

Assessment of Solid Waste Management Strategies in Camarines Norte, Philippines

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Abstract - *The Ecological Solid Waste Management Act of 2000 or RA 9003 mandates the local government units to take initiatives in managing their daunting problems on ecological solid waste disposal. Consequently, compliance of Camarines Norte, Philippines on this mandate needs assessment to determine the existing solid waste management (SWM) strategies, the effectiveness and the possibility of adoption in each municipality. This study utilized the descriptive method using questionnaire as the main tool supplemented by interview. Results showed that the existing SWM strategies with the highest percentages of existence in the twelve (12) municipalities were provision of number of trucks in transporting solid wastes and knowledge on waste segregation conducted at every household/establishment. Varying levels were observed. However, high level of effectiveness is still required for significant impact, seeing that from the six areas assessed only four municipalities were identified to have more and highly effective SWM strategies. Generally, only availability of technology for composting was considered more effective and can be adopted in all municipalities. Better solid waste management may be fully attained through the involvement, political will and commitment of the implementers in the implementation of politically passed resolutions and undertaking of their initiatives that will stimulate active participation of the community. All these measures may bring change in health and environment in the province.*

Keywords: *assessment, solid waste management, strategies, effectiveness*

INTRODUCTION

The condition of the Philippine environment has reached critical proportions in relation to solid waste management that needs immediate and collective action from all sectors of the government. The enactment of RA 9003, otherwise known as the Ecological Solid Waste Management (ESWM) Act of 2000, provides for an Ecological Solid Waste Management Program creating the necessary institutional mechanisms and incentives, declaring certain acts prohibited and providing penalties, appropriating funds therefore and for other purposes [1].

This mandates each city or municipality to create a Municipal SWM Board to prepare, submit and implement a plan for the safe and sanitary management of solid waste generated in areas under its geographic and political coverage. The major

responsibilities rest on the LGUs as the lead implementers in the full implementation of the Act.

As defined, waste management is the collection, transport, processing, recycling or disposal of waste materials. The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, aesthetics or amenity. Waste management is also carried out to reduce the materials' effect on the environment and to recover resources from them. It can also involve solid, liquid or gaseous substances, with different methods and fields of expertise for each [2]-[3].

Since the signing of RA 9003 in January 2001, significant accomplishments have to be seen from the LGUs relative to their solid waste management (SWM) strategies. However, compliance of the local government units in Camarines Norte to the mandates of the law is still undisclosed unlike in other parts of

the province where several activities and strategies have been implemented and earned awards and recognitions. In 2010, the local government of unit of Magarao in Camarines Sur had proven remarkable initiatives in solid waste management. Through the environmental efforts made by their people, they were adjudged as the Lone National Winner of the Zero Basura Olympics sponsored by the National Solid Waste Management Commission (NSWMC). Changes in the lives of the people could be seen in this municipality since aside from reduction in the quantity of generated wastes, they also obtained income out of this [4].

In the study regarding the implementation of the Legaspi Ecological Solid Waste Management System (ESWMS) in the pilot barangays of Gogon, Sabang and Dapdap in Legaspi City, information education campaign (IEC) and collection and transport were highly implemented while the rest were moderately implemented, except recovery and marketing of recyclable materials. It also revealed that inadequacies in logistics could be aggravated by the persistence of wrong habits [5]. Another study was conducted in Legaspi City on the six (6) major functional elements of Solid Waste Management (SWM) namely: waste generation, storage, collection, transfer and transport, processing and recovery, and disposal of the SWM which revealed that these have not been implemented despite the support of Local Government Units and the private sectors [6]. Further, a research on the SWM practices of households in Manila was conducted which disclosed that SWM practices of households are not fully implemented [7].

On that note, no study yet has been conducted similar to the covered six areas of concern about SWM strategies in RA 9003. Hence, a critical look into the implementation of SWM strategies in the 12 municipalities of Camarines Norte is imperative to assess how effective the strategies are and to identify what strategies are for adoption in all municipalities. Further, through this study, the municipalities will identify their bottlenecks in undertaking environmental management activities and in ensuring the disposal of functions mandated by Law.

OBJECTIVES OF THE STUDY

The general objective of this study was to assess the Solid Waste Management Strategies in the municipalities of Camarines Norte. Specifically it aimed to determine the existing solid waste

management strategies in the twelve (12) municipalities of Camarines Norte, determine the solid waste management strategies that are effective in each municipality in terms of: a) waste segregation; b) reuse and recycling of marketable materials; c) collection & transport; e) composting of organic waste; f) information education and communication campaign; and g) policies and identify effective strategies that can be adopted in all municipalities.

MATERIALS AND METHODS

The descriptive method using survey questionnaire designed to assess the solid waste management strategies in the twelve municipalities of Camarines Norte was utilized as the main tool in data gathering. The questionnaire was translated to Tagalog as suggested during the dry run to twenty (20) respondents. It made use of the Likert's Scale Type with the following guides: 5- Highly Effective (HE), 4- More Effective (E), 3- Effective (ME), 2- Less Effective (LE), and 1-Not Effective (NE). Interview was also conducted to supplement the data gathered.

Percentage and rank were obtained for each strategy in the first objective and the existing solid waste management strategies were determined through selection of the strategies with the highest common ranks.

Median was used in the second objective to determine the effective strategies in each municipality where the researchers considered the highly and more effective strategies as assessed by the local and barangay officials and their households. In the third objective, the strategies that can be adopted in the twelve municipalities were obtained from the results of the data gathered in the number two objective wherein the median of each of the solid waste management strategy was computed and the existing effective strategies with the highest median was identified.

The respondents were the 60 LGU and 235 barangay officials with direct involvement on the subject of the study and the 394 households which were categorized as head of the family. The identified barangay officials and households came from the list of urban barangays of the twelve municipalities obtained from the Provincial Planning and Development Office (PPDO) of Camarines Norte. The researchers set a quota of five respondents in each municipality and urban barangay while respondents

for households were determined using proportion allocation procedure.

Table 1. Distribution of Respondents Per Municipality

Municipalities	LGU Officials	Barangay Officials	Household Population	Households	Total
Daet	5	40	5665	83	128
Jose Panganiban	5	25	3296	46	76
Mercedes	5	40	3914	58	103
Labo	5	30	2300	34	69
Talisay	5	5	504	7	17
Basud	5	10	1110	16	31
Capalonga	5	10	1296	19	34
Paracale	5	25	3513	52	82
San Lorenzo Ruiz	5	15	1380	20	40
San Vicente	5	15	822	12	32
Sta. Elena	5	5	1710	25	35
Vinzons	5	15	1259	22	42
Total	60	235	26769	394	689

RESULTS AND DISCUSSIONS

Existing Solid Waste Management Strategies

Figure 1 shows the existing strategies in the twelve municipalities of Camarines Norte. The existing SWM strategies with highest percentages on the six identified areas were: a) presence of properly designed waste bins/receptacles at strategic places and availability of container/receptacles for each type of waste in waste segregation; b) conduct of seminars on livelihood skills training and identification of potential markets for recyclable goods in reuse and recycling of marketable wastes; c) provision of trucks and regular collection and scheduling for transport and final disposal in collection and transport; d) provision of skills training in composting of organic waste; e) knowledge on waste segregation and education and public information dissemination in information, education and communication campaign; and f) adopting an ecological solid waste management program and promulgating rules and regulations in policies.

Results showed that majority of the municipalities have properly designed waste bins placed in identified strategic places to ensure proper waste management in their locality. They also have containers/sacks for each type of waste as to biodegradable and non-biodegradable wastes and have their own mechanisms on how they will inform their residents about waste

segregation. Provision of livelihood skills trainings in the barangay have been the priority activity since this is perceived as a good strategy to inform the people how to reuse and recycle the wastes collected into marketable materials. Conduct of skills training on composting in some municipalities is noticeable but limited due to lack of funds and linkages since the said strategy would not be possible without proper fund allocation for the conduct of trainings and procurement of equipment for composting.

The municipalities have their trucks for collection and transport of waste, but few of them have separate compartments in their trucks for collection of different wastes and the number and size of trucks do not complement to the bulk of wastes generated and its scope in other municipalities. In terms of formulation and strict and full implementation of policies within their jurisdiction, particularly on the adoption of revenue generating measure to promote the viability of its solid waste management plan and monitoring of solid waste management strategies in the barangay, the concerned municipalities still have a lot of things to consider. Policies are necessary for planning, design and operation of the solid waste management programs. Their absence can impede or limit improvements in garbage collection and disposal [8].

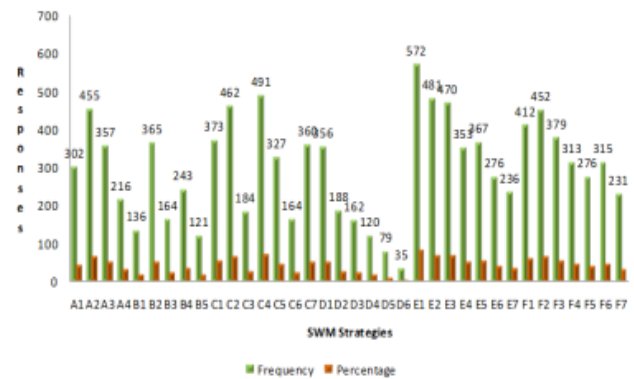


Figure 1. Existing Solid Waste Management Strategies

- Legend:
- A1 – A4: Existing strategies on waste segregation
 - B1 – B5: Existing strategies on reuse and recycling of marketable materials
 - C1 – C7: Existing strategies on collection and transport
 - D1 – D6: Existing strategies on composting of organic materials
 - E1 – E7: Existing strategies on information education and communication campaign
 - F1 – F7: Existing strategies on policies

Effective Existing Solid Waste Management Strategies

Table 2 presents the median measure of the existing effective strategies on waste segregation.

Table 2. Median Measure of the Existing Effective Strategies on Waste Segregation

A. Waste Segregation	D	JP	M	L	T	B	C	P	SLR	SV	SE	V
1. Segregate solid wastes at the source	3	3	3	3	3	4	3	2.25	3	3	3	3
2. Presence of properly designed wastes bins/receptacles at strategic places in the municipality	4	3	3	3	2	4	3	2	4	3	3	2
3. Availability of containers/receptacles for each type of waste to biodegradable, recyclable, non-recyclable of household wastes	3	3	2	3	2	3	5	2.5	3	3	3	3
4. Sponsorship of contest or reward system for Barangays following the proper waste segregation program	3	3	2.5	3		4	4	3	4	3	3.5	5
Median	3	3	2.75	3	2	4	3.5	2.38	3.5	3	3	3

Legend: D- Daet; JP – Jose Panganiban; M – Mercedes; SV- San Vicente; L – Labo; T –Talisay; C- Capalonga; SLR- San Lorenzo Ruiz; P-Paracale; SE- Sta. Elena; V- Vinzons; B – Basud

In the conduct of waste segregation, Table 2 shows that Basud (4) had the more effective strategy in segregating solid wastes along waste segregation. Daet (4), Basud (4) and San Lorenzo Ruiz (4) were more effective on the strategy for placement of waste bins at strategic places of the respective municipalities. Capalonga (5) was highly effective in their strategy of having available containers for each type of waste to biodegradable, recyclable, non-recyclable of household wastes while Basud (4), Capalonga (4), San Lorenzo Ruiz (4) and Sta. Elena (3.5) were more effective in sponsoring contest or reward system for barangays following the proper waste segregation program.

Among the twelve municipalities, Basud (4), Capalonga (3.5) and San Lorenzo Ruiz (3.5) were more effective in waste segregation. The local government and barangay officials and households of the mentioned municipalities had the same responses on the effectiveness of the existing strategies.

Varying readiness in each municipality, barangay officials and households in the implementation of waste segregation strategies can be attributed to the performance and political will of the local officials. Without the support of the local officials, programs such as Ecological Solid Waste Management Act will not go any further than the existing method of mixed collection and open dumping of wastes [9]. As noted, Basud, Capalonga and San Lorenzo Ruiz have the more effective strategies in waste segregation but there are municipalities that are more and highly effective on a particular waste segregation strategy like Capalonga which is highly effective in availability of containers for biodegradable and recyclable and non-recyclable wastes of household wastes. This municipality has uniformed plastic

containers distributed in strategic places within Poblacion area. Vinzons, Basud, Capalonga, San Lorenzo Ruiz and Sta. Elena are also very active in giving rewards and sponsoring contest to motivate and acclimatize their constituents in practicing waste segregation.

Tables 3 shows the strategy on reuse and recycling of marketable materials where the municipalities of Capalonga, Basud and San Vicente were highly and more effective on the strategy relative to establishment of material recovery facility as indicated by the medians of 5, 4 and 3.5, respectively. Basud was more effective or obtained a median of 4 in the conduct of seminars on livelihood skills trainings in barangays and a median of 4.25 on recycling projects. The medians of Capalonga (5), Daet (4), Mercedes (4), Basud (4) were highly and more effective in identifying potential markets for recyclable goods. For demonstration and promotion of recycling methods to the constituents, Basud (4) and San Lorenzo Ruiz (3.5) were regarded as more effective.

From the twelve municipalities, Basud (4) was more effective in terms of reuse and recycling of marketable materials. This municipality, as far as all strategies are concerned, was given a more effective feedback by the respondents. Based on the interview conducted to the residents and local officials, some people in the barangays are recycling the plastic wastes into baskets, and Christmas flower decors. Basud has a material recovery facility where the waste generated in all the barangays are being transferred to segregate and recycle the collected biodegradable and non- biodegradable wastes such as plastics, dried leaves and others.

Table 3. Median Measure of the Existing Effective Strategies on Reuse and Recycling of Marketable Materials

B. Reuse and Recycling of Marketable Materials	D	JP	M	L	T	B	C	P	SLR	SV	SE	V
1. Establishment of Material Recovery Facility (MRF)	3	3	3	3		4	5	2	3	3.5	2.5	2
2. Conduct of seminars on livelihood skills trainings in barangays	3	2	2	3	2	4	2.5	1.5	3	2	2	1
3. Existence of recycling project	3	3	3	3		4.25	2	3	3	2	2.5	3
4. Identification of potential markets for recyclable goods	4	2.5	4	3	1	4	5	2	3	3	3	3
5. Demonstration and promotion of recycling methods to the constituents	3	2		3	1	4	2.5	2	3.5	2.5	3	3
Median	3	2.5	3	3	1	4	2.5	2	3	2.5	2.5	3

Legend: D- Daet; JP – Jose Panganiban; M – Mercedes; SV- San Vicente; L – Labo; T –Talisay; C- Capalonga; SLR- San Lorenzo Ruiz; P- Paracale; SE- Sta. Elena; V- Vinzons; B – Basud

Table 4. Median Measure of the Existing Effective Strategies on Collection and Transport

C. Collection and Transport	D	JP	M	L	T	B	C	P	SLR	SV	SE	V
1. Availability and provision of 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	3	3	3	2.5	4	2.5	3	3.5	3	3	3
2. Regular collection and scheduling of properly segregated wastes for transport and final disposal of non-recyclable materials at the municipal level	3	3	3	3	2	3.5	3	3	2.5	3	3.5	3
3. Materials for recycling are collected separately from general to sorted directly from mixed waste	3	2	3		3	4	3.25			4	3	3
4. Provision of number of trucks in transporting solid wastes	3	3	3	3	1.5	4	3	3	4	4	3	3
5. Provision of properly trained officers to handle solid wastes disposal	3	3	3	3	3	4	3	3	3	3	3	3
6. Availability of separate individual compartments for each type of wastes in the municipal dump truck	3	3	2.5	3.5		4	3.5	3	2	1.5	2	
7. Ensure precautionary and sanitary measures in the collection and transport of solid waste	3	3	3	2	2	4	3	3	3.5	3	3	3
Median	3	3	3	3	2.25	4	3	3	3.25	3	3	3

Legend: D- Daet; JP – Jose Panganiban; M – Mercedes; SV- San Vicente; L – Labo; T –Talisay; C- Capalonga; SLR- San Lorenzo Ruiz; P- Paracale; SE- Sta. Elena; V- Vinzons; B – Basud

Along collection and transport, Table 4 shows that Basud (4) and San Lorenzo Ruiz (3.5) were rated as more effective on the strategy regarding availability and provision of 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. Basud (3.5) and Sta. Elena (3.5) were more effective on regular collection and scheduling of

properly segregated wastes for transport and final disposal of non-recyclable materials at the municipal level. The same rating was given to Basud (4) and San Vicente (4) under materials for recycling are collected separately from general to sort directly from mixed waste. Similar rating of effective were given to Basud (4), San Lorenzo (4) and San Vicente (4) on provision of number of trucks in transporting solid wastes and on the strategy pertaining to provision of properly

trained officers to handle solid waste disposal. For availability of separate individual compartments for each type of wastes in municipal dump truck, Labo (3.5), Basud (4) and Capalonga (3.5) were more effective while Basud (4) and San Lorenzo Ruiz (3.5) were more effective in ensuring precautionary and sanitary measures in the collection and transport of solid waste.

The more effective strategies for collection and transport could be observed in the municipality of Basud due to their system and schedule of collection set for each type of wastes. Their collection of wastes from commercial establishments and households is two days for biodegradable wastes and three days for non-biodegradable. The wastes collected are being segregated in their material recovery facility and all the residual wastes are disposed in their dumpsite and covered with soil. They have three collectors and segregators provided with masks and other safety gadgets.

On the other hand, San Lorenzo Ruiz was more effective in some of the strategies along collection and transport but there is no collection and transport of wastes yet in the municipality. All the wastes generated by the households are being thrown in their respective open pits. In this situation, the municipality guides and monitors their households in managing the wastes in their open pits as storage for biodegradable and non-biodegradable wastes. San Lorenzo Ruiz has waste bins in every office but it does not provide containers in possible collection points within the municipality since the wastes generated are still manageable and are being disposed in their open pits only.

Table 5 shows the strategies on composting of organic materials in which the municipalities of Mercedes (4), Basud (4) and San Lorenzo Ruiz (4) were evaluated as more effective by the respondents for provision of skills training on composting. Basud (4), San Lorenzo Ruiz (3.5) and San Vicente (4) were effective on collection and use of municipal waste for composting. For diversion of organic wastes from landfills to produce valuable soil was more effective in the municipalities of Basud (4), Capalonga (4) and San Lorenzo Ruiz (4.25). Basud (4) was more effective in allocation of funds for composting. Basud (4.5), Labo (4), San Lorenzo Ruiz (3.75), and Sta. Elena (4) were highly and more effective on the strategy for availability of technology for composting.

Generally, Basud and San Lorenzo Ruiz were more effective on composting of organic materials strategies. These two municipalities were given a more effective assessment by the respondents in composting organic materials due to their mechanisms in composting the biodegradable and non biodegradable waste. Basud has composting facility where biodegradable wastes are being converted to organic fertilizer. The Solid Waste Management Board of the municipality is also providing trainings on composting to the residents through the assistance of DENR and DA. The readiness of these municipalities as well as the application of the skills and knowledge acquired through trainings of their constituents help to lessen the quantity of waste collected at source as can be seen in these municipalities.

Table 5. Median Measure of the Existing Effective Strategies on Composting of Organic Materials

D. Composting of Organic Materials	D	JP	M	L	T	B	C	P	SLR	SV	SE	V
1. Provision of skills training on composting	3	2	4	3	2.5	4	3	3	4	3	3	3
2. Collection and use of municipal waste for composting	3	2	3	3		4	3	3	3.5	4	3	3
3. Diversion of the organic wastes from landfills to produce valuable soil	3	1.5	3	2	2	4	4	1	4.25	3	3	1
4. Practice composting methods.	3	3	3	3	2.5		2.25	2.5	2.5	3	3	3
5. Allocation of funds for composting.	2	2	2	3	2	4		3.25		2	2	2
6. Availability of technology for composting.	3	2	3.5	4	2	4.5		3	3.75		4	1
Median	3	2	3	3	2.5	4	3	3	3.5	3	3	3

Other municipalities were more effective in particular strategies like Mercedes which is conducting trainings in every barangay to educate their residents and also investing on the procurement of technology for composting such as shredding machine. Sta. Elena, Daet and Labo also have shredding machine to convert the waste generated into organic fertilizer.

Table 6 reveals the strategies along information, education and communication campaign where San Vicente (5) and Basud (4) were highly and more effective on the provision of knowledge on waste segregation conducted at every households/establishments, respectively. The same rating was noted for Basud (4) and San Lorenzo Ruiz (4) on education and public information dissemination on importance of waste segregation, recycling, re-use through forums, public announcements and assemblies. In Labo (4), Basud (4) and San Lorenzo Ruiz (4), the strategies pertaining to involvement of the school in the solid waste management advocacy of the municipal government were more effective while posting of signboard/billboards relative to RA 9003 were more effective in Basud (4) and San Vicente (4). For conduct of seminars to every barangay re: SWM practices, Mercedes (4), Basud (4), Paracale (3.5), San

Lorenzo Ruiz (4) and Vinzons (4) were more effective while provision of success stories to the public encouraging them on recycling business thereby reducing waste and distribution of educational materials for local adaptation were more effective in the municipalities of Daet (4) and Basud (4).

Overall, the information, education and communication campaign strategies of Basud were more effective. The municipality through their MENRO is disseminating information regarding classification of solid wastes and providing success stories on recycling for business during PTA meeting in elementary schools and also during regular sessions and barangay assembly. They involve the schools in different contests such as slogan and painting contests. They also distribute educational materials and educate the residents in every purok regarding proper waste 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 proper waste segregation and disposal methods [10].

Table 6. Median Measure of the Existing Effective Strategies on Information, Education and Communication Campaign

E. Information Education, Communication Campaign	D	JP	M	L	T	B	C	P	SLR	SV	SE	V
1.Provision of knowledge on waste segregation conducted at every household/establishments	3	3	3	3	2	4	2	2.5	3	5	3	3
2. Education and public information dissemination on importance of waste segregation, recycling, re-use through forums, public announcement and assemblies	3	3	3	3	2	4	3	3	4	3	3	3
3. Involvement of the school in the solid waste management advocacy of the municipal government	3	3	3	4	3	4	3	3	4	3	3	3
4. Posting of signboard/ billboards relative to RA 9003	3	2	3	3.5		4	2	3	3	4	2	3
5. Conduct of seminars to every barangay re: SWM practices	3	2	4	3	3	4	2	3.5	4	3	3	4
6. Provision of success stories to the public encouraging them on recycling business thereby reducing waste	4	2.5	2.5	2	3	4	2	2	3	2.5	2	3
7. Distribution of educational materials for local adaptation	4	2	3	3	2	4	3	2	3	2	2	3
Median	3	2.5	3	3	2.5	4	2	3	3	3	3	3

Legend: D- Daet; JP – Jose Panganiban; M – Mercedes; SV- San Vicente; L – Labo; T –Talisay; C- Capalonga; SLR- San Lorenzo Ruiz; P-Paracale; SE- Sta. Elena; V- Vinzons; B – Basud

Table 7. Median Measure of the Existing Effective Strategies on Policies

F. Policies	D	JP	M	L	T	B	C	P	SLR	SV	SE	V
1. Existence of a solid waste management plan	4.5	3	3	5	2	4	2	3	4	3	3	3
2. Adoption of ecological solid waste management program, promulgating rules and regulation on waste minimization, segregation, packing and disposal, declaring certain prohibited acts and providing penalties	3	3	3	3	2	4	3	3	4	3	3	2
3. Prohibition of throwing all kinds of dirt in creek and its tributaries and also roads or streets whether National or provincial or municipal within the jurisdiction of the municipality and providing penalties	3	2.5	4	2	2	4	1	1.75	3	3	3	2
4. Monitoring of SWM strategies of the Barangay	4	3	3	2	1	4	3	2	2	3.75	3	3
5. Prohibition of making of pits and/or other dug holes at the river bank	3	3	3	2.5	2	4	3	3	3	3	3	3
6. Creation of municipal solid waste management board	4	3	3	3	2.5	4	2	3	3	3	3	3
7. Adoption of a specific revenue generating measure to promote the viability of its solid waste management plan	4	2	3	3	2	4	4	3	3	3	2	3
Median	4	3	3	3	2	4	3	3	3	3	3	3

Mercedes, San Lorenzo Ruiz and Vinzons were rated more effective on the conduct of seminars to every barangay regarding solid waste management, the conduct of seminars are usually being done through the assistance and participation of DILG, DENR and DepEd. They disseminate information on solid waste management to the local and barangay officials, conduct film showing and caravan during barangay evaluation. They also post billboards on proper waste management. Further, the municipality of Daet was regarded as more effective in the distribution of local materials and provision of success stories to the residents and the community through the information and knowledge they gathered from study tours they conducted.

Along policies on solid waste management, Table 7 shows that Labo (5), Daet (4.5), Basud (4) and San Lorenzo Ruiz (4) were highly and more effective on the strategy regarding existence of solid waste management plan. Basud (4) and San Lorenzo Ruiz (4) were more effective on adoption of ecological solid waste management program, promulgating rules and regulation on waste minimization, segregation, packing and disposal, declaring certain prohibited acts and providing penalties. Mercedes (4) and Basud (4) were more effective on prohibition of throwing all

kinds of dirt in creek and its tributaries and also roads or streets whether National or provincial or municipal within the jurisdiction of the municipality and providing penalties. Daet (4) and Basud (4) were more effective on monitoring of SWM strategies of the barangay. Basud (4) were more effective on prohibition of making pits and/or other dug holes at the river bank. For creation of municipal solid waste management board, Daet (4) and Basud (4) were more effective while in adoption of specific revenue generating measures to promote the viability of its solid waste management plan were more effective in Daet (4), Basud (4) and Capalonga (4).

Overall, Basud and Daet were more effective in terms of policies. The data revealed that the ratings given by the respondents in their evaluation are manifestations of the initiatives and strategies of these municipalities in the implementation of policies pertaining to solid waste management. These municipalities have 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,

nevertheless they are implementing SWM strategies in accordance with the Act.

Strategy that can be Adopted in 12 Municipalities

Table 8 illustrates that availability of technology for composting was regarded as the effective strategy that can be adopted in the 12 municipalities registered a median of 3.5.

Table 8. Identified Effective Strategy that can be Adopted in the Twelve (12) Municipalities

Strategy	Median	Interpretation
Availability of technology for composting	3.5	More Effective

Results showed that one strategy along the area of composting of organic materials was more effective and can be adopted in the twelve municipalities. Five municipalities such as Mercedes, Labo, Basud, San Lorenzo Ruiz and Sta Elena regarded the composting method using the necessary technology as an effective measure to reduce waste; thus, even at the barangay level, they are persistent to source out funds from local and outside donors and establish linkage with different government agencies to undertake and facilitate composting of their generated wastes.

The respondents viewed the presence of technology for composting as significant in solid waste management for it contributes to waste minimization and reduction and income generation as observed in their existing composting facility, though the technology in the municipal and barangay levels is still very limited due to financial constraints.

CONCLUSIONS AND RECOMMENDATIONS

The strategies with the highest ranks of existence from the six areas of SWM strategies are provision of trucks in transporting solid wastes and knowledge on waste segregation conducted at every household/establishment. Several strategies implemented show varying levels of effectiveness. Waste segregation, reuse and recycling of marketable materials, collection and transport, composting of organic materials, information, education and communication campaign and policies are more effective in Basud; reuse and recycling of marketable wastes in Capalonga; and waste segregation, collection and transport and composting of organic

materials in San Lorenzo Ruiz. The strategy that is more effective, that can be adopted and may be effective in the 12 municipalities is availability of technology for composting.

In the implementation of SWM strategies, the 12 municipalities of Camarines Norte have to intensify these for widespread compliance of the people. They must ensure that they have technical functional committee and adequate number of personnel equipped with knowledge regarding implementation and monitoring of SWM strategies. The varying results of effectiveness of SWM strategies implementation per municipality require observance of these in all municipalities particularly to those where residents are not familiar to other strategies. It is also necessary to establish and toughen linkages and coordinative mechanisms with other government agencies and possible outside donors. The municipalities must allocate funds for composting and ensure that material recovery facility (MRF) is functional and able to generate funds. Conduct of seminars on livelihood skills training in barangays may be strengthened through provision of substantial budgetary allocation while technology available for composting may be reinforced for highly effective waste reduction. 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.

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