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Research Paper

A Comparative Policy Design for Halalan Thayyiban Food Waste Governance: Insights from Japan for a Proposed Framework in Brunei

Nabilah Ulfah Mujib[1]*, Sumimura Yoshinori[2], Raihana Mohd Raffi[1], Hamzah Mohd. Salleh[1]

[1] Universiti Islam Sultan Sharif Ali, Brunei Darussalam

[2] Osaka University, Institute for International Initiatives, Japan

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Abstract

Food waste management remains a policy concern in Brunei Darussalam, where gaps in source separation, recovery infrastructure and institutional coordination limit opportunities for food waste prevention and resource recovery. Existing research has examined food waste and halalan thayyiban in Brunei's food supply chain, but less attention has been given to how policy approaches can be adapted to develop a coordinated food waste governance system. This study uses a qualitative comparative policy analysis of Brunei and Japan to identify governance gaps in Brunei, examine relevant Japanese policy approaches and consider their adaptation to the Brunei context. Documentary sources included policies, legislation, institutional reports and relevant academic literature. The analysis focused on four areas: prevention and reduction; source separation and collection; redistribution and resource recovery; and institutional coordination and policy support. The findings indicate that Japan has more established policy arrangements for food-loss reduction, food-resource recycling, reporting and stakeholder coordination. In Brunei, recent initiatives indicate growing attention to food waste management, but gaps remain in measurement, source separation, recovery infrastructure, institutional responsibilities and connections between food businesses and recovery organisations. In response, the study proposes a Halalan thayyiban food waste governance framework for Brunei. The framework prioritises prevention, redistribution of suitable surplus food and appropriate resource recovery, supported by institutional responsibilities, infrastructure, monitoring and stakeholder coordination. It also incorporates Halalan thayyiban requirements across relevant pathways, particularly in relation to food safety, cleanliness, contamination control, handling and the intended use of recovered materials. The proposed framework offers a policy design for strengthening food waste governance in Brunei while accounting for the country's halal requirements and institutional conditions.

Keywords: *Food Waste Governance, Comparative Policy Analysis, Circular Economy, Halalan Thayyiban, Policy Design*

INTRODUCTION

Food waste has become an important policy issue because food is discarded while the resources used to produce, transport and sell it are also lost. The issue extends beyond waste collection and treatment. It involves decisions across the food chain, including purchasing, production, inventory management, pricing, distribution and handling. Reducing food waste at the policy level requires attention to prevention, measurement, infrastructure, responsibilities and coordination among the organisations involved. Sustainable Development Goal (SDG) 12.3 calls for food waste at the retail and consumer levels to be halved by 2030, while the United Nations Environment Programme (UNEP) emphasises food waste measurement as a basis for tracking progress and informing reduction measures (O'Connor, 2024)

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Corresponding author's email: Ulfahmujiburrahman@gmail.com

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A circular economy approach places greater emphasis on keeping food and its resources in use rather than directing them immediately to disposal. Prevention is prioritised, followed by redistribution and other recovery options where food can no longer be used for its original purpose (Papargyropoulou et al., 2014). Do et al. (2021) in a systematic review of 297 studies, identified policy and legislation as areas requiring further attention alongside technical, logistical and market considerations. This highlights the importance of governance in supporting food waste circularity.

This issue is relevant to Brunei Darussalam. The 2023 Voluntary National Review reported that around 500-600 tonnes of waste were being disposed of at the Sungai Paku landfill each day, with food waste accounting for about 32% of the waste stream. Recent research has also identified limited source separation, gaps in institutional responsibilities and weaknesses in coordination within Brunei's waste-management system (Shams et al., 2024).

These issues affect the ability to prevent food waste and direct discarded food towards suitable recovery pathways. Food waste is already receiving greater attention in Brunei. The Department of Environment, Parks and Recreation (JASTRe) launched the Eco Food Waste Initiative on 27 February 2025 to encourage environmentally friendly food-waste management practices through public awareness, food waste reduction and recycling. The initiative also involves engagement with selected hotels, restaurants, and food catering companies to promote food-waste recycling, including the conversion of food waste into fertilizer (Department of Environment, 2025; Department of Environment, 2026). Brunei research has also examined food waste for organic fertiliser and other value-added products (Sulaiman et al., 2023; Sulaiman & Talib, 2024). Brunei is thus not starting from an absence of initiatives. The policy issue is how existing activities and emerging recovery options can be organised within a more coordinated food waste governance system.

Food waste governance involves different actors and responsibilities. Food businesses can prevent waste through stock management, purchasing and pricing practices, while suitable surplus food may require redistribution through recipient organisations. Food that is no longer suitable for human consumption may have potential for animal feed, composting or other recovery, depending on its condition, separation, collection arrangements, treatment facilities and intended use. Government agencies also have different responsibilities relating to environmental management, food safety, halal matters, local administration and business support. Coordination between these actors is important if available prevention and recovery options are to function in practice.

Japan provides a useful reference case for examining these policy functions. Japan has developed national policies covering both food-loss and food waste reduction and food-resource recycling. The Food Recycling Act supports the reduction and recycling of food waste, while the Act on Promotion of Food Loss and Waste Reduction, enacted in 2019, assigns responsibilities to national and local governments, businesses and consumers and promotes cooperation among them (Consumer Affairs Agency, 2019). Japan's Basic Policy on Promotion of Food Loss and Waste Reduction was revised in March 2025, with current measures including reduction targets, reporting arrangements, food-bank support and local government planning (Ministry of Environment, 2025)

Additionally, Japan is not treated as a model to be directly copied. Its population, administrative arrangements, infrastructure, recycling markets and institutional history differ from those of Brunei. Policy-transfer research has also shown that policy approaches may produce different results when applied across different institutional and national settings. The relevant question is how selected Japanese policy approaches address food waste governance issues, what conditions support their implementation, and which elements may require adaptation for Brunei.

A further consideration is the halalan thayyiban context of Brunei's food sector. Halal concerns the permissibility of food and its handling, while thayyib is commonly associated with qualities such as wholesomeness, cleanliness, safety and suitability. Recent research has connected

halalan thayyiban with circular economy and resource-management practices in Brunei (Mujib & Salleh, 2026). Other studies have examined halal organic fertiliser and value-added uses of halal food waste (Sulaiman et al., 2023; Sulaiman & Talib, 2024). These considerations are relevant when food is redistributed or when food waste is directed towards animal feed, composting or other recovery options, particularly in relation to safety, cleanliness, contamination and intended use.

This study examines how food waste governance approaches can be developed for Brunei by drawing on relevant policy experience from Japan while accounting for local institutional, infrastructural, regulatory and Halalan Thayyiban considerations. Although previous studies have examined Brunei's waste-management challenges, food waste recovery and Halalan Thayyiban, less attention has been given to how these areas can be connected through a practical governance framework informed by comparative policy analysis. The study addresses this gap through a qualitative comparative policy analysis of Brunei and Japan. It examines four areas of food waste governance: (1) prevention and reduction, (2) source separation and collection, (3) redistribution and resource recovery, and (4) institutional coordination and policy support. The comparison identifies governance gaps in Brunei, examines relevant Japanese policy approaches and considers their adaptation to local conditions. These findings inform the development of a proposed Halalan Thayyiban food waste governance framework for Brunei Darussalam.

Research Questions

The study addresses four research questions:

1) RQ1. What are the main food waste governance gaps in Brunei Darussalam?
2) RQ2. What policy approaches used in Japan are relevant to these governance gaps?
3) RQ3. Which Japanese policy approaches could be adapted to Brunei Darussalam, and what conditions affect their feasibility?
4) RQ4. How can these findings inform a proposed halalan thayyiban food waste governance framework for Brunei Darussalam?

LITERATURE REVIEW

Food waste Governance and Circular Economy

Food waste research has moved beyond disposal towards prevention, redistribution and resource recovery. This shift is closely related to circular economy thinking, which seeks to retain the value of resources and reduce material losses. In food systems, this can involve preventing surplus, redistributing edible food and finding appropriate uses for food that is no longer suitable for human consumption. Research has examined various recovery approaches, including composting, anaerobic digestion, bioconversion and nutrient recovery. Do et al. (2021) reviewed 297 studies and found research covering food waste quantities, prevention and management practices, logistics, markets, sustainability assessment, policy and legislation. Similarly, strong interest was found in the recovery and valorisation of food waste (Chauhan et al., 2021)

However, the availability of recovery technologies does not guarantee their implementation. Composting requires a reliable supply of suitable organic material, while food redistribution depends on access to surplus food, collection arrangements and recipient organisations. Animal-feed production also requires suitable inputs and appropriate controls. These activities rely on more than technical solutions; they need supporting policies, infrastructure, funding and cooperation between organisations. Prevention also depends on business practices such as stock management, purchasing and pricing, while redistribution and recovery require arrangements for food safety, separation, transportation and suitable end uses.

This highlights the importance of considering the policy conditions that support food waste prevention and recovery. In this study, circular economy is treated as the direction of food waste

policy, rather than as a separate model. The focus is on how policy can support a shift away from disposal towards prevention, redistribution and appropriate resource recovery.

Food waste Hierarchy and Policy Priorities

The food waste hierarchy gives a clear starting point for deciding which uses should receive priority. Papargyropoulou et al. (2014) distinguish between food surplus and food waste and place prevention above redistribution, animal feed, other forms of recovery and disposal. The hierarchy also recognises that not all food waste is avoidable and that the most appropriate option depends on the type and condition of the material.

The hierarchy is useful, but it does not answer several policy questions. It does not say which agency should be responsible for prevention, how businesses should be encouraged to participate, how surplus food should be moved to potential recipients, or what infrastructure is needed for recovery. It also does not resolve questions about food safety, contamination, cost or the suitability of a particular recovery pathway.

For this reason, the present study uses the hierarchy as a policy priority**,** not as a complete governance framework. It is used to examine whether policy arrangements give preference to preventing food waste and retaining food for its original purpose before moving to lower-value recovery or disposal. This distinction is important for Brunei. A policy that simply increases food waste recycling may improve diversion from landfill but could still place too little attention on preventing waste in supermarkets and food businesses. A governance approach should distinguish between food that can still be used as food, food that may be suitable for another recovery pathway, and material that has to be disposed of.

Governance and Coordination Across the Food waste Chain

Food waste management involves several organisations with different responsibilities. Government agencies may provide regulation and policy support, food businesses generate surplus and waste, while charities, community organisations, recovery operators and other users may receive or process food and recovered resources. Food waste governance therefore needs to consider how responsibilities are distributed among actors and how different organisations are connected across the food waste chain (Szulecka et al., 2024).

Coordination is relevant where food needs to move between organisations. Suitable surplus food may require a recipient organisation, collection arrangements and appropriate handling, while food intended for recovery may require separation, collection, treatment facilities and an appropriate end use. Weak connections between these actors can limit the implementation of available food waste prevention and recovery options (Szulecka et al., 2024). The governance question is practical: *which actors are involved, what responsibilities are assigned, how are organisations connected, and what policy support is needed for food waste prevention, redistribution and recovery?* These aspects facilitate the analysis for institutional coordination in Brunei and Japan.

Policy Learning and Adaptation

Comparing another country's policy with Brunei's situation raises a question about how lessons should be used. Policy-transfer literature examines how policies, programmes, administrative arrangements and ideas developed in one setting may influence policy in another. Policy-transfer is the use of knowledge about policies, administrative arrangements, institutions and ideas from one setting in developing policies in another. More recent work on lesson-drawing also cautions against treating policy transfer as a one-size-fits-all process and highlights the need to consider the institutional context of both the policy being transferred and the receiving setting.

This is important for the Japan-Brunei comparison. Japan's food waste system has developed over many years and includes national legislation, reporting arrangements, local government plans, business participation, food-bank support, and established recycling activities. Brunei does not need to reproduce these arrangements in the same form. A Japanese policy can instead be examined according to the problem it addresses and the function it performs. The analysis then considers whether the same function is relevant to Brunei and what changes would be required to reflect local institutional, infrastructural and regulatory conditions.

This comparison considers five aspects of policy learning: the problem addressed by the policy, how it is implemented, the conditions supporting its implementation, differences between Japan and Brunei, and the changes required if a similar approach were considered for Brunei.

Halalan Thayyiban in Food waste Governance

Halalan thayyiban adds a context that is not normally included in general food waste governance frameworks. In Brunei, food production, handling and consumption operate within a halal regulatory and cultural environment. Food waste policy must consequently consider not only environmental and economic outcomes but also the way food resources are handled and recovered. Recent work by Mujib and Salleh (2026) connects halalan thayyiban with circular economy principles and food waste management in Brunei. Their study discusses values including safety, cleanliness, responsibility, and waste prevention and argues that these values can strengthen the ethical dimension of circular resource management. Brunei research has also considered the use of food waste to produce halal organic fertiliser and other value-added products (Sulaiman et al., 2023).

Within this context, different Islamic principles can inform different aspects of food waste management. Israf, associated with excess and wastefulness, is relevant to food waste prevention. Avoidable food waste can therefore be considered not only as a resource-management problem but also in relation to responsible consumption. Khalifah is relevant to responsible use of resources and environmental stewardship (Javaid, 2022). Thayyib adds considerations of wholesomeness, hygiene, safety, and quality in the handling and use of food (Zainal Arifin et al., 2021). These principles point towards practical requirements such as appropriate segregation, controlled handling, contamination prevention, and suitable recovery pathways.

Halalan thayyiban does not replace legislation, food-safety requirements or technical standards. Nor does it mean that every recovery activity must be classified as halal. Rather, it provides additional considerations for assessing how food resources are handled and recovered within Brunei's halal food context. For example, suitable surplus food may be considered for redistribution, while food that is no longer suitable for human consumption may be directed towards other recovery options according to its condition, contamination status and intended use. The relevance of halalan thayyiban extends across the food waste pathway rather than forming a separate stage of waste management.

This perspective is relevant to the policy design developed in this study. A circular economy approach may identify food waste as a resource for continued use or recovery, while a halalan thayyiban perspective also requires attention to the safety, cleanliness, quality and appropriateness of that use. The proposed framework consequently incorporates these considerations into relevant food waste pathways rather than treating halalan thayyiban as a separate governance stage.

Policy Design for Food waste Governance in Brunei

The literature points to the need for a food waste policy approach that connects prevention, redistribution, recovery and disposal rather than treating food waste only as a waste-treatment issue. The food waste hierarchy establishes the policy priority, circular economy research

emphasises resource retention, and governance literature highlights the roles of public and private actors. Policy-transfer research further shows that policy approaches need to be adapted to local conditions. In Islamic context, halalan thayyiban adds considerations of cleanliness, safety, quality, and responsible resource use that are relevant to food waste handling and recovery.

Existing Brunei research has identified weaknesses in areas such as source segregation, facilities, institutional responsibilities, training, and waste monitoring (Shams et al., 2024). Recent work has also discussed the relationship between halalan thayyiban and circular economy principles. However, less attention has been given to how these elements can be brought together into a practical food waste governance design for Brunei. This study addresses this gap through comparative policy analysis of Brunei and Japan. The comparison considers the governance gaps in Brunei, relevant Japanese policy approaches, the conditions supporting those approaches, and the adaptations required for the Brunei context. The resulting framework brings together policy priorities, institutional roles, supporting conditions, and halalan thayyiban considerations across the food waste chain.

RESEARCH METHOD

Research Design

This study adopted a qualitative comparative analysis based on documentary evidence. Brunei was examined to identify existing food waste governance arrangements and areas requiring further development, while Japan was selected as a policy reference to examine approaches that may be adapted to Brunei. The comparison covered four areas: food waste prevention and reduction; source separation and collection; redistribution and resource recovery; and institutional coordination and policy support. The analysis focused on the policies, arrangements and supporting conditions relevant to these areas. It did not measure policy effectiveness statistically or through stakeholder surveys. Instead, it examined how the policy approaches identified in Japan could inform the development of a proposed food waste governance framework for Brunei.

Document Selection and Analysis

Twelve core policy and institutional documents were selected, comprising six Brunei documents and six Japanese documents. The Brunei documents included national development and environmental policies, legislation, the Voluntary National Review, and the Eco Food Waste Initiative Official Press Release. The Japanese documents covered the Food Recycling Act, the Act on Promotion of Food Loss and Waste Reduction, national food-loss policies, and relevant Osaka food waste plans.

Twelve core policy and institutional documents were selected for the analysis, comprising six documents from Brunei and six from Japan. The documents were obtained from official government websites, ministry portals and relevant institutional repositories. The selection covered policy and institutional documents published between 2000 and 2026, including legislation, national policies, development plans, government reports and local waste-management plans. The analysis considered documents available in English, including official English translations of Japanese government publications.

Documents were selected based on their relevance to the four analytical areas: food waste prevention and reduction; source separation and collection; redistribution and resource recovery; and institutional coordination and policy support. Documents were included when they provided information on food waste management, institutional responsibilities, stakeholder coordination, supporting infrastructure, or policy implementation. General waste-management documents were excluded from the core selection unless they contained information relevant to food waste or organic waste management. Documents without a clear connection to the study's analytical areas

were also excluded. The selected documents are listed in Table 1.

Table 1. Core Documentary Sources Used for the Comparative Policy Analysis

No.	Documentary source	Type	Year/Version	Main relevance to the analysis
Brunei Darussalam				
1.	**Twelfth National Development Plan (RKN12), 2024–2029**	National development plan	2024–2029	National priorities relating to sustainable environment, climate change, development planning and governance
2.	**Environmental Protection and Management Act, Chapter 240, Revised Edition 2022**	Legislation	Revised ed. 2022	Environmental governance, waste management responsibilities and regulatory provisions
3.	**Brunei Darussalam Second National Communication**	National report	Current national communication	Waste generation, waste management context, environmental governance and institutional responsibilities
4.	**Brunei Darussalam Voluntary National Review 2023**	National SDG report	2023	Sustainable development priorities, institutional roles and progress relating to SDGs and environmental management
5.	**Ministry of Development Policy Framework 2018–2023**	Institutional policy framework	2018–2023	Institutional responsibilities and coordination within environmental and development planning
6.	**Eco Food Waste Initiative Official Press Release (2025)**	Government initiative	2025	Food waste reduction, awareness, recycling, food waste treatment and planned recovery initiatives
Japan				
7.	**Food Recycling Act / Food Recycling System**	National legislation and policy system	2000-present	Food waste reduction, recycling, resource recovery and reporting requirements
8.	**Act on Promotion of Food Loss and Waste Reduction (2019)**	National legislation	2019	National and local government responsibilities and coordinated food-loss and waste reduction
9.	**Basic Policy for Promotion of Food Loss and Waste Reduction**	National policy	2nd Basic Policy, 2025	Policy objectives, stakeholder responsibilities and implementation direction
10.	**Reducing Food Loss and Waste in Japan**	Government policy document	Current policy materials	National approaches to food-loss prevention, reduction and the NO-FOODLOSS Project
11.	**Osaka City General Waste Management Basic Plan (2026)**	Municipal plan	2026	Waste prevention, reuse, circular economy, food-loss reduction and stakeholder collaboration at city level
12.	**Osaka Prefecture Food Loss Reduction Promotion Plan, revised 2026**	Prefectural plan	Revised 2026	Food-loss reduction, stakeholder coordination and local implementation in Osaka

Following Bowen (2009), the documents were reviewed and coded according to the four analytical areas. Brunei and Japan were examined separately before their policies, institutional arrangements and supporting conditions were compared. This allowed the analysis to identify areas where Japanese approaches could inform policy development in Brunei, while taking account of differences between the two countries.

Comparative Policy Assessment

The comparative assessment examined the governance gaps identified in Brunei, the corresponding policy approaches in Japan, the conditions supporting those approaches, and their potential relevance to Brunei. Attention was given to differences in institutional arrangements, infrastructure, available resources, regulatory requirements, and stakeholder roles. Japanese approaches were not assumed to be directly transferable. Each approach was considered in terms of the changes and support required for its application in Brunei. The potential feasibility of adapting the identified policy approaches was assessed using three criteria: institutional capacity; infrastructure and resources; and regulatory and stakeholder requirements. These criteria were used to consider whether the approaches could be adapted within Brunei's existing arrangements and what additional support might be required. The assessment criteria are presented in Table 2.

Table 2. Criteria for Assessing the Feasibility of Policy Adaptation

Assessment criterion	Considerations
Institutional capacity	Existing agency responsibilities, organisational capacity and coordination arrangements
Infrastructure and resources	Availability of facilities, technology, technical expertise and financial resources
Regulatory and stakeholder requirements	Compatibility with existing regulations, required policy changes and involvement of relevant stakeholders

Based on these criteria, each proposed policy response was assigned a qualitative feasibility rating of High, Moderate or Low. The ratings were guided by the extent of institutional, infrastructural, financial, regulatory and stakeholder-related changes required for adaptation. The definitions of the three ratings are provided in Table 3.

Table 3. Definitions of Feasibility Ratings

Rating	Assessment
High	Requires relatively limited changes to existing arrangements and resources.
Moderate	Requires additional resources, infrastructure, coordination or regulatory support.
Low	Requires substantial changes or resources, or faces significant institutional or regulatory constraints.

The ratings represent a qualitative assessment based on the documentary findings. They do not measure actual implementation or policy effectiveness and have not been independently validated through stakeholder or expert assessment.

Development of the Proposed Framework

The proposed framework was developed from the comparison of food waste policies in Brunei and Japan, with halalan thayyiban principles also taken into account. These principles guide how food waste should be prevented, handled and recovered. The Islamic eco-theology of *Israf*

relates to avoiding unnecessary food waste, while *Khalifah* emphasises the responsibility to use and manage resources wisely. *Thayyib* concerns cleanliness, safety, quality and proper handling throughout the food waste management process.

The framework identifies the main policy priorities, the roles of relevant stakeholders, the support needed for implementation and the safeguards required at different stages of food waste management. It also takes account of the need to separate food waste streams and select recovery options according to their suitability, particularly in relation to halal requirements. The framework is a proposed policy design and has not yet been tested or validated through stakeholder consultation. Further assessment with relevant agencies and stakeholders in Brunei is needed to determine its practical application.

FINDINGS AND DISCUSSION

The comparison examined food waste governance in Brunei Darussalam and Japan across four dimensions: food waste prevention and reduction, source separation and collection, food redistribution and resource recovery, and institutional coordination and policy support. The main difference is not the absence of food waste initiatives in Brunei or the presence of a single Japanese policy. Rather, Japan has developed a more connected policy system in which prevention, recycling, institutional responsibilities, and implementation measures are supported by legislation and national targets. Brunei has begun to strengthen food waste action, but the reviewed documents show less integration across policy instruments, recovery pathways, and institutional coordination.

Food Waste Prevention and Reduction

Food waste prevention is the first policy area because reducing waste at source avoids the need for later collection, treatment and disposal. Both Brunei and Japan recognise food waste reduction as a policy concern, but their policy arrangements differ in scope and level of formalisation. Japan's food waste policy also places prevention before the recycling of food resources that have already been generated, reflecting a priority order in which avoiding waste is preferred to managing it after generation (Ministry of Agriculture, n.d.-b, 2025). This shows the priority of placing prevention and reduction at the first stage of the proposed framework.

In Brunei, food waste has been addressed mainly through wider environmental and sustainability policies and more recent initiatives. The Eco Food Waste Initiative, launched by the Department of Environment, Parks and Recreation (JASTRe) in February 2025, includes public awareness activities, recycling activities, planned food waste digesters, a digital platform to promote 3R practices, and a Food Waste Reduction Guidebook for the public, restaurants and food providers. The initiative also identifies food waste as a major component of waste disposed of at Sungai Paku, reporting that it accounted for 32% of the waste stream based on a 2019 waste composition study (Department of Environment, 2025; Department of Environment, 2026). These measures show a move towards recovering food waste, but they remain relatively recent.

Japan has a more established policy structure for food waste management. The Food Recycling Act provides a legal basis for reducing food waste and promoting the recycling of food resources. It also establishes industry-level targets covering food manufacturers, wholesalers, retailers, and food service businesses. For FY2029, the targets are 95% for food manufacturing, 75% for wholesale, 65% for retail, and 50% for food service. These are targets for each industry as a whole rather than mandatory quotas for every individual business (MAFF, 2025).

Table 2. Japan's food recycling targets by food-related industry

Food-related industry	Target recycling/resource recovery rate	Target year
Food manufacturing	95%	FY2029
Food wholesale	75%	FY2029
Food retail	65%	FY2029
Food service	50%	FY2029

Source: Ministry of Agriculture, Forestry and Fisheries (MAFF)(2025)

The importance of the Japanese approach is not only the targets themselves, but the policy structure around them. Food-related businesses are expected to monitor food waste generation and recycling activities, while the targets are reviewed over time. Japan has also strengthened food-loss prevention through the Act on Promotion of Food Loss and Waste Reduction 2019, which assigns roles to national and local governments, businesses, consumers and other organisations. Its second Basic Policy, approved in March 2025, sets a target of reducing business-related food loss and waste by 60% from FY2000 levels by FY2030.

For Brunei, the relevant lesson is not to introduce the same targets immediately. Such a system would require reliable baseline data, clear reporting responsibilities and an institution with sufficient capacity to monitor progress. A more suitable starting point could be food waste measurement and reduction guidance for larger supermarkets and food suppliers, followed by sector-specific targets when sufficient data are available. This would also build on the direction of the Eco Food Waste Initiative.

The comparison also shows that prevention extends beyond waste disposal. Japan's food-loss policies include changes in business practices and the redistribution of suitable surplus food. For Brunei, prevention could similarly include inventory management, ordering, product rotation, pricing and redistribution before food becomes waste. This is significant especially to supermarkets and food suppliers, where decisions made before expiry can determine whether food remains suitable for human consumption or becomes waste. Moreover, halalan thayyiban considerations should be maintained throughout these activities. *Israf* supports the prevention of unnecessary food waste, while *Thayyib* requires attention to food safety, cleanliness, quality and appropriate handling. Prevention should not involve retaining or redistributing food that is no longer safe or suitable for consumption.

The main governance gap identified in this area is therefore the limited integration of food waste prevention into a structured system of measurement, sector responsibility and monitoring. Brunei has begun developing prevention and recovery initiatives, but a more structured approach could strengthen accountability and support future targets. The proposed framework should place prevention and measurement at the first stage of food waste governance, before redistribution, recovery and disposal.

Source Separation and Collection

Source separation is important because the quality of food waste affects whether it can be reused, composted, converted into animal feed, or processed through other recovery methods. Once food waste is mixed with other waste, recovery becomes more difficult and contamination can reduce the value of the material. However, in Brunei, source separation remains underdeveloped. The Second National Communication reported that food waste accounted for 36% of the waste stream and described municipal solid waste management as part of the responsibilities of JASTRe and the Department of Drainage and Sewerage (Energy and Industry Department, 2017). The Environmental Protection and Management Act further provides the broader legal basis for

environmental protection and management, but it does not establish a dedicated food waste separation system (Attorney General's Chambers, 2022b)

Shams et al. (2024) also identified the absence of waste segregation at the household level and proposed separation at the point of generation as a priority for improving Brunei's waste-management system. Recent policy activity has started to address this gap. The Eco Food Waste Initiative, launched in February 2025, promotes food waste separation and composting at different levels. Guidance issued under the initiative includes keeping kitchen organic waste in separate containers and provides advice on composting and reducing food waste (Department of Environment, 2025). This represents a move towards treating food waste as a separate resource stream rather than only as part of general municipal waste. However, the initiative is still relatively new, and the available policy does not yet indicate a comprehensive system requiring food businesses to separate, record, and channel food waste through designated recovery routes.

Source separation should also be connected to what happens after collection. Keeping food waste separate can support its movement into appropriate recovery routes, including composting and other forms of resource recovery. Local research has demonstrated the potential for food waste to be converted into compost-based organic fertiliser (Sulaiman et al., 2023), while research on Brunei's waste-management system has highlighted the need for segregation and suitable treatment facilities (Shams et al., 2024).

For Brunei, food waste separation could begin with larger food businesses and other suitable premises. This would require appropriate containers, storage and collection arrangements, as well as clear arrangements for where the separated waste would go. Separating food waste should be planned alongside the availability of recovery facilities so that collected materials have a suitable destination. Halalan thayyiban requirements also need to be considered during separation, storage and transfer. Cleanliness, food safety, contamination control and proper handling are particularly important when surplus food is redistributed for human consumption or when food waste is directed to other recovery uses. The controls needed will depend on the intended use of the material.

Brunei has started promoting food waste reduction and recovery through recent initiatives, but the links between source separation, collection and recovery remain underdeveloped. A more organised approach would need to clarify who is responsible for separating food waste, how it should be stored and collected, where it should be sent and which recovery option is suitable. In the proposed framework, source separation and collection serve as the link between food waste prevention and subsequent recovery, rather than being treated as a separate waste-management activity.

Food Redistribution and Resource Recovery

Once food waste has been generated, policy should distinguish between food that is still suitable for human consumption and material that is no longer suitable for consumption. The first can potentially be redistributed, while the latter may be directed to appropriate recovery options such as animal feed, composting or other forms of resource recovery. This distinction is consistent with the food waste hierarchy, which places redistribution of suitable food before lower-value recovery options.

In Brunei, redistribution and recovery activities exist, but they appear to be developing through a combination of government initiatives, community organisations and individual projects. The 2023 Voluntary National Review highlighted the work of *Kilang ReRoot,* which has undertaken food distribution to underprivileged families and migrant workers while also developing food upcycling activities (Prime Minister's Office, 2023). The initiative illustrates how non-government actors can contribute to both food redistribution and food waste reduction.

Resource recovery has also been explored through local research and private-sector initiatives. Sulaiman et al. (2023) examined the conversion of kitchen food waste into compost-based organic fertiliser and reported that the resulting compost supported plant growth and nutrient recycling. A separate local initiative involving Brunei Shell Marketing and Biofield Solutions collected food waste for conversion into compost for local farmers, showing the potential for food waste to be connected with agricultural production (The Bruneian, 2023). More recent research has also examined the use of halal-compliant food waste as a potential raw material for pet food, although this remains a developing area rather than an established national recovery system (Sulaiman, 2026).

Japan has developed a more systematic connection between food redistribution and resource recovery. Its food waste policies encourage businesses to provide edible surplus food for people who need it, while food that cannot be redistributed can enter recycling routes. The 2025 revision of the Food Recycling Act's Basic Policy specifically encourages businesses to provide unused food that is still edible for donation and to report the amount donated. It also promotes food banks and other organisations involved in food donation (Ministry of Environment, 2025).

For food that is no longer suitable for human consumption, Japan's Food Recycling Act provides a policy structure for recycling food resources. The system includes recovery routes such as animal feed and fertiliser, while methane fermentation is also recognised as a recycling option. The Ministry of Agriculture, Forestry and Fisheries (MAFF) requires food-related businesses generating 100 tonnes or more of food waste annually to submit periodic reports on food waste generation and the recycling or other utilisation of food resources. The reported data are used to monitor food waste generation and recycling and to support measures for food waste reduction and resource recovery (Ministry of Agriculture, n.d.-a)

However, the recovery options identified in Japan cannot all be applied directly within a halal food waste system. Japan's eco-feed system includes the use of recycled food materials in feed for livestock such as pigs and poultry. Although this provides an example of recovering food residues as animal feed, the use of recovered materials for pig feed would not be suitable within a halal recovery system in Brunei. The use of food waste in poultry feed would also require controls over its ingredients, source and handling to ensure that halal integrity is maintained.

This has implications for how different food waste streams should be managed in Brunei. Food waste from halal-compliant sources should be kept separate from non-halal food waste and materials contaminated with *najis* at the point of generation. Separate, clearly identified containers, storage areas and collection arrangements would help prevent these materials from entering recovery pathways intended for halal use. Non-halal and *najis*-contaminated waste should not be directed to halal animal-feed production or food redistribution. Instead, these streams should be managed separately and assessed for other treatment options, such as energy recovery, where the process and intended end use are acceptable under relevant halal and environmental requirements. Where suitable treatment cannot be established, controlled disposal would be the alternative. This distinction is important because non-halal materials and *najis* contamination are not necessarily the same classification, and their treatment should follow the applicable requirements set by the relevant halal authorities.

Mixed food waste presents a further concern because its composition and contamination status may be difficult to establish once different materials have been combined. Such waste should not automatically be considered suitable for halal animal feed or other halal recovery uses. Composting or other forms of resource recovery may be considered only after the material, contamination risks, treatment process and intended end use have been assessed against the relevant requirements. These considerations mean that food waste recovery in Brunei must account not only for the value of materials recovered, but also their origin, composition, separation,

handling and final use.

Given that, the comparison suggests that the main lesson for Brunei is the need to connect different recovery routes rather than treating redistribution and recycling as separate projects. Suitable surplus food should first be considered for human consumption, subject to food safety and handling requirements. Food that is no longer suitable for people can then be assessed for appropriate recovery, depending on its condition and the available facilities. This would create a better progression from food redistribution to animal feed and other suitable uses, followed by composting and other forms of resource recovery, with disposal as the final option. Stronger connections are also needed between food businesses and recovery organisations. Brunei has examples of redistribution and recovery through individual initiatives, but the documentary evidence does not yet show a coordinated system for directing surplus food and food waste to suitable outlets. Such a system would need clear arrangements for collection, storage, transport, quality, and receiving organisations.

Furthermore, halalan thayyiban considerations are relevant throughout these pathways. Food intended for human redistribution must remain safe and suitable for consumption, while other recovery routes require appropriate controls for cleanliness, contamination and end use. The requirements may differ by recovery pathway and should be clearly defined. The main governance gap is the lack of a coordinated system connecting food businesses with redistribution and recovery outlets. The proposed framework should strengthen these connections while setting clear requirements for safety, handling and the intended use of recovered materials.

Institutional Coordination and Policy Support

Food waste prevention and recovery involve several actors, including government agencies, food businesses, recovery organisations and local communities. Coordination is important because activities such as separation, redistribution and recycling depend on defined responsibilities and connections between waste generators and recovery outlets. In Brunei, waste management involves several government bodies, including the Department of Environment, Parks and Recreation (JASTRe), the Department of Municipal Services and other relevant agencies. RKN12 places sustainable environment among the country's national development priorities and emphasises an integrated approach to implementation (Department of Economic Planning and Statistics, 2024). The Ministry of Development Policy Framework 2018-2023 also identifies environmental planning, waste reduction, recycling and stakeholder collaboration as part of its environmental priorities (Ministry of Development, 2019). The Environmental Protection and Management Act provides a statutory basis for environmental protection, including duties relating to prevention and reduction, regulatory oversight, inspection and environmental management (Attorney General's Chambers, 2022a).

The Second National Communication further shows that Brunei has experience with inter-agency and stakeholder arrangements in environmental governance (Energy and Industry Department, 2017). However, Shams et al. (2024) identified the need for defined institutional roles, stronger coordination, better enforcement and greater stakeholder participation in Brunei's waste-management system. The governance gap is not the absence of environmental institutions or policy instruments, but the limited integration of these arrangements into a coordinated food waste governance system.

Meanwhile, Japan provides a more formal example of shared responsibility. The Act on Promotion of Food Loss and Waste Reduction assigns roles to national and local governments, businesses and consumers and promotes cooperation among these actors. Local governments also have responsibilities for promoting food-loss reduction within the national policy framework (Consumer Affairs Agency, 2019). Coordination is also supported by the Food Recycling Act. Large

food-related businesses generating 100 tonnes or more of food waste annually are required to report their food waste generation and recycling activities each year. The reported information supports monitoring of food waste generation and recycling and the implementation of food-recycling policies (MAFF, 2025). This connects business activities with government monitoring and national recycling objectives.

Local government planning provides another level of implementation. Osaka City's 2026 General Waste Management Basic Plan places waste reduction and resource circulation within a wider circular economy approach and calls for cooperation among citizens, businesses and local communities (Osaka City Government, 2026). Not only that, Osaka Prefecture's revised Food Loss Reduction Promotion Plan also promotes food-loss reduction through cooperation among businesses, consumers and government (Osaka Prefectural Government, 2026) . These plans show how national food waste policy can be supported through local planning and coordination among different actors.

The comparison does not suggest that Brunei needs to introduce the same reporting requirements immediately. The more relevant lesson is the need for clearer roles and information flows between the actors involved in food waste management. Brunei could begin by defining the responsibilities of relevant government agencies, food businesses and recovery organisations, particularly for food waste measurement, separation, redistribution, collection and recovery. Given that, the governance gap is the lack of coordinated structure that connects policy, food businesses and recovery actors. The proposed framework should address this through clear institutional responsibilities, information sharing and coordination across the food waste chain, supported by appropriate policy, guidance and monitoring.

Synthesis of Comparative Findings and Policy Design

Table 3. Synthesis of Comparative Findings and Its Implications for Brunei

Policy area	Brunei governance gap	Relevant Japanese approach	Implication for Brunei
Prevention and reduction	Limited specific measurement, targets and monitoring	Industry-level recycling targets and food-loss reduction targets	Establish food waste measurement and reduction measures, initially focusing on larger food businesses
Source separation and collection	Limited source segregation and connection between separation and recovery	Food waste recycling system supported by proper segregation policy and established recovery routes	Develop separate food waste collection linked to suitable recovery facilities
Redistribution and resource recovery	Recovery and redistribution activities remain relatively dispersed	Food donation, food banks, animal feed, fertiliser and other recycling routes	Strengthen connections between food businesses, redistribution organisations and recovery operators
Institutional coordination and policy support	Roles and coordination across actors require further development	Defined responsibilities across government, businesses and	Clarify institutional roles and strengthen coordination,

	consumers, supported by monitoring and local planning	information sharing and monitoring

The comparison shows that Brunei does not necessarily need an entirely new set of food waste measures, but a clear policy structure to connect existing and emerging activities. Japan offers examples of how prevention, separation, recovery and institutional responsibilities can be supported through policy, but these approaches need to be adapted to Brunei's institutional and resource conditions. The proposed framework developed from these finding places prevention first, followed by redistribution and appropriate resource recovery, with disposal as the final option. Institutional coordination, source separation, infrastructure, monitoring and stakeholder participation support these stages, while halalan thayyiban considerations are incorporated where relevant to food safety, cleanliness, appropriate handling and responsible resource use.

Proposed Halalan Thayyiban Food waste Governance Framework for Brunei

The comparative findings were used to develop a proposed halalan thayyiban food waste governance framework for Brunei. The framework covers four policy areas identified in the comparison: prevention and reduction, source separation and collection, redistribution and resource recovery, and institutional coordination and policy support. It is a policy-design framework, not a tested or validated model

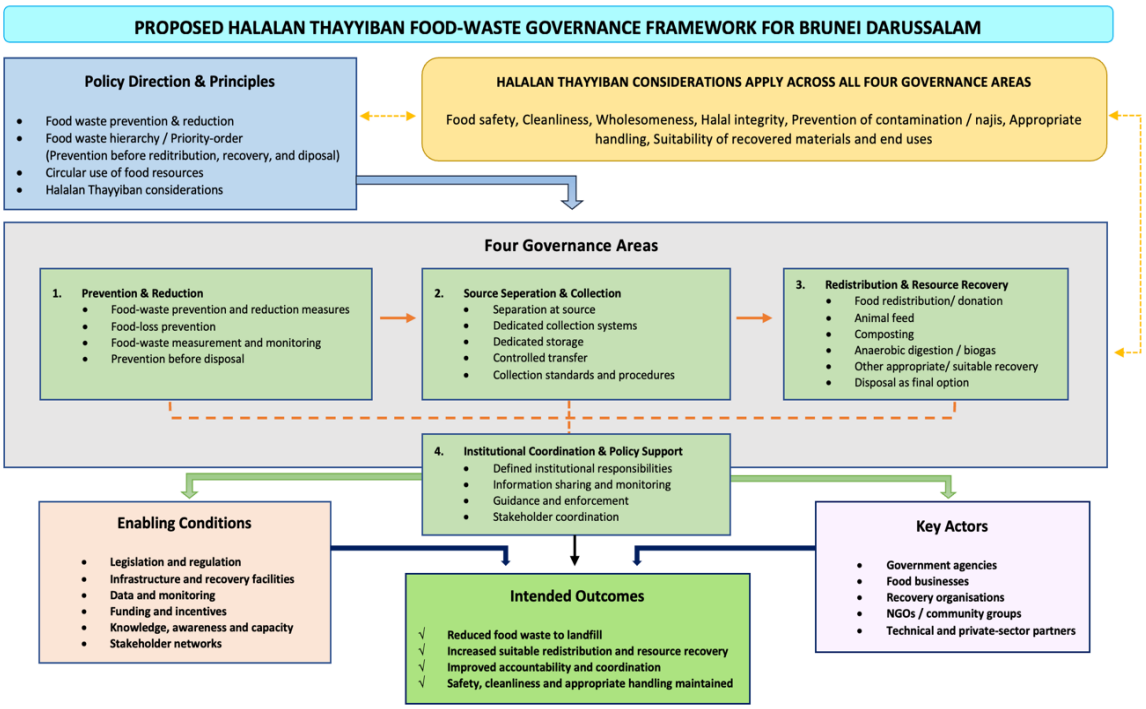


Figure 1. Proposed Halalan Thayyiban Food waste Governance Framework for Brunei (Developed by Authors)

Food waste prevention and reduction form the first stage, consistent with the food waste hierarchy. Food that remains suitable for human consumption can then be redistributed, while other food waste can be directed to appropriate recovery pathways. Disposal is the final option. The sequence aims to retain food and material value where safety and suitability permit, instead of

directing all food waste to disposal. Moreover, source separation and collection support the movement of food waste towards appropriate recovery pathways. Separate handling can reduce contamination and make it easier to direct materials to redistribution, animal feed, composting or other recovery options. Separation is thus considered as part of the wider process from collection through to recovery

Institutional coordination is another component of the framework. Government agencies, food businesses, recovery organisations and other relevant actors have different responsibilities across the food waste chain. Clear roles, information sharing, monitoring and coordination are needed to support prevention and connect food businesses with recovery opportunities. This is consistent with the Japanese system, in which national and local governments, businesses and other actors have defined roles in food-loss and waste reduction.

Several supporting conditions are also included in the framework. These include suitable policy and regulatory arrangements, infrastructure and recovery facilities, data and monitoring systems, knowledge and capacity, funding or incentives, and networks between food businesses and redistribution and recovery organisations. These conditions reflect the governance gaps identified in Brunei and highlight the practical requirements for implementing food waste policies.

Halalan thayyiban considerations apply across the framework rather than forming a separate stage. Relevant considerations include cleanliness, food safety, quality, appropriate handling, contamination control and responsible use of food resources. Their application depends on the intended pathway. Food for human redistribution requires appropriate safety and handling controls, while recovery pathways require attention to contamination, end use and applicable requirements. This recognises that food waste does not have a single status or recovery route.

The framework also distinguishes halal-compliant food waste streams from non-halal and *najis*-contaminated materials. These streams should be separated at source and managed through distinct storage and collection arrangements to prevent contamination of materials intended for halal recovery. Non-halal and contaminated waste are excluded from halal redistribution and animal-feed pathways. Energy recovery may be considered where the treatment process and end use meet relevant requirements; otherwise, controlled disposal should be used. Mixed food waste requires assessment before a recovery route is selected, as its suitability for halal-related uses cannot be assumed.

The framework draws on relevant policy functions identified from Japan without directly transferring Japanese arrangements to Brunei. Japan provides examples of prevention targets, reporting, recovery pathways and institutional coordination, while the proposed framework takes account of Brunei's institutional, infrastructural and food waste management conditions. It provides a basis for connecting existing Brunei initiatives with clearer policy responsibilities and recovery pathways. The framework remains a proposed policy design and requires further consultation and empirical assessment before implementation.

Discussions

Strengthening Coordination in Food waste Governance

The comparison shows that Brunei already has several food waste initiatives, but their activities are not yet well connected. Prevention, source separation, redistribution and recovery involve different programmes and organisations, with limited coordination across these stages. This makes it difficult to establish a consistent approach to managing food waste from its generation to its eventual use or disposal.

This finding is consistent with Shams et al. (2024), who identified limited source segregation, infrastructure constraints, gaps in institutional responsibilities and the need for greater stakeholder participation in Brunei’s waste-management system. Recent initiatives such as

the Eco Food Waste Initiative indicate increasing attention to food waste prevention and recovery. However, further arrangements are needed to link such initiatives with food waste measurement, collection, redistribution and recovery activities carried out by businesses and other organisations.

The Japanese case demonstrates how food waste policy can connect these functions through defined responsibilities, reporting arrangements, local planning and established recovery pathways. The relevance for Brunei is not the direct adoption of Japan's system, but the way different policy functions are organised within a connected governance arrangement.

For Brunei, this suggests a need to define the responsibilities of government agencies, food businesses and recovery organisations across the main stages of food waste management. Food waste measurement and prevention could be developed at the business level, while source separation and collection could be connected to appropriate redistribution and recovery outlets. Clear responsibilities would also support progress monitoring and help identify areas requiring further policy or infrastructure support.

The proposed framework highlights this governance approach by placing institutional coordination across the food waste system rather than treating it as a separate administrative function. The framework therefore connects policy responsibilities, supporting conditions and stakeholder roles with prevention, separation, redistribution and recovery activities. This provides a policy structure through which existing and future food waste initiatives in Brunei can be developed as connected parts of the same system.

Policy Learning from Japan and Adaptation to Brunei

The Japanese case provides useful lessons for Brunei, but the findings do not support direct transfer of Japanese policies. The two countries differ in population size, institutional arrangements, waste-management infrastructure and the scale of food waste generation. A policy that works within Japan's established system may not produce the same results if introduced in Brunei without adjustment.

One example is Japan's use of industry targets and reporting. Japan has set recycling targets for food manufacturers, wholesalers, retailers and food-service businesses, together with reporting requirements for larger food waste generators (Ministry of Agriculture, 2024, 2025). These arrangements give businesses and government information on the amount of food waste generated and the extent to which it is recycled. For Brunei, a similar system would first require reliable information on food waste generation across relevant businesses. Measuring food waste could therefore be a practical first step before introducing formal targets or reporting requirements.

A similar issue applies to food redistribution and resource recovery. Japan has developed food banks, food donation arrangements and established recycling routes for food resources. Brunei has some redistribution and recovery activities, but these remain smaller in scale and involve fewer established outlets. The relevant lesson is to strengthen connections between food businesses and organisations that can receive surplus food or recover food waste. The form of these arrangements would need to reflect the facilities, organisations and demand available in Brunei.

Infrastructure is another area where adaptation is important. Japanese food waste policies operate alongside established collection and recycling systems. Brunei would need sufficient collection, storage, treatment and recovery facilities before similar approaches could operate on a wider scale. The proposed framework therefore treats infrastructure as a supporting condition rather than assuming that policy requirements alone will lead to greater recovery.

The Japanese experience also shows the importance of involving government and businesses in food waste reduction. National and local authorities have different responsibilities, while businesses play a direct role in reducing and recycling food waste (Consumer Affairs Agency, 2019; MAFF, 2025). For Brunei, relevant government agencies, food businesses, recovery

organisations and community groups could be given roles according to their existing functions and capacity. These findings support a lesson-drawing approach rather than policy copying. The Japanese experience provides examples of policy approaches that may be relevant to Brunei, while the Brunei context determines how they should be organised. The proposed framework therefore adapts selected elements of the Japanese approach to Brunei's existing initiatives, institutional arrangements and available resources. The result is a Brunei-focused policy design informed by international experience rather than a replication of the Japanese system.

Integrating Halalan Thayyiban into Food waste Governance

Halalan Thayyiban adds requirements for cleanliness, food safety, quality and proper handling to food waste management, alongside efforts to prevent waste and recover resources. Recent studies have also discussed its relevance to responsible resource use and circular economy practices in Brunei (Sulaiman & Talib, 2024; Mujib & Salleh, 2026). In this study, these principles are considered across the main areas of food waste governance rather than as a separate stage of management. This has particular implications for food redistribution and resource recovery. The food waste hierarchy prioritises food suitable for human consumption for redistribution before other recovery options are considered (Papargyropoulou et al., 2014). Food that is no longer suitable for consumption may be considered for other recovery pathways, depending on its condition, contamination status and intended end use. Although Japan's food recycling system provides examples such as animal feed and fertiliser production (MAFF, 2025), their application in Brunei would require appropriate controls to protect food safety, prevent contamination and maintain halal integrity. These considerations distinguish the proposed framework from a general food waste governance model by incorporating Halalan Thayyiban requirements into decisions about how food waste is handled, separated and recovered.

Policy Implications for Brunei

The findings have several implications for food waste policy in Brunei. First, food waste measurement should be strengthened. Reliable data on the amount and sources of food waste would provide a basis for setting reduction targets, identifying priority businesses and monitoring progress. This is particularly relevant given the data and monitoring gaps identified in previous research on Brunei's waste-management system (Shams et al., 2024).

Second, food businesses should have defined responsibilities for prevention and source separation. Larger supermarkets and food suppliers could be initial points for food waste measurement, separation and reporting, supported by appropriate guidance and facilities. This would allow policy requirements to develop alongside practical capacity rather than imposing requirements that businesses may not yet be equipped to meet.

Third, Brunei could strengthen the network connecting food businesses with redistribution and recovery organisations. Suitable surplus food could be directed to organisations able to redistribute it, while other food waste could be channelled to appropriate recovery facilities. This would help move food waste management beyond collection and disposal towards greater reuse and resource recovery. Finally, institutional roles need to support these activities. Relevant government agencies, food businesses and recovery organisations need defined responsibilities for measurement, collection, redistribution, recovery and monitoring. Policy development should also consider halalan thayyiban requirements where food or recovered materials are intended for further use.

LIMITATION AND FURTHER RESEARCH

This study has several limitations. The analysis was based on selected policy and institutional documents and did not involve interviews or consultations with government agencies,

food businesses or recovery organisations. As a result, the findings may not fully reflect the practical challenges faced by those involved in food waste management. The Japanese documents examined were available in English, including official English translations. Policies and implementation details published only in Japanese may not have been captured.

In addition, Osaka was the only local case examined, and its policies may not cover the arrangements in other Japanese municipalities. The feasibility ratings were also based on the researcher's assessment of the documentary evidence and were not reviewed or validated by external experts or stakeholders. They should be read as preliminary assessments rather than confirmed measures of feasibility. Further research could involve relevant government agencies, halal authorities, food businesses and recovery organisations in Brunei to review the proposed framework and assess its practical requirements. Expert consultation and comparisons with other Japanese municipalities could also provide a wider understanding of policy implementation and the suitability of different approaches for Brunei.

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CONCLUSION

This study compared food waste governance in Brunei and Japan across four areas: prevention and reduction, source separation and collection, redistribution and resource recovery, and institutional coordination and policy support. The findings show that Brunei has begun addressing food waste through recent initiatives and recovery activities, but gaps remain in measurement, source separation, infrastructure, institutional roles and connections between food businesses and recovery organisations. Japan provides relevant policy approaches in areas such as food-loss reduction, reporting, recycling and stakeholder responsibilities. These approaches require adaptation to Brunei's institutional and infrastructure conditions rather than direct transfer. The main contribution of the study is a proposed halalan thayyiban food waste governance framework for Brunei. The framework connects food waste priorities with institutional roles and supporting conditions, while incorporating halalan thayyiban considerations relating to safety, cleanliness, handling, contamination and end use.

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