Universitas Muhammadiyah Malang, East Java, Indonesia

Journal of Community Service and Empowerment

p-ISSN 2442-3750, e-ISSN 2537-6204 // Vol. 4 No. 1 April 2023, pp. 130-138

Utilization of plastic waste into garden decoration using ecobrick techniques

Ridwan Akbar [a,1], Renny Nurhasana [a,2], Chotib [a,3], Rizqita Oktorini [a,4], Dhaneswara N. Indrajoga [a,5], Utoyo Harjito [a,6], Redidzia Hernandi [a,7], Dyah N. Ratnasari [a,8], Astri Hanna Grace Waruwu [b,9], Imam Budi Hartono [c,10]

[a] *Urban Development Studies, School of Strategic and Global Studies, University of Indonesia, Jl. Salemba Raya No. 4 Jakarta 10430, Indonesia*
[b] *International Relations, Faculty of Social and Political Sciences, President University, Jl. Ki Hajar Dewantara, Kota Jababeka, Cikarang Baru, Bekasi, West Java 17550, Indonesia*
[c] *Depok City Government of West Java, Jl. Margonda Raya No.54, Kemiri Muka, Kecamatan Beji, Depok, West Java 16425, Indonesia*
[1] *ridwan.akbar@office.ui.ac.id;* [2] *rennynurhasana@ui.ac.id*;* [3] *chotib.m@ui.ac.id;* [4]*rizqitaoktorini@gmail.com;* [5]*dhaneswara.nirwana@ui.ac.id;* [6]*utoyotujuh@gmail.com;* [7]*redidzia.hernandi@ui.ac.id;* [8]*dyah.n@ui.ac.id;* [9]*astriwaruwu@gmail.com;* [10]*imam.budi11@ui.ac.id;*
**** Corresponding author***

ARTICLE INFO

Article history
Received: 2023-01-05
Revised: 2023-02-06
Accepted: 2023-02-10
Published: 2023-02-25

Keywords
Community empowerment
Eco-brick
Waste utilization

ABSTRACT

Plastic waste which is dangerous and difficult to manage is still one of the factors causing environmental damage which is still a big problem for the people of Indonesia. Depok City has a fairly chronic problem in terms of solid waste. This study aims to determine the relationship between the level of public knowledge on the use of waste through the Eco-brick Technique in the management of plastic waste. Community service is carried out to provide facilitation with assistance and training on the dangers of plastic waste, as well as waste management through eco-brick techniques that have high utility value. The method of a community development program with a model of tutoring and empowering the communities, especially women in Cinangka District, Depok City. From the results of the community empowerment, it can be seen that community service activities through workshops and implementation of the use of plastic waste are useful for human daily life, in this case in the form of garden decorations. Some of the program targets/indicators are that the people of Cinangka Village, Depok City are able to apply eco-brick techniques in the creativity of building furniture for the needs of sleeping land that will be processed together into a functioning public space. People are starting to understand why we need eco-brick and making eco-brick can be used as garden decorations that are used as an alternative solution to the use of a lot of plastic waste through creative community empowerment activities.

Kata Kunci
Pemberdayaan masyarakat
Pemanfaatan limbah
Eco-bricks

Pemanfaatan sampah plastik menjadi dekorasi taman dengan teknik ecobrick. Sampah plastik yang berbahaya dan sulit dikelola masih menjadi salah satu faktor penyebab kerusakan lingkungan yang masih menjadi masalah besar bagi masyarakat Indonesia. Kota Depok memiliki masalah yang cukup kronis dalam hal limbah padat. Penelitian ini bertujuan untuk mengetahui hubungan antara tingkat pengetahuan masyarakat tentang pemanfaatan sampah melalui Teknik Eco-brick dalam pengelolaan sampah plastik. Pengabdian kepada masyarakat dilakukan untuk memberikan fasilitasi dengan pendampingan dan pelatihan tentang bahaya sampah plastik, serta pengelolaan sampah melalui teknik eco-brick yang memiliki nilai utilitas tinggi. Metode program pengembangan masyarakat dengan model bimbingan belajar dan pemberdayaan masyarakat, khususnya perempuan di Kabupaten Cinangka, Kota Depok. Dari hasil pemberdayaan masyarakat dapat dilihat bahwa kegiatan pengabdian kepada masyarakat melalui workshop dan implementasi pemanfaatan sampah plastik bermanfaat bagi kehidupan manusia sehari-hari, dalam hal ini berupa hiasan taman. Beberapa sasaran/indikator program adalah masyarakat Desa Cinangka, Kota Depok mampu menerapkan teknik eco-brick dalam kreativitas membangun furnitur untuk kebutuhan lahan tidur yang akan diolah bersama menjadi ruang publik yang berfungsi. Masyarakat mulai memahami mengapa kita membutuhkan eco-brick dan pembuatan eco-brick dapat dijadikan hiasan taman yang dijadikan alternatif solusi pemanfaatan sampah plastik secara berlebihan melalui kegiatan pemberdayaan masyarakat yang kreatif.

How to cite: Akbar, R., Nurhasana, R., Chotib., Oktorini, R., Indrajoga, D.N., Harjito, U., Hernandi, R., Ratnasari, D.N., Waruwu, A.H.G., & Hartono, (2023). Utilization of plastic waster into garden decoration using ecobrick technique. *Journal of Community Service and Empowerment, 4*(1), 130-138. https://doi.org/10.22219/ jcse.v4i1.24239

INTRODUCTION

Plastic is a material that can be recycled through many processing methods. The characteristics of plastics are chemicals that are difficult to degrade or decompose by nature; It takes hundreds or even thousands of years to decipher them (Widodo et al., 2018). Waste is the residue of daily human activities and natural processes that are solid (Article 1 of Law Number 18 of 2008 concerning Waste Management). The degree of public health is determined by the condition of the host, agent (cause of disease), and environment (Leria et al., 2020). Environmental factors are one of the determining elements of public health. If there is a change in the environment around humans, there will be changes in the health conditions of the community environment (Istirokhatun & Nugraha, 2019). Environmental factors and behavioral factors greatly affect public health, so they deserve serious attention. Healthy behavior factors are expected to maintain, improve health and protect themselves from the threat of disease, while a healthy environment is expected to create a conducive, pollution-free residential environment (KLHK, 2020).

Plastic is widely used in various types of living needs. From food wrappers to automotive gear. Plastic is the most popular material for the manufacture of automotive elements other than metals, such as iron (Khoirina, Opti & Ludwina, 2016). Non-biodegradable plastic waste is a major plastic problem. Cleaning up plastic waste from the face of the earth takes a very long time. In addition, the use of plastic is almost uncontrollable (Suminto, 2017). The air temperature of plastics is also getting warmer day by day, due to the non-porous nature of the polymer. Today, most products are manufactured without considering where they are used (Kalfas et al., 2022). The cause behind the overflow of landfills, mountains of plastic and wraps, packaging, and products that obscure the region's ecosystem is the design philosophy of poor waste management (Widodo et al., 2018).

Many companies need massive investment and restructuring, including production, material sourcing, and the implementation of new systems for product absorption to set up plastic waste treatment systems. Healthy and effective waste management can be something that must be completed (Istirokhatun & Nugraha, 2019). Today, waste is a severe environmental problem around the world and is closely related to everyday human life. As a party that produces waste, no one can escape the waste problem (Kurniawan, 2003). Thus, the problem of waste is a matter of the perception of society itself and the choice of whether to cultivate it or not.

Depok City will enter it is 24th year in April 2023. At such a young age, Depok has a fairly chronic problem in terms of waste. So far, Depok City has only relied on the Cipayung landfill to be used as a landfill, which is increasingly exceeding its proper capacity. There are at least about 1.3 tons per day of mountainous waste in the Cipayung landfill. This mountain of garbage will undoubtedly be a potential landslide-prone disaster (Kumar & Hafiz, 2013).

The discourse on transferring waste disposal from the Cipayung landfill to the TPPAS (Waste Management and Final Processing Site) in Lulut Nambo, Bogor Regency was initiated in 2019. However, this idea has not been approved by the West Java Provincial government, so it has been delayed until now. The Head of the Depok City Environment and Hygiene Office proposed a revitalization plan for the Cipayung landfill to be able to increase the capacity of waste storage every day (Kurniawan, 2003). This revitalization is carried out by structuring infrastructure, active zones, and other facilities. The old litter will be spent, so it will leave only five percent residue.

In terms of number and type, waste is a problem that is increasing day by day along with the increasing population, activity level, lifestyle, socioeconomic level, and technological advances (Susanto, 2020). Plastic waste which is dangerous and difficult to manage is still one of the factors causing environmental damage which is still a big problem for the people of Indonesia (Ministry of Environment and Forestry Indonesia, 2021). Plastic bag waste that is needed by the community, it requires decomposition within tens or even hundreds of years (Wardani & Khotimah, 2021). Plastic waste that cannot be decomposed by bacteria is a severe problem for soil pollution. It would be nice if plastic waste can be reused by recycling and creating new products. Plastic waste management is currently not effective; many people throw garbage without regard to the category (Shakir et al., 2013).

Behavior is an attitude that is born as a result of interaction between humans and the environment (Tantiwat et al., 2021). The behavior of individuals and society can affect environmental conditions, and public awareness can influence it (Maulana & Haryanto, 2020). Community service in Bunga Raya Subdistrict found that one of the factors influencing waste management behavior is the level of education and public knowledge about local regulations on waste (Fauzi et al., 2020). About 80% of housewives dispose of plastic waste in the garden and burn plastic waste around their homes (Singh & Singh, 2022). Housewives in Depok City, who are around 75% of whom work as teaching staff, are often seen carrying drinks using used mineral water bottles (Ariyani et al., 2021). This community service aims to determine the relationship between the level of knowledge of housewives and the behavior of plastic waste management.

Ecobricks are one of the innovations in the construction world that uses plastic waste. Ecobricks use Polyethylene terephthalate (PET) bottles known as plastic materials that are widely used as mineral water packaging to carbonated drinks. According to a study conducted by the Ministry of Environment and Forestry (2020) together with UNEP, the food and beverage industry in Indonesia utilizes PET for production packaging which accounts for 60% of the total plastic production. However, the other side of PET is that it has a petroleum base, and it is not easily decomposed when released into the earth's environment through plastic waste leakage (Benyathiar, 2022).

The creation of PET bottle contents to eco-bricks varies widely from sand to brick to plastic (Ariyani et.al., 2020). However, to maximize plastic waste management, many communities choose to fill PET bottles with plastic waste (Antico et al., 2017). Ecobricks using plastic waste can use household plastic waste such as plastic bags, detergent wraps, instant food, and the like (Taaffe et al., 2014). Experiments conducted by Antico et al., (2017) show that at least an eco-brick containing plastic with a density of 481.9 kg/m^3 is needed to be used instead of solid materials such as brick and below it can be used as a roof or partition.

Departing from the problems faced by Cinangka Village, Depok City, Exposure to communities with the impact of plastic waste accumulation is crucial to avoid. Unfortunately, does not have adequate knowledge in managing waste, so waste is allowed to accumulate in one sleeping area in the middle of community housing. The behavior of individuals and society can affect environmental conditions, and public awareness can influence it. Community service is carried out to provide facilitation with assistance and training on the dangers of plastic waste, as well as waste management through eco-brick techniques that have high utility value. In addition, this activity can be a provision for the community in being creative in managing plastic waste which has been an environmental problem for many years. In addition, this activity has also indirectly clouded the implementation of SDGs 11 targets on sustainable cities and settlements with the aim of reducing adverse per capita urban environmental impacts, including by paying special attention to air quality, including handling municipal waste.

METHOD

This community service is a community service with a tutorial approach and assistance to the community (Table 1). This is done to the community and especially women in Cinangka Village, Depok City (Figure 1) with 65 participants. This program begins by collaborating with the local community, namely the head of the RT, PKK Cadre then conveys the technical activities that will be carried out, namely in the form of direct socialization to the community regarding eco brick management. This will affect the environment in the future.

Table 1. Stages of implementation of Community Service activities

No	Activities	Implementation Time	Explanation
1	First survey	Oct 21, 2022	The first survey was carried out in order to observe the situation of the local community as well as introduce team members who will carry out the workshop
2	Second survey	Oct 30, 2022	Explore the problems experienced by the community in depth and discuss the schedule of activities together with representatives of the activity participants.
3	Conducting workshops	November 5, 2022	Before the workshop began, the committee divided the participants into 4 groups with a total of 5-6 people per group. After that, each participant will be handed out a tool kit containing a pen and a book to facilitate participants in expressing their ideas related to land arrangement designs which will be discussed together in a Focus Group Discussion. Each group will be given 30 minutes to discuss simple land use ideas and the desired layout of eco-brick furniture. Then, each group will be given 5 minutes each for the presentation of ideas in front of the other group. At the end of the session, the committee will determine the best land arrangement design ideas and reward the group with the best design ideas. This is done to encourage the enthusiasm of the activity participants to bring out their best ideas in the land arrangement design to be realized.
4	Closing and Evaluation Events	December 18, 2022	With the assessment of the implementation of land management carried out by the community, whether it has reached the target or indicators of the success of the activity while again reminding the community of the urgency of good and correct waste management and avoiding the accumulation of waste that can endanger the environment and public health

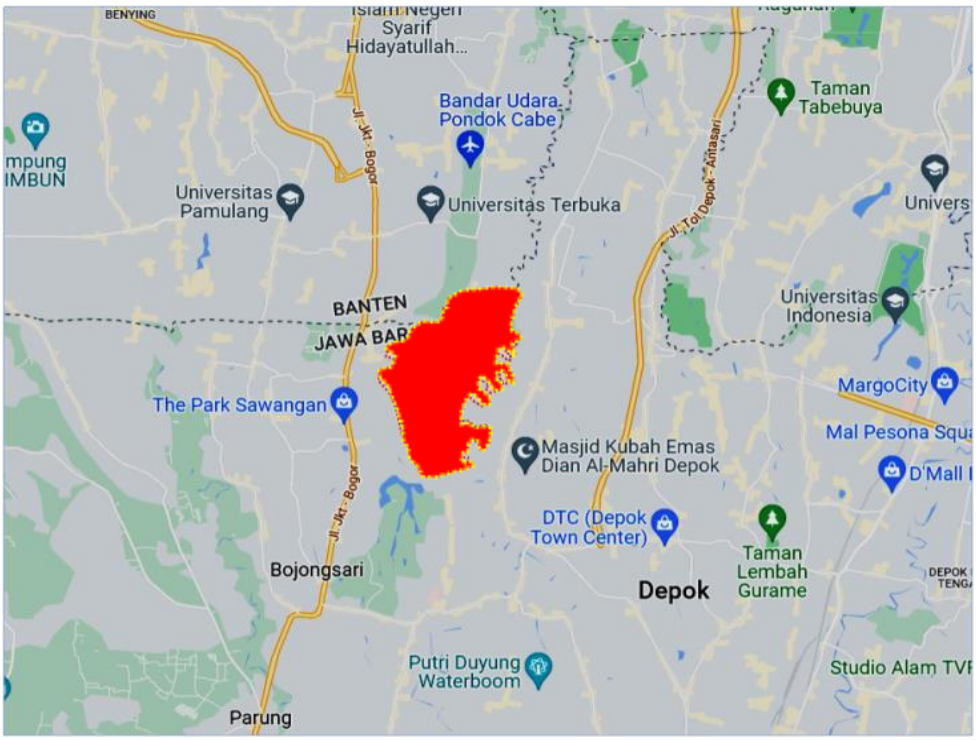

Figure 1. Location of Community Service Activities in Cinangka Village, Depok City

This is done by teaching the public about eco-bricking techniques and manufacturing procedures (Sujatini, 2018). The implementation stage is carried out by socializing and explaining plastic waste, its impact on the environment, and environmentally friendly management methods as well as training on managing plastic waste into value-added and environmentally safe products. Community service activities are a follow-up process of control for eco-brick results carried out. At this stage, it is also explained about the advantages and economic value of products made from plastic waste. The community and related parties are expected to be able to understand and practice how to manage plastic waste that is environmentally friendly and can socialize it to the communities around where they live.

RESULTS AND DISCUSSION

The role of the academic community in the downstream of science

The University of Indonesia through the Academic Community of the Urban Development Studies Study Program, the School of Strategic and Global Studies (SKSG), together with the Depok City Government have carried out Community Service and Empowerment in East Bulak Village RW 04 Cinangka Village, Sawangan Depok. This village is an area that has been used as an example of the Women's Empowerment, Healthy, and Prosperous Family Program (P2WKSS). This community service activity aims to contribute education to the community in reducing and utilizing plastic waste which is a problem in urban areas through active collaboration between the government, academics, and especially, local communities (Figure 2).

According to Maturbongs and Lekatompessy (2020), academics are one of collaborator agents who are responsible for solving development problems through their scientific capacity. In accordance with this, academics conduct training activities on eco-bricking from bottle waste and plastic to be reused into used items. The implementation of the program is a form of transferring knowledge for the ability to reprocess waste or recycle. Together with reuse and reduction, reprocessing waste is one of the easiest ways to implement waste control at the household level (Chowdhury et al,. 2014). It's just that the level of public awareness of waste control in Bulak Village is still minimal. This is supported by the participants' narrative that their understanding of waste reuse in daily life is higher. In fact, waste such as snack packaging and hygiene fluids, and plastic bottles are items that are never released in their daily lives. Therefore, the participation of academics in channeling their abilities and knowledge can have a big impact on the lives of people in settlements, especially the community in Bulak Village RT 3 RW 4, Cinangka Village.

Figure 2. Waste Utilization Training Activities.

Garden decoration making makes use of eco-brick products

The documentation of this program can be seen in the Figure 3. In practice, the eco-bricking described in the training can be explained in the order in which it is carried out. The manufacturing step consists of collecting used plastic bottles, such as used beverage bottled bottles (e.g. mineral water), used cooking oil bottles, and so on. Then wash well, then dry. Collect various kinds of plastic packaging, such as instant noodle packaging, instant drinks, plastic wrapping, plastic bags, and so on. It must be ensured that the plastic is free from all kinds of food (left in it), dry, and does not mix with other materials such as clips, threads, or paper. Put all kinds of plastic in point b into the plastic bottle in point a. With a side note, namely not mix with organic waste materials or other toxic and hazardous waste Should not be mixed with paper, glass, metal, sharp objects, and other materials other than plastic. The plastic material put in the plastic bottle must be compressed to a very dense state and fill the entire space inside the plastic bottle. Compact it by using tools made of bamboo or wood (such as bamboo sticks or wood). If you want to make something with this eco-brick, such as making a table, chair, or another object, you can use bottles of the same size, or even the same type and brand, making it easier to set up. If you want a colorful result, the plastic packaging arranged in it can be arranged in such a way that it produces the desired color. You can also wrap a plastic bottle with a colored adhesive. After all plastic bottles are filled with plastic packaging until solid, the plastic bottles are ready to be arranged and combined into other objects such as tables, chairs, even the walls and floors of the stage, room dividers, and others. For the purpose of gluing one bottle to another, adhesive glue or cement/gibs can be used. To hold them firmly, the bottles are tightly tied using rope or twine. The use of raffia rope will provide a good color effect while reducing other types of plastic waste.

Ecobricks are a valuable step forward in the transition to protecting the environment. All technical nutrient cycles are captured by eco-bricks and non-biodegradable materials. Ecobricks can also be used as construction materials such as eco-friendly bricks. Eco-friendly bricks allow craftsmen to get started by shaping cradle-to-cradle designs.

Figure 3. Ecobrick Product Manufacturing

Previous considerations and planning allow for the production of community empowerment products quickly and efficiently or also called eco-brick products (Nurazizah et al., 2021). There are no official licenses, certificates, or tests in making eco-brick products. By making this good and attractive product, it is hoped that it can be valuable from an economic point of view. In addition, in the long term, the use of waste can save human lives from plastic waste. Something has shifted here, where waste, the use of plastic that was previously only processed or handled by certain people such as scavengers, is now changing. Through eco-bricks, more and more people, and more and more groups, regardless of social class, are interested in processing plastic waste, especially those used in everyday life.

That's the target, not just how to manage the plastic that continues to be consumed, not just with the goal of building or shaping something eco-bricked but about reducing plastic consumption and not using it to the fullest. How to build mass awareness, become a community movement on all fronts and paths, because eco-bricking does not require special skills, and is free of charge because it departs from daily consumption of used use, can be done at any time, and can also be done together or alone while doing other daily activities, while filling the time. Not only does it avoid chemicals and make sure to consume everything healthier and more natural, but the reason is that these products are almost always

packaged in plastic wrap. Some ingredients that are difficult to make into eco-brick products include shampoo bottles, toothpaste tubes, liquid soap, and the like.

Plastic does not have to be disposed of or can be treated as well as possible or placed in the right place. Storing plastic is equivalent to reducing the effects of toxins that spread and damage the lives of living things. If stored in a place protected from sunlight, the bottle will last for 300-500 years. Ecobricks allow us to get the idea of changing product lines to slow down pollution. No substances in the product will corrode the plastic over time. The product can be mounted/cut into components that fit a standard bottle with a neck diameter of 22 mm. There are no sharp protrusions/shapes on the product that can pierce from the inside of the person working on the eco-brick when it is packed (e.g. glass, metal). The product does not contain reactive chemicals; if it does, this component is marked as ecobrickable. The product does not contain paper, liquids, or materials other than plastic. The product can be installed on the neck/plane with a diameter or size of 10-20 cm. The results of eco-brick formation provide results that can be used in everyday life.

Plastic is a hard waste that decomposes naturally, and over the years it has become a dilemma (Leria et al., 2020). Scientists, environmentalists, and ecologists have tried to solve the problem of plastic waste in various ways. Ecobricks are creative in handling plastic waste. It does not serve to destroy plastic waste, but it extends the life of such plastic and makes it useful for people in general (Shakir et al., 2013). Ecobrick production in the wider community is still not very popular. Most people still process household-made plastic waste, polluting the environment, and waterways and polluting daily life unknowingly. For this reason, more intensive socialization is needed related to creative efforts to process plastic waste. Starting from household plastic waste. With a little effort, one crucial environmental problem will unravel little by little.

Ecobricking is regularly held once a week or two when there is a lot of plastic waste, that's when awareness and concerns arise, such as: how difficult it is to put a plastic spoon in a bottle, how difficult it is to compact styrofoam from used food wrap, how difficult it is to put mica plastic from used data cable wrap or audio cables, the difficulty of eco-bricks an old toothpaste tube, or some plastic-coated paper bottles such as milk cartons, which even have metal or metal parts on the lid, or a little plastic in the hole.

There is an awareness that some packages are tricky to work with because they contain mixed materials and are difficult to become eco-friendly bricks. At the same time, eco-bricks are the only solution to trapping plastic, so as not to roam the environment and the earth. Or make eco-friendly bricks a new habit. Only then is the awareness of reducing plastic consumption and the need to protect the environment from toxic plastics. Plastic waste must be treated because it does not biodegrade; They are photodegraded. So that the plastic decomposes into small pieces and then seeps into the soil or water. Because the pieces, leaving garbage cans, garbage trucks, and garbage cans, will not have any impact; will end up even more horrifying (Suminto, 2017). Even when trying to recycle, it does nothing more than delay the final arrival of plastic waste to the process of polluting the soil, air, water and plants, forests and food and ourselves and our bodies or pregnant women or newborns, babies about to be born (Khoirina, Opti &Ludwina, 2016). Only from household waste that is used, from there we will be more aware and careful and reduce our plastic consumption.

Arrangement of Environmentally Friendly Social Facilities

Petrochemical plastics are produced but these substances are not ecologically suitable. Scientific studies show that these chemicals are toxic to humans (Apriyani et al., 2020). This is known when the smell of plastic combustion occurs. When these substances dissolve into the soil and water and air over time, they are absorbed in absorbed plants and animals causing damage to the soil, water, and air. Plastic waste that is disseminated, burned, or disposed of produces toxic substances. Even TPST (Integrated Landfill) engineering cannot be a successful solution. These chemicals will eventually enter the biosphere and affect the lives of livestock and humans within ten years or even a hundred years. The documentation of this program can be seen in the Figure 4 and Figure 5.

Figure 4. Land Planning and Decorating the Garden with Ecobrick Products.

Plastics do not biodegrade and will decompose for a long time (Fauzi et al., 2020). So that the plastic decomposes into small pieces and then seeps into the soil or water. Because the pieces are so small, the plants, fish, and animals we eat are easily absorbed. According to research (Singh & Singh, 2022) today the oceans are filled with plastics and other non-biodegradable non-biodegradable materials. Many studies have shown adverse effects on marine animals and the

environment. The researchers found that the effect of cold on the human body is the absorption of chemicals formed from plastic materials into the human body. In the United States and Europe, chemicals such as Biphenyl A and Phalates are now banned. But in the Philippines and in other Asian countries the chemical is still common (Leria et al., 2020). Even a small amount of this chemical causes allergies, hormonal imbalances, cancer, and acute poisoning in humans. These chemicals cause allergies. The parties most susceptible to unfavorable effects are young children. Petrochemicals combine to form dioxins when plastic is burned (Istirokhatun & Nugraha, 2019). Dioxin pollutes the air through smoke and soil and water through the soil. Dioxin is a destructive poison.

Figure 5. Results of Land Arrangement and Garden Decoration Activities Before and After Renovation

At the end of the workshop, the committee urged all participants to realize the land arrangement design using furniture made of eco-bricks (Figure 6). The realization of this land arrangement will be proof that the targets and indicators of the success of the activities carried out have been achieved. Local communities are given a period of one month before the closing ceremony which will be held on December 18, 2022. The closing ceremony will be accompanied by an assessment of the implementation of land management carried out by the community, whether it has reached the target or indicators of the success of the activity as well as reminding the community of the urgency of good and correct waste management and avoiding the accumulation of waste that can harm the environment and public health.

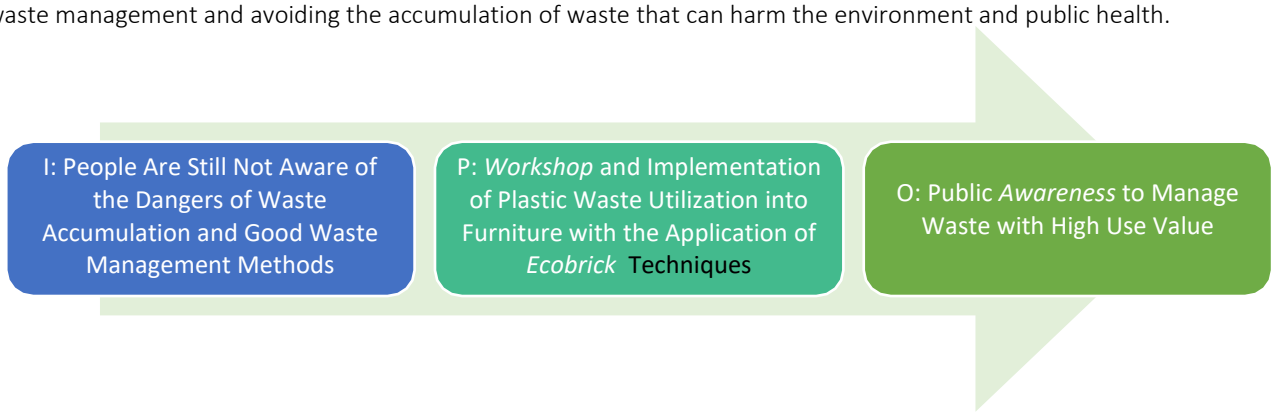

Figure 6. Diagram proses

Input: In terms of number and type, waste is becoming a problem that is increasing day by day as the population grows, activity levels, lifestyles, socioeconomic levels, and technological advances. Plastic waste that is dangerous and difficult to manage is still one of the factors causing environmental damage which is still a big problem for the people of Indonesia. Plastic waste that cannot be decomposed by bacteria is a severe problem for the environment. Environmental factors are one of the determining elements of public health. If there is a change in the environment around humans, there will be changes in the health conditions of the community's environment. Environmental factors and behavioral factors greatly affect public health, so they deserve serious attention. Healthy behavior factors are expected to maintain, improve health and protect themselves from the threat of disease, while a healthy environment is expected to create a conducive, pollution-free residential environment. The urgency of plastic waste management lies in the difficulty of plastic waste to decompose. By not decomposing waste, plastic particles that are classified as toxic will pollute the soil, groundwater, and underground creatures. In addition, plastic waste will disrupt waterways that seep into the soil and decrease soil fertility due to plastic blocking air circulation in the soil. There are several efforts made to tackle waste, one of which is through burning. However, the process of burning waste is increasingly adding to problems in the environment and public health. When plastic particles do not decompose completely, they will become dioxins in the air. Dioxin is a very dangerous compound if inhaled by humans. Dioxin can cause various diseases such as cancer, swelling of the liver, nervous system disorders, hepatitis, and depressive symptoms. Exposure to communities with the impact of plastic waste accumulation is crucial to avoid.

Process: Bulak Timur 04 Village is one of the villages experiencing waste management problems. Garbage is left lying and piled up in one of the sleeping fields that have no function. The accumulated waste greatly affects the health of the community and the environment of the village. The lack of public understanding of the dangers of accumulated waste and the lack of knowledge to manage waste are the main factors in choosing the location of the activity. Through community service by KPP-SKSG UI in this location, it is hoped that it can bring changes for the surrounding community to be able to manage waste into an object that has utilities. In addition, the community wants to use the sleeping land as a public space for the community that has functions such as playgrounds, gathering rooms, or tourist attractions. But unfortunately, they are confused about how to use the sleeping land while there is garbage piled up on it. By utilizing eco-brick techniques in managing waste, people can build furniture that can be used to renew the locus and reduce waste accumulation in Cinangka Village, Depok City.

Output: Through knowledge transfer means, it is hoped that the activities carried out can create a resilient and sustainable society. Some of the program targets/indicators are that the people of Cinangka Village, Depok City are able to apply eco-brick techniques in the creativity of building furniture for the needs of sleeping land that will be processed together into a functioning public space. In addition, the community is expected to increase awareness of how important it is to properly manage waste and use waste as a medium of creativity and has a high utility value. The program will also produce several outputs in the form of activity videos, popular news, product prototypes, and ISBN books as a medium for disseminating knowledge to the audience.

The results of the service activities to the community can be seen from the indicators of the success of the program carried out with a comparison before and after the implementation of the program in Cinangka Village, Sawangan Depok.

Table 2. Targets/Indicators knowledge transfer

No.	Targets/Indicators	Before	After
1	Knowledge of the Dangers of Waste Accumulation	Don't know	Know
2	Able to Apply Ecobrick Techniques in Waste Management	Incapable	Able
3	Able to Create Ecobrick Techniques into Something of Use Value	Incapable	Able
4	Able to Manage Sleeping Land Used for Waste Accumulation into Land that Has a Function	Incapable	Able

Some of the program targets/indicators are that the people of Cinangka Village, Depok City are able to apply eco-brick techniques in the creativity of building furniture for the needs of sleeping land that will be processed together into a functioning public space. In addition, it is hoped that the public will increase awareness of how important it is to properly manage waste and use waste as a medium of creativity and have high utility value.

CONCLUSION

From the results of community service, it can be seen that eco-bricking can be used as a solution to the use of household plastic waste produced by residents of Kampung Cinangka Village, Sawangan Depok. This community empowerment activity can convey the urgency of processing household plastic waste into eco-bricks from the process of transferring knowledge between academics and the community to support regulations that have been echoed by UNEP, and the Ministry of Environment and Forestry to the Depok City Government regarding plastic waste reduction. The emphasis of this community service is to encourage people to understand the usefulness of eco-bricks that are robust in any temperature conditions and reduce negative impacts on the environment and reduce marine pollution. Thus, eco-bricking household plastic waste into eco-bricks adds aesthetic, utility, and economic value and massively reduces plastic consumption.

ACKNOWLEDGEMENTS

The author would like to thank the Local Government and the People of Depok City for being community service partners. This activity was initiated in collaboration with the Study of Urban Development, Regional Studies of Japan, and the School of Environmental Sciences, University of Indonesia. In addition, thank you for the full financial and technical support of the Health, Social Welfare, and Human Development Research Cluster Grant from the School of Strategic and Global Studies, the University of Indonesia in 2022.

REFERENCES

Apriyani, A., Putri, M. M., & Wibowo, S. Y. (2020). Pemanfaatan sampah plastik menjadi ecobrick. *Masyarakat Berdaya dan Inovasi, 1*(1), 48–50. https://doi.org/10.33292/mayadani.v1i1.11

Ariyani, D., Warastuti, N., & Arini, R. (2021). Ecobrick Method To Reduce Plastic Waste in Tanjung Mekar Village, Karawang Regency. *Civil and Environmental Science*, 004(01), 022–029. https://doi.org/10.21776/ub.civense.2021.00401.3

Benyathiar, P.; Kumar, P.; Carpenter, G.; Brace, J.; Mishra, D.K. Polyethylene Terephthalate (PET) Bottle-to-Bottle Recycling for the Beverage Industry: A Review. (2022). *Polymers. 14*, 2366. https:// doi.org/10.3390/polym14122366

Fauzi, M., Sumiarsih, E., Adriman, A., Rusliadi, R., & Hasibuan, I. F. (2020). Pemberdayaan masyarakat melalui pelatihan pembuatan ecobrick sebagai upaya mengurangi sampah plastik di Kecamatan Bunga Raya. *Riau Journal of Empowerment, 3*(2), 87–96. https://doi.org/10.31258/raje.3.2.87-96

Istirokhatun, T., & Nugraha, W. D. (2019). Pelatihan Pembuatan Ecobrick sebagai Pengelolaan Sampah Plastik di Rt 01 Rw 05, Kelurahan Kramas, Kecamatan Tembalang, Semarang. *Jurnal Pasopati "Pengabdian Masyarakat Dan Inovasi Pengembangan Teknologi*," 1(2), 85–90.

Kalfas, D., Chatzitheodoridis, F., Loizou, E., & Melfou, K. (2022). Willingness to Pay for Urban and Suburban Green. *Sustainability (Switzerland), 14*(4). https://doi.org/10.3390/su14042332

Khoirina, F, Opti, S., Ludwina, H. (2016). Self-awareness (kesadaran pribadi) masyarakat dalam mewujudkan sustainable environment ditinjau dari perspektif audit lingkungan. *Kesejahteraan Sosial : Journal of Social Welfare, 3*(2), 104–119.

KLHK. (2020). Roadmap Nationally Determined Contribution (NDC) Adaptasi Perubahan Iklim. 4, 763–773. http://ditjenppi.menlhk.go.id/reddplus/images/adminppi/adaptasi/dokumen/Roadmap_NDC_API_opt.pdf

Kumar, S., & Hafiz, K. A. (2013). decision making cosmetics stimuli on consumer purchase decision of Malaysia's cosmetic industry. https://www.academia.edu/35086019/Decision_Making_Cosmetics

Kurniawan, T. (2003). manajemen kota berkelanjutan di Indonesia: Indikator dalam upaya pengembangan kebijakan kota berkelanjutan oleh pemerintah kota di Indonesia. (Studi Kasus pada Kota Depok, Bogor, dan Bandung). *Jurnal Bisnis & Birokrasi, XI*(1), 26–38.

Leria, P. S. P., Febrianto, M. W., Astari, S. A., Fitriasari, E. T., & Syarifuddin, A. (2020). Pengolahan sampah plastik melalui kreativitas produk ecobrick di Dusun Baron, Muntilan, Magelang. *Community Empowerment, 5*(1), 11–15. https://doi.org/10.31603/ce.v5i1.3130

Maulana, E., & Haryanto, H. C. (2020). Bagaimana kondisi kesadaran lingkungan terkait pencemaran udara yang dimiliki oleh masyarakat perkotaan (Studi pendahuluan pada masyarakat di Jakarta). *INQUIRY Jurnal Ilmiah Psikologi*, *11*(1), 40–50. https://doi.org/10.51353/inquiry.v11i1.415

Ministry of Environment and Forestry Indonesia. (2021). Long-term Strategy on Low Carbon and Climate Resilience 2050 (LTS-LCCR 2050). United Nations Climate Change, 1–32. https://unfccc.int/sites/default/files/resource/Indonesia_LTS-LCCR_2021.pdf

Ministry of Environment and Forestry (2020): National Plastic Waste Reduction Strategic Actions for Indonesia, Republic of Indonesia

Nurazizah, E., Mauludin, I. I., Afifah, I. R., & Aziz, R. (2021). Pemberdayaan masyarakat guna pemanfaatan sampah plastik menjadi ecobrick di Dusun Kaliwon Desa Kertayasa. Proceedings UIN Sunan Gunung Djati Bandung, 1(16), 139–151. Retrieved from https://proceedings.uinsgd.ac.id/index.php/proceedings/article/view/474/418

Shakir, A. a, Naganathan, S., Nasharuddin, K., & Mustapha, B. (2013). Development of bricks from waste material: a review paper. *Australian Journal of Basic and Applied Sciences, 7*(8), 812–818.

Singh, E. J., & Singh, N. R. (2022). Ecobrick an effective technique to manage plastic waste at home. *Indian Journal of Environment Sciences, 26*(2), 61–64.

Sujatini, S. (2018). Keberlanjutan ekologis: Proses pembangunan kawasan hunian sebagai Sustainable Development Goals (SDGS) (Studi kasus proses pembangunan kawasan hunian pada kota mandiri). *IKRA-ITH TEKNOLOGI: Jurnal Sains & Teknologi, 2*(2), 27–37

Suminto, S. (2017). Ecobrick: solusi cerdas dan kreatif untuk mengatasi sampah plastik. PRODUCTUM Jurnal Desain Produk (Pengetahuan Dan Perancangan Produk), 3(1), 26-34. https://doi.org/10.24821/productum.v3i1.1735

Susanto, A. D. (2020). Air pollution and human health. *Medical Journal of Indonesia, 29*(1), 8–10. https://doi.org/10.13181/mji.com.204572

Taaffe, Jonathan & O'Sullivan, Seán & Rahman, Muhammad & Pakrashi, Vikram. (2014). Experimental characterisation of Polyethylene Terephthalate (PET) bottle Eco-bricks. *Materials & Design, 60*, 50–56. https://doi.org/10.1016/j.matdes.2014.03.045

Tantiwat, W., Gan, C., & Yang, W. (2021). The estimation of the willingness to pay for air-quality improvement in Thailand. *Sustainability (Switzerland), 13*(21), 1–23. https://doi.org/10.3390/su132112313

Wardani, F., & Khotimah, N. (2021). Making eco-bricks as a solution to environmental problems through empowering creative children: A case study in Baruga District, Kendari City. *International Journal of Science and Society, 3*(2), 214–221. https://doi.org/10.54783/ijsoc.v3i2.331

Widodo, S., Marleni, N. N. N., & Firdaus, N. A. (2018). Pelatihan pembuatan paving block dan eco-bricks dari limbah sampah plastik di Kampung Tulung Kota Magelang. *Community Empowerment, 3*(2), 63–66. https://doi.org/10.31603/ce.v3i2.2460