

Evaluating Material Recovery Facilities and Community Engagement in Lugait, Misamis Oriental, Philippines

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Abstract

The study aimed to evaluate the Material Recovery Facilities (MRFs) operation and implementation in the municipality of Lugait, Misamis Oriental, Northern Mindanao, Philippines. The study also looked into the community's knowledge, perception and attitudes towards MRFs in their barangay together with the analysis of gender considerations. The study did interviews with MRF personnel in each barangay, and interviews with community residents living close to MRFs. Results were analyzed using descriptive statistics and basic gender gap analysis. Results showed that the MRFs are female-dominated workforce, and that there is a need for increased education and awareness about MRFs and recycling initiatives in the community. Residents generally have a positive perception of the MRF. Female respondents tend to have a slightly more positive perception of the MRF than male respondents. There is a strong majority support for the existence of the MRF in the barangay, and there was a high appreciation for MRF workers.

Introduction

As stated in RA 9003 (Ecological Solid Waste Management Act of 2000), Material Recovery Facilities (MRFs) include the following: a) Solid waste transfer stations or sorting station facilities where waste is organized and separated based on its type and content; b) Drop-off centers where residents can deliver segregated garbage; c) Composting facilities where biodegradable garbage undergoes a process of transformation into compost; and d) Recycling facilities where recyclable materials are treated and prepared for reuse.

Section 32 of the law requires the development of Material Recovery Facilities (MRFs) in barangays or groups of barangays, with the aim of promoting waste management at the local level. RA 9003 seeks to shift focus from open dumps to priority resource recovery through Material Recovery Facilities (MRFs).

Section 33 of the law emphasizes the importance of community involvement in promoting public education and awareness programs. These campaigns aim to support the operations of Material Recovery Facilities (MRFs) and promote the practice of source separation.

The most important aspects of MRFs include the following: a) The efficiency and efficacy of MRFs: These are determined by examining the facility using measures such as production, recovery rates, sorting accuracy, and environmental impact, b) the social and economic effects, including the use of informal garbage collectors, the creation of employment opportunities, the active participation of the community, and the viability of the financial situation, c) gender dynamics in the context of MRF activities, including the promotion of gender equality and the provision of equal opportunity and participation for both men and women, d) enhancing public knowledge and engagement in waste segregation by including informal waste collectors in the formal waste management system is a recommendation, and e) one of the challenges is that there are limitations in terms of finance, infrastructure, and operational effectiveness.

The RA 9003's purpose is to establish sustainable waste management in the Philippines, and Material Recovery Facilities (MRFs) collectively play a significant part in the achievement of this objective. It is possible for MRFs to make major contributions to the cleanliness of the environment, the health of the community, and the economic inclusion of the community by addressing problems and making the most of their potential.

As such this study aimed to evaluate the operational effectiveness of the MRFs in the municipality of Lugait, Misamis Oriental and to assess gender dynamics and community knowledge, perception, and attitudes towards MRFs. In turn, this study could provide a holistic understanding of MRFs in Lugait, their operational strengths and weaknesses, and the complex social fabric that surrounds them. This insight could not only form future strategies for enhancing the effectiveness of MRFs but also paved the way for a more sustainable waste management future for Lugait and beyond.

Methodology

Study area

The study was done in the municipality of Lugait, Misamis Oriental. It is a 2nd class municipality in the province of Misamis Oriental, Philippines. According to the 2020 census, it has a population of 20,559 people. Lugait is bounded on the west by Iligan Bay; north by the municipality of Manticao, Misamis Oriental; and south by Iligan City. As the westernmost municipality of Misamis Oriental, it lies approximately 80 km from the regional capital of Northern Mindanao, Cagayan de Oro. It is also approximately 17 km north of Iligan City. It has a total land area of 27.45 km². The coasts of Lugait are

suitable for anchorage and navigation. Lugait's weather patterns follow the wet and dry seasons prevalent throughout the country. It however enjoys a typhoon free topography. Lugait is politically subdivided into 8 barangays: Aya-aya, Betahon, Biga, Calangahan, Kaluknayan, Talacogon (Lower Talacogon), Poblacion, and Upper Talacogon (Philippine Standard Geographic Code, 2023).

Entry Protocol

Prior to the conduct of the study of the study a permission letter was submitted to the Mayor's Office of Lugait. The letter stated the purpose of the activity, when to conduct the activity, the number of people who will be doing the interviews, and the persons to interview. As a form of approval an endorsement letter from the Mayor for each of the barangays of Lugait was issued. The endorsement letter was duly submitted to each barangay captain upon entry to the barangay.

Gathering of primary and secondary data

Household interview (HI) (Siemiatycki,1979) was done among houses situated close to the MRF. Interviews of MRF personnel in all barangays was done as well. Photos of existing MRFs and its corresponding measurements were taken. Secondary information regarding existing number of MRFs, its location, names of barangay captains were sourced from the municipal MPDO office. Other used were taken from the internet.

Sampling and Data Collection

Since information about the number of personnel per MRF was not available, the study team interviewed all available persons of concern, thus only a total of 13 personnel all representing various positions across all existing MRFs were interviewed. The very small sample size was due to the recent barangay elections that brought about changes in political positions in each barangay. Most of the previous MRF personnel were due for replacement by the present set of barangay captains. For the community residents a purposive, stratified random sampling was used to determine the number of respondents per barangay. A total of 95 respondents were interviewed. The choice of respondents was also made in such a way that both sexes be represented equally. However, since some residents living close to MRFs refuse to be interviewed the breakdown of respondents was 46 Male, and 49 Female.

The study used quantitative data collection methods using an interview schedule. The MRF personnel were asked about the operational aspects of the MRFs, reviewing the capacity, production, recovery rates, and sorting accuracy. This objective sought to understand how efficiently these facilities are functioning, identifying both strengths and areas for improvement. The community residents were asked about their knowledge, perceptions, and attitudes towards MRFs. Understanding their level of awareness, their opinions on the facilities' effectiveness, and their potential concerns are critical in building trust and fostering a collaborative approach to waste management. Furthermore, the researcher looked into the unseen forces at play: gender dynamics within MRF operations.

Data Analysis

The study used descriptive statistics to analyze the survey data including testing the relationship of socio-demographic factors and gender roles. The quantitative data from the interviews was analyzed using the following analysis:

MD = male dominated, higher participation of men is observed

FD = female dominated, higher participation of women is observed

E= equal participation of male and female is observed

The formula of gender gap is:

Gender gap = frequency of male responses - frequency of female responses

Total number of male respondents - total number of female respondents

Ethical Considerations

The study observes the ethical guidelines for research when working with people. The respondents were briefed about the activity and how their responses will be treated confidentially and were formally asked permission to be interviewed.

Results and Discussion

Effectiveness of MRF Operations, Purpose and Function

The primary purpose of the MRF is segregation and garbage collection. This is mentioned by several MRF workers in both the female and male categories. The specific types of recyclable materials processed by the MRF include busted bulbs, plastic bottles, steel, old tires, and batteries. The capacity of the MRF is not clearly defined, with operations and processes merely on sorting and processing of recyclables at the MRF involves biodegradable and non-biodegradable segregation, with some materials being sent to Holcim for further processing. Non-recyclable materials are either not accepted, placed in a compost pit, or accepted for some reason that is not entirely clear. The educational programs offered by the MRF primarily focus on seminars and IEC (Information, Education, and Communication) campaigns about recycling.

Gender and Workforce

The data table does not provide a clear picture of the number of male and female employees at the MRF. There is also limited information about the average wage for women and men, benefits and opportunities for employees, and whether the work and responsibilities are the same for both genders. Overall, the data table provides some general information about the MRF's operations and its role in the community. However, there are many gaps and inconsistencies in the data, making it difficult to draw definitive conclusions.

Females make up 61.54% of the MRF personnel, while males constitute only 38.46%. This indicates a significant gender gap of -23.08% in favor of females. This gender imbalance could have various implications, both positive and negative, depending on the specific context and goals of the MRF. To fully understand the implications of this gender distribution, it's essential to consider the nature of the MRF's work, its organizational culture, and the broader social and cultural context in which it operates.

Overall, female personnel make up a larger proportion of MRF personnel across barangay locations, comprising 53.85% compared to 23.08% for males (Table 1). Gender distribution varies by barangay: Ayaaya is male-dominated with 7.69% males and no females. Betahon, Kaluknayan, Poblacion, and Upper Talacogon are female-dominated, with females outnumbering males by 7.7% to 15.38%. Kalanghan has an equal distribution of males and females at 7.69% each. The overall gender gap is -30.77%, favoring females. The most pronounced gap is in Upper Talacogon, with 15.38% more females than males. Kalanghan is the only barangay with no gender gap, having equal male and female representation.

The findings suggest that MRF personnel generally reflect a fair representation of females across barangays.

Further exploration is needed to understand factors contributing to the gender distribution differences across barangays, such as social norms, employment opportunities, or recruitment strategies.

Table 1. Distribution of MRF personnel grouped according to barangay location.

Barangay Location	Male	Female	Gender Gap	Analysis
Aya-aya	7.69	0	7.69	MD
Betahon	15.38	23.08	-7.7	FD
Kalangahan	7.69	7.69	0	FD
Kaluknayan	0	7.69	-7.69	FD
Poblacion	0	7.69	-7.69	FD
Upper Talacogon	7.69	15.38	-7.69	FD

Knowledge of the community towards MRFs

Results of interview about the knowledge of community residents towards Material Recovery Facility. The majority of respondents answered "Yes" for most questions, indicating a generally good understanding of the MRF and its role in waste management. Over 90% of respondents correctly identified the MRF's role in waste management, recycling, and sorting recyclables. Around 67% of respondents knew the location of the nearest MRF and could provide contact information. Over 75% of respondents understood the general process of how recyclables are sorted and processed at the MRF. A majority of respondents acknowledged the environmental benefits of recycling and the MRF's positive impact. Both genders expressed concern for the safety of MRF workers, with over 65% agreeing that it's important. Residents recognized the economic benefits the MRF brings to the community and its positive impact on sustainability efforts. There was a high level of openness (over 90%) to new technologies and approaches at the MRF. On Gender differences, females tended to have slightly higher levels of knowledge than males for most questions. For example, 63.04% of females knew what an MRF is compared to 43.16% of males (Table 2).

Perceptions of the community towards MRFs

Results on residents' perceptions of a Material Recovery Facility. There is a positive overall perception among the residents about MRF. Most respondents answered "Believed" for most questions, indicating that they believe the MRF is important, well-run, and beneficial to the community (Table 3).

For gender differences, the female respondents tend to have a slightly more positive perception of the MRF than male respondents. For example, 93.88% of females believe the MRF is a necessary and important component of the recycling process, compared to 88.46% of males.

Specifically, 91.30% of females and 85.71% of males believe the MRF is a necessary and important component of the recycling process; 89.13% of females and 83.67% of males perceive the MRF as a clean and well-maintained facility; 89.13% of females and 81.58% of males believe the MRF is operated in an environmentally responsible manner; 63.04% of females and 42.86% of males believe the MRF contributes to the barangay's sustainability efforts; 41.05% of females and 45.26% of males believe operating an MRF is complex; over 90% of both genders agree that MRF workers' hard work should be appreciated. The majority of both genders support the MRF's educational programs. Residents acknowledge the economic benefits the MRF brings to the barangay and its positive impact on the community. There's a high level of agreement (over 90%) on being open to new technologies and innovative approaches at the MRF.

Attitudes of the community towards MRFs

There's strong support for the MRF's existence and operations among community residents (Table 4). Agreement rates for most statements are above 90%, indicating a positive attitude towards the facility. Females generally more supportive than males: While both genders express positive views, females

consistently show higher levels of agreement with statements about the MRF's benefits, importance, and impact. Males are more likely to believe that operating an MRF is easy (76.09%), while females are less likely to agree (65.31%). This suggests potential differences in understanding or expectations regarding the facility's operations. A majority of both genders agree that concern for MRF worker safety is important, with a slightly higher percentage of females (65.31%) than males (76.09%) indicating this belief. There's strong agreement (over 90%) that MRF workers' hard work should be appreciated, and a majority also support the MRF's educational programs. Residents acknowledge the economic benefits the MRF brings to the barangay and its positive impact on the community. There's a high level of openness to new technologies and innovative approaches at the MRF, suggesting a willingness to embrace advancements in waste management practices.

Table 2. Knowledge of community residents towards a Material Recovery Facility (MRF)

Questions to respondents	Answered Yes		Gender Gap	Analysis	Answered No		Gender Gap	Analysis	Had No idea		Gender Gap	Analysis
	Male	Female			Male	Female			Male	Female		
1. Do you know what is an MRF?	63.04	93.88	-30.83	FD	23.91	6.12	17.79	MD	13.04	0	13.04	MD
2. Do you know what is the role of an MRF in waste management?	65.22	91.84	-26.62	FD	21.74	2.04	19.70	MD	13.04	6.12	6.92	MD
3. Do you know what type of wastes are collected in an MRF?	73.9	91.84	-17.93	FD	15.22	6.12	9.09	MD	10.87	2.04	8.83	MD
4. Do you know the general process of how recyclables are sorted and processed at an MRF?	76.1	87.76	-11.67	FD	8.70	10.20	-1.51	FD	15.22	2.04	13.18	MD
5. Do you know the Environmental benefits of recycling	69.6	85.71	-16.14	FD	10.87	10.20	0.67	MD	17.39	6.12	11.27	MD
6. Do you know where the nearest MRF and provide its location and contact information?	67.39	73.47	-6.08	FD	19.57	24.49	-4.92	FD	8.70	2.04	6.66	MD
7. Can you explain contamination and how it can affect the recycling process?	67.4	63.27	4.12	MD	21.74	20.41	1.33	MD	17.39	16.33	1.06	MD
8. Can you explain the proper ways to prepare recyclables for collection or delivery to an MRF?	78.3	73.47	4.79	MD	6.52	8.16	-1.64	FD	17.39	16.33	1.06	MD
9. Can you explain your own recycling habits?	84.8	79.59	5.19	MD	8.70	8.16	0.53	MD	6.52	12.24	-5.72	FD

10. Do you know where to find information or educational programs about recycling and MRFs in your barangay?

71.7	67.35	4.39	MD	13.0 4	16.33	-3.28	FD	15.22	16.33	-1.11	FD
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Table 3. Perception of community residents towards a Material Recovery Facility (MRF)

Questions for respondents	Answered Believed				Answered Did Not Believe				Had No comment			
	Male	Female	Gender Gap	Analysis	Male	Female	Gender Gap	Analysis	Male	Female	Gender Gap	Analysis
1. Do you believe that the MRF is a necessary and important component of the recycling process?	91.30	93.88	-2.57	FD	4.35	0.00	4.35	MD	4.35	6.12	-1.77	FD
2. Do you perceive that an MRF is a clean, well-maintained facility?	89.13	91.84	-2.71	FD	2.17	2.04	0.13	MD	8.70	6.12	2.57	MD
3. Do you believe the MRF is operated in an environmentally responsible manner?	89.13	91.84	-2.71	FD	0.00	2.04	-2.04	FD	8.70	8.16	0.53	MD
4. Do believe that the MRF is contributing to the barangay's sustainability efforts?	63.04	42.86	20.19	MD	23.9 1	48.98	-25.07	FD	13.04	8.16	4.88	MD
5. Do believe that the operation of an MRF is a complex one?	84.78	87.76	-2.97	FD	4.35	8.16	-3.82	FD	10.87	4.08	6.79	MD
6. Do appreciate the challenges faced by MRF operators in sorting and processing recyclables?	84.78	95.92	11.14	FD	6.52	0.00	6.52	MD	6.52	6.12	0.40	MD
7. Do you believe the MRF is taking steps to minimize contamination and improve efficiency?	84.78	91.84	-7.05	FD	10.8 7	6.12	4.75	MD	4.35	2.04	2.31	MD
8. Do you believe that the MRF can handle recyclables responsibly?	82.61	87.76	-5.15	FD	10.8 7	4.08	6.79	MD	6.52	8.16	-1.64	FD
9. Do believe that the MRF can create jobs and economic opportunities for the barangay?	84.78	83.67	1.11	MD	6.52	0.00	6.52	MD	8.70	16.33	-7.63	FD
10. Do you appreciate the educational and outreach programs of the MRF, (if any)?	89.13	100.00	10.87	FD	4.35	0.00	4.35	MD	6.52	0.00	6.52	MD

Table 4. Attitude of community residents towards a Material Recovery Facility (MRF)

Questions for respondents	Agreed to the Statement		Gender Gap	Analysis	Disagreed to the Statement		Gender Gap	Analysis	Had No comment		Gender Gap	Analysis
	Male	Female			Male	Female			Male	Female		
1. Do you agree to support the existence of the MRF in the barangay?	93.48	100.00	-6.52	FD	4.35	0.00	4.35	MD	2.17	0.00	2.17	MD
2. Do you agree that the MRF is effective in sorting and processing recyclables?	91.30	97.96	-6.65	FD	6.52	0.00	6.52	MD	2.17	2.04	0.13	MD
3. Do you agree to use the MRFs to dispose of your recyclables?	89.13	93.88	-4.75	FD	8.70	6.12	2.57	MD	2.17	0.00	2.17	MD
4. Do agree that the MRF is an important component of the recycling process?	91.30	93.88	-2.57	FD	6.52	6.12	0.40	MD	2.17	0.00	2.17	MD
5. Do you agree that the operation of the MRF is easy?	76.09	65.31	10.78	MD	15.22	18.37	-3.15	FD	8.70	16.33	-7.63	FD
6. Do you agree that the hard work of MRF workers be appreciated?	91.30	100.00	-8.70	FD	6.52	0.00	6.52	MD	2.17	0	2.17	MD
7. Do you agree that there is a need to be concerned about the safety of MRF workers?	76.09	65.31	10.78	MD	13.04	22.45	-9.41	FD	10.87	12.24	-1.38	FD
8. Do you agree that the MRF bring economic benefits to the barangay?	86.96	87.76	-0.80	FD	8.70	8.16	0.53	MD	4.35	4.08	0.27	MD
9. Do you agree that the MRF educational programs be appreciated?	86.96	93.88	-6.92	FD	4.35	0.00	4.35	MD	8.70	6.12	2.57	MD
10. Do you support the MRF's efforts to engage with the barangay?	91.30	97.96	-6.65	FD	6.52	0.00	6.52	MD	2.17	2.04	0.13	MD
11. Do you agree that the MRF have a positive impact on the barangay?	91.30	100.00	-8.70	FD	4.35	0.00	4.35	MD	4.35	0.00	4.35	MD
12. Are you open to new technologies and innovative approaches being implemented by MRFs?	91.30	97.96	-6.65	FD	6.52	0.00	6.52	MD	2.17	2.04	0.13	MD

Gender Representation in the Workforce

The data suggests a potential imbalance in gender representation at the MRF. While the exact numbers are unclear due to inconsistencies in responses, it seems there might be more female employees than male employees. The types of jobs mentioned for women and men seem to differ. Men are more often associated with leadership positions like supervisor and purok president, while women are mentioned in roles like secretary and utility. This could indicate potential gender bias in job assignment or career progression within the MRF. The data on wages is inconclusive. While some respondents mention a wage gap between men and women, others report equal pay or are unsure. Further investigation is needed to determine the actual pay disparity, if any.

In terms of gender and occupational health and safety suggests that the physical demands of the job might be perceived differently by men and women. Some respondents mention that the hard jobs are for men, while others indicate that the work is the same for both genders. This could be due to various factors, including assigned tasks, personal experiences, or societal norms. The data is inconsistent regarding exposure to hazardous substances like chemicals, dust, or fumes. Some respondents believe both genders are equally exposed, while others suggest men face a higher risk. More research is needed to understand the specific hazards and ensure equal protection for all employees. Similar to the physical demands, there are conflicting views on whether workstations and equipment are suitable for both genders. Further assessment is necessary to ensure a safe and comfortable work environment for all employees, regardless of their gender.

Gender-Responsive Workplace Policies

While there is some indication of efforts to promote equal employment opportunities, the data is inconclusive. More transparency and data-driven approaches are needed to ensure fair hiring and promotion practices. The data suggests potential concerns regarding gender-based discrimination and harassment. While some respondents report the existence of anti-discrimination policies, others remain unsure or express doubts about their effectiveness. A thorough review and enforcement of such policies, along with awareness-raising campaigns, are crucial to create a respectful and inclusive workplace. The data indicates that gender-sensitive training and capacity-building opportunities might be limited or unevenly distributed. Providing accessible and relevant training for all employees on topics like gender equality, unconscious bias, and respectful communication can foster a more inclusive and supportive work environment.

Conclusions and Recommendations

The study was able to gather the needed information. Thus, it would conclude the study with the following statement:

1. There is a strong support for the MRF's existence and operations among community residents.
2. The barangay MRFs is doing well in educating and communicating with residents about its operations and benefits.
3. The MRF could continue to build on its positive reputation by continuing to provide good service and being a responsible member of the community.
4. The survey results show that most people have some general knowledge about MRFs, including their role in waste management, the types of waste they collect, and the sorting and processing of recyclables. However, there is less knowledge about the specific locations of MRFs, contamination, and how to prepare recyclables properly.

5. The survey results show that the general perception of MRFs is very positive. Most respondents believe that MRFs are important, well-run, and beneficial to the community. There is also a strong appreciation for the challenges faced by MRFs and the efforts they are making to improve.
6. The survey results show a very positive attitude towards the MRF in the barangay. People seem to believe that the MRF is effective, important, and beneficial to the community.
7. A notable finding is that both genders agree on the need to be concerned about the safety of MRF workers, highlighting potential safety issues that warrant attention.

The results of the study both gave informative and inconclusive results due to various complex factors that surround barangay Material Recovery Facilities. Thus, the several actions are recommended:

1. For MRF personnel, explore the underlying factors contributing to the gender imbalance, especially for senior citizens; develop strategies to promote gender diversity and inclusivity within MRF personnel, potentially through targeted recruitment and retention initiatives, and regularly track gender representation to assess the effectiveness of implemented strategies.
2. For gender gap, conduct deeper analysis to uncover the root causes of the gender gap and its potential impacts, ensure that the MRF's gender distribution aligns with its organizational goals and values, for diversity and inclusion priorities, consider strategies to attract and retain more male personnel, while also ensuring equitable opportunities for women.
3. There is a need for better communication about the MRF's processes to align understanding across genders.
4. Address worker safety concerns, that is, prioritize measures to ensure the safety of MRF workers, potentially through training, equipment upgrades, and safety protocols.

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Conflicts of Interest

The authors have disclosed no conflicts of interest.

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