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Bagmaking: Waste utilization and evaluation

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Abstract

Plastic pollution is one of the significant environmental challenges experienced at present. Only a small percentage of these wastes are recycled or transported to the landfill while the majority are either burned or thrown to the oceans, hence, contributing to the continuous increase of global carbon dioxide emission affecting marine life. Most of the plastic wastes are laminated sachets consisting mainly of aluminum foil and polyethylene. In connection, this study generally aims to contribute to the Sustainable Development Goals (SDG) by upcycling waste laminated sachets into a more useful product. Specifically, this aims to contribute to SDG 12 which pertains to "responsible consumption and production" as the awareness level of the participants, specifically the Women's Association of Barangay Pan-ay, Clarin, Misamis Occidental, on solid waste management and plastic waste utilization were determined using a mixed methods research design. Purposive sampling technique was used to choose the 18 participants. Further, descriptive statistics was used to analyze the data obtained from the awareness survey as well as the acceptability of the product while thematic analysis was used for the interviews. Based on the results, the participants were not at all aware that laminated sachets can be upcycled without chemical means as it obtained a weighted mean of 1.42. The participants also appreciated the training and emphasized that it helped them hone their skills for livelihood. Hence, the researchers suggest that plastic wastes, specifically laminated sachets, be gathered at source, completely sanitized and ready for upcycling. Another product which may be of high demand may also be developed.

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Introduction

Since the commercial development in 1930 and 1940, the utilization of plastics and plastic packaging have dominated the consumer marketplace until the 21st century (Kosior and Crescenzi, 2020). Plastics which consist of synthetic polymers have long been mass-produced and have, in fact, been a very useful man-made material. Although there are a large variety of polymers, eight of these contribute the 95%, exceeding nine billion metric tons by the end of 2017. From this, seven billion tons of plastic wastes were generated, and only about 10%, 14%, and 76% were recycled, incinerated, and transported to landfills, dumps, or surroundings, respectively. If the annual primary plastic production in the world continues, it is estimated to reach 1.1 billion tons in 2050 (Geyer, 2020).

Plastic offers a wide range of uses due to its remarkable properties with ease of processing which satisfies the modern lifestyles of people. In fact, it is considered to be a sustainable alternative over other materials such as glass, metals and paper. Due to these, plastics play a vital role in promoting sustainability as part of a circular economy (CE) which is basically a concept that promotes a sustainable way of living, using resources more efficiently and retaining in the economy for as long as possible.

The cost efficiency and convenience offered by plastic sachets as well as the inefficient waste disposal result in several negative environment impacts (WWF Philippines, 2018). In Europe, a laminated flexible packaging film, which were actually more difficult or even impossible to recycle, composed approximately 3-4% of the packaging products. Similarly, around 65% of the laminated flexibles are disposed with the mixed municipal solid waste and 35% are collected in separate collection schemes for lightweight packaging wastes in the Netherlands. Further, the Philippines is expected to have an increasing consumption of plastic wastes, specifically laminated sachets which are composed of polyethylene (PE) and polyethylene terephthalate (PET) used in various food and non-food products.

Plastics pose one of the biggest challenges to achieving a circular economy because a huge amount of its waste basically escapes into the environment due to mismanagement (Hahladakis *et al.*, 2020). According to Meier *et al.* (2021), the country is found to be one of the largest contributor of marine plastic pollution from rivers with 4,820 rivers emitting 356,371 metric tons of plastic per year with the Pasig River as the single greatest polluting river in the world (Meijer *et al.*, 2021; Parkinson, 2021). The increasing demand of laminated sachets has led the country to become one of the top ocean polluters in the world (Deang *et al.*, 2020). Most stakeholders involved in plastic packaging are dedicated to creating a more sustainable, circular plastics industry, however, several challenges with regards to sustainable recycling of flexible laminates exist (Velzen *et al.*, 2020).

In response to the Sustainable Development Goal (SDG) 12, known as the "responsible consumption and production" (United Nations, n.d.), this study aims to contribute to sustainable development goals by upcycling waste laminated sachets and produce a more useful product. Specifically, this study aims to conduct an awareness survey for the solid waste management and plastic waste utilization of an organization, provide an intervention by conducting a training-workshop on producing an innovative product, evaluate the output produced, and lastly, determine the participants' perception on the training.

Materials and methods

The study was conducted in Barangay Pan-ay, Clarin, Misamis Occidental. Using mixed methods research design, the quantitative aspect pertains to the awareness level on solid waste management and plastic waste utilization of the participants as well as the acceptability level of the output produced. Meanwhile, the qualitative aspect pertains to the perception of the participants towards the training conducted.

Purposive sampling technique was used as the participants involved in this study belong to the Women' Organization of Barangay Pan-ay. Specifically, 18 participants were requested to answer the floated survey questionnaires to determine the awareness and acceptability level. The data obtained from the awareness and acceptability levels were both analyzed using descriptive statistics while the perceptions of the participants towards the training were analyzed through thematic analysis.

Results and discussion

The level of awareness of the participants on solid waste management is summarized on Table 1. Based on the results, the participants are extremely aware that the common households contribute to plastic waste pollution and that plastic wastes can be eradicated through burning as it both obtained a weighted mean of 5.0. The participants are moderately aware that plastics contribute greatly to solid waste as it obtained a weighted mean of 3.50. Further, with a weighted mean of 4.10, the participants are moderately aware that these wastes pollute the land and oceans which may cause different diseases/illnesses. The participants are also moderately aware that not all plastics are recycled as it obtained a weighted mean of 3.90. With a weighted mean of 2.80, the participants are somewhat aware about the importance of solid waste management; however, only slightly aware that plastics can harm the environment when burned, not all these are transported to landfills, and that the local government has an important role to play in plastic waste disposal obtaining a weighted mean of 1.90, 1.90, and 2.50, respectively. Overall, the participants are moderately aware about solid waste management as it obtained a weighted mean of 3.47.

Table 1. Participants' awareness level on solid waste management

STATEMENT	WEIGHTED MEAN	VERBAL DESCRIPTION
1. Solid waste management is important.	2.80	Somewhat aware
2. Plastics contribute greatly to solid waste.	3.50	Moderately aware
3. Plastic waste pollutes the land and oceans.	4.10	Moderately aware
4. Different diseases/illness may rise from improper solid waste management.	4.10	Moderately aware
5. Plastic waste can be eradicated through burning.	5.00	Extremely aware
6. Plastic waste can harm the environment when burned.	1.90	Slightly aware
7. Not all plastic wastes are transported into landfills.	1.90	Slightly aware
8. Not all plastic wastes are recycled.	3.90	Moderately aware
9. Common households contribute to plastic waste pollution.	5.00	Extremely aware
10. The local government unit plays a vital role in disposing plastic waste.	2.50	Slightly aware
OVERALL	**3.47**	**Moderately aware**

Similarly, the awareness level of the participants on plastic waste utilization was also measured. As presented in Table 2, all the participants are extremely aware that upcycling plastic wastes can help the environment as it obtained a weighted mean of 4.60. With a weighted mean of 3.70, the participants are moderately aware that plastic wastes can make a sturdy material. Moreover, the participants are slightly aware that plastic wastes can still be useful in the community, that it can be a source of livelihood, that it can be utilized to develop innovative products, that it can be upcycled through handicrafts, and that it can be used to create promising designs as it

obtained a weighted mean of 1.90, 2.30, 2.50, 2.20, and 1.90, respectively. The participants are not at all aware that plastic wastes can be upcycled without contributing to carbon emission and without chemical means as it obtained a weighted mean of 1.50 and 1.42, respectively. Obtaining a weighted mean of 1.65, the participants are also not at all aware that plastic wastes can be upcycled to be a sustainable product. Overall, the awareness level of the participants on plastic waste utilization obtained a weighted mean of 2.37 with a verbal description of slightly aware.

Based on the results of the awareness survey on the solid waste management and plastic waste utilization, training on bagmaking out of waste laminated sachets was conducted. Basically, waste laminated sachets were collected from households and sorted accordingly. These were properly washed and sanitized overnight. Once done, the wastes were dried before being trimmed and cut into strips. The strips were then folded using the 'oripoly' technique which was eventually connected using nylon strings and shaped into a bag.

Table 2. Participants' awareness level on plastic waste utilization

STATEMENT	WEIGHTED MEAN	VERBAL DESCRIPTION
1. Upcycling plastic wastes can help the environment.	4.60	Extremely aware
2. Plastic wastes can be upcycled without contributing to carbon emission.	1.50	Not at all aware
3. Plastic wastes can be upcycled without chemical means.	1.42	Not at all aware
4. Plastic wastes can be useful in the community	1.90	Slightly aware
5. Plastic wastes can be a source of livelihood.	2.30	Slightly aware
6. Plastic wastes can be a sustainable product.	1.65	Not at all aware
7. Plastic wastes can be utilized to develop innovative products.	2.50	Slightly aware
8. Plastic wastes can be upcycled through handicrafts.	2.20	Slightly aware
9. Plastic wastes can make a sturdy material.	3.70	Moderately aware
10. Plastic wastes can be used to create promising designs.	1.90	Slightly aware
OVERALL	**2.37**	**Slightly aware**

Table 3. Acceptability level of the innovative product

CHARACTERISTICS	WEIGHTED MEAN	VERBAL DESCRIPTION
1. Color	6.00	Acceptable
2. Design	6.50	Perfectly acceptable
3. Shape	6.10	Acceptable
4. Size	6.30	Perfectly acceptable
5. Strap	4.62	Slightly acceptable
OVERALL	**5.90**	**Acceptable**

An interview was conducted to determine the perceptions of the participants on the training. Once done, the participants were asked about the acceptability level of the product and the results were summarized in Table 3.

Here, the participants have rated the design and size of the product as perfectly acceptable with a weighted mean of 6.50 and 6.30, respectively. The color was acceptable while the strap is slightly acceptable with a weighted mean of 6.00 and 4.62, respectively. Overall, the product is acceptable as it obtained a weighted mean of 5.90.

Lastly, to determine the perception of the participants on the training, the participants were asked which concept or activity do the participants found useful to their respective organizations in which the result can be mainly categorized into six: solid waste management, recycling, innovative products, community, livelihood and training. Presented below

is a summary of the perceptions expressed by the participants from the training.

A. Solid waste management
"We should segregate plastic bottle and cellophanes." (W4)
"We should not throw away plastic wastes." ((W12)
"Wastes should be disposed properly to avoid pollution." (W4,W12,W16)

B. Recycling
"Recycling plastic sachets." (W1,W2,W5,W8,W10)
"Any type of plastic can still useful." (W5)
"Any type of plastics can still be recycled or reused." (W8)
"Information about recycling plastic wastes." (W10)

C. Innovative product
"We learned a lot of things about plastiknology especially recycling plastic wastes." (W9)
"We can innovate a useful product out of plastic waste materials." (W9,W14)

D. Community
"It can be helpful to the community" (W13)
"It can help our organization and community." (W6,W13, W15)
"It provides us knowledge to help the community." (W6)

E. Livelihood and training
"It could be a nice source of income." (W11)
"Knowledge on plastic waste management can be provided to the community through conducting seminars and workshops." (W3,W7,W18)

Conclusion

The participants are moderately aware on solid waste management. Specifically, the participants are slightly aware that plastic wastes can harm the environment when burned, not all of these are transported to landfills, and that the LGU has a vital role in the waste disposal. This might be due to the lack of information or awareness to the community. Another reason could be the lack of implementation of waste collection in the area which may be an important factor resulting in the burning of plastics. Moreover, the participants are slightly aware of the uses of plastic wastes.

Specifically, the participants are not at all aware that plastic wastes can be upcycled without contributing to carbon emission, without chemical means, and that it can be used to create a sustainable product. This might be attributed to the lack of knowledge or skills of the participants to create a more useful product out of plastic wastes. Hence, the researchers conducted a training which taught the participants to create bags out of sanitized plastic wastes. The participants then rated the product as acceptable which might be attributed to the aesthetics, durability and significance of the product.

Recommendation(s)

Based on the findings obtained in the study, the researchers suggest the following:

1. Conduct intensive awareness orientation specially on the importance of solid waste management.
2. Highlight the negative environmental effects of improper waste disposal especially the burning of plastics, which is commonly performed in the community.
3. Promote upcycling of plastic wastes without chemical means so as not to contribute to greenhouse gas emissions.
4. Gather and sanitize plastic wastes at source.
5. Create other innovative products out of laminated sachets.
6. Upcycle other types of plastics.
7. Encourage livelihood out of upcycling plastic wastes.
8. Strengthen design of strap.

Explore more on color and artistic designs and shape for a more marketable product.

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