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Brawijaya University's Community Service Programs in Climate Change Mitigation

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ABSTRACT

Introduction: Climate change presents critical global challenges, particularly in climate-vulnerable regions such as Indonesia, where agricultural systems and coastal ecosystems are at significant risk. In response, Brawijaya University in Malang has implemented two major community service initiatives—**Doktor Mengabdi (DM)** and **Mahasiswa Membangun Desa (MMD)**—to foster climate change mitigation and community resilience through academic-community partnerships. **Methods:** This study employs a mixed-method approach, combining qualitative interviews with 80 faculty members, quantitative surveys of 13,600 students, and participatory discussions with local community leaders across East Java. The research evaluates the implementation and impact of DM and MMD programs, focusing on sustainable practices in reforestation, agriculture, renewable energy, and waste management. **Results:** The DM program facilitated the planting of over 5,000 trees, monitored through the Tetenger Bumi mobile application, which also promoted sustained community engagement. In agriculture, 65% of 300 participating farmers adopted environmentally sustainable practices such as organic farming and crop rotation, leading to improved yields and reduced chemical input. Workshops conducted on renewable energy and waste management led to 75% of participants expressing intent to implement solar or biogas systems. Moreover, waste management programs initiated by MMD students resulted in 60% of villages establishing recycling initiatives and a 65% improvement in household waste separation. Tree-planting efforts contributed to a 15% reduction in landslide incidents in targeted areas, with 90% of residents endorsing the effectiveness of the 3R (Reduce, Reuse, Recycle) approach. **Discussion:** These outcomes demonstrate the tangible benefits of integrating academic expertise with grassroots engagement to promote environmental stewardship. However, challenges persist, including limited resources, infrastructural constraints, and initial community resistance. **Conclusion:** Brawijaya University's community service programs represent a promising model for climate change mitigation in developing regions. Ensuring their long-term sustainability and scalability requires strategic investment, ongoing stakeholder collaboration, and adaptive policy frameworks to address existing barriers and amplify community impact.

Keywords: Climate change, community service, sustainable development, reforestation, waste management, university engagement

1. INTRODUCTION

Climate change is an urgent issue that poses significant risks to ecosystems, economies, and human livelihoods worldwide. The scientific consensus on the impacts of global warming highlights the need for effective strategies to reduce greenhouse gas emissions, promote environmental sustainability, and strengthen vulnerable communities (Develay & James, 2024; Puppim de Oliveira & Bhuiyan, 2024). Governments and industries play a key role in addressing these challenges, but institutions of higher education also have a crucial part to play (Filho et al., 2023a). Universities, with their research, education, and community engagement capabilities, are well-positioned to lead initiatives for sustainability and climate action (Leal Filho et al., 2018).

In Indonesia, a country highly vulnerable to climate change due to its extensive coastlines and reliance on agriculture, universities have become key players in fostering environmental awareness and action. Brawijaya University, located in Malang, East Java, has a long history of successful research and community engagement programs aimed at addressing various social and environmental issues (Sugiarto, Ahmad, et al., 2024; Suroto et al., 2014). For instance, the *Kuliah Kerja Nyata* (KKN) or Community Service Program engages students in practical problem-solving projects with rural communities and has long served as a model for fostering collaboration between the university and local residents (Nurul et al., 2018). Another initiative, the Green Campus Program, focuses on waste management and energy conservation within the university's campus and successfully demonstrates the potential of environmental stewardship within academic institutions. These prior successes laid the foundation for more focused and ambitious community projects, specifically in the areas of climate change mitigation.

The paper explores Brawijaya University's initiatives to address climate change, focusing on two main programs: "*Doktor Mengabdikan*" (DM) and "*Mahasiswa Membangun Desa*" (MMD). DM is a community service program led by university lecturers that applies academic expertise to address community needs. In contrast, MMD is a student-driven initiative aimed at involving students in hands-on community service projects, which promote local development and sustainability. These programs effectively combine academic expertise with local community action to tackle the causes and effects of climate change. By working closely with rural communities, the DM and MMD programs not only promote sustainable practices like reforestation, waste management, and renewable energy use but also empower local residents to take an active role in environmental stewardship. In the upcoming sections, this

paper will conduct a thorough analysis of these programs, emphasising their structure, implementation, and impact on climate change mitigation. Through an examination of the accomplishments and obstacles of these initiatives, this study aims to contribute to the wider discussion on the role of universities in promoting sustainable solutions to global environmental issues.

2. MATERIALS AND METHODS

This research assesses the community service initiatives at Brawijaya University, specifically the DM and MMD programs. These programs are instrumental in local climate change mitigation efforts. This paper used both qualitative and quantitative methods for analysis. These methods allowed for the examination of both the measurable impacts of the programs and the perspectives and experiences of participants and local communities. The study encompassed rural and semi-urban areas across East Java, Indonesia, selected for their susceptibility to climate change, including issues such as deforestation, agricultural challenges, and flooding.

Study Area and Program Design

Both the DM and MMD programs focus on initiatives to combat climate change. The DM program engages university lecturers in community service, collaborating with local communities to address environmental challenges through activities such as reforestation, sustainable agriculture, renewable energy education, and waste management. In parallel, the MMD program involves students in rural development efforts, promoting sustainable practices like 3R (Reduce, Reuse, Recycle) education, establishing community recycling centres, and leading tree planting campaigns. While these programs target different participants—lecturers for DM and students for MMD—they share the common aim of fostering environmental stewardship and sustainable development. These programs aim to combine academic knowledge with community collaboration to create long-term environmental and social impact.

Data Collection Techniques

A mixed-method approach was used to collect data. Program documentation, including reports, schedules, and implementation plans, was reviewed to understand the scope and goals of the DM and MMD programs. These documents offered insights into the evolution of the programs over time and their alignment with sustainable development objectives (Yin et al., 2018). For DM program, an interview was conducted with 80 lecturers to explore their roles, challenges, and strategies for engaging communities. The DM Program was conducted in 25 cities and regencies across East Java (Figure 1). There were

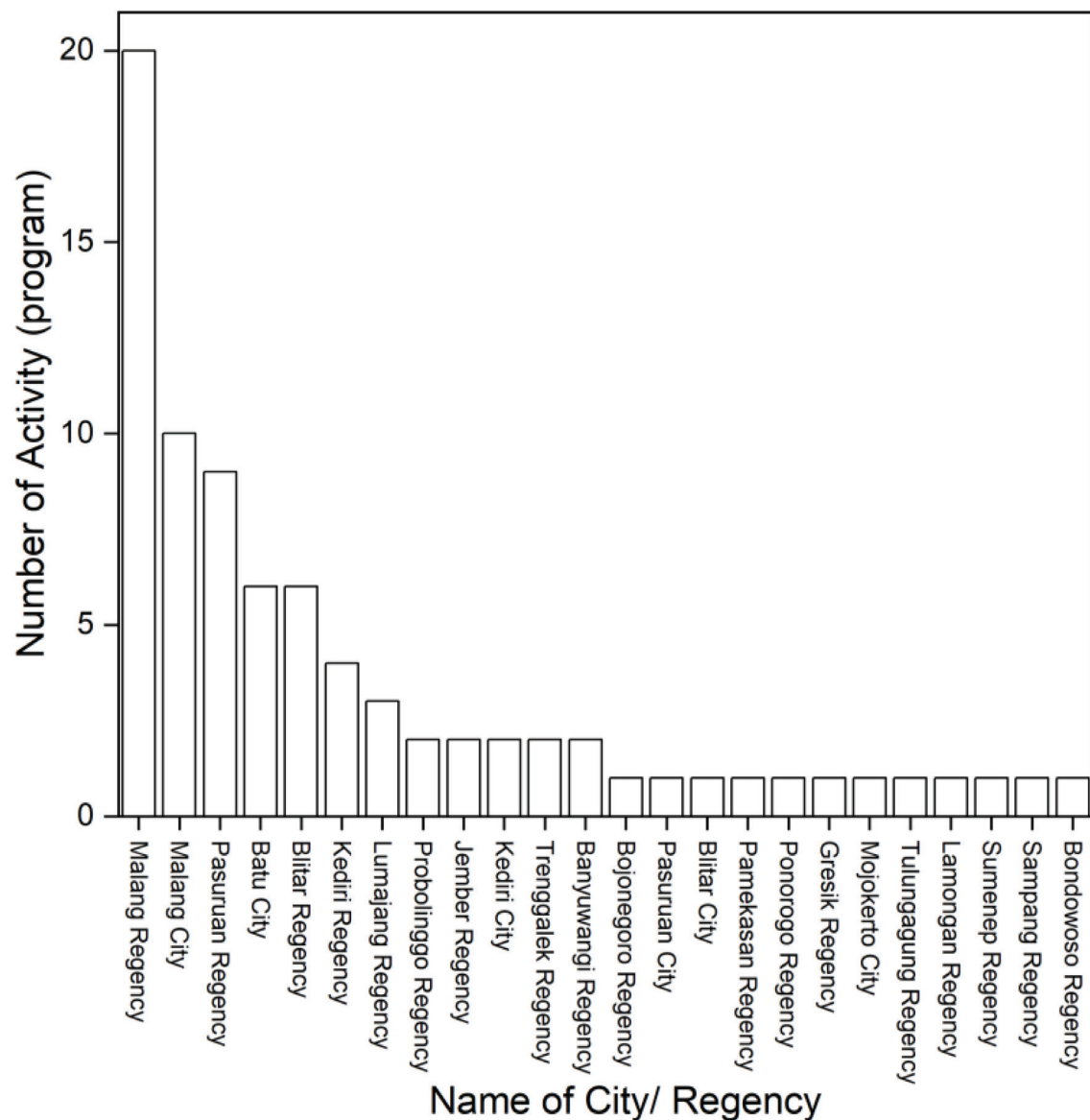


Figure 1. The location of the DM Program.

Malang Regency, Malang City, Pasuruan Regency, Batu City, Blitar Regency, Kediri Regency, Lumajang Regency, Probolinggo Regency, Jember Regency, Kediri City, Trenggalek Regency, Banyuwangi Regency, Bojonegoro Regency, Pasuruan City, Blitar City, Pamekasan Regency, Ponorogo Regency, Gresik Regency, Mojokerto City, Tulungagung Regency, Lamongan Regency, Sumenep Regency, Sampang Regency, Bondowoso Regency. The semi-structured format allowed for open-ended discussion, capturing both planned outcomes and unexpected insights (Lewis, 2015).

To evaluate student engagement, surveys were distributed to 13,600 students who took part in the MMD program between 2023. The students were assigned to 30 districts in East Java (Figure 2). There were Malang Regency, Blitar Regency, Jombang Regency, Kediri Regency, Tulungagung Regency, Batu City, Madiun Regency, Magetan Regency, Nganjuk Regency, Ngawi

Regency, Pacitan Regency, Ponorogo Regency, Trenggalek Regency, Bangkalan Regency, Bojonegoro Regency, Gresik Regency, Lamongan Regency, Mojokerto Regency, Pamekasan Regency, Sampang Regency, Sidoarjo Regency, Sumenep Regency, Tuban Regency, Banyuwangi Regency, Bondowoso Regency, Jember Regency, Lumajang Regency, Pasuruan Regency, Probolinggo Regency, and Situbondo Regency. The survey aimed to gather feedback on participants' experiences, the impact of their projects, and the long-term sustainability of their environmental initiatives after finishing the program.

Village-level interviews and focus group discussions were conducted with community leaders and residents to gather in-depth qualitative data on the community's perspective regarding the effectiveness of the programs. The discussions brought to light themes such as reforestation outcomes, participation in recycling programs, and the adoption of renewable energy. The

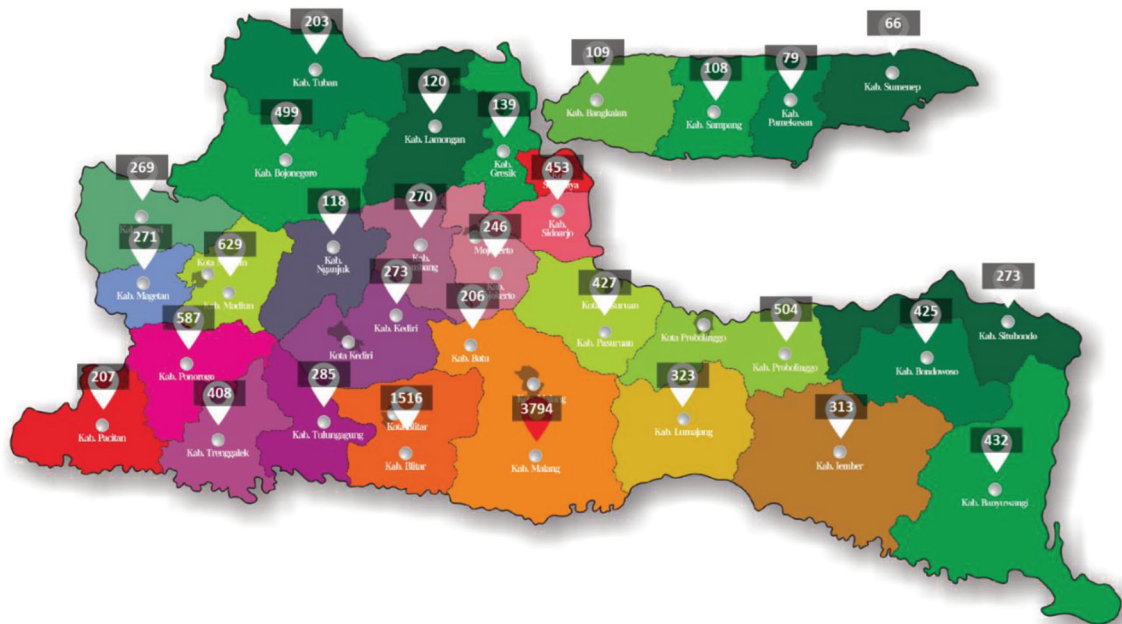


Figure 2. The area of MMD program in East Java.

involvement of community leaders ensured that local opinions and experiences were incorporated into the analysis.

3. RESULTS

The results of this study provide an in-depth analysis of Brawijaya University's community service programs, DM and MMD and their effectiveness in promoting climate change mitigation practices in local communities. The findings are organised into two sections: (1) outcomes of the DM program and (2) outcomes of the MMD program.

a. Reforestation Program

Reforestation is essential for community services, especially in mitigating climate change, enhancing local ecosystems, preventing natural disasters, and supporting local livelihoods. Trees absorb CO₂, helping reduce greenhouse gases while also restoring biodiversity and stabilising soil, which is crucial in areas prone to erosion and flooding (IPCC, 2021). The *Doktor Mengabdi* (DM) program at Brawijaya University exemplifies this approach by engaging faculty and local communities in reforestation efforts. This program emphasises community involvement through education on sustainable practices and hands-on tree-planting activities, fostering ownership and responsibility for environmental stewardship (Ministry of Environment and Forestry, 2019). By providing training on species selection and sustainable land use, the DM program ensures long-term maintenance of reforested areas and addresses specific local challenges in East Java, leading to measurable environmental benefits and increased community participation (Leal Filho et al., 2015; UNESCO, 2020).

One of the primary activities of the *Doktor Mengabdi* (DM) program was reforestation in deforested and degraded areas. Over the study period, approximately 5,000 trees were planted in 6 regencies across East Java (Figure 3). There were *Kabupaten Malang*, *Kabupaten Kediri*, *Kabupaten Bojonegoro*, *Kabupaten Banyuwangi*, *Kabupaten Blitar*, and *Kabupaten Tulungagung*. The species planted included kepel or burahol (*Stelechocarpus burahol*), guava (*Psidium guajava*), mango (*Mangifera indica*), mangosteen (*Garcinia mangostana*), jackfruit (*Artocarpus heterophyllus*), longan (*Dimocarpus longan*), starfruit (*Averrhoa carambola*), and sapodilla (*Manilkara zapota*).

One of the activities for the reforestation program is Tetenger Bumi. During this program, Tetenger Bumi created an Android application that allows users to monitor the condition of the planted trees, fostering ongoing engagement and care (Figure 4). The Tetenger Bumi UB information system application was developed to monitor and evaluate tree planting activities in East Java, involving local officials and residents. The system includes a mobile application for recording tree data, such as location (tagging), species, age, and other relevant details. Training for users is essential and can be conducted either in person or online. The outcome is the Tetenger Bumi UB information system application, which tracks tree growth information to raise public awareness about the importance of environmental protection and natural resource conservation. It also supports the achievement of tree planting targets, especially in East Java. The Android-based Tetenger Bumi application offers a comprehensive solution for monitoring tree planting activities. It functions as both a mobile app and a



Figure 3. Activity of Tetenger Bumi Program in Kabupaten Kediri, Kabupaten Bojonegoro and Kabupaten Malang.

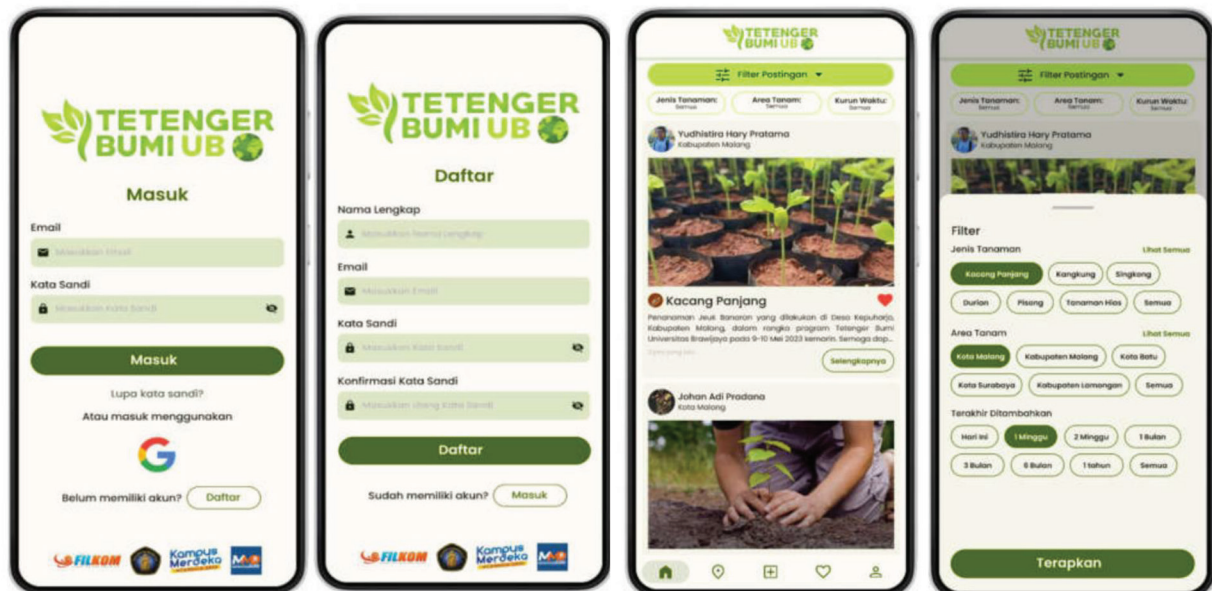


Figure 4. Tetenger Bumi Application.

web-based platform, making it accessible to a wider range of users. This allows individuals to easily and practically use the application anytime and anywhere.

Interviews with local leaders indicated that these initiatives have raised awareness about the ecological and economic benefits of reforestation, including the restoration of local biodiversity and the prevention of soil erosion. This combined approach not only enhances the effectiveness of reforestation efforts but also empowers communities to take an active role in environmental stewardship. In addition to planting activities, the DM program organised community workshops on reforestation, which were attended by 1,500 local

members in 6 regencies across East Java. The workshops aimed to raise awareness of the ecological and economic benefits of reforestation while also providing training in tree care and sustainable land use. As a result of these efforts, 80% of attendees expressed very interest in participating in tree-planting activities during the DM program (Figure 5). The study showed that local involvement and commitment encouraged a sense of environmental stewardship.

b. Sustainable Agricultural Practices

Sustainable agricultural practices are essential for ensuring food security, protecting the environment,

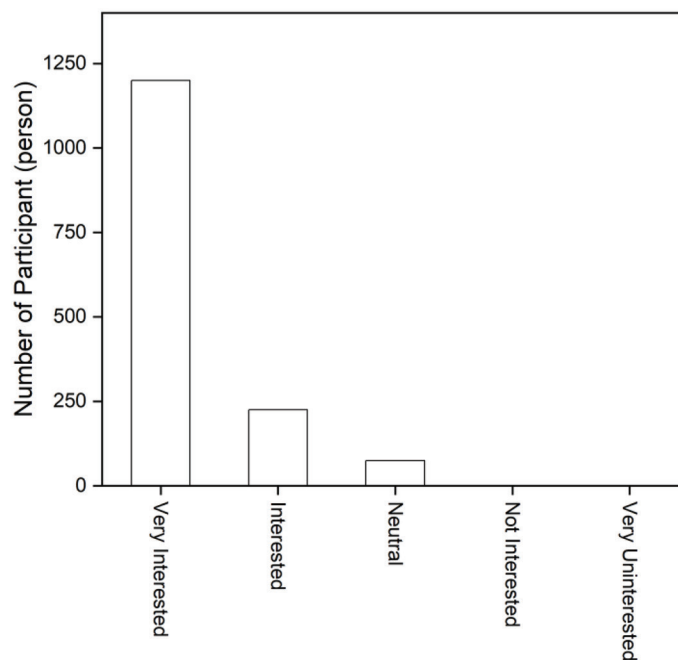


Figure 5. Response of the community expressed interest in participating in tree-planting activities.

and promoting economic viability. These practices aim to minimise the negative impacts of farming on natural resources by using methods that enhance soil health, conserve water, and reduce dependency on chemical fertilisers and pesticides. By integrating crop rotation, organic farming, and agroforestry, sustainable agriculture fosters biodiversity, improves resilience to climate change, and enhances the overall productivity of the land (Rosati et al., 2021; Sugiarto, Nugrayani, et al., 2024). Moreover, these practices contribute to the livelihood of farmers by promoting local markets and reducing costs associated with synthetic inputs (Zou et al., 2024).

The DM program introduced sustainable agricultural methods, including organic farming and agroforestry, to promote environmental conservation and improve farmers' livelihoods. A survey of 300 local farmers found that 65% of participants adopted at least one sustainable practice after attending DM workshops (Figure 6). These practices included reducing the use of chemical fertilizers, implementing crop rotation to maintain soil fertility, and integrating livestock with crop farming to lower methane emissions and enhance farm productivity. The adoption of these practices offers several benefits to farmers. Using organic fertilizers and reducing reliance on chemical inputs not only lowers farming costs but also decreases the risk of soil degradation (Filho et al., 2023b; Pandian et al., 2024). Crop rotation helps disrupt pest cycles, improves the stability of crop yields, and promotes long-term soil health. Integrating livestock into farming systems allows farmers to produce their own

organic manure, which reduces methane emissions and enhances nutrient cycling on the farm (Zou et al., 2024). Additionally, agroforestry practices provide an alternative source of income through the sale of timber or fruit crops, thereby increasing the farm's resilience against market fluctuations (Filho et al., 2023b).

Field observations confirmed that several communities have started producing their own organic fertilizers, reducing their dependence on costly chemical alternatives. This practice not only enhances soil health but also boosts crop productivity, enabling farmers to achieve higher yields while adhering to sustainable practices. These methods enhance environmental stewardship and economic stability for local farmers, helping them adapt to climate change challenges.

c. Renewable Energy and Waste Management

Renewable energy and waste management are crucial for addressing climate change, reducing pollution, and promoting sustainable development. Transitioning to renewable energy sources, such as solar, wind, and biomass, helps decrease reliance on fossil fuels, which are major contributors to greenhouse gas emissions. This shift not only mitigates climate change but also improves air quality and public health by reducing harmful pollutants associated with fossil fuel combustion. Effective waste management practices, including recycling and composting, minimise waste sent to landfills, conserve natural resources, and promote circular economies (Erdiwansyah et al., 2024; Hassan et al., 2024; Swadi et al., 2024).

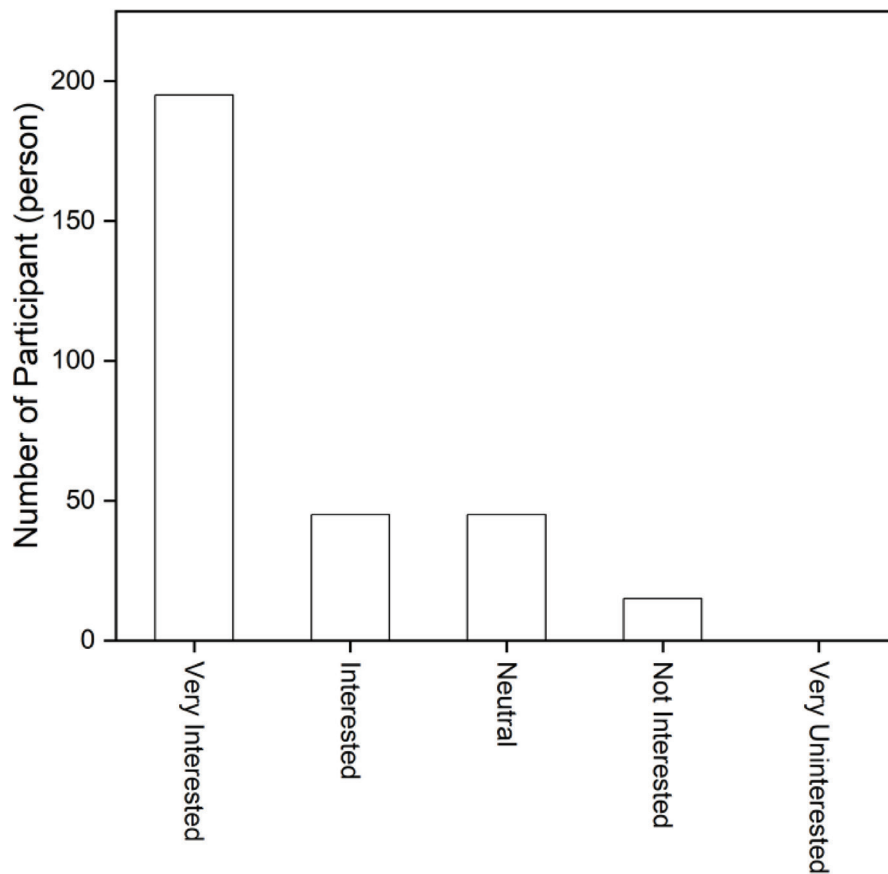


Figure 6. Response of the community to adopt the sustainable practice.

The DM program focused on education related to renewable energy and waste management (Figure 7). Eight workshops were conducted on the use of solar energy and biogas, which 587 participants attended. Post-workshop surveys revealed a significant increase in knowledge about renewable energy technologies, with 75% of attendees expressing very interest in adopting solar panels or biogas systems in their households (Figure 7).

One of the solutions for waste management during the DM program is making coenzyme (Figure 8). Furthermore, 60% of villages implemented new waste management practices, such as community-based recycling centres, composting programs, and the production of ecoenzyme. Ecoenzyme, a natural multipurpose cleaner made from organic waste, gained traction in the workshops as an innovative approach to converting kitchen scraps into useful cleaning products and fertilizers (Benny et al., 2023). This not only helped reduce household waste but also promoted sustainable living practices within the community.

d. Circular Economic

Circular economics is intricately linked to waste treatment as it emphasises minimising waste generation and maximising resource recovery. By adopting circular

economy principles, industries are encouraged to design products for longevity, reparability, and recyclability, which directly reduces the volume of waste produced (Chowdhury & Asiabanpour, 2024). Effective waste treatment becomes a critical component of this system, focusing on transforming waste materials into valuable resources rather than viewing them as mere refuse. Practices such as composting, recycling, and upcycling not only divert waste from landfills but also facilitate the recovery of materials that can be reintegrated into production processes (Oyejobi et al., 2024). This closed-loop approach minimises environmental impacts, conserves natural resources, and reduces greenhouse gas emissions associated with waste disposal. Furthermore, implementing circular economy strategies in waste management can foster innovation, create jobs in recycling and resource recovery sectors, and enhance community resilience by promoting sustainable local economies.

The *Doktor Mengabdi* (DM) program has demonstrated significant outcomes in promoting circular economics and effective waste treatment in the communities it serves. Through targeted initiatives, the program has successfully raised awareness about the importance of reducing waste and reusing materials, contributing to a circular economy framework. In

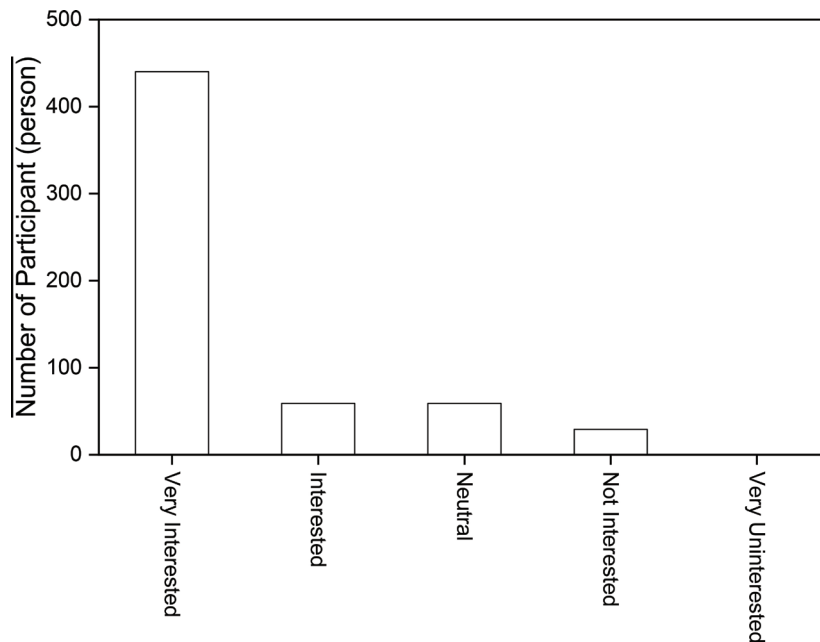


Figure 7. Community response to learning about adopting household solar panels or biogas systems.



Figure 8. The workshop on ecoenzyme from organic waste.

particular, community-based recycling programs established by the DM program have enabled local residents to separate and recycle their waste more effectively, resulting in 65% of participants in households participating in recycling initiatives (Figure 9). This shift has significantly reduced the amount of waste sent to landfills, promoting the recovery of valuable materials that can be reintegrated into the local economy. Moreover, the program's workshops on sustainable practices have educated 1,220 community members on the principles of circular economics, highlighting the importance of resource efficiency and waste reduction. As a result, many participants have adopted practices such as composting organic waste, which not only minimises

landfill use but also enhances soil quality and supports local agriculture. The integration of circular economy principles within the DM program has led to the formation of local environmental committees that oversee ongoing waste management initiatives, ensuring sustainability and community engagement (Elia et al., 2024; Sugiarto et al., 2021; Suroto et al., 2014).

2. Student activity in the *Mahasiswa Membangun Desa (MMD)* Program

a. Youth Planting Initiatives

Youth represent a vital human resource in tree-planting initiatives aimed at mitigating global warming, particularly in rural areas where such efforts can have a

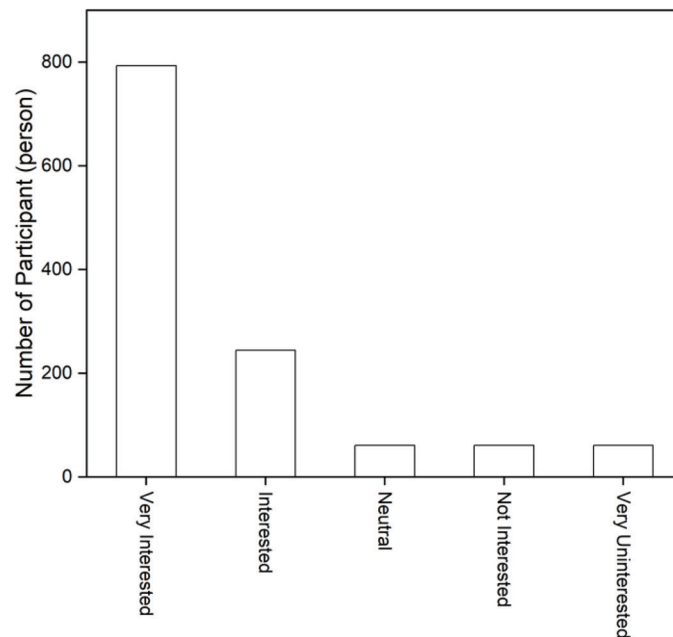


Figure 9. Response of the community to household participation in recycling initiatives.



Figure 10. The activity of students during MMD.

significant impact. Engaging young people in tree planting not only helps combat climate change by enhancing carbon sequestration but also fosters environmental stewardship and community involvement (Pearsall et al., 2024). Their energy and enthusiasm can drive innovative approaches to reforestation and sustainable land management while providing them with valuable skills and knowledge about ecological conservation (Raman et al., 2024; Sousa-Silva et al., 2023). In designated villages, youth-led initiatives can empower local communities, promoting sustainable practices and ensuring the longevity of reforestation projects. By involving the younger generation in these activities, communities can

build resilience against climate change, improve local biodiversity, and enhance their overall environmental health.

As part of the MMD program, students led tree-planting campaigns in partnership with local residents (Figure 10). A total of 7,000 trees were planted across 30 regencies, with a specific emphasis on species that aid in carbon sequestration and soil stabilisation. Observational data indicated that villages involved in tree-planting activities experienced a 15% decrease in landslide incidents during the rainy season, demonstrating the immediate environmental advantages of the initiative.

b. Youth Community-Based Recycling Programs

Youth community-based recycling programs play a crucial role in promoting environmental sustainability and fostering a culture of waste reduction among younger generations. These programs engage youth in hands-on activities that educate them about the importance of recycling and waste management, encouraging them to take an active role in their communities (Raman et al., 2024). By participating in local recycling initiatives, young people not only learn about environmental stewardship but also develop leadership skills and a sense of responsibility towards their surroundings (MacDonald et al., 2023). Such programs have been shown to increase recycling rates significantly, as youth mobilize their peers and families to adopt more sustainable practices (Buttazzoni et al., 2024). Additionally, these initiatives help create awareness about the circular economy, illustrating how materials can be repurposed and reused, ultimately reducing waste and conserving resources for future generations.

The MMD students helped establish community-based recycling programs in rural areas. The students played a key role in establishing community-based recycling programs that encouraged local residents to engage in waste management efforts actively. As a result of these initiatives, 65% of households started practising waste separation and participated in recycling, significantly reducing the amount of waste sent to local landfills. This shift not only addresses waste disposal challenges but also conserves natural resources by promoting recycling. The students introduced the 3R framework—Reduce, Reuse, Recycle—as an effective method for managing waste. This framework emphasizes minimizing waste production, repurposing materials, and recycling to lessen environmental impact. In fact, 90% of surveyed community members reported that the 3R framework was highly effective in reducing plastic waste, underscoring its significance in promoting sustainable behaviour. Through these initiatives, the MMD students not only enhanced waste management practices but also encouraged long-term environmental awareness and responsibility among local residents.

c. Youth Sustainability of Practices

Youth sustainability of practices programs is essential for empowering young people to adopt and promote sustainable behaviours that contribute to environmental stewardship and community resilience. These initiatives focus on educating youth about sustainability concepts, including energy conservation, waste reduction, and biodiversity protection, while encouraging them to implement these practices in their daily lives (Buttazzoni et al., 2024). Involving youth in hands-on projects, like

community gardens or renewable energy workshops, fosters practical skills and a deeper understanding of ecological systems (Leal Filho et al., 2018). Moreover, when young individuals actively engage in sustainable practices, they become advocates for change within their communities, influencing their peers and families to adopt similar behaviours (Filho et al., 2023a). This ripple effect not only enhances the overall sustainability of local practices but also cultivates a generation of environmentally conscious citizens committed to addressing climate challenges.

The MMD program has significantly advanced youth sustainability of practices by actively engaging students in grassroots initiatives that promote environmental awareness and sustainable behaviours in rural communities. Through this program, students work collaboratively with local residents to implement projects such as community gardens, waste management systems, and renewable energy workshops, which not only educate youth about sustainable practices but also empower them to take leadership roles within their communities (Filho et al., 2023b, 2023a). As a result, participants have reported increased knowledge and commitment to sustainability, leading to a measurable improvement in local environmental practices. Surveys indicate that approximately 70% of youth involved in the MMD program continued to apply sustainable practices, such as recycling and organic farming, even after project completion. This ongoing engagement highlights the program's effectiveness in fostering a culture of sustainability among young people, equipping them with the skills and motivation to address climate challenges and advocate for environmental stewardship in their communities.

3. DISCUSSION

The findings from this study highlight the important role that universities can play in addressing climate change through community engagement, education, and direct action. The DM and MMD programs at Brawijaya University have shown how academic institutions can bridge the gap between research and practical implementation, especially in rural communities vulnerable to the impacts of climate change (Develay & James, 2024; Filho et al., 2023a).

1. University-Community Partnerships for Climate Action

One of the central takeaways from this research is the value of university-community partnerships in promoting climate change mitigation. The DM and MMD programs offer examples of how university expertise can be translated into actionable strategies that benefit both the local environment and the community. By engaging

both lecturers and students, these programs provide a model for integrating theoretical knowledge with practical applications.

The success of the DM program in reforestation and sustainable agriculture highlights the importance of targeted, expert-led interventions in mitigating climate change. The adoption of sustainable farming practices by 65% of participating farmers, as well as the extensive community participation in reforestation efforts, showcases the effectiveness of these knowledge-sharing programs. Furthermore, the workshops on renewable energy and waste management led to significant shifts in community practices, particularly in waste management, where 60% of villages adopted new systems. The MMD program's grassroots approach demonstrated the power of student involvement in climate action. The widespread adoption of the 3R framework and the establishment of community-based recycling programs underscore the capacity of student-led initiatives to drive behavioural change. The positive results in tree planting and environmental education further indicate that when students have the right tools and knowledge, they can act as catalysts for long-term change in local communities (Buttazoni et al., 2024; Filho et al., 2023b)

2. Challenges to Scaling Climate Mitigation Programs

Despite the positive outcomes, there are several challenges that may limit the scalability and long-term sustainability of these programs. One of the main obstacles encountered was the limited availability of resources. Both DM and MMD faced logistical and financial challenges, especially in ensuring a consistent supply of materials needed for reforestation and renewable energy projects. Addressing these resource gaps will be critical for scaling the programs and ensuring that their benefits can be sustained over time (Develay & James, 2024; Puppim de Oliveira & Bhuiyan, 2024).

In some cases, we observed that the community was resistant to change, especially when it came to new agricultural and waste management practices. This resistance usually stems from long-standing traditional practices and a lack of trust in new technologies. While the DM and MMD programs were successful in bringing about change in many areas, future initiatives may need to include more targeted strategies to overcome resistance. This could involve providing ongoing support, offering more hands-on demonstrations, and working closely with local leaders to build trust and ensure that the community is fully on board (Develay & James, 2024).

3. Sustainability and Long-Term Impact

The long-term sustainability of the initiatives introduced through DM and MMD remains an important

consideration. While 70% of villages that participated in MMD projects continued the environmental practices after the program ended, there is still a need for stronger institutional frameworks to ensure that these practices can be maintained and scaled. One potential strategy for enhancing long-term impact is the establishment of local environmental committees that can oversee ongoing activities, as was observed in some communities (Ardoin et al., 2020).

Furthermore, it is crucial to maintain ongoing collaboration between Brawijaya University and local governments to ensure that these programs are not isolated initiatives but are integrated into broader regional and national climate change strategies. Although the establishment of local regulations, such as those targeting the reduction of plastic waste and land use management, represents a positive step in this direction, there is still a need for further efforts to institutionalise these initiatives (Arifin et al., 2023; Sinha et al., 2024)

4. The Role of Universities in Climate Change Mitigation

The results of this study add to the growing evidence that universities have a unique and critical role in mitigating climate change. This is particularly evident through their ability to conduct research, educate future leaders, and directly engage with local communities (Filho et al., 2023b; Leal Filho et al., 2018). The DM and MMD programs are examples of how academic institutions can use their knowledge to address real-world problems, empowering communities to take meaningful action against climate change.

These programs provide environmental benefits and help communities adapt to climate change, fostering social resilience. For instance, by adopting sustainable agricultural practices, communities can reduce carbon emissions and better withstand climate-related economic disruptions (Sinha et al., 2024; Sugiarto, Ahmad, et al., 2024). Similarly, focusing on waste management and renewable energy brings long-term economic and environmental benefits that enhance community sustainability (Sinha et al., 2024; Sugiarto et al., 2023).

5. CONCLUSION

The study emphasises the important role that universities, specifically Brawijaya University, can play in addressing climate change through community engagement and education. By examining the DM and MMD programs, it is clear that academic institutions have the potential to make significant contributions to climate change mitigation at both the local and regional levels. The DM program, through initiatives such as reforestation, sustainable agricultural practices, and educational workshops on renewable energy and

waste management, effectively raised environmental awareness and encouraged concrete actions within communities. Similarly, the MMD program enabled students to lead grassroots climate action, resulting in community-based recycling programs, tree-planting campaigns, and increased climate literacy. Despite these successes, challenges such as limited resources, community resistance, and the sustainability of practices persist. Addressing these issues will be crucial to ensuring the long-term impact and scalability of these programs. Boosting resource support, overcoming resistance through targeted outreach, and strengthening institutional frameworks can help maintain and expand these climate mitigation efforts.

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Declaration of Conflicting Interests

The authors declare that they have no competing interests.

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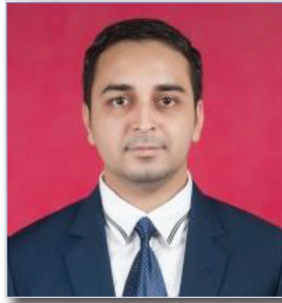
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