The Recyclable Waste Management of Urban Communities of Maha Sarakham Municipality and Related Areas

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Abstract

This article aimed at 1) investigating the recyclable waste management model and the stakeholders involved; 2) analyzing the cycle of recyclable waste management in the municipality and related areas; and 3) providing recommendations for an integrated management method involving local authorities, government, community, and the private sector. The study employed in-depth interviewing as its primary research method and involved two main participant groups: an informal sample group comprising individuals from local communities and a formal group consisting of businesses engaged in purchasing recyclable waste. The research methodology encompassed four key steps: Step 1: Classification of Recyclable Wastes and Methods. Step 2: Interviewing Selected Sample Groups. Step 3: Construction of a Recyclable Waste Management Cycle Chart. Step 4: Recommendations for Integration. The findings from this research revealed a lack of connection within the waste management process, emphasizing the need for a more cohesive and interconnected system. It underscored the importance of designing a management model that aligns with the concepts of circular economy and symbiosis within the waste management ecosystem, aiming for more sustainable waste practices. Moreover, this article contributed to a broader study on The Study of Community Waste Flow Management through the Urban Symbiosis Concept of Sustainable Waste Management: The Case Study of Maha Sarakham

Municipality. The study was part of a larger research initiative supported by funding from the Thailand Research Fund, specifically the Office of Thailand Science Research and Innovation Promotion Council (TSRI), in 2019. This funding indicates the significance and support for research endeavors addressing waste management and sustainability in the country.

Keywords: Circular economy; Recyclable Waste Management; Symbiosis

Introduction

The waste management issue in Thailand, especially regarding environmental residues, appears to be a pressing concern. The situation outlined by the Pollution Control Department is indeed critical and warrants urgent attention. The reported statistics reveal significant challenges in waste handling and disposal, which ultimately pose severe environmental risks, including pollution and potential cross-border impacts. Key observations from the report highlight critical areas that demand immediate focus and concerted efforts for resolution (Department of Pollution Control, 2021): 1) Improper Disposal: A substantial volume of waste, approximately 6.69 million tons, is not being adequately managed, leading to environmental hazards. This improper disposal raises concerns about pollution and its far-reaching consequences. 2) Insufficient Sorting at Input: Inadequate waste sorting at the source impedes efficient recycling or reusing of materials. This inefficiency directly affects the potential for effective waste management and resource utilization. 3) Challenges in Waste Collection: The readiness and efficiency of local authorities in waste collection are identified as problematic. This inefficiency could disrupt the entire waste management process, especially recycling and the transformation of waste into valuable resources like energy. 4) Lack of Proper Guidelines: The absence of concrete studies and comprehensive guidelines across sectors further compounds the waste management issue. This absence impedes the development and implementation of effective waste management strategies. 5) Community Solid Waste Management Challenges: Community-level waste management faces persistent challenges, particularly in inappropriate end-of-stream management that emphasizes disposal over sustainable practices like recycling. 6) Varying Recycling Capacities: Disparities in recycling capacities across different areas underscore an uneven distribution of resources or infrastructure for effective waste management. To address these challenges, comprehensive studies, effective guidelines, and collaborative efforts among concerned sectors are necessary. Improving waste sorting at the source, enhancing local authorities' readiness in waste collection and recycling, and

prioritizing sustainable waste management practices are crucial steps towards mitigating this growing environmental issue.

From what has been discussed above, the importance of recyclable wastes and the study of waste management to understand the methods used and those with major roles in the cycle would illustrate the connection and disconnection that can be the obstacle, and hence the viable approaches could be promoted until the management cycle becomes efficient. This was the reason behind the study of recyclable waste management in urban communities. Maha Sarakham Municipality and the related areas were chosen as the places of study. The Municipality has to dispose of an amount of 61,925 tons of waste per year. The greatest portion was food waste (63%), followed by plastics (18%), waste paper (13%), and 6% others. There are 2 ways of disposal, i.e., landfill and turning into compost (Sripokhangkul & Aj-Sri, 2017). The waste problem is therefore a concern. The Municipality's place for disposal of garbage and sewage is at the Nong Pling Waste Disposal Site. The landfill method is presently relied on, and shortly, the waste is going to be disposed of by an incinerator and the byproducts can be used for generating electricity.

The most important problem nowadays that has led to this study is the management of community waste because the disposal places in Nong Pling Sub-district, Muang District, and Chiang Yuen District do not have sufficient capacity and are under critical situation. Nevertheless, the province solves the problem by relying on the Government's policy that has placed waste management as a national agendum. In addition, the Act of Country Cleanliness and Orderliness (Second Edition), 2017, allows the Municipality to manage waste disposal by cooperating with the private sector. Therefore, other methods have been sought to dispose of wastes with the private sector under the principle of Public Private Partnership (PPP). The Act of State Enterprise Co-investment Act, 2013 is based on community waste management (National Reform Council, 2016). Presently, the private sector is interested in and has asked to cooperate with the province and Maha Sarakham Municipality to incinerate waste for the purpose of electricity generation. The management of waste in Maha Sarakham Municipality and other urban communities, however, is still a concern because the management of wastes from households, industrial factories, markets, shops, and communities is all under the load of the local administrative organization. The organization has been facing shortages of places and conflicts at the area level. Many other local administrative organizations have to tackle the great amount of waste and thus the costs for disposal become high. Therefore, notwithstanding whether the disposal method is incinerating or

landfill, the end result is to be able to manage community wastes from the input and to reduce the amount and load for management at the downstream level. Hence, the Community Solid Waste Flow Management should be studied from the input towards the end, i.e., disposal.

This study formed a part of the research study on The Community Waste Flow Management through the Urban Symbiosis Concept of Sustainable Waste Management: The Case Study of Maha Sarakham Municipality. The study has been allocated the 2019 budget support from the Thailand Research Fund (at present the Office of Thailand Science Research and Innovation Promotion Council (TSRI). The case study was aimed at producing a Waste Flow Management Cycle on the part of those with roles in community recyclable waste management. The outcome would lead to recommendations that connect to or are integrated with the management of the responsible local organization, i.e., Maha Sarakham Municipality.

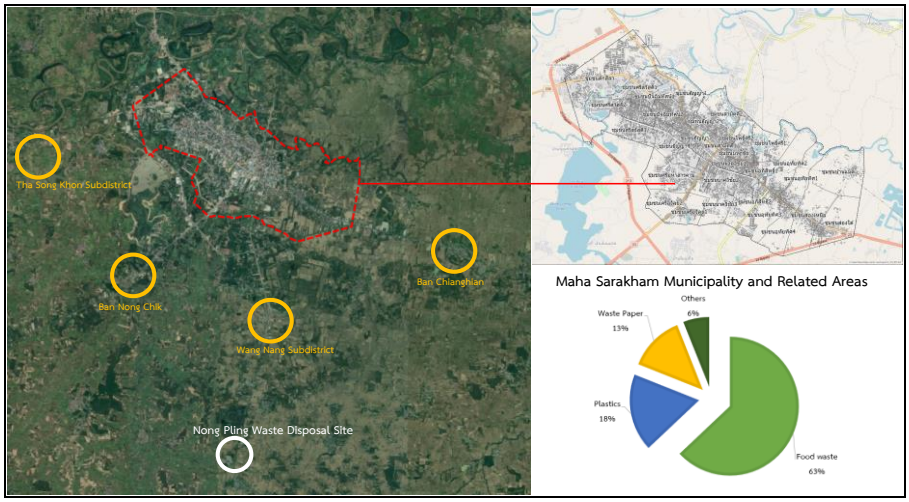


Fig. 1 Maha Sarakham Municipality and Related Areas

Research Objectives

1. To investigate the recyclable waste management model and the stakeholders

2. To analyze the cycle of recyclable waste management in the municipality and related areas

3. To provide recommendations for an integrated management method involving local authorities, government, community, and the private sector

Literature Review

The literature review provides valuable insights into the complexities of waste management and the evolving strategies aimed at addressing this global challenge.

1. **Linear Economic Model and Waste Generation:**

– Linear Economic Development: The linear economic model of 'take', 'make', and 'dispose' generates massive quantities of waste, posing significant environmental impacts when managed inefficiently.

– Waste Valorization and Circular Economy: Emphasizes the importance of waste valorization within the concept of symbiosis and the circular economy. This approach links economic growth to waste management, highlighting the significance of resource efficiency (Loizidou, 2015).

2. **Waste Management for Sustainable Development Goals (SDGs):**

– Waste Recycling and SDGs: Focuses on the need to recycle urban waste into raw materials or energy to meet Sustainable Development Goals (SDGs) while ensuring environmental, economic, and social benefits. This approach aims to reduce waste and pollution while promoting continuous utilization of resources and energy (Albino, Fraccascia & Savino, 2015).

3. **Industrial and Urban Symbiosis:**

– Industrial Symbiosis: Discusses the concept of industrial symbiosis based on mutual dependence, emphasizing geographic proximity for resource transfer (Chertow, 2007).

– Urban Environmental Management: Extends the idea of symbiosis to urban areas, Urban Symbiosis identifies the potential use of urban waste as alternatives for raw materials and energy in industrial processes (Van Berkel et al., 2009).

4. Successful Case Studies:

– Eco–Towns and SymbioCity: Showcases successful implementation of symbiosis concepts in waste management, such as Japan's Eco–towns in Kawasaki and Kitakyushu and Sweden's SymbioCity initiative. These examples demonstrate how waste can be leveraged as a resource and the potential for successful environmental management practices.

Overall, the literature review underscores the shift toward more sustainable waste management practices, emphasizing the importance of recycling, resource efficiency, and symbiotic relationships between industrial and urban areas to achieve environmental and economic benefits. The case studies provide concrete examples of how these concepts have been effectively implemented in real–world scenarios.

Conceptual Framework

The study area was delineated to Maha Sarakham Municipality and the related areas that cover the distribution of recyclable wastes, the collection route, and the selling and buying among people who take both formal and informal management roles.

This research emphasized the study of the method and the people having an informal role in recyclable waste management, i.e., the community people; and the group having a formal role in the waste management, i.e., the group buying recyclable wastes. The compiled content was obtained from the primary data, site surveys, interviews, and focus group discussions. The secondary data was collected from relevant and available documents.

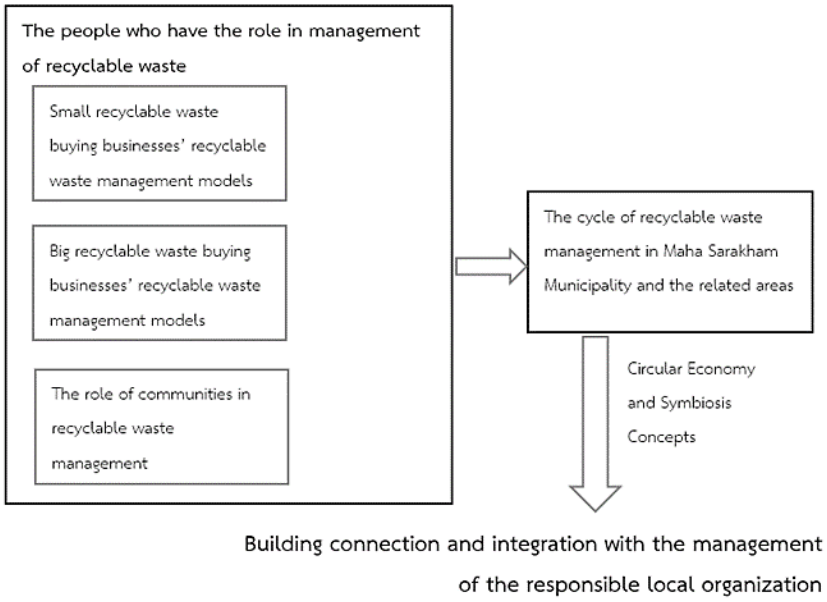


Fig.2 Conceptual Framework

Research Methodology

This study utilized qualitative research methodology and a content analysis approach to evaluate the potential application of circular economy and symbiosis within municipal contexts. The study was structured into four distinct steps:

Step 1 – Data Compilation: The initial step involved compiling both secondary and primary data. Secondary data were collected from existing documents and research materials to construct a foundational framework for the study. This framework aimed to understand the stakeholders involved in managing recyclable waste, different types and categories of recyclable waste, and

their alignment with primary data gathered through on-site surveys conducted within Maha Sarakham Municipality and its connected areas.

Step 2 – Study on Stakeholders: This phase encompassed a comprehensive study focusing on both informal (community members) and formal (private business groups) stakeholders involved in recyclable waste management. The study delved into various facets such as the locations, methods used for managing recyclable waste, categories and types of recyclable waste, and the transfer of these materials to other sources for further management. The sample groups were chosen through purposive sampling method based on specific criteria, including key informants and relevant places for information. Research methods employed included interviews, focus groups, observations, and photography. The sample groups consisted of 4 communities recommended by the Municipality and 6 waste-buying business groups willing to provide information.

Step 3 – Construction of Connection Cycle: A connection cycle was developed to illustrate a network or pathway depicting the movement and routes of various types of recyclable waste. This network aimed to provide an overview of Maha Sarakham Municipality and its related areas influenced by the flow and pathways of recyclable wastes.

Step 4 – Recommendations for Integration: The final step involved formulating recommendations for integrating recyclable waste management practices with the overall waste management systems within Maha Sarakham Municipality.

Research Results

The study's outcomes provided comprehensive insights into the pattern of recyclable waste management, the roles of individuals involved in this management, and the community's contribution to this process. These findings effectively addressed the primary objective of examining the recyclable waste management model, identifying key stakeholders encompassing formal businesses and informal community members, and delineating the dynamics between these formal and informal entities within the system. Moreover, the study focused on understanding the recycling waste management cycle and proposed recommendations to establish links and integrate this cycle with local organizations' management. Through a graphical representation, the study illustrated the cycle of recyclable waste management in Maha Sarakham Municipality and related areas. This visual depiction showcased the flow of recyclable waste within the system, emphasizing connections and opportunities for integration based on the concepts of circular economy and symbiosis. By combining these findings with recommendations grounded in these

sustainability concepts, the study contributed valuable insights into how the waste management cycle could align with principles promoting sustainability, resource efficiency, and interdependence among stakeholders and systems.

1. **The pattern of recyclable waste management**

Recyclable wastes or recyclable materials from the community are out-of-use materials or old items that can be reused and have been accumulated at old-item buying shops for reselling. These materials include items that are damaged or remain unused, as defined by the Public Health Committee under the Public Health Act, 1992. The definition shows that the terms "recyclable waste" and "old items" are often used interchangeably. They have two meanings: first, the asset proposed for sale or exchange or distribution like used assets, including antiques; and second, the damaged objects, used or left-over from sorting community wastes, but not including unused materials from industry defined according to the Ministerial Regulation, Second Version, 1992, and according to the Factory Act (Department of Pollution Control, 2008). In this study, however, recyclable waste is defined as waste from communities, not from industry.

Recyclable wastes or "old items" goods can be of many forms and categories of old objects that the law (Announcement of the Governing Department on "Authorization for Auction and Old Items Businessmen according to the Auction and Old Item Sale Control Act 1931) defined as an object that requires permission of an issuance officer. These objects include: 1) antiques that are defined according to the Law on Historical Sites, Antiques, Artifacts, and National Museum, 2) old items categorized under the class of jewellery, gold, silver, copper alloy or gems, 3) vehicles according to the Law on Vehicles, and 4) other old objects such as mobile phones, paper, scrap iron, bottles, stainless steel, sacks, computer, cameras, musical instruments, stereo, electrical appliances, wood from old houses, leatherwork, office utensils, clocks, bicycles, accessories, car parts, motorcycles, vehicle tires, vehicle wheel drums, stamps, coins, bank notes, furniture, tanks, pawn shop objects, sewing machines, amulets, plastics, etc. (Thai Civil Rights and Investigative Journalism (TCIJ), 2014). In other words, community recyclable waste is defined as any of the old objects in the last group.

Additionally, the study of the present information related to recyclable waste sorting for reuse showed that there is a tendency in Thailand to sort the recyclable materials for reuse. These items are principally classified into glass, paper, plastics, metal, and non-metal, aluminum, brass, copper, stainless steel, and lead. The other types include coconut shells, old kapok mattresses, foam, and candles. These materials are to undergo different recycling methods for reuse as a new

raw material (Office of the Environment, Bangkok Metropolitan, 2012). It can be said that if recyclable waste enters the management system, then it can be recycled for reuse and in turn, will benefit the country's economy.

The survey of Maha Sarakham Municipality area and related areas to select the sample group with responsibilities to manage waste revealed that these people comprised those in the informal sector such as the community that sorts waste to sell to tricycle merchants who buy old items and wastes as well as shops that run the same business; and those in the formal sector including the registered old-object buying shops. This business is an effective mechanism that promotes the reuse of recyclable materials. Its role is to connect with recycling factories such as mills, smelters, or other types of manufacturing mills (Department of Pollution Control, 1998, cited in Jetsadapatipat, 2010). Traders in this business are found in different forms, such as tricycles, small and big old object-buying shops, and specific industrial factories. With the economic problem from the import of recyclable waste from abroad into the country, however, impacts have arisen on the business. Many tricycles quit and turned to other jobs. Therefore, the effect was on the amount of recyclable waste circulated in small and big businesses. In this study, 2 small recyclable waste-buying traders were selected, who were in Maha Sarakham Municipality, 2 small recyclable waste-buying merchants, and 2 big merchants in the related areas of Maha Sarakham Municipality. These sample groups were selected by the criterion-based selection method, confining only cooperative people for the study in the next step.

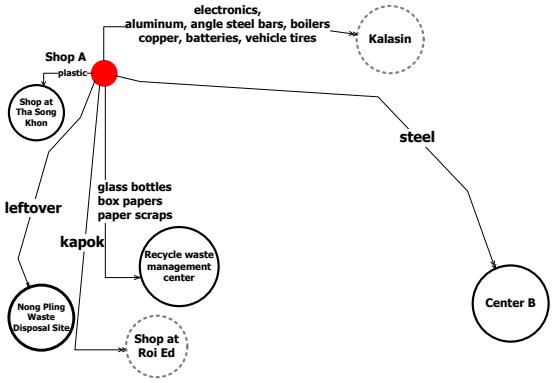
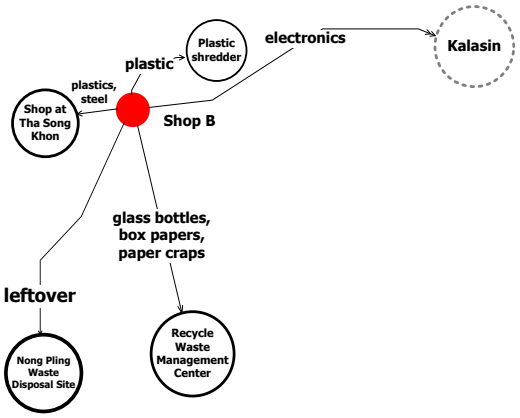
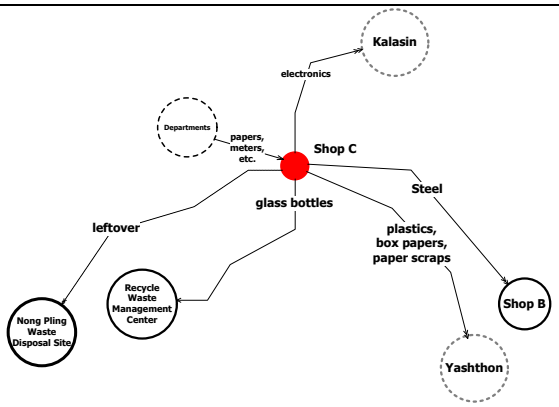
From the survey conducted on the communities in Maha Sarakham Municipality and the information from the Municipality for selecting the sample group, 4 communities were obtained by the Purposive Random Method. These samples were to be studied for their roles in recyclable waste management.

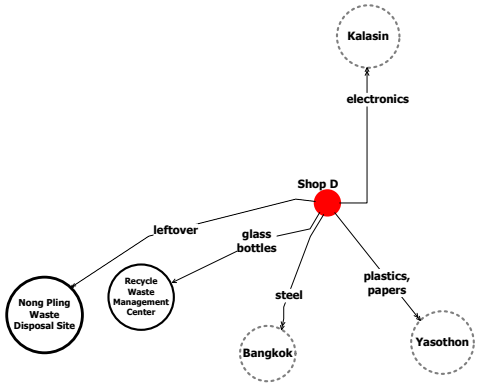
2. The people who have the role in management of recyclable waste

The study of recyclable waste sorting for reuse and the presently showed that the sorting of recyclable waste in Thailand is carried out according to the types of waste, which are discussed above. The following big and small businesses of recyclable wastes were selected as the sample groups:

(1) Small recyclable waste buying businesses

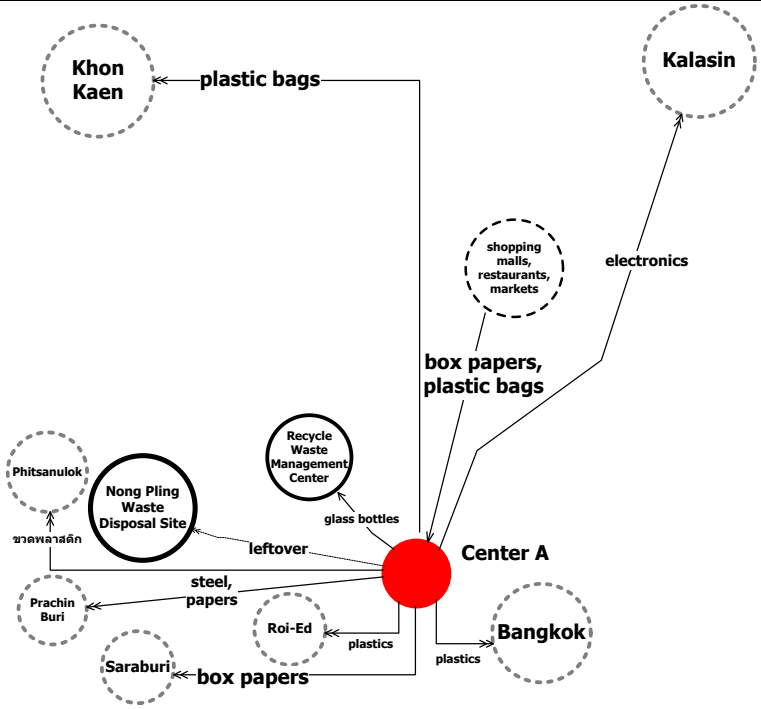
Table 1 Small businesses of recyclable wastes

Small recyclable waste buying businesses	Recyclable waste management models
Shop A: With role in recyclable waste management: Collecting recyclable waste from communities nearby and transferring to the network business and big business in Maha Sarakham Province, including Waeng Nang Sub-district, Tha Song Khon Sub-district, Khwao Sub-district and provinces close by, i.e., Roi Et and Kalasin. The leftover wastes and unsold wastes are sent to the Municipality for disposal. (Rattawat, S., personal communication, October 18, 2019)	
Shop B: With role in recyclable waste management: Collecting recyclable waste from communities nearby and transferring to the network business and big business in Maha Sarakham Province, including Koeng Sub-district, Waeng Nang Sub-district, and Tha Song Khon Sub-district, and provinces close by, i.e., Roi Et and Kalasin. The leftover wastes and unsold wastes are sent to the Municipality for disposal. (Paso, P., personal communication, October 18, 2019)	
Shop C: With role in recyclable waste management: Collecting recyclable waste from communities nearby and transferring to the network business and big business in Maha Sarakham Province, including Waeng Nang Sub-district, Khwao Sub-district and provinces close by, i.e., Roi-et, Kalasin and Yasotorn. The leftover wastes and unsold wastes are sent to the Municipality for disposal. (Khui, personal communication, December 19, 2019)	

Small recyclable waste buying businesses	Recyclable waste management models
Shop D: With role in recyclable waste management: Collecting recyclable waste from communities nearby and transferring to the network businesses which are in other provinces, including Kalasin, Yasothon, and Bangkok. The leftover wastes and unsold wastes are sent to the Municipality for disposal. (Ruangkitjaroenchai, D., personal communication, December 19, 2019)	

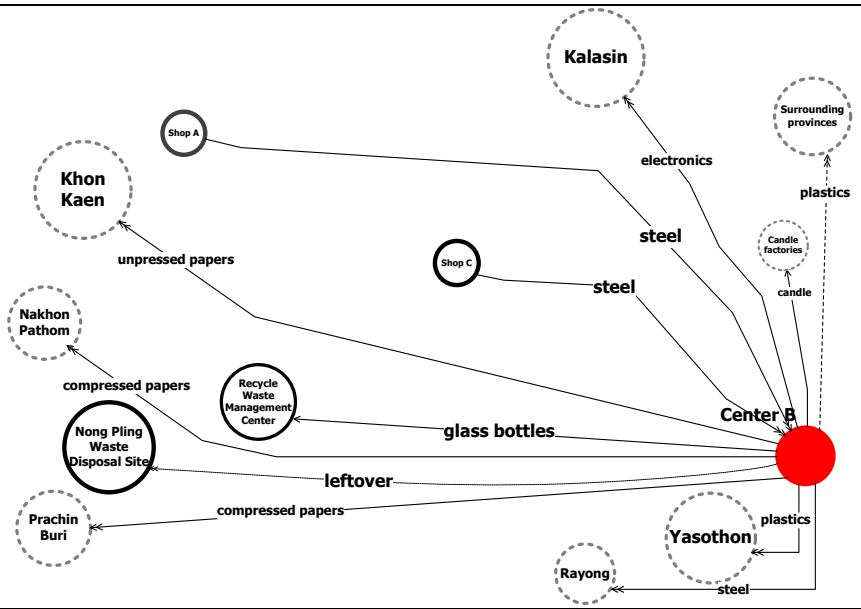
(2) Big recycle waste buying businesses

Table 2 Big recycle waste buying businesses

Recyclable waste management models


Center A: With role in recyclable waste management: Collecting recyclable waste from the communities and from small businesses and transferring to companies in the group and the networks, most of which are in other provinces, i.e., the head office in Phitsanulok, and the network company in Prachin Buri. Other networks include Khon Kaen, Roi Et, Kalasin, Saraburi, Bangkok, etc. The leftover wastes and unsold wastes are sent to the Municipality for disposal. (Srisathit, W., personal communication, October 18, 2019)

Recyclable waste management models



Center B: With role in recyclable waste management: Collecting recyclable wastes from the communities and from small businesses and transferring to the networks, most of which are in other provinces including Khon Kaen, Roi Et, Kalasin, Yasothon, Nakhon Pathom, Prachin Buri, Rayong, etc. The leftover wastes and unsold wastes are sent to the Municipality for disposal. (Pollasen, S., personal communication, October 18, 2019)

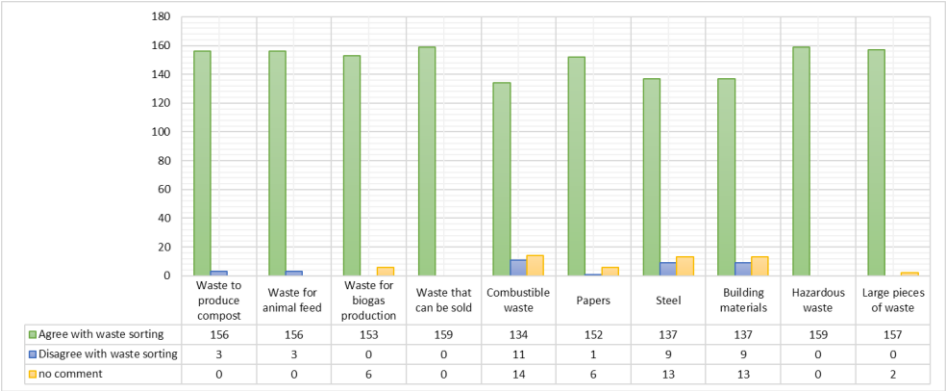
3. The role of communities in recyclable waste management

Following is the result of the study on cooperation in garbage sorting and the sorting method of the 4 communities in Maha Sarakham Municipality. The study was conducted by focus group meeting of 159 people:

All community people (100%) agreed with the sorting of toxic wastes for disposal and the sorting of wastes that can be sold to recyclable waste-buying businesses. 98.74% agreed with sorting big-sized wastes such as cabinets, beds, or tables for recycling, while 98.11% agreed with sorting decomposable garbage for animal feed and making compost. 96.23% believed in sorting decomposable garbage for making biogas for electricity generation, while 95.60% believed in the sorting of paper waste to feed recycling paper factories, 86.16% equally agreed with sorting metal for smelter factories and sorting construction materials for disposal. Lastly, 84.28% believed flammable wastes such as paper, plastics, and cloth, should be sorted out and fed to the electricity generating system, as shown in Chart 1.

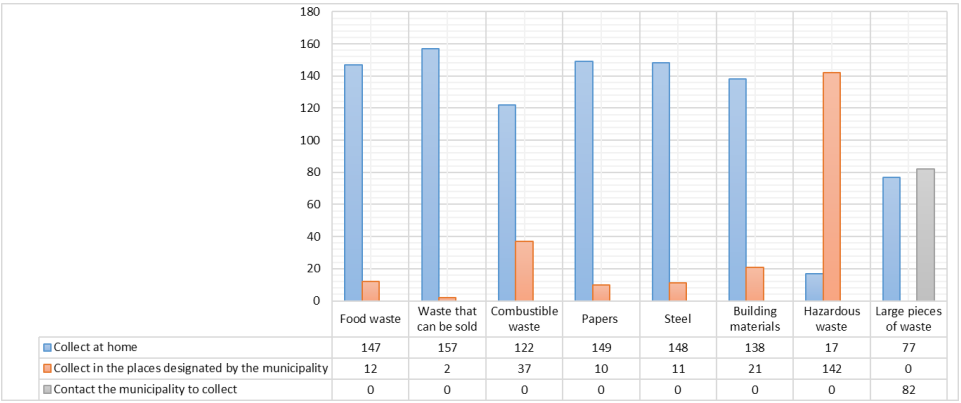
In general, the present practice in waste sorting in communities is sorting wastes at the household level. The wastes that can be sold such as cans, plastic bottles, and glass bottles are mostly sorted (9 8 .7 4 %), followed by paper to be sold to paper factories (92.71%), and metal

scrap for selling to smelter factories (93.08%). They also preferred to sort decomposable waste such as leftover food (92.45%), scraps from construction materials for selling to floor tile factories (86.79%), and flammable wastes such as paper, plastic bags, and tires (76.73%). The little portion left is sorted out and placed at the point set by the Municipality. The toxic wastes that necessitate special disposal are sorted and placed at the Municipality's assigned spot (89.31%) while for some big pieces of waste, most (51.57%) contacted the Municipality for pick-up and 48.43% stacked the waste at home, as shown in Chart 2.



	Waste to produce compost	Waste for animal feed	Waste for biogas production	Waste that can be sold	Combustible waste	Papers	Steel	Building materials	Hazardous waste	Large pieces of waste
Agree with waste sorting	156	156	153	159	134	152	137	137	159	157
Disagree with waste sorting	3	3	0	0	11	1	9	9	0	0
no comment	0	0	6	0	14	6	13	13	0	2

Chart 1 Communities' opinions in waste sorting



	Food waste	Waste that can be sold	Combustible waste	Papers	Steel	Building materials	Hazardous waste	Large pieces of waste
Collect at home	147	157	122	149	148	138	17	77
Collect in the places designated by the municipality	12	2	37	10	11	21	142	0
Contact the municipality to collect	0	0	0	0	0	0	0	82

Chart 2 Communities' methods of waste sorting

The study of communities' role in waste management revealed their readiness in terms of raw materials to send to the recyclable waste buying sources. This also relies on the mechanism of flow for effective circulation in the system. The Maha Sarakham communities' readiness is only at the frontier part that enables the mechanism. It is necessary to integrate the systems of the Municipality and the private sector that runs the recyclable waste-buying business in the Municipality and the related areas for more efficient cooperation.

4. The cycle of recyclable waste management in Maha Sarakham Municipality and the related areas

To understand the circulation of recyclable wastes in the area and their indicators, a model was made to demonstrate the possible flow of communities' recyclable wastes as shown in Figure 3.

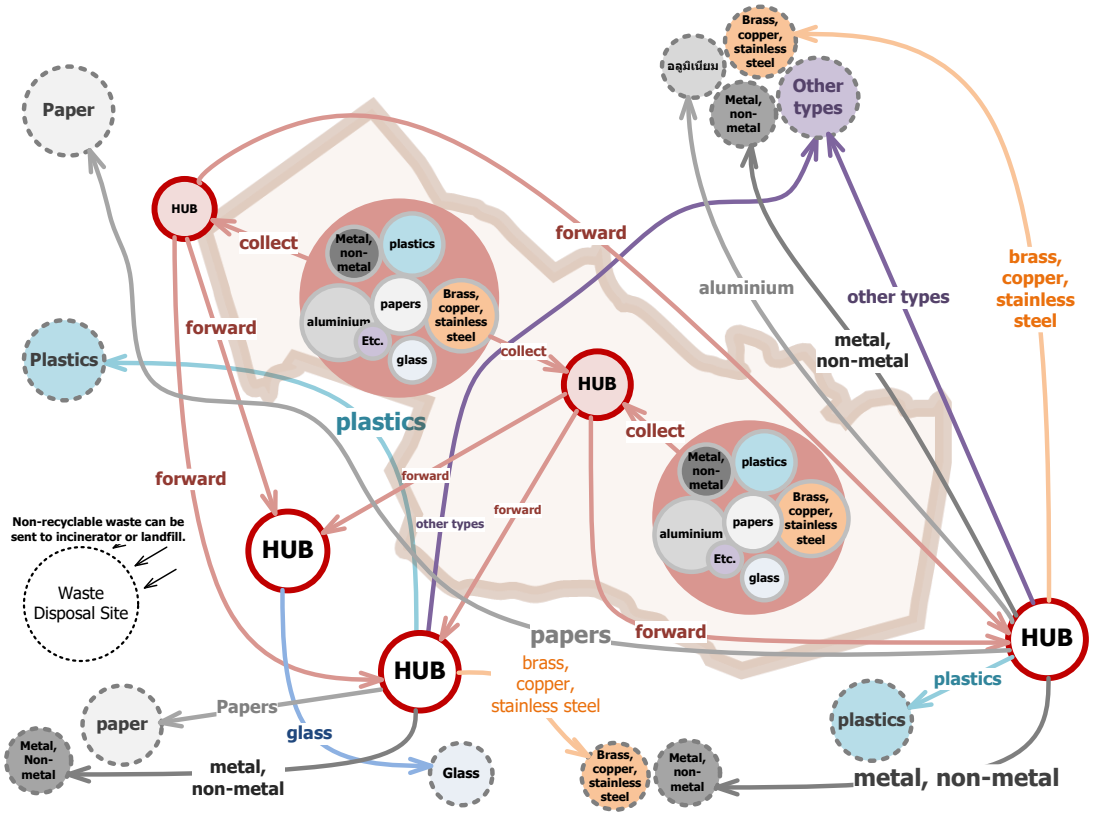


Fig. 3 The model of recyclable waste cycle made from the study result

From Figure 3, the recyclable wastes from the communities that comprise plastics, non-metal, metal, aluminum, brass, copper, glass, and others are gathered and waiting for collection or selling to old object-buying businesses. Only a small portion is placed at the point set by the Municipality. The streamlined mechanism for the Municipality should be the agreement between the Municipality and the private sector to manage recyclable wastes. Small recyclable waste-buying businesses can buy the waste based on the types. The Municipality may charge the collection fee at appropriate rates. This means the wastes will enter the system through the appropriate flow of each type.

Discussions

The study successfully achieved its objectives by offering a comprehensive view of recyclable waste management and the roles played by formal and informal participants. By detailing waste management practices and identifying key stakeholders, the study laid a strong foundation for understanding the dynamics between these stakeholders and their functions within the system.

The detailed analysis of waste management in Maha Sarakham Municipality, and its surrounding areas, provides valuable insights into the entire waste cycle – from collection to processing. This understanding becomes crucial for making informative recommendations on integrating this cycle with local organizations involved in waste management, thereby facilitating more effective and sustainable practices.

The study's in-depth exploration covers waste movement, stakeholder identification, integration opportunities, and recommendations for synergy. Moreover, the comprehensive account of how recyclable waste is defined, categorized, and managed within the region, along with the emphasis on collaboration between the Municipality and private sectors, signifies a strong framework for efficient waste management.

The proposed model and graphical representation depicting the flow of recyclable waste highlight crucial interaction points, enabling a clearer understanding of the system's dynamics and opportunities for improved integration. Additionally, the community's active involvement and willingness to participate in waste sorting and management serve as promising indicators for the successful implementation of effective waste management strategies.

Conclusions

The study met its initial objective by offering a comprehensive understanding of the recyclable waste management model and delineating the roles of both formal and informal participants within this system. The study's outcomes seem to have achieved several key aspects: 1) Clarity on Recyclable Waste Management Practices, 2) Identification of Key Stakeholders, and 3) Analysis of Formal and Informal Dynamics. Additionally, for objectives 2-3, the study's comprehensive analysis of recyclable waste management in urban communities, particularly within Maha Sarakham Municipality and its related areas, offers a valuable understanding of how waste progresses through various stages, right from its collection to processing. This in-depth comprehension serves as the foundation for making informed recommendations regarding the

integration of this waste management cycle with the responsibilities and functions of local organizations involved in waste management. The study provides insights into 1) Waste Movement and Processes, 2) Identification of Key Stakeholders, 3) Opportunities for Integration, and 4) Recommendations for Synergy

From the above discussion, conclusions can be drawn as follows:

1. Pattern of Recyclable Waste Management:

– Definition Differences: Understanding the distinction between recyclable wastes and old items based on their intended use was highlighted. Recyclable wastes differ from items collected for selling and buying purposes.

– Categorization of Wastes: Recyclable wastes were categorized into major groups such as glass, paper, plastics, metals, and miscellaneous items, aligning with Maha Sarakham Municipality's survey data.

2. Roles in Managing Recyclable Wastes:

– Categorized Roles: Participants managing recyclable wastes were divided into the informal sector (tricycle merchants and community members) and the formal sector (businesses purchasing recyclable waste).

– Small Buyers' Operations: Small buyers near communities collect and transport waste to larger centers for further processing into raw materials.

3. Recyclable Waste Management Cycle:

– Optimization of Flow: Emphasizing the need for a more organized flow within the management cycle from communities to buyers. A system that aggregates different waste types at small buyer locations before moving to larger businesses can enhance cycle efficiency.

4. Building Connections and Integration with Local Organizations' Management:

– Efficiency Enhancement: Suggesting that the Municipality improve waste sorting efficiency and establish a cooperative system with businesses purchasing recyclable waste. This collaboration ensures all waste is collected and directed back into the cycle.

– Probability Studies: Recommending studies on management, economic systems, and motivational aspects to enhance the overall waste management system.

These conclusions highlight the need for a more streamlined and collaborative approach between stakeholders involved in recyclable waste management and local organizations. The recommendations put forth can significantly enhance the efficiency and effectiveness of the waste management cycle within Maha Sarakham Municipality and its related areas.

Suggestions

These guidelines outline a structured approach for establishing connections and integration between the private sector and Maha Sarakham Municipality in recyclable waste management:

(1) Agreement and Collaboration:

– Partnership Formalization: Forming agreements between private entrepreneurs managing recyclable waste and the Municipality. Define roles and responsibilities clearly, outlining waste compilation and transfer procedures from various communities to these entrepreneurs for better management.

– Specification of Roles: Clearly stipulating the management roles and types of recyclable wastes to ensure mutual benefit between the entrepreneurs and the Municipality.

Regarding the establishment of agreements, implementation of collection fees, and facilitation of waste flow:

– Formal Agreements: Establishing formal agreements between the Municipality and recyclable waste–buying businesses to outline types of waste purchased and buying rates.

– Collection Fee System: Introducing appropriate fees based on waste types or quantities collected to incentivize proper waste management.

– Organized Flow: Structuring agreements and fee systems to channel wastes into the system in an organized manner, ensuring efficient processing and utilization.

(2) Community Awareness and Participation:

– Promoting Awareness: Initiate awareness campaigns to educate people about the importance and benefits of segregating recyclable wastes from general waste. Focus on urban communities with historically lower awareness levels.

– Establishing Collection Points: Create easily accessible collection points that gather different types of recyclable wastes. Analyze the flow of each waste type to ensure efficient sorting and readiness for integration into the proper waste management system.

(3) Improvement of Waste Disposal Infrastructure:

– Differentiated Receptacles: Implementing clear differentiation in bin colors or providing designated receptacle points in communities, shopping malls, or public places. This differentiation assists in encouraging proper waste segregation among the public.

(4) Continuous Market Studies and Motivation:

– Market Analysis: Conducting regular studies on recyclable waste buying markets within the governmental mechanism. This analysis aims to motivate entrepreneurs and communities by

providing insights into market opportunities and continuous integration of unmanaged wastes into the system.

These guidelines offer a structured framework for collaboration, awareness, infrastructure enhancement, and ongoing market studies. Implementing these suggestions can significantly improve recyclable waste management practices, promote community participation, and establish effective connections between the private sector and the Municipality for sustainable waste management initiatives.

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