

Collecting and Recycling Practices in Barangays of Naujan, Oriental Mindoro: Basis for Proposed Solid Waste Management Plan

Cristia F. Rojas*, Leonel C. Mendoza, Dr. Elvi C. Escarez, Jermaine Ritzchelle D. Marquez

College of Teacher Education, Mindoro State University (MinSU)-Calapan City Campus,
Masipit, Calapan City, Oriental Mindoro, Philippines 5200

*Corresponding author: cristiarojas21@gmail.com

Received February 27, 2022; Revised March 28, 2022; Accepted April 05, 2022

Abstract The world is struggling with a waste problem that is affecting public health, polluting the environment, and threatening to drown some poor countries in toxins, signaling the need for an efficient solution. The goal of this study was to identify the various wastes collected and recycled in Naujan, Oriental Mindoro, as well as to define resident practices connected to waste collection and recycling that might be used to establish a waste management strategy. This study included descriptive, correlational, and comparative research approaches. The profile of the respondents, as well as the level of collecting/recycling behaviors and their relationship, were determined using a self-made questionnaire. The bulk of the respondents was between the ages of 41 and 50, indicating that they were in the center of adulthood. Furthermore, biodegradable waste items account for a significant portion of the municipality's overall garbage. Unfortunately, a large number of materials were not effectively recycled. Moreover, the barangay's waste segregation collection practice was at a moderate degree. The establishment of the municipality's Solid Waste Management Board may improve waste collection and transportation methods in Naujan. The board and government agencies such as DENR and DA may provide composting and solid waste management training and information.

Keywords: *collecting and recycling practices, compostable waste, Naujan, Oriental Mindoro, special waste, waste management*

Cite This Article: Cristia F. Rojas, Leonel C. Mendoza, Dr. Elvi C. Escarez, and Jermaine Ritzchelle D. Marquez, "Collecting and Recycling Practices in Barangays of Naujan, Oriental Mindoro: Basis for Proposed Solid Waste Management Plan." *American Journal of Environmental Protection*, vol. 10, no. 1 (2022): 29-40. doi: 10.12691/env-10-1-4.

1. Introduction

The growing waste problem, which harms public health, pollutes the environment, and threatens to drown some poor countries in toxicity, is one of the most disheartening concerns facing the world. Garbage is becoming an increasingly serious issue for both us and the environment. People are using more natural resources and increasing pollution in our environment as they continue to waste more. Every year, the United States produces over 220 million tons of waste. For example, in 2007, the United States generated almost 260 million tons of municipal solid waste. This equates to around 2.1 kilograms per person every day [1].

The average daily global municipal solid waste (MSW) creation per person is roughly 1.2 kg and this amount is predicted to climb to 1.5 kg by 2025. As a result, every state and municipal government faces difficulty with appropriate garbage disposal as a result of excessive waste output. The issue is that today's era is characterized by

throw-away consumerism, with businesses and manufacturers aiming to maximize profits by making one-time-use products that do not prioritize reuse, recycling, or the use of ecologically friendly materials. Asia, on the other hand, has experienced rapid urbanization and population increase. A high population rise in Asian countries will have significant ramifications for a range of urban environmental challenges, such as solid waste management. Waste management is currently a serious burden in Asian countries, as it contributes to environmental issues [2].

As India's population rises, the country has challenges in handling solid waste. Every year, the country generates 62 million metric tons of rubbish, yet only 43 million are collected. Twelve million metric tons of garbage are recycled or disposed of in different ways, while the remaining 31 million metric tons are dumped. The end product isn't pleasing. Almost 19 million metric tons of waste are dumped on streets and rivers, or illegally burned. However, government officials saw the waste's huge economic potential - a \$13 billion industry by 2025 — and decided to take action [3].

Ordinary rubbish is either burned or buried throughout the majority of the world, including North America. Neither is beneficial to people or the environment. Incinerating garbage emits harmful gases and dust (particulate matter), which contribute to global warming and damage lakes, forests, oceans, and towns half a world away from their source. In most industrialized countries, incinerators currently remove huge amounts of particulates and contaminants, resulting in cleaner air. The majority of what they remove, however, ends up in a landfill. Garbage burying pollutes both the air and the water, and simply carrying it to the landfills consumes a rising quantity of important fossil fuels, resulting in greater pollution and other issues [4].

The majority of current waste management initiatives are concentrated at the local government level and are based on high-tech/high-energy waste disposal methods such as landfill disposal. However, these methods are becoming increasingly costly and inefficient in terms of energy use. The financial costs of managing the long-term environmental implications of trash disposal are higher than what is charged for this service, and corrective action is sometimes impossible. Environmental costs, such as negative impacts on habitat, animals, and biodiversity, are also taken into account. To put it another way, trash disposal is unsustainable and has long-term consequences for future generations [5].

The Philippines is grappling with one of the world's most serious environmental problems: inappropriate waste disposal. It resulted in more serious issues that harm not just the environment but also people's health and lives. This issue may be remedied or will continue to be a concern for the country in the coming years. Waste management mistakes have major consequences for ground and surface water contamination, flooding, air pollution, and water pollution, among other things. If individuals continue to operate in this manner, they will suffer in the coming years. When it comes to consuming contaminated water as a result of incorrect waste disposal, health will be protected.

Furthermore, the Philippines was placed third on the source of plastic entering into oceans in February 2015. Every year, the country produces 2.7 million metric tons of plastic waste, of which 20%, or 521,000 tons, ends up in the ocean. Despite this, the country had one of the highest garbage collection rates in the region, with an average of 85 percent across the country and nearly 90 percent in some densely populated areas [6].

The Philippine Ecological Solid Waste Management Act of 2000 defines recycling as "the treatment of used or waste materials through a process of making them sustainable for beneficial use and other purposes and includes any process by which solid waste materials are transformed into new products in such a way that the original products may lose their identity." [7].

Moreover, many elder Filipinos argue that recycling is not a new concept to them. Food jars are reused, old furniture is refurbished/transformed to new uses, and even leftover lunch is "recycled" into new supper fare at the individual family level. Modern lives and a consumer/convenience-oriented society, on the other hand, have fostered a throwaway attitude. Recycling, on the other hand, is making a comeback [8].

Additionally, trash management encompasses all components of the waste management process, from generation to final disposal. Waste is collected, transported, sorted, treated, and disposed of in this process. Monitoring and regulation, which apply to both commercial and home waste disposal, are also included. Trash management, in general, refers to all types of waste, including industrial waste, as well as raw materials and finished goods. Garbage management is a concept that aims to limit the harmful consequences of waste on the environment. The phrase "3 Rs" – reduce, reuse, and recycle – is meant to categorize waste management into three important aspects in terms of trash reduction suitability. There are numerous benefits to reducing, reusing, and recycling. Everything we use takes resources and may need to be disposed of once we're done with it. Reduced packing, in particular, can have a significant influence on environmental damage.

Furthermore, rather than dumping products, reusing them, finding new possible applications for them, or simply passing them on to others can help conserve resources and money. Similarly, most of the products that individuals use daily may be recycled. The advantages of recycling are numerous, including the reuse of materials and the generation of energy from landfills and combustion processes [9].

The study focused on garbage collection and recycling procedures in Naujan Municipality, Oriental Mindoro, and was limited to the various wastes generated by inhabitants, which would serve as the foundation for the planned waste management. Naujan is a first-class municipality in the Philippines' province of Oriental Mindoro. It is the province's largest municipality, with 50,310 hectares (124,300 acres) and accounting for 12 percent of the province's total land area. Act 1280 gave it the status of a full-fledged municipality on January 4, 1905. Its limits were set in stone permanently in 1919. Naujan has seventy (70) barangays, with a population of 102, 998 people according to the 2015 census.

When it comes to the matter at hand, the Naujan Municipality Trash Management Team plays a critical role in reducing and eliminating the waste produced by humans in everyday life. To assure zero waste, dump truck drivers follow a series of schedules around the whole municipality, including private and public schools. Even though there is a municipality rule prohibiting garbage from being thrown anywhere, wastes in the surrounding area are nonetheless visible.

However, due to a lack of personnel, domestic waste is not collected completely. Everyone is affected by the current trash problem. Everyone should bear some kind of responsibility. The researcher hopes to learn more about Naujenos' sense of responsibility in trash management through this study. The study's goal is to find out what types of waste are collected and recycled in these municipalities, as well as how inhabitants collect and recycle. With these possibilities in mind, all Filipinos should place a premium on waste management.

Concerned organizations such as non-governmental organizations (NGOs), community-based organizations (CBOs), and municipal solid waste management (MSW) must take the lead in effectively educating all individuals and communities about zero waste and the 3R's Reduce,

Reuse, and Recycle. "If you aren't buying recycled things, you aren't actually recycling," says Ed Begley Jr., which is why this study on trash management in the Municipality of Naujan was conceived. Humans, regardless of which culture they belong to, should play an important role in effectively managing their trash. They should also be appropriately distributed with accurate knowledge and understanding of the importance of waste management today.

2. Objectives of the Study

This study aimed to determine the collecting and recycling practices in Naujan, Oriental Mindoro. Specifically, it aimed to: (1) determine the profile of the residents from the selected barangays in terms of age, gender, and residency; (2) determine the different collected and recycled solid wastes of the residents from the selected barangays of Naujan; (3) determine the extent of collecting and recycling practices of the residents from the selected barangays of Naujan; (4) determine the significant difference between the extent of collecting and recycling practices from selected barangays of Naujan; (5) determine the relationship between the profile of the residents and the extent of collecting and recycling practices from selected barangays of Naujan; (6) develop a solid waste management plan based on the results of the study.

3. Materials and Methods

3.1. Time and Place of the Study

This study was conducted in the top three (3) most populated barangays from the eight (8) districts of Naujan, Oriental Mindoro. The whole second semester was spent in conducting the study and analyzing the result of the study.

3.2. Research Design

The research method employed in this study was descriptive correlational and comparative.

A correlational study is a quantitative method of research in which two or more quantitative variables from the same set of subjects are compared to see if there is a relationship between them [10].

The researcher described the profile of the respondents of the study and determine the extent of collecting and recycling practices in Naujan. A test of relationship between the respondents' profile and the extent of recycling and collecting practices in Naujan was determined.

3.3. Research Locale

The study was conducted in Naujan, Oriental Mindoro. This municipality has the largest population growth rates in the province. The waste management of Naujan never stops finding solutions on how to alleviate the waste produced by residents in their everyday living. Knowing

the big responsibility, the researcher would also like to determine how responsible the residents are and if they have waste management practices applied at home that will be useful in disseminating information to help others and the environment.

3.4. Respondents of the Study

The respondents of the study were the 715 residents from eight (8) districts in Naujan, Oriental Mindoro. This sample size was generated using G-Power Analysis Software with the following assumptions: effect size of 0.30, alpha error probability of 0.05, and power of 0.95.

3.5. Sampling Technique

The study utilized proportional stratified random sampling technique to determine the number of respondents of the study. The selection was focused only on the top three (3) most populated Barangay per district in Naujan. The details of the respondent population and sample size of every barangay were presented below

Table A. Distribution of Respondents

DISTRICT	BARANGAY	HOUSEHOLD	RESPONDENTS
1	Estrella	577	35
1	Santiago	510	31
1	Motoderazo	431	26
2	Pinagsabangan II	599	36
2	Pagkakaisa	515	31
2	Pinagsabangan I	505	31
3	Bancuro	458	28
3	Bayani	395	24
3	San Agustin I	348	21
4	Montelago	458	28
4	Melgar A	358	22
4	Melgar B	372	23
5	Nag iba II	369	22
5	Bacungan	329	20
5	Pinahan	312	19
6	Barcenaga	1101	67
6	Santa Maria	638	39
6	Sampaguita	553	34
7	Aurora	706	43
7	Evangelista	650	40
7	Del Pilar	480	29
8	Inarawan	427	26
8	Mahabang Parang	341	21
8	General Esco	311	19
TOTAL	24	11743	715

3.6. Research Instrument

A self-made questionnaire composed of three (3) parts was utilized in the conduct of the study. The first part dealt with questions about the profile of the respondents including their age, gender, and the number of years of residency in their respective barangay. The second part dealt with the different wastes collected and recycled in twenty-four (24) selected barangays in Naujan while the last part was divided into two: collecting practices and recycling practices on waste management.

3.7. Scaling and Quantification

A five-point numerical scale with its statistical limits and description was used to describe the extent of collecting and recycling practices in the Municipality of Naujan. The scale is presented as follows:

Table B. Numerical Scale, Statistical Limit, and Verbal Description on the extent of collecting and recycling the waste in the Municipality of Naujan

Numerical Scale	Statistical Limit	Verbal Description
5	4.50-5.00	Very High
4	3.50-4.49	High
3	2.50-3.49	Moderate
2	1.50-2.49	Low
1	1.00-1.49	Very Low

3.8. Validation of the Instrument

In the conduct of the study, assistance was sought from different experts in the related field for the validation of the instrument. After constructing the questionnaire, this was sent to the different officials from the local DENR (PENRO and CENRO) and the environmental offices of the provincial government. Comments, suggestions and recommendations for the betterment of the research instrument were acknowledged and accepted.

3.9. Reliability of the Instrument

To determine the reliability of the instrument, ten non-respondents were requested to answer the instrument twice with ten (10) days of interval. After getting the raw scores, the researcher computed the reliability coefficient using Cronbach alpha.

Table C. Result on the reliability of the instrument

Variables	Cronbach's alpha	Internal Consistency	Interpretation
Collecting practices (for collection and transport at the barangay level)	0.7262	Acceptable	Reliable
Collecting practices (for waste segregation at the Barangay level)	0.8545	Good	Reliable
Recycling practices (for reuse and recycling of marketable materials at the barangay level)	0.8505	Good	Reliable
Recycling practices (for composting of organic materials at the barangay level)	0.8633	Good	Reliable
Recycling practices (for the existence of SWM policies at the barangay level)	0.7927	Acceptable	Reliable
Recycling practices (for information, education, and communication campaign at the barangay level)	0.8327	Good	Reliable

3.10. Data Gathering Procedures

The researcher sent a letter of request to the Mayor of Naujan and barangay captains to ask permission to conduct the study. Then visitation of the respondents was scheduled for the distribution of survey questionnaires and conducted interviews.

The questionnaires were personally administered by the researcher. Then, the retrieval of the questionnaires from the respondents was done immediately after the administration. A follow-up interview with the respondents was also done to supplement the data gathered from the instrument.

Finally, the data was consolidated, organized, tabulated, analyzed, and interpreted.

3.11. Statistical Treatment of Data

The statistical methods used in the analysis of data gathered are the following:

1. Frequency and percentage. This was used to analyze the profile of the respondents.
2. Weighted mean. Since the test scores were rated using the 5-point scale, weighted mean was used to compute the extent of collecting and recycling practices of the respondents.
3. t-Test for independent samples. This was used to compare the extent of collecting and recycling practices of the respondents.
4. Pearson's r. This was used to measure the extent of relationship between the profile of the respondents such as age and years of residency and the extent of collecting and recycling practices of the respondents.
5. Coefficient of Determination (R^2). This was used

to determine the proportion of the variance in the dependent variable that is predictable from the independent variable.

6. Scheffe Test. This was used to test the differences in mean in collecting and recycling practices.

4. Results and Discussion

4.1. Profile of the Residents from the Selected Barangays of Naujan

4.1.1. Age

The profile of the respondents from the selected barangays in Naujan in terms of their age is presented in [Figure 1](#) where it shows that there were 87 respondents, 12.17 %, who were in the age range of 20-30 years old. Another 190 respondents, 26.57 % whose age ranged within 31-40 years old. Additional 249 respondents, 34.83 % with age ranging from 41-50 years old and lastly 26.43 % whose age belonged in range of 51-60 age bracket made the 189 respondents. The youngest respondent was 22 years old. The oldest was 59 years old. According to the data, the bulk of the respondents was between the ages of 41 and 50, indicating that they were in the center of adulthood. This was a good reflection on the note that the majority of the people living in selected barangays were those with a sense of responsibility and community indulgence that could guide the youth of today to involve themselves in programs, projects, and activities relative to collecting and recycling practices of the community.

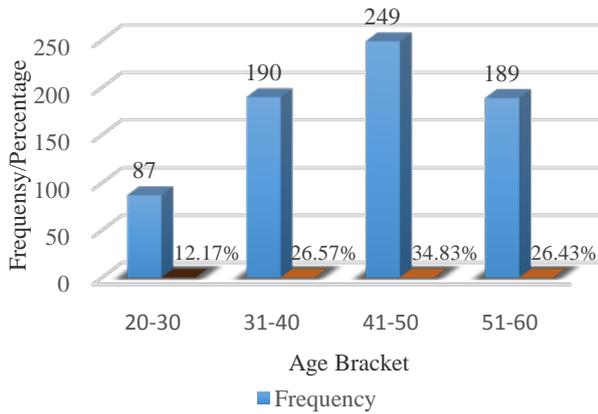


Figure 1. Distribution of Respondents as to Age

4.1.2. Gender

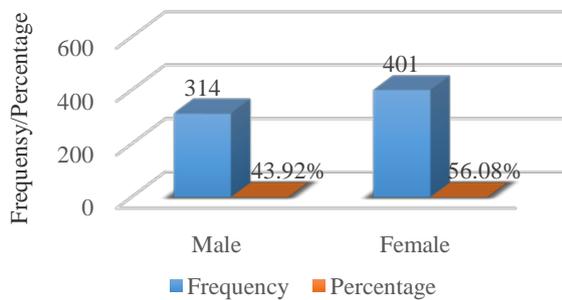


Figure 2. Distribution of Respondents as to Gender

It is evident in Figure 2 that out of the total respondents investigated for this study, more than half of (56.08%) of them were female whereas about 43.92% were found to be male.

The data suggested that there were more female respondent residents of the selected barangay in Naujan than males. This might be a good point for discussion because Tiwari [11] found out that household waste management practices are influenced by the demographic factors age, gender, education, occupation and income level. The study shows that women, rather than men, handle the household waste. Female participation was mostly involved in recycling, composting and landfill activities. The final research results show that women’s participation was found to be higher than that of men in managing household waste.

4.1.3. Residency

Another salient factor to be considered was the respondents’ length of residency which can be gleaned from Figure 3. It clearly shows that there are 329 respondents, 46.01 %, who were in the range of 30 years and above residency in the selected barangay in Naujan and this comprised the majority of respondents. Another 155 respondents, 26.68% are within 21-30 years of residency. Additional 124 respondents, 17.34% are within 11-20 years of residency and lastly 14.87% whose length of residency fell within the 0-10 year’s bracket which completed the 107 respondents. This was the smallest group of respondents.

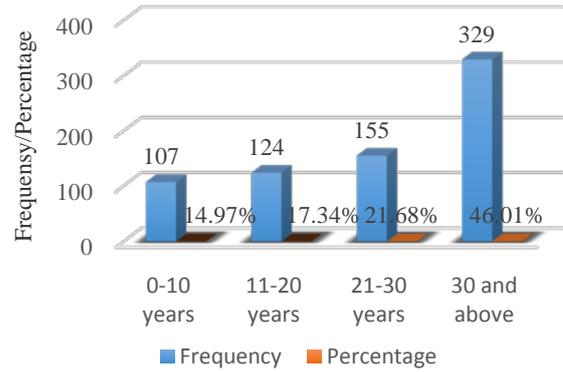


Figure 3. Distribution of Respondents as to Residency

This provided a good discussion because it correlated with a study entitled “Residents’ perception of solid waste disposal practices” by Kaoje et al. [12] that 55% of the residents were responsible for the poor sanitation while 38% said government and 7% don’t know who were responsible. For the cleaning of the surrounding, 41% of respondents said resident was responsible for cleaning their environment, 19% government and 40% said its responsibility of both government and the residents.

4.2. Different Solid Waste Collected and Recycled of the Residents from the Selected Barangays of Naujan

Table 1. Distribution of respondents as to compostable solid wastes collected and recycled

WASTES	TOTAL	PERCENTAGE (%)
Fruits and vegetable peeling	715	100.00
Leftover food	715	100.00
Vegetable trims	465	65.03
Fish/fowl/meat/animal entrails	297	41.54
Soft shells	94	13.15
Plant Debris/ Yard waste	646	90.35

The compositions of compostable waste collected in selected barangay of Naujan are shown in Table 1. It vividly shows that bulk of fruits and vegetable peeling and leftover food covers the total 715 or 100% of collected compostable waste materials. These records were accounted as the biggest number of collected compostable waste materials from the selected barangays of Naujan. However, a total of 646 or 90.35% included the plant debris and yard wastes and about 465 or 65.03% of compostable waste materials were composed of vegetable trims. The record was tailed by 297 or 41.54% collected fish/fowl/meat and animal entrails. The lowest record from compostable waste materials was soft shells of about 94 or 13.15%.

The data indicates that compostable waste materials share a great number in the total waste materials of the barangay and the municipality as well. It could be correlated to a study titled “Overview of waste disposal and landfills/dumps in Asian countries” that more organic waste, such as kitchen wastes, and fewer recyclable items,

such as paper, metals, and plastics are found at the rural areas. The percentages for paper and plastics (19% and 18%, respectively) observed in the Philippines were comparatively higher than in other developing Asian countries [13].

Table 2. Distribution of respondents as to recyclable solid wastes collected and recycled

WASTES	TOTAL	PERCENTAGE (%)
Newspaper	418	58.46
Ferrous Scrap Metal	522	73.01
Nonferrous Scrap Metal	522	73.01
Corrugated Cardboard	403	56.36
Aluminum	316	44.20
Glass	178	24.90
Office paper	380	53.15
Tin Can	507	70.91

In Table 2, recyclable wastes are defined as any waste material that is free of contamination, may be converted to a useful use, and can be changed into new products. Scrap metal, both ferrous and nonferrous, accounted for 522, or 73.01 percent, of the total recyclable materials collected in the Naujan barangay. This was the barangay's largest reported amount of recyclable materials. It was followed by 507 tin cans, accounting for 70.91 percent of the total. In addition, 418 newspapers, or 58 percent, 403 corrugated cardboards, or 56.36 percent, and 380 office papers, or 53.15 percent, were among the total recyclable items collected by the barangay and the municipality. Aluminium, with 316, or 44.20 percent, and glass, with 178, or 24.90 percent, contributed the least to the gathered recyclable materials.

These figures reveal that a significant amount of materials were not adequately recycled. Similarly, according to a news report, the creation of materials recovery facilities at the barangay level, where collecting of parched papers, plastics, and metal/aluminum glass might be enabled, should be encouraged. After that, they might be sold to junkshop owners and scrap purchasers, proving that there is "cash in garbage," as recycling campaigns claim [14].

Table 3. Distribution of respondents as to residual wastes collected and recycled

WASTES	TOTAL	PERCENTAGE (%)
Sanitary napkins	587	82.10
Disposable Diaper	494	69.09
Worn-out Rugs	715	100.00
Cartons which contain a plastic lining	358	50.07
Ceramics	351	49.09
Candy wrapper/sachets	715	100.00
Plastic	715	100.00
Styrofoam	312	43.64

The term "residual waste" refers to the material that remains after the waste treatment procedure has been completed. Such materials were also collected in Naujan's selected barangays, as shown in Table 3. The majority of

leftover waste was made up of 715 worn-out rugs, candy wrappers/sachets, and plastics, accounting for 100% of the total. It was followed by 587, or 82.10 percent, of sanitary napkins and 494, or 69.09 percent, of disposable diapers. Cartons with a plastic lining (358 or 50.07 percent), ceramics (351 or 49.095), and Styrofoam had the lowest number of leftover waste items (312 or 43.63 percent).

The statistics revealed the need of addressing the issue of residual waste management. This is an interesting topic to discuss because it is mentioned in the study "Review of the Waste Management System in the Philippines" [15], where they conducted a pilot testing of the Department of Science and Technology – Industrial Technology Development Institute (DOST-ITDI) Plastic Densifier technology in Payatas, Quezon City. Waste plastics, particularly styro, polyethylene, and polypropylene plastic bags, are converted into useful items such as walkway blocks, tabletops, seats, and floorings using this simple and economical technology.

Based on the number of collected residual waste items in the selected barangays in Naujan, this is a good strategy to use.

Table 4. Distribution of respondents as to special wastes collected and recycled

WASTES	TOTAL	PERCENTAGE (%)
Paint thinners	250	34.97
Household batteries	162	22.66
spray canisters	227	31.75
Large worn-out or broken furniture	120	16.78
Lamps	118	16.50
Bookcases	94	13.15
Filing cabinets	71	9.93
Discarded radios, stereos and TV sets	78	10.91
Worn-out or broken stoves, refrigerators	83	11.61
Oil	194	27.13
Tires	126	17.62

Specific garbage necessitates special treatment, specially trained personnel, and/or unique disposal procedures. Because of its number, concentration, or physical, chemical, or biological features, it may be classified as a particular waste. Table 4 shows the samples collected in the designated barangays of Naujan. Paint thinners accounted for the greatest number of special wastes collected in the selected barangay of Naujan, at 250 (or 34.97%). It was followed by 227 spray canisters, or 31.75 percent, and 194 oil canisters, or 27.13 percent. Household batteries accounted for 162 percent of the total special trash collected, while tires accounted for 126 percent. Large worn-out or broken furniture was also collected, accounting for 120 percent of the total. A total of 118 (or 16.50%) abandoned lamps and 94 (or 13.15%) discarded bookcases were also collected. Worn-out or broken stoves and refrigerators, with a total of 83 or 11.61 percent, discarded radios, stereos, and TV sets, with 78 or 10.91 percent, and file cabinets, with 71 or 9.93 percent, all contributed to the bulk of special waste items.

Despite information on correct and safe special waste identification, transportation, and disposal, a percentage of

these waste products were disposed of irresponsibly, according to the statistics. It's worth noting that properly disposing of hazardous household waste (HHW) helps to keep dangerous compounds out of the environment. When exposed to air, water, or other chemicals, hazardous home items can burn or start a fire, eat away at materials, destroy live tissue on touch, generate an explosion, or release deadly vapors, and damage or destroy cells and chromosomal material. These goods should not be placed in DPW's garbage or recycling receptacles, nor should they be mixed up with bulk trash collection items.

4.3. Extent of Collecting and Recycling Practices of the Residents from the Selected Barangays of Naujan

Table 5 reveals that families were aware of garbage segregation and classification at the barangay level, as it received the highest 3.55 mean. This demonstrates that waste separation is observed and done at the household level. The installation of waste bins and receptacles at key locations across the municipality, on the other hand, is moderately (3.27) observed by the respondents. The respondents assigned the same moderate (3.00) rating to the provision of containers and receptacles for each sort of garbage. Sponsoring of a contest or reward system at the barangay level, on the other hand, was moderately

observed (3.09), which could be related to a study that offers incentives to residents who practice waste segregation, but the residents refuse to accept the reward because they believe it is for their own good [16].

The management of special trash by professional and laboratory employees was somewhat (2.54) noticed by the respondents, indicating that this activity was not frequently seen at the barangay and municipality levels. The same was true for solid waste management contracts with private and municipal haulers, with a 2.54 mean that was described as moderate. The barangay received a 2.51 mean or moderate rating in the establishment of a cooperative to handle solid waste operations. Similarly, respondents reported a moderate description (2.50) for collecting broken glassware and disposing of it in a suitable box labeled "broken glassware," and a mean of 2.81 for transferring the remaining solid waste and disposing of it at a city or municipal landfill.

The total weighted mean (2.87) in Table 5 suggests that the collecting techniques of the selected barangay of Naujan were moderately observed. The collection processes at the barangay level can be blamed for varying levels of readiness in each municipality, barangay officials, and households in implementing waste segregation schemes. With the help of municipal officials and programs such as the Ecological Solid Trash Management Act, waste segregation has become a practice and a lifestyle choice [17].

Table 5. Mean on collecting practices as to waste segregation

No.	Items	Weighted Mean	Description
1	Segregates solid wastes at the house level	3.55	High
2	Designates wastes bins/receptacles at strategic places in the municipality	3.27	Moderate
3	Provides containers/receptacles for each type of waste to biodegradable, recyclable, non-recyclable of household wastes	3.00	Moderate
4	Sponsors contest or reward system in barangays following the proper waste segregation program	3.09	Moderate
5	Manages special wastes by professional and laboratory personnel	2.54	Moderate
6	Manages contracts with private/public hauler for solid waste disposal	2.54	Moderate
7	Sets-up cooperative to managed solid waste operations	2.51	Moderate
8	Collects broken glassware and disposes in a right box that is marked as "broken glassware"	2.50	Moderate
9	Brings remaining solid waste brought and disposed in city or municipal landfill	2.81	Moderate
Overall Mean		2.87	Moderate

Table 6. Mean on collecting practices as to collection and transport

No.	Items	Weighted Mean	Description
1	Provides properly designed containers or receptacles in selected collection points for the temporary storage of solid wastes while waiting collection and transfer to processing sites or to final disposal sites	3.1	Moderate
2	Designates collection points for the temporary storage of solid wastes while waiting collection and transfer to processing sites or to final disposal sites	2.84	Moderate
3	Collects segregated wastes for transport and final disposal of non-recyclable materials at the barangay level	2.72	Moderate
4	Schedules properly of segregated wastes for transport and final disposal of non-recyclable materials at the barangay level	2.82	Moderate
5	Collects materials for recycling separately from general to sorted directly from mixed waste	2.46	Low
6	Provides number of trucks in transporting solid wastes	2.80	Moderate
7	Provides properly trained officers to handle solid wastes disposal	2.66	Moderate
8	Provides separate individual compartments for each type of wastes in the municipal dump truck	2.87	Moderate
9	Ensures precautionary and sanitary measures in the collection and transport of solid waste	2.95	Moderate
10	Promotes the "3R's" (reduce, reuse, and recycle) locally when collecting solid waste	2.72	Moderate
11	Collects solid wastes daily at designated area	2.4	Low
12	Provides MRF for segregation, processing and or buying area for recyclables	2.63	Moderate
Overall Mean		2.75	Moderate

Along collection and transport, Table 6 demonstrates the collecting practices of the selected barangay in Naujan specifically for collection and transport at the barangay level. The respondents rated their barangay moderate (3.1) in providing properly designed containers or receptacles in selected collection points for the temporary storage of solid wastes while waiting collection and transfer to processing sites or to final disposal sites. Designation of collection points for the temporary storage of solid wastes while waiting collection and transfer to processing sites or to final disposal sites was given moderate (2.84) rating. The respondent provided another moderate (2.72) account of the collection of segregated trash for transportation and final disposal of non-recyclable items at the barangay level. Similarly, a moderate description was given to properly scheduling segregated wastes for transportation and final disposal of non-recyclable materials at the barangay level (2.82), providing a sufficient number of trucks to transport solid wastes (2.80), assigning properly trained officers to handle solid waste disposal (2.66), providing separate individual compartments for each type of waste in the municipal dump truck (2.87), and ensuring precautionary and sanitary measures in the c (2.63). Residents, on the other hand, noted both poor descriptions in terms of collecting recyclable goods separately from general waste to be sorted straight from mixed rubbish (2.46) and collecting solid wastes every day at a designated spot (2.40).

Due to their method and schedule of collection specified for each sort of garbage, the municipality of Naujan has moderately successful collecting and transportation tactics. They collect rubbish from businesses and houses every two days for biodegradable waste and every three days for non-biodegradable waste. The wastes collected are separated at their material recovery facility, while the remainder is disposed of in a dumpsite and buried with soil. They have three collectors and segregators, all of whom are outfitted with masks and other protective gear.

Low ratings, on the other hand, were given to collection and transportation procedures, notably the collection of materials for recycling separately from general waste to be sorted straight from mixed waste and the daily collection of solid wastes at a designated place. Residents at the

barangay level are said to have failed to gather materials for recycling. There was no rubbish collection on a daily basis at the authorized area. The collection and transportation methods might be improved if the municipality established a Solid Waste Management Board to provide composting training to citizens with the help of DENR and DA. As can be observed in these towns, the preparedness of these municipalities, as well as the implementation of skills and knowledge obtained through constituent trainings, contribute to reduce the amount of waste collected at source [17].

Table 7 shows the general strategy on reuse and recycling practices of marketable materials at the barangay level in the municipality of Naujan, which was moderate with a mean of 2.62. The same trend was seen at the barangay level, with a mean of 2.99 for the development of a material recovery facility, 3.09 for conducting seminars on livelihood skills training in barangays, 2.52 for providing a recycling project, and 2.60 for identifying prospective markets for recyclable commodities. Similarly, the respondent gave a moderate rating to the following categories: collection of scrap iron and materials sold for MRF maintenance (2.58), enhancement of partnerships with industry, academic, and community groups to reuse recycled materials (2.61), and use of compostable wastes in the production of organic fertilizers (2.61). (2.73). Demonstration of recycling methods to constituents (2.42), promotion of recycling methods to constituents (2.44), conversion of paper waste into paper pulp that can be used as cooking fuel (2.45), and conduct of recyclables processing to ensure that diverted materials are recovered and reused locally (2.45) received low ratings from respondents (2.38). Despite the respondents' general moderate rating of reuse and recycling procedures of marketable materials at the barangay level, the low indications or items related these practices were noteworthy. The municipality of Naujan should concentrate on developing and providing numerous recycling methods/processing options for the respondents. This meant that while barangays had MRFs, not all of them were using paper waste as cooking fuel. As a result, paper charcoal technology could be incorporated into local SWM operations [18].

Table 7. Mean on recycling practices as to reuse and recycling of marketable Materials

No	Items	Weighted Mean	Description
1	Establishes Material Recovery Facility (MRF)	2.99	Moderate
2	Conducts seminars on livelihood skills trainings in barangays	3.09	Moderate
3	Provides of recycling project	2.52	Moderate
4	Identifies potential markets for recyclable goods	2.6	Moderate
5	Demonstrates recycling methods to the constituents	2.42	Low
6	Promotes recycling methods to the constituents	2.44	Low
7	Converts paper waste into paper pulp which can be used as cooking fuel	2.45	Low
8	Collects scrap iron and materials which and are sold for maintenance of MRF	2.58	Moderate
9	Enhances partnership with the industry, academic and community groups to reuse recycled materials	2.61	Moderate
10	Conducts recyclables processing to ensure that the diverted materials are recovered and reused locally	2.38	Low
11	Uses compostable wastes in the production of organic fertilizers	2.73	Moderate
Overall Mean		2.62	Moderate

Table 8. Mean on Recycling Practices as to composting of organic materials

No	Items	Weighted Mean	Description
1	Provides skills training on composting	2.78	Moderate
2	Collects and use of municipal waste for composting	2.46	Low
3	Uses of municipal waste for composting	2.52	Moderate
4	Diverges organic wastes from landfills to produce valuable soil	2.69	Moderate
5	Practices composting methods	2.28	Low
Overall Mean		2.56	Moderate

Table 8 shows the recycling techniques for composting organic resources at the barangay level. Three of the five descriptions were moderate, such as offering composting skills training (2.78), using municipal trash for composting (2.52), and diverting organic wastes from landfills to produce good soil (2.52). (2.69). However, both the collection and utilization of municipal garbage for composting (2.46) and the implementation of composting procedures received low ratings (2.28).

The municipality and the barangay should also consider providing other methods of composting organic debris, despite the fact that it obtained an overall grade of 2.56 and was described as moderate. At the barangay level, the municipality should promote composting technologies. Plain vanilla composting, 3-Bin composting, fast composting, anaerobic composting, trench composting, and worm composting are some of the alternatives [19].

Table 9 shows the strategies for an information, education, and communication campaign at the barangay level. The solid waste management advocacy of the municipal government with the support and involvement of the schools received a very significant observation with a mean of 3.79, which is high in description. The majority of the indicators for recycling practices were rated as moderate, such as providing knowledge on waste segregation to every household/ establishment (3.31), providing public information on the importance of waste segregation, recycling, and re-use through forums, public announcements, and assemblies (3.49), posting of signboards/ billboards related to RA 9003 (3.21), conducting seminars to every barangay on SWM practices (2.94), and sharing of RA 9003 documents (2.94). (2.63).

The total mean of 3.16, which was moderate in description, indicated that information, education, and communication at the barangay level were reasonable, but that if the municipal government put more attention on it, the barangay level would absorb the practice of solid waste management. During PTA meetings in primary schools, as well as regular sessions and barangay assembly,

the municipality's ENRO disseminates information on solid waste classification and success stories on recycling for business. They engaged the students in various events, such as slogan and painting competitions. They also handed out instructional materials and taught locals in each barangay about appropriate garbage management. Through this, a positive transformation in the attitudes and perceptions of the people towards proper solid waste management is possible through information dissemination not only about the hazards and risks of improper waste disposal but at the same time the sharing of knowledge about the advantages and benefits of applying [18].

Policies on solid waste management at the barangay level is shown in Table 10. The recycling practices in terms of existing SWM policies at the barangay level were all found to be moderate in description. The respondents rated moderate in description the barangay solid waste management plan (3.35), barangay ecological solid waste management program (3.05), barangay rules and regulation on waste (3.32) and barangay acts and penalties relative to SWM (3.04). Equally the acts of throwing all kinds of dirt in creek and its tributaries and also roads and streets (3.19), monitoring SWM strategies (3.18), making fits and/or other dug holes at the river bank (2.6), creating barangay SWM board (2.74) and adopting specific revenue generating measure to promote the viability of its SWM plan (2.81).

The data revealed that the ratings given by the respondents in their evaluation are manifestations of the initiatives and strategies of the barangay and municipality in the implementation of policies pertaining to solid waste management. The municipality has solid waste management plans which could be their basis in identification of the strategies, initiatives and activities to be undertaken in relation to solid waste management. The said plans of these municipalities are not yet approved by the DENR since they are still on the process of complying on the needed requirements as indicated in RA 9003 [17].

Table 9. Mean on recycling practices as to information, education and communication campaign

No.	Items	Weighted Mean	Description
1	Provides knowledge on waste segregation conducted at every household / establishments	3.31	Moderate
2	Provides public information dissemination on importance of waste segregation, recycling, re-use through forums, public announcement and assemblies	3.49	Moderate
3	Involves school in the solid waste management advocacy of the municipal government	3.79	High
4	Posts signboard/ billboards relative to RA 9003	3.21	Moderate
5	Conducts seminars to every barangay re: SWM practices	2.94	Moderate
6	Provides success stories to the public encouraging them on recycling business thereby reducing waste	2.75	Moderate
7	Distributes educational materials for local adaptation	2.63	Moderate
Overall Mean		3.16	Moderate

Table 10. Mean on recycling practices as to existence of SWM policies

No.	Items	Weighted Mean	Description
1	Observes solid waste management plan	3.35	Moderate
2	Adopts ecological solid waste management program	3.05	Moderate
3	Promulgates rules and regulation on waste minimization, segregation and packing and disposal.	3.32	Moderate
4	Declares certain prohibited acts and providing penalties relative to SWM	3.04	Moderate
5	Prohibits throwing all kinds of dirt in creek and its tributaries and also roads or streets	3.19	Moderate
6	Penalizes throwing all kinds of dirt in creek and its tributaries and also roads or streets	3.2	Moderate
7	Monitors SWM strategies	3.18	Moderate
8	Provides making of pits and/or other dug holes at the river bank	2.6	Moderate
9	Creates barangay solid waste management board	2.74	Moderate
10	Adopts specific revenue generating measure to promote the viability of its solid waste management plan	2.81	Moderate
Overall Mean		3.05	Moderate

4.4. Difference between the Extent of Collecting and Recycling Practices from Selected Barangays of Naujan

Table 11 shows the Analysis of Variance of the difference between the extent of collecting and recycling practices from selected barangays in Naujan. Results revealed that the independent and dependent variables are significant ($P > 0.05$). Contrary to the result of the study of Manigbas [20], linkage was found significantly related to environmental practices of tree planting, plastic waste management, and waste segregation but not to energy conservation, plastic waste management, disaster risk and reduction management and composting. Socio-cultural sustainability was significantly related to environmental practice except for energy conservation.

There is no significant difference found on the extent of environmental practices of teachers and students because they have the same desire to achieve sustainable development.

The Scheffe test result on the differences on mean in collecting and recycling practices is shown on Table 12. It was found out that there is a significant difference between the collecting practices for collection and transport and for waste segregation and recycling practices for information, education and communication campaign at the barangay levels.

The results imply that the residents in the different barangay in Naujan have a varying perception and understanding to the different indicators provided. Because respondents are influenced by different levels and magnitude of experiences and practices and learning occurs in the social context and what is learned is gained through observation as stated in Albert Bandura's Social Cognitive Theory 1986 [20].

4.5. Relationship between the Profile of the Resident and the Extent of Collecting and Recycling Practices from Selected Barangays of Naujan

It could be gleaned on Table 13 the correlation analysis between variables wherein it revealed that age and respondents is not significantly related to the collecting practices for waste segregation at the barangay level which attained 0.32% and 0.11% respectively, however, sex is correlated to the collecting practices with a percentage of 0.56%. On the other hand, the collecting practice for collection and transport is not correlated to sex and respondents obtaining 0.06% and 0.09% correspondingly, whilst age shows significance to the collection and transport (1.24%). The strategy on reuse and recycling practices of marketable materials at the barangay level in the municipality of Naujan shows no significance in terms of age, sex and respondents which get hold of 0.47%, 0.51% and 0.53% individually. The recycling practices for composting of organic materials at the barangay level displays no correlation to age, sex, and respondents which attained percentage of 0.47%, 0.51% and 0.53% respectively. In terms of recycling practices for information, education and communication campaign at the barangay level, only sex reveals with correlation to the recycling practices which achieved a percentage of 0.75% while age and respondents displays significance with 0.23% and 0.00% correspondingly. Along policies on solid waste management at the barangay level shows no significance and correlation in terms of age, sex and gender which obtained .26%, .32%, and .07% respectively.

Table 11. Analysis of Variance on the differences between the extent of collecting and recycling practices

Source	SS	Df	MS	F	Prob>F	Result
Between Groups	177.11454	5	35.42291	59.77	0.000	Significant
Within Groups	2539.09917	4284	0.592694			
Total	2716.21371	4289	0.633298			

Table 12. Scheffe Test Results on the differences in Mean in Collecting and Recycling practices

Scheffe			
Extent	Mean	Std.Err.	Groups
Collecting practices as to collection and transport	2.867754	0.0287914	C
Collecting practices as to waste segregation	2.747552	0.0287914	BC
Recycling practices as to reuse and recycling of marketable materials	2.620598	0.0287914	AB
Recycling practices as to composting of organic materials	2.620598	0.0287914	AB
Recycling practices as to existence of SWM policies	2.564476	0.0287914	AB
Recycling practices as to information, education and communication campaign	3.158641	0.0287914	D

Note: Means sharing a letter in the group label are not significantly different at 5 % level.

Table 13. Correlational Analysis between profile of respondents and collecting and recycling practices

IV	DV					
	AGE		SEX		RESIDENCY	
	r	r ²	r	r ²	r	r ²
COLLECTING PRACTICES for waste segregation at the barangay level	-0.0569 ns	0.0032	0.0745*	0.0056	-0.0329 ns	0.0011
COLLECTING PRACTICES for collection and transport at the barangay level	-0.1112*	0.0124	0.0234 ns	0.0006	-0.0299 ns	0.0009
RECYCLING PRACTICES for reuse and recycling of marketable materials at the barangay level	-0.0688 ns	0.0047	0.0711 ns	0.0051	-0.0731 ns	0.0053
RECYCLING PRACTICES for composting of organic materials at the barangay level	-0.0688 ns	0.0047	0.0711 ns	0.0051	-0.0731 ns	0.0053
RECYCLING PRACTICES for information, education and communication campaign at the barangay level	0.0482 ns	0.0023	0.0864*	0.0075	-0.0052 ns	0.0000
RECYCLING PRACTICES for existence of SWM policies at the barangay level	-0.0514 ns	0.0026	0.0567 ns	0.0032	-0.0267 ns	0.0007

Significant (*) Not Significant (ns).

5. Conclusion and Recommendation

Majority of the respondents were in the middle age and residing for 30 years and above. Bulk of leftover foods or kitchen wastes composed the majority of compostable waste materials which are collected and recycled from the selected barangays of Naujan. Furthermore, the respondents are segregating wastes but there is a problem regarding management of special waste. The respondents are not compliant with the barangay or municipal standards. Moreover, the residents in the different barangays in Naujan have a varying perception and understanding to the different indicators provided. Lastly, the respondents are influenced by different levels and magnitude of experiences and practices and learning occurs in the social context and what was learned is gained through observation.

The barangay government should encourage the residents to practice household segregation and recycling of waste materials and the barangay officials should establish awareness among barangay residents the habit of segregation and recycling. They may also coordinate with the barangay schools to help in the information dissemination regarding solid waste management. Special task force to confront improper solid waste management at the barangay level may be organized to monitor the strict adherence to solid waste management. The officials may craft a barangay ordinance to penalize/punish those who are not compliant to solid waste management. Furthermore, the municipalities must allocate funds for composting and ensure that material recovery facility (MRF) is functional and able to generate funds. The

barangay officials may invite resource speakers about organic farming and recycling for the barangay residents. The municipalities must show commitment and sincerity to encourage direct involvement, cooperation and sense of ownership on the programs and activities. For future researchers, a similar study is recommended to include more strategies relating to waste characterization and waste disposal to justify further the results of the present study.

References

- [1] Rinkesh. (2017). Retrieved October 15, 2017, from Conserve Energy Future: <https://www.conserve-energy-future.com/various-waste-disposal-problems-and-solutions.php>.
- [2] Khajuria, A., Yamamoto, Y., & Morioka, T. (2008). Solid waste management in Asian countries: Problems and issues. *WIT Transactions on Ecology and the Environment*, 109, 643-653.
- [3] Musulin, K. (2016). Waste Dive. Retrieved October 11, 2017, from <http://www.wastedive.com/news/global-garbage-how-5-influential-countries-are-combating-issues-with-waste/417895/>.
- [4] Planet Natural. (2017). Garbage Problems. Retrieved October 10, 2017, from Planet Natural Research Center: <https://www.planetnatural.com/composting-101/environmental-issues/garbage-gripes/>.
- [5] Murphy, M., Baxter, D., Turnbull, H., Gqirana, M., Wilson, C., Law, J., & Meyer, M. (2009). How is waste dealt with? Full Cycle Green by Nature. Retrieved October 10, 2017, from: <http://www.fullcycle.co.za/index.php/what-is-waste-and-why-is-it-a-problem.html>.
- [6] Ranada, P. (2015, October 6). Retrieved from Rappler Philippines: <https://www.rappler.com/science-nature/environment/108276-philippines-plastic-pollution-ocean-conservancy-study>.
- [7] NSWMC. (2000). The Implementing Rules and Regulations of Republic Act 9003. *Environmental Management Bureau*, (10651), 1-44.

- [8] Antonio, L. C. (2010), 'Study on Recyclables Collection Trends and Best Practices in the Philippines', in Kojima, M. (ed.), 3R Policies for Southeast and East Asia. ERIA Research Project Report 2009-10, Jakarta: ERIA. pp. 40-70.
- [9] Iver, F. (2016, May 24). WASTE MANAGEMENT – THE 3 'R'S. Retrieved October 13, 2017, from <https://fjlrecycling.co.uk/waste-management-the-3-rs/>.
- [10] Pestaño R. (2016). Coastal Resources Management Program and Conservation Practices of the Municipality of Bongabong, Oriental Mindoro. An Unpublished Master Thesis, Mindoro State College of Agriculture and Technology (MinSCAT), Alcate, Victoria, Oriental Mindoro.
- [11] Tiwari, N. (2001). *Gender Roles in Environmental Household Waste Management: A case study in Palmerston North, New Zealand*.
- [12] Umar, Kaoje & Sabir, Anas & Yusuf, S. & Jimoh, Abdulfafar & Raji, Mansur. (2017). Residents perception of solid waste disposal practices in Sokoto, Northwest Nigeria. *African Journal of Environmental Science and Technology*. 11. 94-102.
- [13] Idris, Azni & Inanc, Bulent & Hassan, Mohd. (2004). Overview of Waste Disposal and Landfills/dumps in Asian Countries. *Journal of Material Cycles and Waste Management*. 6. 104-110.
- [14] PhilStar Global (2009), SM pursues environmental programs, Retrieved from: <https://www.philstar.com/business/agriculture/2009/06/07/474773/netflix>.
- [15] Waste Management. Ezine articles.com. Retrieved from [ezinearticles.com: http://ezinearticles.com/?Waste-Management-Disposal-and-Treatment&id=2646104](http://ezinearticles.com/?Waste-Management-Disposal-and-Treatment&id=2646104).
- [16] Wadehra, Rajnish. (2016). Coal and Renewables in India Rajnish Wadehra 2016.
- [17] Azuelo, M. C. C., Barbado, L. N., & Reyes, L. M. L. (2016). Assessment of Solid Waste Management Strategies in Camarines Norte, Philippines. *Asia Pacific Journal of Multidisciplinary Research*, 4(4), 44-53.
- [18] Gequinto, A. C. (2017). Solid Waste Management Practices of Select State Universities in CALABARZON, Philippines Related Papers Assessment of Solid Waste Management Strategies in Camarines Norte, Philippines. *Asia Pacific Journal of Multidisciplinary Research*, 5(1), 1-8.
- [19] Leineriza. (2011). Soil Facts: Basic Information on Soil You Need to Know. [Blog post]. Retrieved from <http://agverra.com/blog/soil-facts/>
- [20] Manigbas, M. (2017). Eco-friendly School Policy Implementation and Environmental Practices on Climate Change in Public Secondary School in the Municipality of Naujan: Basis for a Two-Year Strategic Plan for Eco-friendly Environment (Unpublished Thesis). Mindoro State College of Agriculture and Technology (MinSCAT), Alcate, Victoria, Oriental Mindoro. pp.117.



© The Author(s) 2022. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).