' involvement, Japanese knowledge, and vibrant local government activities can be appropriate areas of learning from Japan. Researchers and policymakers will benefit from this research as a reference for rural SWM activities and promote sustainable environmental development in rural regions.*

Keywords: *Rural SWM, Household SWM, Citizen participation, Citizen groups, Lesson learn, Japan, Bangladesh*

1. INTRODUCTION

Solid waste management (SWM) is the process of managing the generation, storage, collection, transfer, and disposal of solid waste (SW) in line with best practices in public health, economics, finance, engineering, administration, legislation, and the environment (Shakil et al., 2023). According to several studies, households are the primary generators of SW in urban areas (Suthar & Singh, 2015; Dangi et al., 2011). Only partial SWM services are available in upper-middle-income countries, whereas in low-income countries, SWM services are inadequate or absent for the rural population (Mihai & Taherzadeh, 2017; Kaza et al., 2018; Ferronato & Torretta, 2019).

Numerous studies have been conducted on urban areas and municipalities in Bangladesh (Biswas et al., 2020; Sujauddin et al., 2008; Salequzzaman et al., 1998; Salequzzaman et al., 2001; Salequzzaman, 2000; Ahmed and Rahman, 2000; Alam et al., 2002; Hasan and Chowdhury, 2005; Enayetullah et al., 2005; Rahman et al., 2006; Sinha, 2006). Prior research conducted by Abedin and Jahiruddin (2015), Rahman (2017), and Shams et al. (2017) has demonstrated that rapid urbanization and population increase in Bangladesh are responsible for significant quantities of solid waste generation. There is a dearth of research on SWM in rural areas of Bangladesh (Matin & Mridha, 2010, Tajkir, 2024). Approximately 74 percent of the population in Bangladesh resides in rural areas, excluding the city corporation and municipal regions, which encompass almost 90 percent of the nation's landmass.

Japan has become a lid country in terms of SWM activities and an example for developing countries (MoE, 2014). In the 1960s, Japan experienced a significant increase in mass-produced goods, leading

to environmental restrictions due to inadequate dumping sites and hazardous emissions from SWM facilities (MoE, 2014). The country's strong government leadership and local community support are key to its approach, which requires costly incineration facilities and regular maintenance. Japan's 100% source segregation practice preserves the recycling business model and raises public knowledge of SWM (Yamawaki et al., 2006). Bangladesh is still developing its SWM system, and institutional SWM has not been developed at the village (rural) level (MoLGRD, 2020). This iterative process of learning can guide Bangladesh's SWM strategies, demonstrating the importance of sustainable WM in developing countries.

Several researchers performed significant research on urban SWM in Bangladesh. However, there is a lack of study on SWM practices at the household level in rural areas or conducted a comparison with Japan. This research therefore aims to observe the following issues: management practice, disposal, reuse/recycling, and citizen groups activities at the household level in rural areas of Bangladesh and Japan, and lessons learned from Japan.

2. LITERATURE REVIEW

This section reviews previous research conducted in Japan and Bangladesh on various aspects of SWM at the household level. These include management practices, citizen participation and stakeholder engagement, waste segregation, waste dumping locations and processes, recycling, as well as volunteer and citizen group activities.

2.1. Waste Management Practices

The Bangladesh national 3R strategy for SWM has been criticized for its negative public perception of SWM. Both residents and industrialists view it as the responsibility of city corporations or municipalities (MoEF, 2010). BIGD (2015), Sujauddin et al. (2008), Biswas et al. (2020), Salequzzaman et al. (1998), Salequzzaman (2000), Ahmed and Rahman (2000), Salequzzaman et al. (2001), Alam et al. (2002), and Hasan and Chowdhury (2005) identified the partial participation of citizens in the urban areas of Bangladesh.

In Japan, citizens have developed a sense of trust by following the designated waste separation protocols, sticking to specified discharge schedules and places, and other related guidelines. A hygienic residential milieu is upheld through collaborative endeavors between inhabitants and the municipal authority (JICA, 2022). The SWM legislation in Japan is effective due to active community involvement (Mahajan, 2015).

Volunteer WM activities by the citizens and citizen groups were observed in Kitakyushu (Alam, 2016), Yokohama (RieKimura, 2015), and Tokyo through the "Tokyo Slim" program (Sorensen & Okata, 2011). Tanaka (2021) found 82,000 registered citizen organizations for this purpose.

2.2. Waste Segregation

Bangladesh introduced waste segregation at the household level in 2011 as part of the 3R strategy paper and found resistance to household waste separation (MoEF, 2010). The pilot project by NGOs in Uttara has been recognized as an exemplary initiative and found small-scale segregation (8%) by Enayetullah et al. (2006) but these activities are rarely practiced in rural areas (Ashikuzzaman and Howlader, 2020).

In Japan, waste generation is regulated at the household level, with individuals being expected to categorize their garbage into three groups, including combustible and noncombustible materials and recyclable items (Yolin, 2015).

2.3. Waste Disposal Process and Place

Dhaka City Corporation's SWM collection rate is less than 50%, causing pollution in water, land, and air. The city's residents haphazardly dispose of uncollected rubbish, either burning it or dumping it into bodies of water or floodplains (Matter et al., 2013). This approach is categorized as an "end of pipe" approach, prioritizing waste collection and elimination over reuse and reduction (MoEF, 2010).

There are limited dumping places for waste in rural areas because of a lack of collection facilities by the authorities (Kochi et al., 2001). Tajkir (2024) found citizens often dump waste in pits or lowlands and open spaces near their houses and backyards. Ashikuzzaman and Howlader (2020) described similar findings from all over Bangladesh. Chandrappa & Das (2012) mentioned comparable findings for other rural areas globally which cause pollution and are not environmentally friendly (Mihai & Taherzadeh, 2017).

In Japan waste is deposited in designated bags on a specific day of the week, and valuable components are segregated from collected waste and directed toward a recycling pathway (Mahajan, 2015; Luk, 2023). A group can be formed by a minimum of 10 households, after which, a group collection station is designated for household waste disposal (JICA, 2022; MoE, 2012).

2.4. Recycle and Reuse

Japan's SWM philosophy and societal framework aim to minimize environmental impacts and resource consumption through the 3R approach. Laws and standards, based on the 3R approach, can significantly reduce waste (Rahardyan et al., 2004). Compost is a form of reuse waste in Bangladesh that consists of a high content of organic materials (BIGD, 2015) and an environment-friendly disposal observation by Mihai and Ingrao (2018). El-Haggar (2007) mentioned that rural areas without access to formal waste collection services should be encouraged to conduct home composting or vermicomposting.

Matter et al. (2013) mentioned regular collection or purchase of recyclables by the informal sector is crucial. The informal sector is a private business without a direct relation to local government authorities, and the presence of an informal sector is one of the significant characteristics of developing countries which collects and recycles valuable materials (Schneider et al., 2017; Scheinberg et al., 2010; Gunsilius et al., 2011; Wilson et al., 2009). Chi et al., (2011) observed the informal sector's activities in the urban areas but also found rural areas in Bangladesh (BIGD, 2015; Tajkir, 2024).

Although different issues of WM have been prioritized in previous studies, rural WM in Bangladesh has been neglected. Citizen participation and group activities and their impact were not discussed. At the same time, the issue of WM in Japan and Bangladesh was not noticed. These research gaps are attempted to be filled by the present research.

3. METHODOLOGY

The study collected empirical information from Bangladesh and Japan through comprehensive random field interviews and questionnaires, with data from citizens through questionnaires (Yin et al., 2006). In-depth interviews were conducted with citizen group members in Japan (Babazadeh et al., 2018), while key informant interviews were conducted with relevant stakeholders, eight of which were focus group discussions (BIGD, 2015). The questionnaire was developed based on various studies and was used to gather their opinions (Valera, 2020; Biswas et al., 2020; BIGD, 2015; Kalwani, 2009).

Field data was collected from Japan in August and September 2022 and from Bangladesh in October and November 2022. Questionnaires were received from respondents from April to June 2023, with a total sample size of 131, including 108 citizens and 36 service providers from Bangladesh and 23 from Japan.

Data were collected using preset questionnaires and in-depth interviews with a diverse range of local government (LG) officials- Upazila executive officers, senior officers of LG; elected representatives-chairman and secretary of Union parishad; chairman of Upazila parishad, Mayor of municipalities; related specialists and citizens of different unions of Bangladesh. Moreover, individuals and organizations within the citizenry who had received services were also interviewed.

A questionnaire was used to gather data from service providers in Japan, including interviews with officials from the Setouchi City Office and Takarazuka Cleaning Center. The data was collected from various villages in Takarazuka, Sukugawa, Okayama, and Ube cities.

The research utilized questionnaires with varying contexts (Schneider, 2017; Kalwani, 2009), including both qualitative and quantitative questions, some open-ended and others closed-ended (Yin, 1994; Miles & Huberman, 1994). The subject remained constant, and analyses and answers to relevant questions were used in the study (BIGD, 2015).

The original questionnaire was written in English but later translated into Japanese and Bengali for use in surveys and interviews in Japan and Bangladesh (Qun & Carey, 2023). The respondent's answers were segregated and expressed as statements (Carley, 1990; Weber, 1990). Different statements were designed to be positive and coded with numerical numbers (Miles & Huberman, 1994; Marshall & Rossman, 1989). Data were analyzed using descriptive statistics (frequency and

percentage), while cross-tabulation and nonparametric *t*-tests were used in the inferential part (Rabeiy et al., 2022).

The study involved interviews with respondents, who were given their consent either orally or in writing (Eisner, 1991; Deyhle et al., 1992; Erickson, 1986). The research followed ethical norms, respecting diverse cultures and individuals, ensuring their dignity, rights, safety, and well-being, and properly documenting their statements (Sieber, 1992; House, 1990; McQuillan & Muncey, 1990).

4. RESULTS

4.1. SWM in the Rural Areas of Bangladesh

Trends in SWM in the Rural Areas of Bangladesh

This sub-section describes how citizens in the rural areas of Bangladesh are involved in SWM activities and the practices they follow in four major areas, like management practice, dumping process, dumping places, reuse, and as well as the activities of citizen groups in SWM activities.

(a) Management practice at the household level

The citizens described two types of management practices during their interviews (Table 1). Most respondents (88.9%) said that homeowners disposed of their waste individually at the household level. Sometimes, dumping places were shared with neighbors, as mentioned by 11.1% of the respondents.

Table1. *Management practice in the rural areas of Bangladesh*

Major area	Activities	n	%	Decision
Management practice	Homeowners disposed of their waste by themselves in their own way.	64	88.9	Dominant
	In some cases, neighbors or a group of citizens used the same place for waste dumping.	8	11.1	Rare

(Source: Primary field data; created by the author)

The citizens' opinions were consistent with those of different service providers in the rural local governments. One of the senior supervisory-level government officials in charge of looking at the activities of eight districts mentioned the following: *"The Union and Upazila Parishad regulations do not mandate WM, indicating that rural areas lack a proper system. As a result, citizen participation in WM is voluntary, ad hoc, self-directed, and unique to each location, making it a form of personal management."* (EBD1).

Respondents supported this issue and expressed an opinion –*"They manage and dispose of waste by themselves as part of their responsibilities"* (UPC1). *"It is exclusively managed personally"* (UPC5). *"WM is managed according to the individual's responsibility"* (UPS3).

(b) Waste disposal (dumping process and places) and reuse

Based on the findings citizens often adhere to three distinct procedures when engaging in dumping: burying in the soil, making a hole and then dumping, and burning. Among these procedures in Table 2, most of the respondents (61.1%) made a hole in which to dump their waste. On the other hand, 31.9% of the respondents buried their waste in the soil. Around 7% of the respondents mentioned that waste is sometimes burned.

Table2. *Waste dumping process and places in the rural areas of Bangladesh*

Major area	Activities		n	%	Decision
Dumping process	Waste	is buried in the soil.	23	31.9	Commanding
		is dumped in a hole.	44	61.1	Dominant
		is sometimes burned.	5	7	Rare
Dumping place	Citizens disposed of the waste	in their backyard.	23	32.9	Commanding
		in low/shallow land.	23	32.9	Commanding
		in an open space or pond/river.	24	34.2	Dominant

(Source: Primary field data; created by the author)

Respondent's statement: *"Citizens manage their own household-level waste and dump their waste in open spaces, riversides, and backyards of houses"* (UNO1). *"Most citizens dump their waste in their backyards and other open spaces"* (UPC5).

Field interviews indicate that citizen creates their own waste disposal places due to the lack of official disposal places. As shown in Table 2, the respondents expressed three types of dumping places: their backyard, low/shallow land, and open spaces or ponds/rivers. 32.9% of respondents use low/shallow land for waste disposal, while the same percentage dumps in their backyard. 34.2% of respondents dump waste in open spaces or ponds/rivers.

Respondents expressed: *"The residents in nearby neighborhoods personally accumulate waste within their premises before disposing of it on public roads and in waterways and canals/ponds"* (CBD45). *"People in my union bury their waste at their place. It is left around the house's edge, in surrounding lowlands, fallow land, rivers, and canals"* (UPC6). *"They accumulated all the perishable household items together, buried them in the ground, and dumped them in open spaces"* (UPC8).

(c) Reuse/waste utilization

About 7% of the respondents mentioned that some citizens made compost from their waste (Table 3). In those cases, the respondents were involved in agricultural activities. Compost is made of household perishable products. The UPZC and one citizen discussed this compost issue during their interviews: *"Most of the waste is agricultural waste and is dumped in abandoned sinkholes next to houses. Some of the people are involved in making compost"* (UPZC3). *"Utilizing waste materials for fertilizer production can save producers money by allowing them to purchase it at a discounted rate"* (CBD 32).

Table3. *Waste reuse/ utilization in the rural areas of Bangladesh*

Major area	Activities	n	%	Comments
Reuse/utilization	Some citizens make compost with their waste.	5	7	Organic household waste
	Presence of the informal sector for waste recycling	32	45.7	Others household waste

(Source: Primary field data; created by the author)

A significant number of the respondents, around 45.7%, mentioned the presence of an informal sector (privet waste collector) for waste recycling in the rural areas of Bangladesh. Respondents also discussed the existence of the informal sector: *"The citizens sell some products such as plastic, bottles, and scrap metal. There are about 15 to 20 mobile buyers in Upazila. I have learned that they collect these products from the household level and then send them to Dholaikhal in Dhaka for sale"* (UPZC3). Figure 1 shows the overall SWM activities in the rural areas of Bangladesh

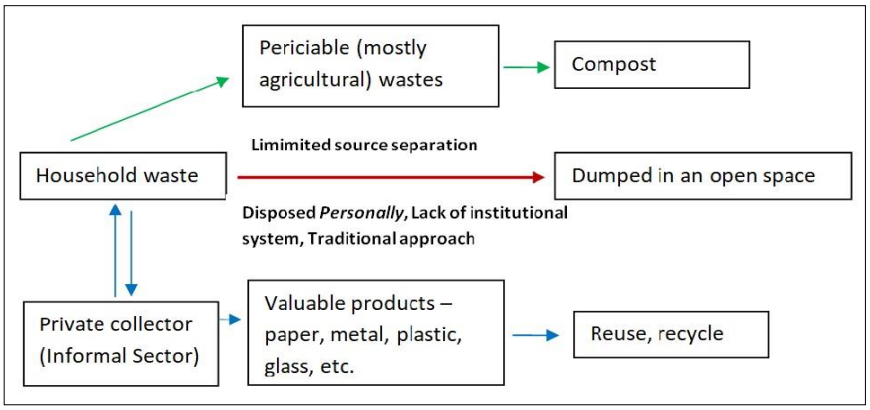

Figure1. *SWM activities in the rural household levels in Bangladesh*

(Source: Primary field data; created by the author)

(d) Level of participation at the household level

The study found that in Figure 2, 41.7% of respondents considered citizen participation in SWM activities moderate, while 27.8% expressed satisfaction. However, only 4.1% reported significant

satisfaction. Additionally, 13.9% expressed dissatisfaction with their involvement, while 12.5% expressed discontent. This indicates a divergence in viewpoints regarding participation levels, with satisfaction slightly above dissatisfaction. The data suggests that there is a need for more effective communication and engagement among citizens in SWM initiatives.

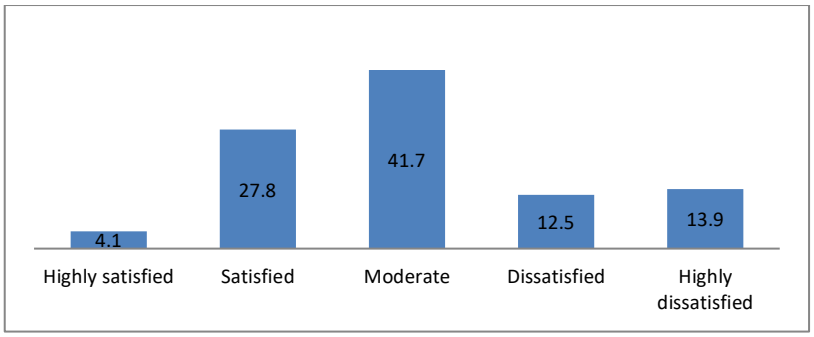

Figure2. *Level of participation in SWM at the household level*

(Source: Primary field data; created by the author)

4.2. Presence of Citizen Groups/Associations and NGOs in SWM

The sub-section discusses the involvement of citizen groups and NGOs in SWM activities in rural Bangladesh, with responses from citizens and service providers cross-checked and validated using numerical values. In addition, the answers and statements were designed to be positive and coded with numerical values as follows: citizen groups/associations or NGOs are not available = 3, citizen groups/associations and NGOs are available= 2, and I don't know = 1.

The majority of citizen and service provider statements in Bangladesh, 91.6% and 75% respectively, reported the absence of citizen groups and NGOs in rural areas. However, only 4.2% and 19.4% of these statements mentioned the availability of these organizations (Table 4), with only 4.2% and 5.6% stating they were unaware of their existence.

Table4. *Statements regarding the presence of citizen groups/associations and NGOs*

Statements	Key	n	%
No citizen groups/NGOs are available	CS	66	91.6
	SPS	27	75
Citizen groups/NGOs are available	CS	3	4.2
	SPS	7	19.4
I don't know	CS	3	4.2
	SPS	2	5.6

(Source: Primary field data; created by the author)

In Table 5, the mean value of the CS is 2.87, close to 3, which indicates the absence of citizen groups/associations and NGOs. The standard deviation is 0.44, which means less diversity in the respondents' opinions. The *t*-statistic value is 6.5 and statistically significant.

Table5. *Level of the presence of citizen groups/associations and NGOs*

Key	Statement	Mean	St. Dev.	*t*-statistic	Decision
CS	Citizen statement	2.87	0.44	6.5	Absence
SPS	Service provider statement	2.69	0.58	4.67	Absence

(Source: Primary field data; created by the author)

Compellingly, SPSs also showed similar findings. In the same table, the mean value is 2.69, close to 3, indicating the absence of citizen groups/associations and NGOs. The standard deviation is 0.58, which means less diversity in the respondents' opinions. The *t*-statistic value is 4.67 and statistically significant. In this case, the coefficient of correlation is 0.44, which indicates a highly positive relationship between the opinions of the CSs and SPSs. That is, both CSs and SPSs have the same opinions.

4.3. SWM Practices at the Household Level in Japan

Table 6 presents trends in SWM at the household level in Japan and describes the role of citizens. Around 95% of the respondents mentioned that citizens play an active role in waste sorting or separation at the household level.

Table6. *Trends in SWM at the household level in Japan*

Major area	Citizen statements	n	%
Source separation	Sorting/separation of waste at the household level	19	95
Disposal place	Waste disposed of at designated places/collection points	19	95
Maintaining schedule	Follow specific dates and times for different waste disposal	18	90

(Source: Field data; created by the author)

An expert in SWM gave his opinion similarly during the interview period: *"The Japanese law stipulates that waste dischargers, including citizens, are responsible for SWM, and it is hoped they will respect this responsibility"* (SPJP01).

Cleaning center officials shared their experience that this is the primary work done by citizens at the very early stage of SWM: *"Citizens generally play a role in reducing the volume of waste through separating at the household level and concerned at the societal level"* (SPJP03). *"The role of citizens in SWM is separating garbage in their house"* (CJP13).

95% of the respondents (Table 4) noted that citizens disposed of their waste at a designated place or collection point. One expert emphasized: *"When discharging waste, citizens should use designated material (mainly transparent plastic bags) and set it out at the designated place and time"* (SPJP01).

According to the citizen's opinion: *"Citizens are responsible for separating waste at the household level and disposing of it properly at a specific date, time, and place"*(CJP02). *"Citizen's responsibility is at the primary level"* (CJP14).

90% of respondents from various cities reported that citizens follow their city's regulations for household waste disposal. The head of a residence association mentioned that: *"Citizens obey the city law and follow the garbage rules accordingly"* (CJP14).

Respondents also explained their experiences and observations of waste disposal during the interviews: *"Citizens separate burnable from nonburnable garbage, pet bottles, and other plastic garbage at their house. Oversized garbage is disposed of differently following all these guidelines accordingly"* (CJP04).

In Japan, SWM at the household level focuses on source separation, disposal locations, and maintaining waste disposal dates and times, with 95% of respondents stating they regularly perform these tasks, while only 5% said they did not understand.

4.4. Satisfaction Level of Participation

Figure 3 shows that around 60% of respondents are satisfied with their activities in existing SWM, 30% are moderately satisfied, and 10% are dissatisfied, indicating that citizens seem to have some satisfaction with SWM activities. A cleaning center official mentioned that: *"Citizens are doing their job as per the city guidelines, this is appreciable"* (SPJP 02).

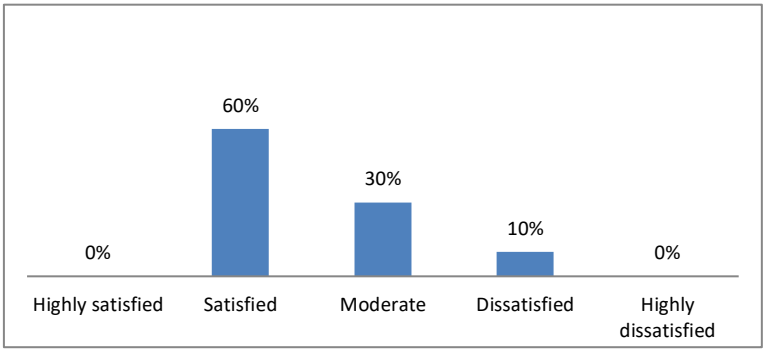

Figure3. *Satisfaction with citizen's activities in SWM*

(Source: Primary field data; created by the author)

4.5. Activities of Citizen Groups/Associations in SWM in Japan

The respondents' answers were accumulated and separated into four different types of statements. These statements were then coded as follows: citizen groups/associations are available = CS1; citizen groups/associations are not available = CS2; I don't know/I don't have any idea = CS3; and citizen groups/associations are available, but I don't have any communication = CS4. These data are presented in Table 7. Around 65% of respondents knew about citizen groups' activities (CS1), with some actively participating. However, 10% of respondents (CS2), primarily students living in university dormitories, did not know about these groups. 15% had no knowledge (CS3), and 10% observed citizen group activities but did not have any communication (CS4).

Table7. *Availability of citizen groups/associations in Japan*

Key	Citizen statement	n	%
CS1	Citizen groups/associations are available	13	65
CS2	Citizen groups/associations are not available	2	10
CS3	I don't know/I don't have any idea	3	15
CS4	Citizen groups/associations are available, but I don't have any communication	2	10

(Source: Primary field data; created by the author)

During the field interviews, similar findings were described by one of the cleaning center officials regarding the citizen group activities in that area: *"There are around 390 citizen groups affiliated with the Takarazuka City Office and existed from an ancient age. They promote group collection methods, which help reduce the volume of garbage and the cost of WM. TCC promotes 'Zero Waste Promotion' through these groups"* (SPJP03).

Setouchi city officials mentioned the existence of citizen groups in their area SWM activities: *"Several citizen groups in the city are actively collecting used cloth and paper for reuse, sorting them into waste and reusable materials, and reusing what they can"* (SPJP02). The respondents' thoughts regarding the activities of citizen groups/associations are depicted in Table 8.

Table8. *Basic characteristics and activities of the citizen groups/associations in SWM*

- Citizen groups are responsible for sorting, managing garbage stations, and reusing waste, but do not directly treat it (CJP01). Their responsibilities vary but include selecting garbage areas, communicating with neighbors, observing disposal, and communicating with the city office (CJP02). They occasionally inform the city about changes in garbage collection schedules (CJP03). These groups sometimes pick up trash on the streets monthly, recruiting participants through their website (CJP12).
- Their activities vary from city to city (CJP02) and are voluntary, and self-motivated (SPJP01, CJP02, CJP03). They have a secondary relationship with city offices and cleaning centers (CJP13, 14). They sometimes organize community programs, such as cherry blossom observation and mochi making (CJP13).

(Source: Primary field data; created by the author)

Figure 4 provides a better understanding of the activities and relationship with the city office, cleaning center, and citizen groups regarding SWM. Although the basic activities are more or less the same due to the laws, in some cases they vary from city to city.

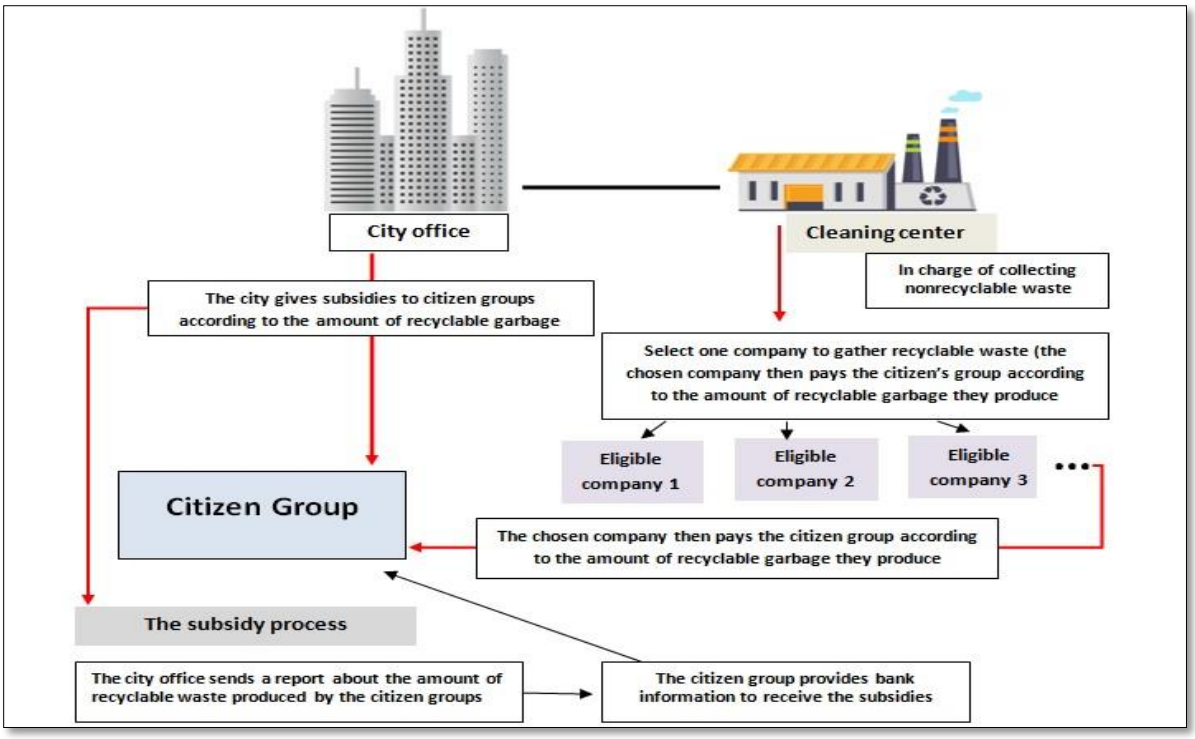

Figure4. *Citizen group activities and relationship with the city office and cleaning center (Source: Field data, created by the author)*

5. DISCUSSION

The preceding discourse about the practices of SWM in Bangladesh and Japan has been succinctly encapsulated in Table 9 for a comprehensive understanding of the subject matter.

Table9. *SWM practices in Bangladesh and Japan*

Issues/country	Bangladesh	Japan
Management practice	SWM is currently conducted in an ad hoc manner, mostly driven by individual initiatives and exclusively maintained as personal activities due to a lack of local government activities.	SWM is regarded as a legal obligation, specifically referred to as "citizen responsibilities". The initiative has a high level of specificity and effective collaboration with key players, including local government entities, business organizations, cleaning centers, and citizen groups.
Source segregation	Source segregation operations are solely determined by individual discretion. On certain occasions, there is a tendency for certain products that can be recycled to undergo this phenomenon.	The inclusion of SWM at the household level is an obligatory component. While there may be some variation in the approach across cities, the fundamental process remains largely the same.
Waste disposal process	Three distinct approaches exist for garbage disposal: burial in the soil, deposition within excavated holes, and occasional burning.	Garbage is accumulated and retained within individual households. It is discarded following the designated procedure outlined by the municipal authorities. Utilizing a designated rubbish bag for waste disposal is generally advisable.
Disposal places	Typically, there is a lack of specified locations for the disposal of waste materials. Common waste disposal procedures include depositing waste materials in one's backyard, disposing of waste in areas with low and shallow landscapes, and selecting open spaces, roads, ponds, rivers, or canals.	The locations for waste disposal are predetermined and widely known among the populace. As an example, in Kobe city, residents adhere to a designated waste disposal schedule, wherein burnable garbage is to be discarded on Mondays and Thursdays between the hours of 5 AM and 8 AM.

Recycling facilities	Private waste collectors (businessmen) can be observed in the trade of inorganic valued products such as paper, iron, glass, and similar items commonly known as the "informal sector". Individual initiatives are not inherently connected to local government.	The promotion of the "3R" principle is the fundamental framework for recycling initiatives, along with the establishment of collaborative partnerships with recycling companies and the implementation of extended producer responsibility policies for recycling.
Composting practices	Composting is being explored as a citizen-level solution for producing organic fertilizer for agricultural use, with many believing it can improve environmental conditions.	Composting is an integral component of SWM implemented by the municipal authorities in Setouchi city. However, it is uncommon for citizen initiatives.
Presence of citizen groups in SWM activities	There is a lack of citizen group activities in rural regions. Certain NGOs primarily focus their efforts on providing safe drinking water and promoting good sanitation practices.	In Japan, citizen groups play a significant role in the solidification of a cultural aspect within the SWM system, and exerting peer pressure characterized by its voluntary, dynamic, and engaged participation.

Source: Primary field data (created by the author)

Lessons from Japan

Developing nations such as Bangladesh can derive advantages from Japanese SWM lessons by strengthening their legislative structure, enacting focused and timeliness WM regulations, and engaging stakeholders in the process of policy formulation. By promoting the active involvement of citizen and citizen associations in waste reduction, segregation, and recycling initiatives, developing countries can reduce the strain on their SWM systems. Japanese WM practices might provide valuable guidance in establishing priorities and developing plans, involving elected representatives, government officials, administrators, and research institutions. Local-level planning enables local authorities to provide customized solutions, promoting community engagement, volunteer activities, and creativity. Japanese knowledge regarding WM procedures through the dissemination of information to relevant stakeholders, embracing the principles of "Mottainai" and 3R activities, establishing systematic group collection and sorting methods, and implementing Kaizen activities. Developing countries can utilize the expertise and resources within their communities. By adopting these teachings, Bangladesh like other developing countries may make substantial progress in enhancing its SWM systems, promoting sustainable development, and protecting public health and the environment for future generations.

6. CONCLUSION

Rural Bangladesh's SWM practices are primarily individual-based, relying on personal knowledge and voluntary compliance. This approach differs from Japan's legal regulations, which are considered "citizen responsibilities." In Japan, actions follow national and municipal regulations, resulting in a consistent homogeneity in the SWM process.

Waste segregation is not regulated in rural areas of Bangladesh, unlike in Japan it is a fundamental practice. Japanese households follow prescribed locations for waste disposal, with waste collectors retrieving materials from designated points. In contrast, rural Bangladesh has a contrasting situation, with most citizens disposing of waste in open spaces, such as backyards, roadside areas, and water bodies. This flexibility allows for flexibility in timing and day selection. Waste is often buried in the earth or burned. In Bangladesh, waste disposal is done without treatment. However, in Japan, responsibility for garbage disposal is mostly with citizens, with designated cleaning centers overseeing the final disposal process.

Many Bangladeshi citizens are actively involved in composting for agricultural use, while private waste collection (informal sector) handles the recycling of valuable inorganic materials like newspapers, plastic, metals, etc. Japan uses composting as an SWM strategy at the organizational level, with government-affiliated entities. Community-level SWM activities are facilitated by citizen organizations, who work voluntarily and collaborate with local governments to maintain Japan's pristine social environment. In rural Bangladesh, NGOs are working to improve water and sanitation

conditions, but they do not directly participate in SWM initiatives and lack citizen groups or associations dedicated to SWM.

Environmental issues are extensive, intersecting, and often contradictory (Majani, 2000). Due to limitations in time and resources, the overall sample size is restricted and does not provide a comprehensive representation of the entire country. The significant challenges to this study arise from the contrasting socioeconomic backgrounds of the two countries. Some issues addressed by this study need future attention, like- policy reforming regarding SWM, active citizen participation in rural areas, technological adaptation, and public health issues in the sense of environmental degradation. It also serves as a demonstration to other nations that are voluntarily planning to enhance their current SWM system (Ono, 2023). Developing countries such as Bangladesh can overcome the shortcomings of the SWM system by applying knowledge of developments in the SWM sector in developed countries such as Japan.

"The coding methodology employed in this study identified individuals belonging to the same occupational group. Unique identifiers were assigned to each subject (e.g., CBD1, UNO1). This code ensured the anonymity of the interviewee. The codes were: CBD, citizen of Bangladesh; UNO, Upazila Nirbahi officer (executive); UPZC, chairman of Upazila Parishad (council); UPC, chairman of Union Parishad (council); UPS, secretary of Union Parishad (council); M, mayor of the municipality; EBD, expert in Bangladesh (senior officers, local government)."

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