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**Community empowerment in making ecobricks to overcome the problem of plastic waste**

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**ABSTRACT**

Ecobricks is an innovation that produces a product made from plastic bottles filled with compacted plastic waste, which has not yet been attempted to be created on a large scale. The target of this activity is all PKK women in Adikarso Village. The implementation method carried out by socialization or counseling begins with a survey of the plastic waste problem. There is a need to utilize plastic waste in a product with use value. This training aims to increase residents' understanding of the use of plastic waste in ecobrick products. This activity began with outreach, collecting plastic waste, and preparing tools and materials, followed by training activities with direct practice in making ecobricks. Data collection techniques were carried out using observation and questionnaires. The results of this training include ecobrick products and increasing residents' understanding of the use of plastic waste. First, plastic waste is used to make ecobrick products, namely garden chairs. Second, residents' understanding is related to knowledge about plastic waste and ecobrick products. Based on these results, community empowerment impacts residents' knowledge regarding the use of plastic waste in ecobrick products that have use value and can generate income for the residents of Adikarso Village.

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**ABSTRAK**

Ecobrick merupakan suatu inovasi untuk menghasilkan suatu produk yang terbuat dari botol plastik yang diisi sampah plastik yang dipadatkan yang secara luas belum diupayakan untuk diproduksi secara besar-besaran. Sasaran dari kegiatan ini adalah seluruh ibu-ibu PKK Desa Adikarso dengan metode pelaksanaan dilakukan dengan sosialisasi atau penyuluhan yang diawali dengan survei permasalahan sampah plastik. Perlu adanya pemanfaatan sampah plastik menjadi sebuah produk yang memiliki nilai guna. Tujuan pelatihan ini adalah meningkatkan pemahaman warga mengenai pemanfaatan sampah plastik menjadi produk ecobrick. Kegiatan ini dimulai dengan melakukan sosialisasi, pengumpulan sampah plastik, persiapan alat dan bahan, dilanjutkan kegiatan pelatihan dengan praktek langsung pembuatan ecobrick. Teknik pengumpulan data dilakukan dengan observasi dan angket. Hasil dari pelatihan ini meliputi produk ecobrick dan peningkatan pemahaman warga mengenai pemanfaatan sampah plastik. Pertama, sampah plastik dimanfaatkan menjadi produk ecobrick yaitu kursi taman. Kedua pemahaman warga terkait pengetahuan tentang sampah plastik dan pengetahuan tentang produk ecobrick. Berdasarkan hasil tersebut, maka pemberdayaan masyarakat berdampak pada pemahaman warga terkait pemanfaatan sampah plastik menjadi produk ecobrick yang memiliki nilai guna dan dapat menghasilkan sumber pendapatan bagi warga Desa Adikarso.

**Kata Kunci:** ecobricks; pelatihan; pemberdayaan masyarakat; sampah plastik

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## INTRODUCTION

Plastics are materials that can be recycled. Additionally, plastic is a complex chemical that breaks down naturally. People's daily needs are highly dependent on plastic because it is affordable and readily available. Plastic is widely used for various daily needs, such as food packaging and vehicle parts. In reality, most plastic products are produced without considering what happens to the plastic after consumption (Suminto, 2017). Waste management has become a significant concern, particularly in urban and rural areas. This is due to population growth accompanied by increasing consumer demand.

The large amount of plastic the community uses results in the accumulation of waste. The most fundamental problem with plastic is that plastic waste cannot be broken down naturally. Waste is an environmental issue that remains unresolved. Waste is something that is not used, liked, worn, or discarded from human activities and does not arise on its own. The Waste Management Law Nomor 18 Tahun 2008 defines waste as the residue of human daily activities and/or natural processes in solid form. The limited availability of waste disposal sites in Adikarso Village, Kebumen District, and Kebumen Regency has made the waste problem increasingly complex. The waste accumulated in the community is primarily composed of plastic waste. Plastic waste can pollute soil, water, and air. Plastic waste pollution in soil can block water absorption and sunlight, thereby reducing soil fertility and potentially contributing to floods. Plastic waste in the ocean is exposed to ultraviolet rays from the sun, which break it down into small pieces containing BPA that can enter the food chain of living organisms, posing a threat to humans. In the air, plastic particles can harm health and the environment.

Plastic waste is the most commonly found and produced waste in everyday life. Additionally, plastic can take at least 200 years to decompose in soil. A study even suggests that plastic waste can decompose over a period of up to 1,000 years (Qomariah, 2020). Plastic waste is generally challenging to decompose and can cause environmental pollution, so efforts must be made to manage plastic waste by creating ecobricks using plastic bottles. Ecobricks are a plastic waste management technique made from used plastic bottles filled with various types of plastic waste until they are completely full, then compacted until stiff (Antico *et al.*, 2017). Ecobricks are one of the recycling efforts aimed at reducing environmental pollution.

Ecobricks are an innovative solution for producing valuable items such as chairs, tables, planters, and many more. Ecobricks are made from used plastic bottles filled with soil, foam, food packaging plastic, plastic bags, and other plastic materials (Antico *et al.*, 2017). Ecobrick is a creative initiative aimed at managing plastic waste. Its function is not to destroy plastic waste, but to extend the life of plastic and process it into something useful that can benefit humanity in general (Jupri *et al.*, 2019). The benefit of ecobricks is that plastic waste can be stored in bottles, eliminating the need for it to be burned or buried.

Ecobrick is a method of managing plastic waste by packing clean and dry plastic into plastic bottles until a specific density is achieved (Fauzi *et al.*, 2020). Currently, ecobrick products are shaped into valuable items, such as chairs, tables, and even brick substitutes for use in house construction (Fitriani & Asih, 2019). Research findings indicate that ecobricks are a creative approach to transforming plastic waste into valuable items (Ikhsan & Tonra, 2021; Yusiyaka & Yanti, 2021). Using ecobricks as furniture can replace bricks, making them more affordable (Muyen *et al.*, 2016). Furniture and buildings made from ecobricks are not easily damaged because they are made from plastic that will decompose over 300 years and can be reused. Houses made from ecobricks are not fragile, can be reused, are easy to build, and are lightweight (Palupi *et al.*, 2020).

Based on this, we conducted a community empowerment activity in the form of a training session on how to make ecobricks to address the issue of plastic waste in Adikarso Village, Kebumen. The ecobrick

training can increase the community's knowledge and awareness, which will eventually influence their behavior in using plastic more wisely. This is supported by the enthusiasm of the women from the Family Welfare Empowerment (PKK) program to participate in the training on turning waste into a valuable product. Previous research also suggests that the greater the knowledge, the more positive the attitude toward sustainable waste management (Gusti *et al.*, 2017). The Community Service Learning (KKN) team hopes that this activity will sustainably address the plastic waste problem and raise public awareness of the benefits of reducing plastic waste. The ecobricks produced will also become more diverse and have high economic value.

## Literature Review

### Community Empowerment

Community empowerment is a process that aims to achieve effectiveness, enabling communities to improve their standard of living (Endah, 2020). Community empowerment is an economic development concept that embraces social values. This concept reflects a new development paradigm: people-centered, participatory, empowering, and sustainable (Herington *et al.*, 2017). Community empowerment is a strategy and a development concept that focuses on the community as the subject of development (Endah, 2020). According to Sumardjo in his book "*Metode-metode Partisipatif dalam Pengembangan Masyarakat*," Community empowerment is a process of developing opportunities, willingness/motivation, and the ability of the community to access resources, thereby increasing their capacity to make decisions in the future, determine their future by participating in making an impact, and achieve quality of life for themselves and their communities.

Community empowerment seeks to awaken all existing community capacities to achieve its goals. Community empowerment is explained by Hamid in "*Manajemen Pemberdayaan Masyarakat*" as giving power or strength to weak groups that do not yet have the ability or strength to live independently, especially in meeting their basic daily needs, such as food, clothing, shelter, education, and health. This empowerment is also a social action undertaken by a community that organizes itself to develop plans and collective actions to address social problems or meet social needs, utilizing its capabilities and available resources. Community empowerment is recognized as an alternative strategy in various literature and ideas, although its implementation in practice has been less than optimal.

### Ecobrick

Ecobrick is an innovative solution for managing plastic waste in a more environmentally friendly manner (Yusiyaka & Yanti, 2021). Ecobrick is the name given to plastic bottles filled with non-biodegradable materials until they are solid and hard (Palupi *et al.*, 2020). The function of ecobrick itself is not to destroy plastic waste but rather to extend the life of plastic and transform it into valuable and beneficial items (Andriastuti *et al.*, 2019). Ecobricks are made by filling solid plastic waste into plastic bottles, such as plastic bags, food containers, or other plastic pieces. Users then compact the plastic waste inside the bottle until it reaches a specific density. After that, the plastic bottle is used as an alternative to traditional building materials, such as bricks, for sustainable construction. Ecobricks can change the sacrifices made by communities and ecosystems in digesting plastic. We can turn plastic into something useful for the community and the local ecosystem. Ecobricks can be used to create furniture such as tables and chairs, as well as rooms, gardens, and even full-scale buildings (Palupi *et al.*, 2020).

Creating activities using ecobricks will stimulate the creativity and imagination of the community. The techniques used to make ecobricks include cutting plastic into smaller pieces and inserting them into used

plastic bottles. The production of ecobricks can prevent plastic waste, reduce pollution, and avoid the ineffective recycling process employed by manufacturers. Plastic waste management, especially plastic waste, must start from oneself and become a daily habit.

The primary source of ecobricks is plastic waste, including single-use plastics and other types of plastic that are difficult to recycle. The use of ecobricks aims to reduce environmental pollution caused by plastic waste, reduce the consumption of natural raw materials for the production of conventional building materials, and provide a creative solution to the problem of plastic waste. The idea is to create more environmentally friendly building materials using plastic waste, which was previously an environmental problem.

## **Plastic Waste**

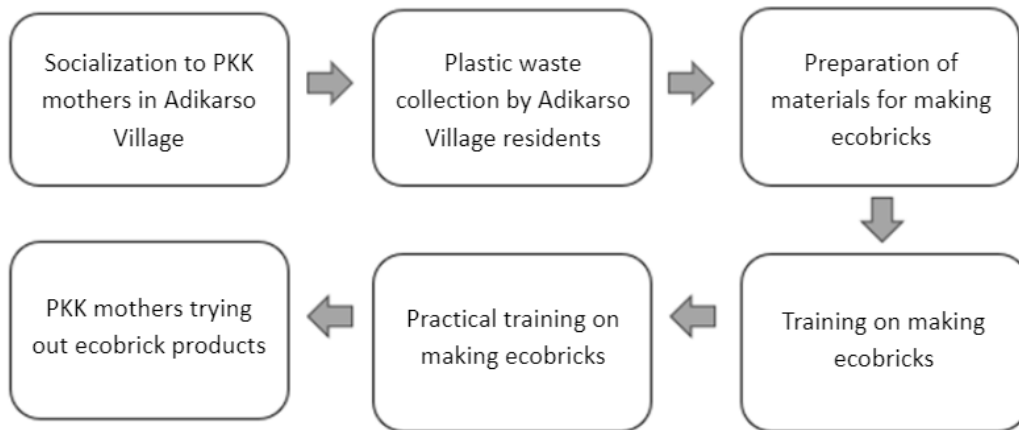
Plastic waste is organic material or substances that are no longer used and contain certain substances that are derived from plastic. It requires heat and pressure to decompose (recycle) (Utami & Ningrum, 2020). Plastic waste hurts the environment because, in addition to its increasing quantity, it is the most challenging type of waste to decompose in the soil.

According to the World Health Organization (WHO), waste is material that is not used, worn, liked, or discarded as a result of human activities and does not occur naturally (Malina *et al.*, 2017). Plastic waste is a type of inorganic waste that is difficult to decompose, toxic, and causes significant environmental pollution. Plastic waste increases annually in line with population growth, threatening environmental sustainability. Efforts must be made to manage plastic waste so that its presence can be minimized and the environment is protected from pollution.

The amount of plastic waste that accumulates daily pollutes the environment, so the community must be creative in overcoming environmental pollution caused by plastic waste while encouraging green behavior by implementing a "paid plastic bag" policy when consumers shop at retail outlets. Unfortunately, this policy, which only applies to modern retail stores, has not been able to encourage the public to completely abandon the use of plastic bags (Novianti & Kartika, 2017). In their daily activities, people often produce waste, ranging from plastic bottles and food packaging to household waste. To date, waste remains a problem in various regions of Indonesia. According to data from the Central Statistics Agency (see: <https://dlh.semarangkota.go.id/solusi-asyik-kurangi-sampah-plastik/>), Indonesia produces 66 million tons of plastic waste annually. Plastic waste is expected to continue increasing over time, particularly as the human population grows.

## **METHODS**

This community empowerment activity was conducted by UNS 140 Community Service Program (KKN) students for the residents of Adikarso Village in August 2023, specifically at the front yard of the UNS 140 KKN post in Gentan Adikarso hamlet. The implementation method used in this activity began with a socialization or awareness-raising session, followed by hands-on practice in making ecobricks into chairs. A field survey on plastic waste issues preceded it. The socialization was conducted with participants consisting of PKK (Family Welfare Movement) mothers representing each RW (neighborhood unit) of Adikarso Village. Data collection techniques involved observation and questionnaires. The UNS 140 Community Service Team made observations in Adikarso Village during the field survey. Questionnaires were distributed to the residents of Adikarso Village. The stages of the ecobrick-making training are presented in **Figure 1**.



**Figure 1.** Stages of the Ecobrick Product-Making Training  
*Source: Author's documentation 2023*

Community empowerment began with socialization sessions with PKK mothers on making ecobricks and utilizing waste as valuable resources. The next activity was collecting plastic waste by PKK mothers, which KKN students then collected as material for making ecobricks. The activity continued with preparing tools and materials for training in making ecobricks. The tools and materials used in making ecobricks include scissors, a cutter, a bamboo compactor, 1500ml plastic bottles, plastic packaging, plastic bags, and chair covers. The next activity is the practical demonstration of ecobrick making, followed by the PKK women trying out the stands made during the training. This activity is shown in **Figure 2**. The results of the ecobricks are shown in **Figure 3**.



**Figure 2.** Ecobrick Making Activity  
*Source: Author's Documentation 2023*



**Figure 3.** Ecobrick Products  
*Source: Author's Documentation 2023*

## RESULT AND DISCUSSION

### Result

The results of this community empowerment activity included discussions and hands-on practice in making ecobricks. This section will focus on two areas: the utilization of plastic waste and the villagers' understanding.

#### 1. Utilization of Plastic Waste

##### a. Plastic Waste

Plastic waste encompasses a wide range of materials, including plastic bags, bottles, straws, styrofoam, balloons, and diapers. Plastic waste can pollute the soil, water, and air. Plastic can interfere with water and sunlight absorption in the ground, reduce soil fertility, and contribute to flooding. Plastic is a recyclable material. The *ecobrick* program, initiated by the UNS 140 Community Service Team, has the potential to maximize the benefits of unused plastic waste by transforming it into finished products. The benefits for the Adikarso Village community are expected to include the development of innovative products from plastic waste, which can generate income for the community.

##### b. Ecobrick Production Activities

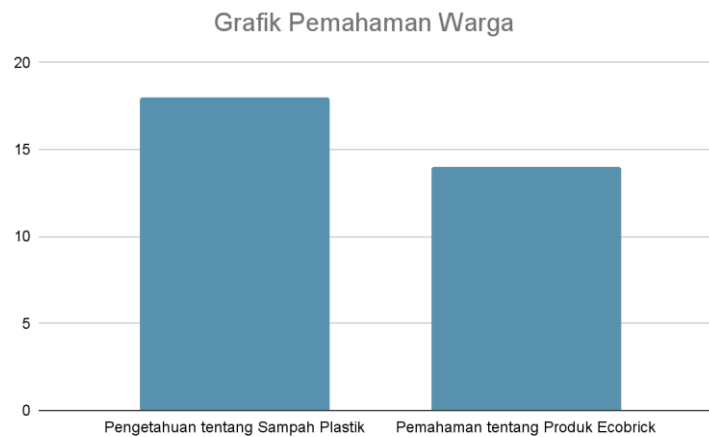
This empowerment activity began with data collection through field surveys to observe the conditions and situation in Adikarso Village. The field survey results revealed piles of plastic waste in several locations within Adikarso Village. The next stage was to conduct a socialization activity for the PKK mothers of Adikarso Village on using plastic waste in ecobrick products, as part of the work program of KKN UNS 140.

Representatives of the PKK women from each RW in Adikarso Village attended the socialization activity. The socialization was very enthusiastic, with the PKK women asking various questions about the activity. After the socialization activity, the event continued with the collection of plastic waste by the residents of Adikarso Village, which was followed by a training session on making ecobricks.

After the plastic waste was collected, the activity continued with the preparation of tools and materials for making ecobrick products. The tools and materials for making ecobricks include 1500 ml used bottles, dry plastic waste, a compactor, scissors, rubber bands, and a cover. The activity continued with training on making ecobricks, accompanied by a presentation by UNS 140 KKN students. The activity continued with hands-on practice with the PKK mothers of Adikarso Village. The ecobrick production process began by cutting dry plastic waste into small pieces, which were then inserted into used bottles and compacted until completely solid. One solid ecobrick bottle weighs approximately 1 kg to 1.5 kg. Seven ecobrick bottles are tied together tightly using rubber bands to form a single garden chair product. The chair is then covered with a protective cover, making the ecobrick product easy to use and visually appealing. The finished ecobrick chair is then tested for strength by having someone sit on it. It was proven that the ecobrick chair can support a person weighing approximately 100 kg.

## 2. Village Residents' Understanding

The success of residents' understanding of plastic waste and ecobrick products was measured using a questionnaire. **Figure 4** illustrates the village residents' knowledge of ecobrick production.



**Figure 4.** Residents' understanding of plastic waste and *Ecobrick* products

*Source: Author's documentation, 2023*

### a. Knowledge about Plastic Waste

There were 20 respondents, each answering 20 questions related to two aspects. The first aspect concerns knowledge about plastic waste, including its definition and utilization. Plastic can be utilized and processed into something of value and marketability by applying the 3R principle (Reduce, Reuse, Recycle). Many respondents (16 people, or 80%) were familiar with plastic waste.

### b. Knowledge about Ecobrick Products

The second aspect is knowledge about ecobrick products, including the definition of ecobricks, their benefits, and the production process. Fifteen respondents (74.5%) demonstrated knowledge about ecobrick products. Based on the responses from the community of Adikarso Village, Kebumen District, and Kebumen Regency, most of the community is already aware of the production of ecobrick products.

## Discussion

### Utilization of Plastic Waste

Waste is not used, worn, liked, or discarded, originates from human activities, and does not occur by itself (Andriastuti *et al.*, 2019). Waste is the residue of human daily activities and/or natural processes in solid form, as defined in Pasal 1 Undang-undang Nomor 18 Tahun 2008 (Hamdi & Amalia, 2023). Meanwhile, the law defines waste as the residue of human daily activities or natural processes in solid or semi-solid form, consisting of organic or inorganic substances that are biodegradable or non-biodegradable and are considered useless and discarded into the environment. Inorganic waste is derived from non-living materials, including synthetic products and mining processing technology (Johnson & Santos, 2020; Puyol *et al.*, 2017). Inorganic waste is categorized into metal waste and processed products, such as plastic. Plastic is a complex chemical that degrades or decomposes naturally, a process that can take hundreds or even thousands of years (Suminto, 2017).

Most inorganic waste cannot be completely broken down by natural or microbial processes. Some of it can only be broken down over a long period. Waste sorting is an effort to reduce waste, particularly waste that is difficult to decompose naturally (Nurdin *et al.*, 2023). One effort to minimize plastic waste is through the use of ecobricks. Making ecobricks is inexpensive and straightforward in terms of cost, and it is effective in reducing plastic waste (Kumar *et al.*, 2020). By utilizing the assets owned by the community and the waste bank community in Adikarso Village, training in making ecobricks can be conducted. The training aims to increase the enthusiasm of the Adikarso Village community about the benefits of processing plastic waste. The advantages of ecobricks include (1) helping to minimize the amount of plastic waste, (2) utilizing plastic waste as valuable and saleable items, (3) introducing culture through the utilization of plastic waste, and (4) strengthening the anti-plastic culture among the community (Reduce, Reuse, Recycle) (Mirdas *et al.*, 2021).

The results of this eco-brick-making training activity will provide the community of Adikarso Village with knowledge on how to utilize plastic waste, previously considered useless, into valuable items, as evidenced by the products produced. This aligns with previous community service activities that reported an increase in knowledge after receiving education and a change in behavior toward adopting clean and healthy living habits in daily life (Nasution, 2020). Similar findings have been reported in previous studies, which indicate that environmentally friendly educational activities can influence positive attitudes and behaviors toward the environment (Kusumo *et al.*, 2017). This ecobrick training activity is also expected to address the plastic waste problem in Adikarso Village in a sustainable manner and raise community awareness that waste also has high value. A similar view was expressed in previous research that utilized waste as a resource for practical purposes, such as disaster preparedness (Warlani, 2019). Training in ecobrick making and digital marketing aims to increase the enthusiasm of the community and waste bank communities about the benefits of processing plastic waste. Additionally, it aims to reduce the volume of plastic waste and utilize free time for productive activities (Susanti *et al.*, 2023). The production of ecobrick products is expected to continue, resulting in a wider variety of products with high economic value and increasing income for the residents of Adikarso Village.

### Understanding of Adikarso Village Residents

Knowledge about plastic waste was measured using two aspects: understanding and utilizing plastic waste. This was evidenced by the results of respondents with sufficient knowledge about plastic waste, namely 16 people (80%). Additionally, 15 respondents (74.5%) were aware of using waste through ecobricks. Based on the responses from residents of Adikarso Village, Kebumen District, and Kebumen

Regency, it can be concluded that most residents are aware of plastic waste and its utilization. The movement to utilize waste using the ecobrick method in Indonesia is gaining momentum. Various communities within society, including schoolchildren, can create ecobricks (Ohee & Keiluhu, 2020), ranging from children to adults.

Managing plastic or inorganic waste is crucial to reduce its volume compared to organic waste, given its non-biodegradable nature. Plastic waste is one of the significant types of household waste that contributes significantly to environmental degradation. The plastic waste we discard eventually accumulates in landfills or is buried in the ground. This disrupts soil structure and fertility, mainly if it contaminates river flows. Plastic waste encompasses a wide range of materials, including plastic bags, bottles, straws, styrofoam, balloons, and diapers. Plastic waste can cause pollution in the soil, water, and air (Lestari *et al.*, 2020). It can be concluded that plastic waste is a type of waste made from plastic materials that are difficult to decompose and can cause pollution.

Therefore, this community service activity was conducted to manage plastic waste and reduce its amount by processing it into a product of commercial value through ecobricks. Ecobricks are one way of handling plastic waste by packing clean and dry plastic into plastic bottles to a specified density (Aryanto *et al.*, 2019). Ecobrick is a used bottle filled with plastic waste, using a long piece of wood to create a recycled product block (Fitriani & Asih, 2019). A previous study also stated that an ecobrick is a plastic bottle filled with clean and dry plastic pieces at a specific density, which can be used to create artistic works or cultural structures with high utility value (Istirokhatun & Nugraha, 2020). In addition to plastic, ecobricks can be made using materials that are equally non-recyclable and harmful to the environment, such as styrofoam, cables, small batteries, and others (Edike *et al.*, 2020).

The production of ecobricks does not require any special skills or incur any costs, as all the necessary materials come from used items consumed daily (Adiyanto *et al.*, 2022). These items are used as plastic waste by households. The process can be completed at any time, either individually or in groups, during spare time. Therefore, making ecobricks is not tricky, but it requires perseverance and minimal effort. When making ecobricks, several factors must be considered, including the type of plastic waste collected, which is then cleaned and dried to prevent any foul odors from developing inside the ecobrick bottle.

The benefits of making ecobricks include: 1) waste management; making ecobricks is an efficient way to process plastic waste and can be done by everyone due to its simplicity; 2) protecting the environment by reducing plastic waste; 3) using ecobricks as building materials or furniture can reduce production costs (Manisha & Singh, 2017). Ecobricks can also be used as furniture (chairs, tables), planting spaces, walls, and even entire buildings (Antico *et al.*, 2017). Thus, ecobricks are products made from plastic waste placed in bottles and then compacted to create a helpful product. In this community service activity, the result of the ecobrick was a chair that can support a person weighing approximately 100 kg.

## CONCLUSION

The results of this empowerment include increased knowledge about the utilization of plastic waste and residents' understanding of ecobrick products. First, plastic waste has been effectively utilized to produce ecobrick products. Second, the residents of Adikarso Village better understand ecobrick production, particularly regarding plastic waste and ecobrick products. Based on these results, community empowerment has increased plastic waste utilization and improved understanding and enthusiasm among residents regarding ecobrick products. It is hoped that community empowerment regarding ecobrick products will make it easier for residents to utilize plastic waste in ecobrick products and become an economic opportunity for the residents of Adikarso Village.

## AUTHOR'S NOTE

The author declares that there is no conflict of interest related to the publication of this article. The author affirms that the data and content of this article are free from plagiarism.

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