

# Bioplastic Program and Application of CNC Machinery to Support Sustainable Development in Jati Rejo Village, Lendah Kulon Progo

Maun Budiyo<sup>1</sup>, Candra Febri Kurniawan<sup>2</sup>, Eko Prasetyo<sup>3</sup>, Felixtianus Eko Wismo Winarto<sup>3</sup>

<sup>1</sup>Electrical Engineering and Informatics, Vocational School, Universitas Gadjah Mada

<sup>2</sup>Bioresources Technology and Veterinary, Vocational School, Universitas Gadjah Mada

<sup>3</sup>Mechanical Engineering, Vocational School, Universitas Gadjah Mada

\*Corresponding author's email: m.budiyo@ugm.ac.id

doi: <https://doi.org/10.21467/proceedings.151.30>

## ABSTRACT

The use of plastic in society has become a significant need, ranging from being used for plastic bags, bottles, plates, straws, and so on. Plastic excels in lightweight, water resistance, cost-effectiveness, durability, and protecting goods from dirt, shock, and impact. Plastic is currently the material of choice in various activities, from carrying, packaging, and distributing goods. On the other hand, plastic waste is a major environmental problem as it is not readily biodegradable. Efforts to reduce the use of plastic have been carried out with the motto of the 3R program (Reduce, Reuse, and Recycle). The Central Statistics Agency (BPS) stated that in 2022, Indonesia's plastic waste would reach 66 million tons annually. The results of the LIPI study 2018 estimated that around 0.26-0.59 million tons of this plastic flowed into the ocean. The survey results from the Ministry of Environment and Forestry of the Republic of Indonesia reported that 16.91% of waste in Indonesia is plastic, and the volume increased by 0.5% compared to the previous year. This empowerment program aims to provide residents with an understanding of innovative work products in the form of processed products from plastic waste. This activity raises public awareness about the importance of using plastic waste to create products worth selling. This activity was conducted on Friday, 29 July 2022, at the Bukit Cubung restaurant, Jati Rejo Village, Lendah District, Kulon Progo Regency. A total of 30 participants attended the activity.

**Keywords:** Community Empowerment, Jati Rejo, Plastic.

## 1 Introduction

The use of plastic in society has become a significant need, ranging from being used for plastic bags, bottles, plates, straws, and so on. The advantages of plastic materials include being lightweight, waterproof, cheap, strong, and able to protect goods from dirt, shock, and impact. Plastic is currently the choice in various activities, from carrying, packing, distributing, and others.

On the other hand, plastic waste is a major environmental problem because it is not easily decomposed. Efforts to reduce the use of plastic have been carried out with the motto of the 3R program (Reduce, Reuse, and Recycling). The Central Statistics Agency (BPS) stated that by 2022 Indonesia's plastic waste would reach 66 million tonnes per year. Meanwhile, a study by the Indonesian Institute of Sciences (LIPI) 2018 estimated that around 0.26 million-0.59 million tons of this plastic flowed into the ocean. Survey results from the Ministry of Environment and Forestry of the Republic of Indonesia reported that 16.91% of the waste in Indonesia is plastic, and the volume increased by 0.5% compared to the previous year [1].

Based on the problems above, educators in tertiary institutions should play an active role in reducing the use of plastic waste. Therefore, the team and target community jointly move the nation towards a more sustainable future. The concept used in this program is to educate the people of Jati Rejo Village, Lendah District, Kulon Progo Regency (target community) with comprehensive and futuristic insights that raise awareness, a sense of responsibility, behavior change and the ability to manage, repair and save human life and the environment as shown in Figure 1.



© 2023 Copyright held by the author(s). Published by AIJR Publisher in "Proceedings of the 3<sup>rd</sup> International Conference on Community Engagement and Education for Sustainable Development" (ICCEESD 2022). Organized by the Universitas Gadjah Mada, Indonesia on December 7-8, 2022.

Proceedings DOI: [10.21467/proceedings.151](https://doi.org/10.21467/proceedings.151); Series: AIJR Proceedings; ISSN: 2582-3922; ISBN: 978-81-961472-6-6



**Figure 1:** *The Concept of Three Pillars of Education for Sustainable Development*

In the activities carried out, the implementing team has continuously educated the target community by understanding the importance of protecting the environment and information related to plastic waste (impact and effects on the environment) in supporting sustainable development. Subsequently, the proposed team will mobilize the target community for a better future.

## 2 Research Methodology

The methods used in solving the problem and the analysis method are written in this section. The implementation methods used by the team are as follows:

### 2.1 Implementation of Understanding to Citizens

The implementation was done through the Implementation Team coordinating with the Mrs. Sinta, the chair of the Jati Rejo Village BUMDes (*Badan Usaha Milik Desa* or Village-Owned Enterprise). The residents involved were those prepared to manage tourist destinations in the Jati Rejo sub-district, Lendah District. This activity provides training and understanding of innovative work products in the form of processed products from plastic waste. This activity was held at the Bukit Cubung Resto on Friday, 29 July 2022. Approximately 30 community members participated in the activity. This activity collaborates with waste management activists 'Radite Collection Pusdiklat & Recycle' at Taman Sedayu Housing block E3 RT 45, Metes, Sedayu District, Bantul Regency, Special Region of Yogyakarta 55752. In this activity, Mrs. Fajar Purwaningsih, S. Pd., was a marketing manager and resource person.

### 2.2 Creating editable and attractive molds and labels

In the creation of making models that are attractive and very easy to edit, a Computer Numeric Control machine (CNC) is used so that it is easy to handle problems with new forms of work from plastic or printing labels. CNC machines can translate images into programs for making prints and labels/writing that are attractive and do not take a long time so that accuracy and speed can be maintained to remain competitive and profitable. CNC products in architectural work are also very beautiful to be enjoyed as components that are exposed to buildings. As a result, a Computer Numeric Control (CNC) product cannot be categorized as an architectural work if it is only beautiful but without meaning [2].

Implementation of this activity, currently, the machine is still in the laboratory for setting up the program and making guidebooks. It is planned to implement a CNC machine for making souvenirs from original products from the Jati Rejo Village, Lendah District. It is also planned that after the CNC machine has been installed and initiated with the G-Code program, the Implementation Team will then conduct special training for residents. In addition, the Implementation Team coordinates with Partners to appoint residents who will be prepared for this training. This activity will be held on the 3rd week of August 2022 at the

Cubung Resto Kalurahan Jati Rejo, Lendah Kulon Progo District. The material used can be wood since wood is easy to get at partners' places, so the material stock is quite large and cheap. This machine is hoped to be an added income value for BUMDes. As a way to realize the training given previously, the team aims to utilize a CNC machine for making creating logos/labels from the Jati Rejo Village, Lendah District. At present, the machine is still in its program setting stage. The material used is cheaper. Once the machine has been installed and initiated with the G-Code program, it will be used to train the residents. In training, the edition implemented logo marking of Jati Rejo Village. This activity was held in August 2022. Implementing this machine is hoped to empower the residents in logo creative production.

### 2.3 Place of Execution

The activity occurs at Cubung Hill, Jatirejo Village, Lendah District, Kulon Progo Regency, Special Region of Yogyakarta. The distance between the UGM campus and partner locations is approximately 30.5 km. Figure 2 shows the distance between the UGM campus and partner locations.

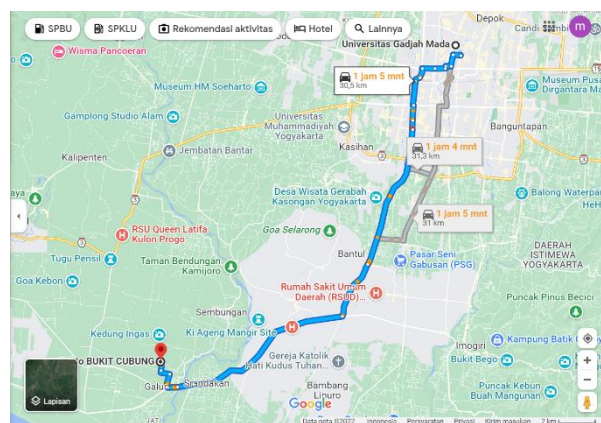


Figure 2: Distance between UGM Campus and Partners

## 3 Results and Discussion

The Implementation Team has carried out various activities at Partner's premises. The results that have been achieved are as follows:

### 3.1 Implementation of Understanding to Citizens.

This activity was held at the Bukit Cubung Resto on Friday, 29 July 2022, attended by approximately 30 participants from members of the community. These residents are projected to manage the Jati Rejo tourist village, as the village plans to develop itself as a tourist village. Some of the results of plastic waste management activities are shown in Figures 3 and 4.



Figure 3: Activity Results



**Figure 4:** Assistance on how to make plastic flowers

### 3.2 Utilization of Appropriate Technology in the Form of Computer Numerical Control (CNC)

A CNC machine is a programmable machine with G-Code [3]. The CNC production machine has been assembled in the Electrical Power Engineering Laboratory of the Department of Electrical and Informatics Engineering, UGM Vocational School. CNC production machines are still in their program setting and manual-making stage and being troubleshoot. The G-Code program is still being initiated to ensure easy implementation by the residents. The development of CNC machines multifunction opens new insights into the manufacturing process that can be done by one machine, with the ability to be multifunctional (milling and laser), delivers new insights for product design for exploring form design and function new due to the milling function, and laser from a multifunction CNC machine [4]. In addition, the Implementation Team will conduct special training for residents, which is planned for the week. In addition, the Implementation Team will coordinate with Partners to appoint residents who will be prepared for this training. Figure 5 shows the CNC tool.



**Figure 5:** The CNC machine that the Partners will use.



**Figure 6:** CNC Machine Results

With this machine, various creative products can be produced. CNC machines are very suitable for mass production. Figure 6. is an example of the results of a CNC production machine.

This activity will be held on the 3rd week of August 2022 at the Cubung Resto Kalurahan Jati Rejo, Lendah Kulon Progo District. Wood can be used as the material for handmade, as it is easy to get. This machine is hoped to be an added income value for BUMDes.

## 4 Conclusion

Technology application activities at partner sites in Jati Rejo Village to increase community empowerment have been carried out by the UGM-appropriate technology team. Community empowerment carried out by the team is an innovation in managing plastic waste into souvenirs and making Cubung Hill souvenirs using a CNC machine.

### 4.1 Suggestion

The activities carried out by the UGM appropriate technology team should continue to provide further assistance in making various souvenirs from plastic materials with CNC machines. In addition, a large variety of souvenirs produced from the CNC machines are hoped to increase income for Jatirejo village and consequently catalyze the development of Jatirejo village.

## 5 Declaration

### 5.1. Funding Source

The Directorate of Community Service, Universitas Gadjah Mada, Indonesia, supported this program with a grant scheme for utilizing research results and applying appropriate technology in 2022.

### 5.1 Competing Interest

The author declares that no conflicts of interest exist in this work.

### 5.1 Publisher's Note

AIJR remains neutral with regard to jurisdictional claims in published map and institutional affiliations.

## How to Cite

Budiyanto *et al.* (2023). Bioplastic Program and Application of CNC Machinery to Support Sustainable Development in Jati Rejo Village, Lendah Kulon Progo. *AIJR Proceedings*, 214-218. <https://doi.org/10.21467/proceedings.151.30>

## References

- [1] Badan Pusat Statistik, *Statistik Lingkungan Hidup Indonesia*, 2022. <https://www.bps.go.id/publication/2022/11/30/eb06d1c8e37285cac10c3086/statistik-lingkungan-hidup-indonesia-2022.html>
- [2] C. Amin, & L. Purwanto, "The Role of Computer Numeric Control in Architecture Works," *SARGA: Journal of Architecture and Urbanism*, vol. 16, no. 2, 2022. <https://doi.org/10.56444/sarga.v16i2.19>
- [3] P. Elmiawan, Dharmanto, S. W. Adik, M. Fazalul, R Arief., "Akurasi Mesin CNC Router Low Budget Berbasis Mach 3", *ROTOR*, vol. 15, no. 2, pp. 70-75, Nov. 2022. DOI: <https://doi.org/10.19184/rotor.v15i2.34645>
- [4] H. A. Yanto, H. Suprpto, A. Kristijono, F. Setianto, "Implementasi Prototyping Produk Fleksible dengan Mesin CNC Multifungsi (milling, laser co2 dan 3D printing)", *SERENADE: Seminar on Research and Innovation of Art and Design*, vol. 1, no. 1, pp. 228–233, 2021. DOI: <https://doi.org/10.21460/serenade.v1i1.36>