

## PKW Program 2018-2020: The Transformation of Mutiara Waste Bank Jakamulya Village Bekasi to Implement 3R-based Technology

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### ABSTRACT

*The impact of not optimal waste management in Jakamulya Urban Village, Bekasi City, which is always flooded by garbage, and Situ Wo which cannot hold water. Efforts to manage waste from its source have been made with waste banks but have not been optimal. The objective of the Regional Partnership Program (PKW, Program Kemitraan Wilayah) with Bekasi City is to increase community participation in waste management with the 3R concept (reuse, recycle, reduce). Based on the results of implementing the PKW program, it can be concluded that the operation of the Mutiara Waste Bank in Pondok Suryamandala, Jakamulya Village, Bekasi City based on TPS 3R is the key to handling community-based (communal) waste which is very effective for waste management that is directly the community as a plus manager (home industry owner). Without this communal system, waste can't be handled completely or sustainably. Cultivating good waste disposal methods starting from the household environment to submitting waste to the Waste Bank is an effective method at the community level that will ultimately be independent of the community in managing their waste. Organizing TPS 3R into a center for the maximum utilization of organic and inorganic waste is a communal-based waste management program that will cut the chain of waste distribution from TPS 3R to landfills.*

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## **INTRODUCTION**

The phenomenon of environmental change has recently become an event that prints our thoughts. Several unfortunate incidents caused by a decline in the environment's quality cause us to think backward and relate these incidents to the educational process so far. The problem of air pollution in big cities is due to a large number of motorized vehicles, the attitude of residents who still litter, and there are still many deviations in behavior that can reduce environmental quality.

Bekasi City has waste management and processing at TPA Sumurbaru, Bantargebang District. This TPA has an area of approximately 12.4 hectares. Of the five existing zones, four zones have been closed due to the accumulated garbage dumping with about 10 hectares. Currently, what is still functioning is zone 5, with an area of about 2.4 hectares. It is planned that there will be a land acquisition for zones 6, 7, and 8. The volume of waste from Bekasi City reaches 2,286,625 m<sup>3</sup> per day. With a population of 2,554,499 people (2013), it is estimated that the waste generated per person reaches 0.64 kg per person per day. Meanwhile, the garbage transportation service carried out by the Bekasi City Sanitation Office is only able to serve no more than 55.45%. This means that around 44.25% of garbage is still scattered in Bekasi City every day. If calculated, the waste transported to the Sumurbatu TPA every day is only 914,650 kg per day or only serves the garbage of Bekasi City residents as many as 1,416,470 people. Based on research conducted by waste experts, the types of waste that exist and enter the Sumurbatu TPA include: putrescible 58.56% (originating from housing, markets and protocol roads, and containers), plastic waste 11.52%, paper waste 11, 14%, textiles 4.74%, glass and glass 4.41%, metal 4.04%, rubber 2.05%, and others 3.55%.

Apart from the inability to process waste, Bekasi City has another crucial problem besides garbage, namely a decrease in groundwater table due to overexploitation of groundwater reserves. The number of green open spaces (RTH) in Bekasi City is only around 50 percent of the law's minimum target. Likewise, the existence of absorption wells and pure bio holes has not yet reached the Bekasi City Government (Pemkot), West Java.

The above problems make us think about whether the public's concern for the environment is experiencing a crisis. All this time, the education that seeks to increase public awareness is still lacking or not optimal. This causes us to think about the efforts that need to be taken to increase their concern for the environment. Kelurahan Jakamulya is that the impact of not optimal waste management is in Kelurahan Jakamulya, which is always flooded due to garbage, and Situ Wo, which cannot accommodate water. Efforts to manage waste from its source have been made with waste banks but have not been optimal. In Jakamulya Urban Village, each RW already has a Waste Bank. New waste management is to sort waste for reuse (reuse) into compost and recycle (recycled) plastic waste into handicraft products but cannot yet be marketed. Waste that cannot be reused and recycled must be reduced (reduced) but cannot yet be done, one way to reduce waste piles at the source is burning

garbage, but burning waste in residential areas will impact ARI disease. Jakamulya Urban Village community awareness is still low in terms of sorting waste and saving waste.

Highlighting some of the problems that occurred in the Jakamulya Urban Village, Bekasi City, among others:

- a. The volume of waste in Bekasi City is increasing so that it increases the volume of waste sent to TPA
- b. Jakamulya Urban Village community awareness is still low in terms of sorting waste and saving waste.
- c. Efforts to manage waste from its source have been carried out with waste banks but are not yet optimal. New waste management involves sorting waste for reuse.
- d. There is an empty land (fasos) that is not used as a trash bin and a place for wild animals.
- e. There is no waste management model (waste bank) to be used as a 3R
- f. Based on the environmental education model 3R-based waste management, it needs to be applied to deal with school children's environment and education.

The Bekasi City Regional Partnership Program's objective is to increase community participation in waste management with the 3R concept (reuse, recycle, reduce). Through the formation of a Waste Bank in Jakamulya Urban Village, it is hoped that it can increase community participation in waste management and improve the community's economy by managing waste banks. Apart from increasing the level of community participation and improving community welfare through integrated waste bank management, this program is expected to be implemented in environment-based learning by optimizing the management of junior high schools and equivalent in Bekasi city. Suppose the Directorate of Research and Community Service still believes in the long-term orientation of this activity. In that case, the Directorate of Research and Community Service is Developing a Waste Bank Extracurricular Model at various education levels in Bekasi City.

## **LITERATURE REVIEW**

Based on the chemical composition, the waste is divided into organic waste and inorganic waste. Research on solid waste in Indonesia shows that 80% is organic waste, and it is estimated that 78% of this waste can be reused (Outerbridge, ed., 1991).

Waste management is all activities carried out in handling waste from its generation to final disposal. Activities in waste management include control of waste generation, waste collection, transfer and transport, processing, and final disposal (Kartikawan, 2007) as follows:

a) Solid waste generated

From the definition, it can be concluded that basically, waste is not produced but is generated (solid waste is generated, not produced). Therefore, in determining the appropriate handling method, the determination of the amount of waste generation is determined by the number of actors and their types and activities. Ideally, to find out the amount of waste generated by a study. But for practical purposes, a standard has been established by the Ministry of Public Works. One of them is SK SNI S-04- 1993-03 concerning waste generation specification for small and medium cities. Where the amount of waste generation for a medium city is 2.75-3.25 liters/person/day or 0.7-0.8 kg/person/day.

b) On-site handling

Waste handling at the source is all treatment of waste that is carried out before the waste is placed in a landfill. This activity starts from a condition where a material that has been thrown away or is not needed often still has economic value. On-site waste handling can have a significant effect on waste handling at a later stage. Activities at this stage vary according to the type of waste, including sorting, reuse, and recycling. The main objectives and activities are to reduce the amount of waste generation.

c) Collecting

It is an activity of collecting waste and its source to the TPS location. This is generally done by using wheelbarrows and houses to the TPS location.

d) Transfer and transport

Is the activity of moving waste and TPS to a waste processing disposal location or final disposal location.

e) Treatment

Depending on the type and composition, waste can be processed. Various alternatives are available in waste processing, among them are:

1. Physical transformation, including separation of waste components (shorting) and compaction (compacting), the purpose of which is to facilitate storage and transportation

2. Incineration is a waste processing technique that can convert waste into gas to reduce volume by 90-95%. Although it is a useful technique, it is not a recommended technique. This is because this technique has the potential to cause air pollution
3. Composting, compost is a natural (organic) fertilizer made from forage and other organic materials that are intentionally added to accelerate the decomposition process, such as livestock manure or, if deemed necessary, factory-made fertilizers, such as urea ( Wied, 2004). In contrast to other waste processing processes, in the compost-making process, both raw materials, manufacturing sites, and manufacturing methods can be done by anyone, anywhere.

f) Income generate

The next process of physical transformation, including the separation of waste components (shorting) whose purpose is for recycling, the waste can generate additional income for the community.

- 1) The process of sorting plastic bottles and glass waste can be chopped and sold to collectors. Technically, efforts are made to procure a plastic crushing machine with a capacity of 300 kg per day.
- 2) Used goods that can be used as a primary material for recycled products are sorted, PKK women can make recycled products such as flowers, bags, hats, and others.
- 3) Leaves and kitchen waste are made of compost and eco-enzyme, packaged for sale to farmers who cultivate organic crops and PKK.
- 4) They are forming a collaborative business group to properly manage all these activities to handle financial management and marketing management issues properly.

**MATERIALS AND METHOD**

The method used in solving the problem includes the process of analysis. The methods used in community service completion are listed in Tables 1 to 3.

**Table 1.**  
PKW Program in 2018

<b>Problem</b>	<b>Program Activities</b>	<b>Program Output</b>
The volume of waste is increasing so that it increases the volume of trash to the TPA. Public awareness is still low in terms of sorting waste and saving waste.	Program to Improve Recycling.  Community Welfare-based Waste Utilization Optimization Program	<ul style="list-style-type: none"> <li>• FGD with local government and community.</li> <li>• Integrated 3R-based waste management.</li> <li>• Joint Business Group (KUBE) in the form of Mutiara Waste Bank.</li> </ul>
Waste that cannot be reused and recycled must be reduced (reduced) but cannot be done, one way is burning waste but in ISPA disease.	Application of 3 R (Reuse, Reduce, Recycle) technology based in RW environment.	<ul style="list-style-type: none"> <li>• 1 unit of an environmental garbage incinerator.</li> <li>• 1 unit of plastic crushing machine.</li> <li>• 1 unit of solid and liquid compost.</li> </ul>

**Table 2.**  
PKW Program in 2019

<b>Problem</b>	<b>Program Activities</b>	<b>Program Output</b>
Efforts to manage waste from the source have been carried out with waste banks, but the new management involves sorting waste for reuse.	Application of 3R technology-based in RW environment.  RTH revitalization is based on environmental education.	<ul style="list-style-type: none"><li>• One waste bank building. Ecobrick was doing training.</li><li>• One unit of water osmosis for water alms program.</li><li>• One unit of a greenhouse for plant cultivation.</li></ul>

**Table 3.**  
PKW Program in 2020

<b>Problem</b>	<b>Program Activities</b>	<b>Program Output</b>
Environmental education learning in junior high schools does not have a 3R-based technology application model	School Waste Bank Program in the framework of school environmental education.	Junior high schools have a waste bank program based on school environmental education.
There is an empty land (social facilities) that is not used as a trash can and a place for wild animals.	Organic vegetable and fruit cultivation program	<ul style="list-style-type: none"><li>• Improvement of waste bank housing facilities.</li><li>• Making RTH.</li><li>• Flower nursery.</li></ul>



## RESULTS AND DISCUSSION

### A. Implementation Program 2018

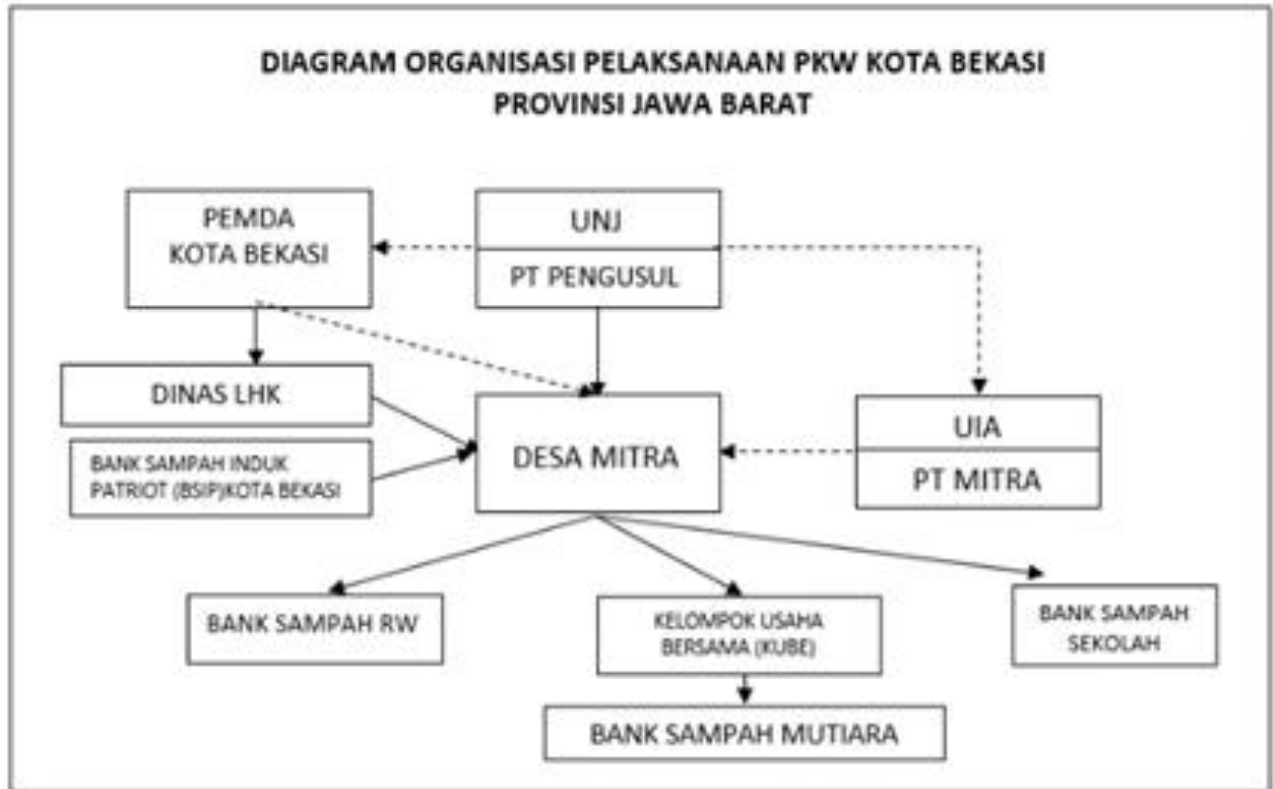
#### 1. Establish a Mutiara Waste Bank

Mutiara Sampah Bank as a technology-based integrated waste management facility, Pondok Suryamandala, Jakamulya Village, South Bekasi District, Bekasi City. With the increasing population, there is still a low level of solid waste services carried out by the Bekasi City Environment Agency, responsible for managing waste. There is always a lack of public awareness of waste management, so efforts are needed to reduce waste from its source (household). The effort made by the PKW Program to reduce the volume of waste carried to the Bantargebang Final Processing Site (TPA) is the Jakamulya Village Waste Bank program, which aims to increase public awareness of waste management by reducing waste and separating waste between organic and non-organic waste. Organic so that the burden of TPA in accommodating waste will decrease. The community carries out waste reduction efforts through the 3R movement, namely: reduce waste, reuse materials that have the potential to become useful, and recycle back waste. Organization diagram of PKW Bekasi City can be seen in Figure 1.

The actors who play a role in the waste bank's activities include the head of the waste bank, the waste bank customers, collectors, the regional government (Dinas LH Kota Bekasi), and the main waste bank in Bekasi City (Patriot). Most of the waste bank customers are housewives, which happens because homemakers are in direct contact with domestic or household waste management. A waste bank is a place used to collect non-organic waste that has been sorted according to its type from households, aiming to raise public awareness of waste management and turn waste into something useful or of economic value for the community through the recycling process.

Waste management by sorting waste according to the technology-based 3R concept has been carried out by the PKW team since 2018. The management includes:

- a. The collection is collecting waste and its sources going to the 3R TPS location. This is generally done by using wheelbarrows and houses heading to TPS 3R.
- b. Treatment, depending on the type and composition, waste can be processed. Various alternatives are available in waste processing, including Physical transformation, including separation of waste components (shorting) and compaction, which aims to facilitate storage and transportation; Incinerate is a waste processing technique that can convert waste into gas so that its volume can be reduced by 90-95%; Composting, compost is a natural fertilizer (organic) made from forage and other organic materials that are intentionally added to accelerate



**Figure 1.**  
Organization diagram of PKW Bekasi City

the decomposition process, such as livestock manure, or if deemed necessary, factory-made fertilizers, such as urea, can be added.

- c. Income generate, the next process of physical transformation, including the separation of waste components (shorting) whose purpose is to recycle, the waste can generate additional income for the community.
  - 1) The process of sorting plastic bottles and glass waste can be crushed and sold to collectors. Technically, efforts are made to procure plastic crushing machines with a capacity of 1000 kg per week.
  - 2) Used goods that can be used as basic materials for recycled products are sorted, PKK women can make recycled products such as flowers, bags, hats, and others.
  - 3) Leaves and leftover kitchen waste are made compost and eco-enzyme, packaged for sale to farmers who cultivate organic crops and PKK.
  - 4) Forming a collaborative business group to manage all these activities so that financial management and marketing management issues can be managed properly.

The operation of TPS 3R, the key to community-based waste management, actually lies in the process chain at the household level and the RT level. Which directly involves the community as a plus manager (home industry owner). Without this communal system, waste can't be handled completely or sustainably. Waste Management with the active role of the community in the Jakamulya Village, Bekasi City in the Regional Partnership Program by way of:

- a. Striving for waste to be managed, sorted, and processed in the early stages, starting from the place where the waste is generated (in this case, most are household environments). This effort can reduce the waste generation that must be collected and transported to the TPS so that the burden is reduced.
- b. In the initial phase at the household level, efforts were made to process organic waste into compost. Inorganic waste was sorted and collected according to its type so that it was possible to recycle.
- c. The next stage is waste processing at the integrated waste processing site, managed by the Mutiara waste bank.
- d. The final stage is the transportation of the absolute waste, waste that cannot be recycled or used again in TPS, around 20-40% of the waste to the TPA. In this phase, the final waste disposal or burning process can be carried out using an incinerator.

**2. Installation of One Plastic Crushing Machine**

In the first year, PKW activities were installing a plastic crushing machine with a blade size of 10 inches with a production speed of 100 kg/8 hours. This machine was purchased from the 2018 Ministry of Research, Technology, and Higher Education PKW funds. The crushing process of the machine can be seen in Figure 2.

Furthermore, the handling of plastic waste is chopped using a plastic crushing machine. The chopped results are collected in sacks and stored in the warehouse to be sold to PT. Majestik Buana.

The proceeds from sales of the census are more profitable than selling directly to generate income for the Waste Bank and residents. The results of the census are sold to PT. Majestik Buana, in one month the sales are only around 3-5 million.

**3. Installation of One Mini Incinerator Unit**

In the first year, a mini incinerator unit with a burning capacity of 1 m<sup>3</sup> per hour was also installed, which is used to burn waste in the Mutiara waste bank area, not disturb the residential environment. With the incinerator, it can reduce the amount of waste brought to Bantar Gebang. Training on the use of mini incinerators can be seen in Figure 3.

**4. Application of Tong POC (Organic Liquid Fertilizer)**

Implement five units of Tong POC to accommodate five housing blocks in the RT 05 / RW 13 area of Jakamulya Village. Domestic waste products such as food scraps are collected in POC barrels given chemical liquid for fermentation to produce organic liquid fertilizer. Mothers learning to make liquid fertilizer can be seen in Figure 4.

**B. Implementation Program in 2019**

**1. Construction of Mutiara Waste Bank Houses**

The Waste Bank House is used to support residents' activities. Funding is made from PKW funds, citizen funds, and the Bekasi City Government. This development uses part of PKW funds from the Ministry of Research, Technology, and Higher Education and partly from community organizations. Construction of a waste bank building can be seen in Figure 5.

**2. Water Osmosis Installation**

The water osmosis installation for the water alms program and the exchange of waste for gallon water can increase active citizen participation in the waste bank. Water osmosis installation can be seen in Figure 6.



**Figure 2.**  
The crushing process of the machine



**Figure 3.**  
Training on the use of mini incinerators



**Figure 4.**  
Mothers learning to make liquid fertilizer

**3. Installation of greenhouses and composter tanks**

In greenhouse installation, it is used as a means of planting flower plants and medicinal plants. Meanwhile, the composter tub is used to make dry compost. In 2019 the installation of greenhouses and composter tanks was not perfect due to the limited funding of PKW funds so that it was perfected in the third year. Construction of a greenhouse and composter can be seen in Figure 7.

**4. Socialization of Ecobrick Making**

Ecobrick is processing plastic waste into environmentally friendly materials. This is an effort to reduce the accumulation of plastic waste. This environmentally friendly material is made by inserting and compacting clean and dry plastic waste into used plastic bottles and using a small stick to compact the plastic waste. Ecobrick is a method to minimize waste by using plastic bottles filled with inorganic waste until it is tough and stable. The eco brick's goal is to reduce plastic waste and recycle it with plastic bottles to make something useful. Examples of their use are the manufacture of tables, chairs, walls, and other art items that even value. Ecobrick making can be seen in Figure 8.

The people of RT 05 RW 13 Kelurahan Jakamulya were excited when they were empowered to make a hexagon module eco brick, which was the most comfortable eco brick result. Made from simple silicone putty, these modules are durable and make incredibly practical indoor pieces of furniture. The modules can be used individually as seats or assembled like legos to produce tables, beds, benches, and more. These modules can be easily stacked and stored. One 600 milliliter plastic bottle can be filled with 250 grams of plastic waste or the equivalent of 2500 food packages in plastic packaging. Just imagine how easy it is we can minimize plastic waste scattered around us with this eco brick.

**C. Implementation Program in 2020**

**1. Open Space Development**

As an integral part of the waste bank environmental area, the Green Open Space will attract the public to carry out activities in that area. Apart from functioning as a garden, it can also work to plant useful plants for residents. Creation of a green open space can be seen in Figure 9.

**2. Flower Nursery at Greenhouse**

The greenhouse created in the previous year is then optimized in the third year by planting flowers. The nursery's interest is then sold to residents, where the proceeds are managed in a waste bank management. Flower nursery in a greenhouse can be seen in Figure 10.





**Figure 5.**  
Construction of a waste bank building



**Figure 6.**  
Water osmosis installation



**Figure 7.**  
Construction of a greenhouse and composter



**Figure 8.**  
Ecobrick making

**3. Improvement of Waste Bank Housing Facilities**

The improvement of the waste bank housing facilities is an effort to make the waste bank better. The work carried out includes plastering the floor for drying chopped results, painting the walls, and adding several parts of the space for additional warehouses. Improved waste bank facilities for drying chopped results can be seen in Figure 11.

**4. Environmental education-based waste bank program with the application of 3R technology in 12 Junior High School & 21 Junior High School**

The problems faced by schools in environmental education for students are usually related to the school's facilities in providing examples of learning about waste processing using 3R-based technology. In environmental education learning in junior high schools, there is no 3R-based technology application model that can be given real examples to students. The School Waste Bank Program in clean environment education is an activity for 2020 with teacher outreach to locations and online activities. It is hoped that junior high schools can have a waste bank program based on environmental education with 3R-based technology in collaboration with Mutiara Waste Bank. This program's output is school management-based environmental learning handouts and the Mutiara Waste Bank Book as examples of students' learning models. Socialization in the framework of drafting a model for environmental education can be seen in Figure 12. Online FGD activities with teachers and visits to schools can be seen in Figure 13.

**D. Economic and Social Impact**

One of the social impacts of Mutiara Pondok Suryamandala Waste Bank Bekasi City's existence can be seen from the presence or absence of influence and encouragement on residents (at the household level) to carry out waste sorting. However, changes in behavior patterns are not easy because they relate to changes in culture and perspective. Changes in community behavior in handling household waste can be seen from the community's behavior before and after the existence of a waste bank in this area. One of the social benefits of having a waste bank is that it can involve the community with community activities in waste bank management. The residents around the waste bank are very enthusiastic about the activities that are carried out every Friday. There was a positive impact on the socio-economic life of the people in Pondok Surya Mandala after the construction of the Mutiara Waste Bank. The residents were increasingly engaged in carrying out activities. This is indicated by an increase in community-owned waste bank savings, although a little, but it provides significant benefits for the community. Not only has income





**Figure 9.**  
Creation of a green open space



**Figure 10.**  
Flower nursery in a greenhouse

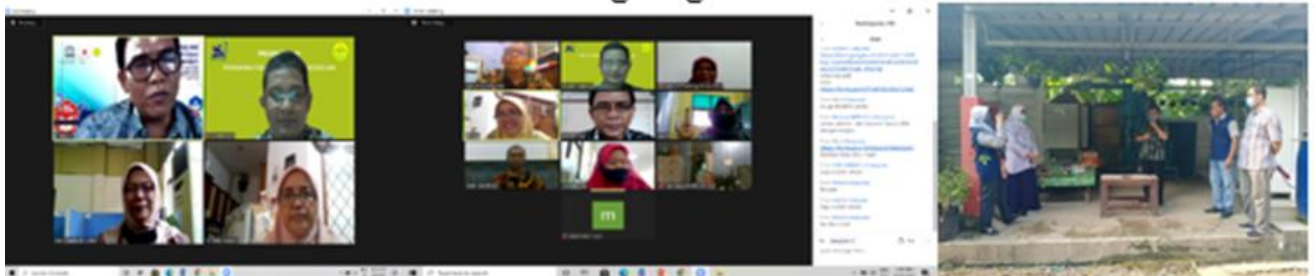


**Figure 11.**  
Improved waste bank facilities for drying chopped results





**Figure 12.**  
Socialization in the framework of drafting a model for environmental education



**Figure 13.**  
Online FGD activities with teachers and visits to schools

increased, but health and better social interaction among the community are also the most important thing is a cleaner environment has also increased over time.

## **CONCLUSIONS AND SUGGESTIONS**

### **CONCLUSIONS**

- a. The PKW program, which was implemented from 2018 to 2020, can transform the Pondok Surya Mandala Mutiara Waste Bank in Jakamulya Village, Bekasi City, to implement 3R-based Waste Management Technology (TPS) with the support of residential residents.
- b. Mutiara Pondok Suryamandala Waste Bank, which is based on TPS 3R, is the key to handling community-based (communal) waste, which is very useful for waste management that is directly carried out by the community as a plus manager (home industry owner). Without this communal system, waste can't be handled entirely or sustainably.
- c. Cultivating useful waste disposal methods starting from the household environment to submitting waste to the Waste Bank is an effective method at the community level that will ultimately be independent of the community in managing their waste.
- d. Organizing TPS 3R into a center for the maximum utilization of organic and inorganic waste is a communal-based waste management program that will cut the chain of waste distribution from TPS 3R to TPA.

### **SUGGESTIONS**

- a. The Bekasi City Government, through the Environmental Agency, is expected to continue the mentoring process for the sustainability of the Mutiara Waste Bank program.
- b. In managing a Waste Bank, a high social spirit is also needed to maintain a business's continuity that involves many people.

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