

## Proposed Solutions On Waste Issues In Kulon Progo Regency Through Society 5.0 Community Service

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**Abstract** — Waste is a global environmental issue. The problem can be unique in each area and it can be organic or plastic. One of the solutions for waste problems is waste processing. In this article, community service on programs related to waste and environmental issues is presented. Due to covid-19 pandemic, community service was carried out with society 5.0 approach instead of with the traditional on-field. Waste problems in Kulon Progo regency were explored, particularly in Giripeni, Temon Wetan, Bendungan, and Kulwaru village. Through literature study, waste-related concerns in each village were explored, followed by the development of solution for each issue. Organic wastes could be processed into organic fertilizer and hand craft, while plastics could be an advantageous ingredient for making paving block. The outputs were arranged in educative and interesting ebooks for inspiring and encouraging positive activities for community empowerment.

**Keywords** — community service, society 5.0, waste processing, educative content, Kulon Progo

### I. INTRODUCTION

Kulon Progo regency is located in the west part of Daerah Istimewa Yogyakarta province. The total area is 586.28 km<sup>2</sup>, which is divided into 12 subdistrict (kapanewon or kecamatan), 87 villages, and 1 urban village. This study was carried out on kalurahan Giripeni, Temon Wetan, Bendungan, and Kulwaru. In these villages, most residents work as farmer & stock farmer. Majority of the area is wetland for rice fields. They also have tourism potentials and cultural activities, such as handicraft and art performances.

Waste is a global issue, both in urban and rural areas. The problem can be unique in each area. In a region dominated by rice fields, the leftover is straw, the dry stem from rice plant after the seeds have been extracted. Waste problem might also arise from industry, such as cigarette factory. The industry delivers positive contributions in economic sector, including working opportunities and business establishments such as boarding houses, parking area, and food stalls. However, the discarded waste can be a problem for the neighborhood. For example, the waste from tobacco wrap might emit disturbing odor [1]. Another type of waste is plastics, mainly from bags and water bottles. These plastics are virtually non-degradable, due to its very long decomposition in nature. It is a global problem, in which 58% of plastic waste are landfilled, allowing them to accumulate over time [2]. According to Statistics Indonesia (Badan Pusat Statistik), plastic waste in Indonesia reach 64 million tones/year [3]. Plastic accumulation, particularly in the oceans, is a concerning environmental issue. One of the

major components of plastic waste is polyethylene terephthalate (PET), a polymer frequently used in many applications, including textiles and food packaging [4]. Three plastic disposal methods are routinely used on a large scale: landfill, incineration and recycling. Each of these methods, however, has drawbacks. Landfill and incineration may cause environmental pollution, while recycle may be inefficient & deteriorate the plastic quality [4].

The abovementioned problems are not without solutions, and even can be advantageous if managed properly. Straws are usually utilized as stock feed. However, it can also be processed into fertilizer, cosmetic, beverage, and art craft. Straws utilization as handicraft can be promising, since it can stimulate the development of craft industry. Besides it can also support tourism, considering that Kulon Progo regency has much potential in this sector. Straws can be used to make crafts, such as puppet, statue, jewelry, bags, painting, furniture decoration, roof top and property for art performance [5]. Different techniques can be applied to develop straws into artworks, including weaving, bundling, pressing, chopping, among others [5]. One of cigarette factory wastes is tobacco wrap made from siwalan or lontar (*Borassus flabellifer*) leaves. It can be processed into compost fertilizer using mud-like solution that contains microbes as activator [6]. The activators can be commercial one, such as EM4, or bioactivator processed from leaves or cow dung [7, 8].

Plastic waste can be utilized as mixture ingredients for making paving blocks. Polyethylene-based waste, such as those from food containers, can improve compressive strength and water resistance [9]. Plastic fibres obtained from mineral water cups could also improve the compressive strength of paving block. Plastic fibres concentration of 0.4% was found to produce the highest compressive strength, as much as 41.83% higher than without plastic reinforcement [10]. Compressive strength and water resistance of paving block can also be improved by adding LDPE & PET. With concentration of 5% plastics, paving block with compressive strength of 8.86 MPa and water absorption of 6.88% was produced, making this mixture suitable as paving block for public parks [11]. The compressive strength increase was 33.03% compared to paving block without plastics content.

In the early 2020, coronavirus disease-19 (Covid-19) emerged and became a global pandemic. This situation prompted social distancing, hence the academic community service, conducted at fourth quarter of 2020, was implemented using society 5.0 approach. In pandemic situation, most activities are encouraged to be carried-out at

home or within local neighborhood with health protocols applied. Despite the limitation, it is still possible to develop and propose positive activities that could even lead to business opportunities.

In this article, society 5.0 approach on community service is presented, specifically on programs related to waste and environmental issues. Empowerment of local community could be encouraged through informative media accessible through internet, particularly through ebook and video. They can be medium for sharing educative contents about the proposed solutions for local problems that are interesting, informative, and easy-to-understand. It is expected to excite environmental awareness and follow-up activities, such as converting waste into useful and even marketable products. Furthermore, productive activities at home are encouraged, especially in a pandemic situation.

## II. METHOD

This study was conducted through literature review, complemented by data obtained from relevant news and government websites. The observed villages were Giripeni, Temon Wetan, Bendungan, and Kulwaru, which are located in Kulon Progo regency, Yogyakarta. The obtained data and knowledge were then discussed and arranged into community empowerment programs that could help solving local problems, particularly those related to waste issue. The proposed solution for each specific problem was then organized into an ebook that could inspire local empowerment. The method is described in figure 1.

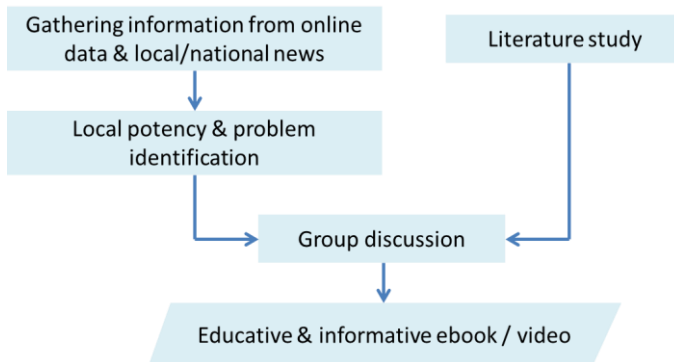


Figure 1. The method for community service 5.0 [12]

## III. RESULTS AND DISCUSSIONS

Straws, byproduct of rice crops, can be processed into useful and even marketable products. These include fertilizer, art craft, cosmetics, briquette, and beverages. Straw can be used to make compost, a substitute for chemical fertilizer. It is also an important ingredient for shampoo and hair wash. Mixed with rice husk and kernels of *Jatropha curcas* plants (jarak), it can be processed into briquette, an alternative for household fuel. Another use of straws is for handcraft, such as hat, basket, and broom, which can offer economical benefit. Figure 2 shows the ebook that explain the potentials of straws.

Organic waste, for instance leaves and trunks, can be processed into compost. It is natural fertilizer made from natural ingredients and additional organic constituents to

accelerate decomposition process. In the case of siwalan waste from cigarette factory, the leaves can be processed into compost by mixing with EM4 solution as activator [7, 8]. The process only requires household tools, such as knives, shovel, bucket, plastic bag, woods, and tarpaulin. The composting process may take around 2 months. The EM4 activator, alternatively, can be substituted by natural bioactivator made from leaves such as those from ketapang (*Terminalia catappa*), angkana (*Pterocarpus indicus*) dan daun mahoni (*Swietenia mahagoni*) [7]. Banana stem, which is abundantly available, is also raw material for compost. The preparation is relatively uncomplicated, requiring sugar, reusable sack, bucket, and water. The result was organic fertilizer in both liquid and solid form. Figure 3 and figure 4 illustrate the ebooks that shows the process of making compost from organic waste. Organic fertilizer offers several benefits, including easy-to-get materials, relatively quick process, space efficient, supporting agriculture business and hobby, and facilitating soil rejuvenation.



Figure 2. Ebook about potentials of straws

Plastics from discarded bottles and containers, including PET & LDPE, can be exploited for making paving blocks. The equipment is quite easy to prepare, such as plastic chopper, drums, mold, hammer, and trowel. Before being processed, the plastic bottles and containers are washed, chopped into small pieces or pellets and then melted in a drum. Then, sand and cement are added into the molten plastic and mixed. This mixture is then put into mold and dried. The characteristic of the paving block can be tuned based on the amount of plastic in the mixture [13, 14]. For LDPE and PET-based mixture, the weight composition of 40: 5: 50 for LDPE: PET: sand is found to be optimum, providing the highest compressive strength and water resistance [13]. This composition was claimed to be able to produce SNI grade C block suitable for pedestrian way. For concrete paving block, the optimum weight ratio for cement: sand: plastic was 1: 1.5: 3 [14]. This composition can produce SNI grade B block appropriate for parking area. Polyethylenes are mechanically tough and chemical resistant materials, typically used as flexible bottle, tumblers, toys, and battery parts [15]. PET is also mechanically tough and has resistance to chemicals and humidity, making it suitable for clothing, beverage containers, and tire compound [15].

The use of plastic waste as paving block could reduce environmental pollution due to plastic. Furthermore, it can deliver the more affordable, yet environment-friendly paving blocks for home garden and parks, pedestrian way, and parking area. The ebook describing the preparation of paving block using plastic waste is presented in figure 5.

maintaining and expanding stakeholders, improving promotion by taking advantage of information technology, and market expansion. Products can be marketed through online shop (e-commerce), farmer shop or *koperasi*, agricultural expo, and consignment.



Figure 3. Ebook about compost preparation using siwalan leaves waste



Figure 5. Ebook about paving block preparation using plastic waste.



Figure 4. Ebook about compost preparation using banana stem

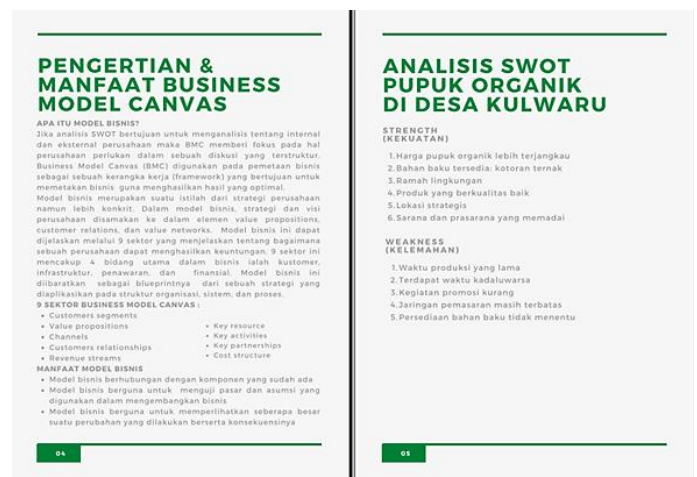


Figure 6. Ebook about business analysis for organic fertilizer.

After the waste is processed into valuable products, the next step could be a business development. Two approaches can be applied, namely SWOT (strength, weakness, opportunity, threat) analysis and business model canvas (BMC) [16, 17]. As the name implies, SWOT analysis is useful tool for management and decision making in business practices. Meanwhile, BMC is a method for business mapping, to help obtaining the optimal results. In this strategy, nine key sectors should be considered: customer segments, value propositions, channels, customer relationship, revenue streams, key resource, key activities, key partnerships, and cost structure. The ebook page that describe these approaches on organic fertilizer product is presented in figure 6. From the SWOT and BMC analysis, four strategies can be applied for an organic fertilizer business, including maintaining fertilizer quality,

#### IV. CONCLUSION

Waste is global environmental problem, thus requires solutions about its management and treatment. Waste recycling and processing can be solution for this issue. Both organic and non-organic waste can be processed into useful products, even can be marketable and offers economic benefits. For example, organic waste can be processed into fertilizer and handcraft, while plastic waste can improve paving block characteristics. This knowledge is worth to share. Hence, ebooks about waste processing were arranged to deliver information about unique problem in a certain region along with the proposed solution. The insight about waste processing was complemented with information about marketing, arranged in ebook about marketing strategy. These educative & informative mediums are expected to inspire productive creativity to resolve the local waste issues. Additionally, activities at home and within local community could be encouraged, particularly in pandemic situation.



Next community service programs should accommodate issues on the application of internet and related technology, to facilitate direct communication and training & counseling effectively in digital era.

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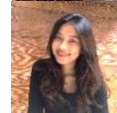
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