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Optimizing Batik MSMEs through the implementation of green economy and sustainable digitalization

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ABSTRACT

The Nona Alif Muclisin MSME in Pasuruan Regency faces challenges in the batik industry, particularly environmental pollution caused by synthetic dyes and limitations in global marketing. This community service program aims to address these challenges by applying green economy principles and digital marketing strategies. Through training sessions, the MSME was taught environmentally friendly waste management practices and the use of natural dyes to reduce pollution. Additionally, digital marketing training was provided to expand market reach and enhance the global visibility of batik products. The program also included tree planting initiatives as a source of natural dyes and an effort to mitigate environmental impacts. The results showed a significant reduction in environmental pollution through the adoption of natural dyes and improved waste management. The implementation of digital marketing strategies successfully expanded the MSME's market and increased product sales. In conclusion, this program effectively addressed environmental and marketing challenges in batik MSMEs. However, continuous follow-up is needed to ensure the sustainability of positive outcomes and to support the future development of MSMEs.

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1. INTRODUCTION

Indonesia is renowned for its rich and extraordinary cultural diversity, one of which is traditional art recognized globally as Intangible Cultural Heritage by UNESCO (Poon, 2020). This art represents the nation's rich cultural identity and plays a crucial role in supporting the economy, particularly in the Micro, Small, and Medium Enterprises (MSMEs) sector (Wang, 2018). As an integral part of the creative economy, traditional art significantly contributes to local and national economic development by creating substantial employment opportunities and serving as a key attraction for tourism, drawing both domestic and international visitors (Harsanto & Permana, 2020). These tourists are captivated by the beauty and uniqueness of artworks that radiate a strong cultural identity.

Despite its achievements, the industry associated with traditional art faces serious challenges, particularly regarding its negative environmental impacts (Kasim et al., 2022). A primary concern is the use of synthetic chemicals in production processes (Krisnawati et al., 2019; Sediyono et al., 2018). These

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chemicals have caused significant and alarming environmental damage (Tangahu et al., 2019). Waste from production is often discharged directly into the environment without proper treatment, resulting in pollution that degrades water and soil quality in surrounding areas. In production hubs, river pollution has become a prominent issue, marked by darkened and murky water, often accompanied by unpleasant odors, indicating strong chemical contamination (Istirokhatun et al., 2021).

The pollution not only disrupts local ecosystems, harming aquatic flora and fauna, but also poses severe health risks to local communities (Jones, 2018). Residents relying on these water sources for daily needs—such as bathing, washing, and consumption—are at risk of exposure to hazardous chemicals, potentially leading to various health issues.

Environmental pollution from unsustainable production practices represents a major challenge that must be urgently addressed (Levi et al., 2021). Beyond environmental degradation, the social and economic impacts are also significant. Reduced agricultural productivity, lower fish yields, and diminished quality of life for affected communities are direct consequences of pollution (Peters et al., 2019). Furthermore, the prestigious image of traditional art as a high-value cultural product could be tarnished if these environmental issues are not properly managed.

Addressing these challenges requires collaborative efforts among the government, industry players, and communities. Adopting more environmentally friendly production practices is a critical step. This includes reducing the use of synthetic chemicals, implementing more effective waste treatment systems, and utilizing natural materials that are safer and more sustainable (Nyamiati et al., 2023). Such measures not only mitigate environmental impacts but also enhance the competitiveness of traditional art products in a global market increasingly concerned with sustainability and environmental responsibility (Nurjanah et al., 2021; Sianturi et al., 2022).

One area facing these challenges is Pasuruan Regency, a prominent batik-producing region. In this area, the MSME Alif Muclisin Artspace has shown great potential in developing batik art, especially through creations aimed at children and teenagers, emphasizing mental health improvement. However, like many other MSMEs, Alif Muclisin Artspace faces significant challenges in managing the environmental impact of its production processes.

The use of synthetic chemicals in batik dyeing remains a common practice, and the resulting waste has caused environmental pollution around production areas. In addition to environmental challenges, Alif Muclisin Artspace also faces difficulties in utilizing digital technology for product marketing. Until now, batik sales have relied on traditional methods, limiting market reach and hindering the potential of Pasuruan batik products to compete in the global market. However, with its quality and uniqueness, the batik products from this MSME have significant potential to attract consumers in broader markets.

Based on the challenges faced, the authors and the team feel the need to get involved in assisting Alif Muclisin Artspace in addressing these issues. The first step to be taken is to guide the MSME toward adopting the green economy concept in its production processes. The green economy emphasizes environmentally friendly production practices, efficient resource use, and social welfare. By applying this approach, the batik industry in Pasuruan Regency is expected to develop sustainably without compromising ecological balance.

The authors and the team will collaborate with Alif Muclisin Artspace to introduce the use of natural dyes that can be sourced locally around the production site. Using natural dyes will not only reduce the environmental pollution impact but also enhance the added value of batik products as eco-friendly items increasingly preferred by global consumers. In addition, the authors and the team will also initiate tree-planting activities around the production area as a broader environmental mitigation effort. This activity aims to create a healthier ecosystem and support environmental sustainability around the business site.

To address marketing issues, the authors and the team will provide assistance in understanding and operating online marketplaces for the partner. With increased understanding and skills in digital marketing, it is expected that Alif Muclisin Artspace can expand its market reach to the global level. This support is also expected to boost sales and strengthen the competitiveness of Pasuruan batik products in international markets, while simultaneously supporting sustainable economic growth in Indonesia.

2. METHODS

Design, Time, Location, and Participants

The design proposed by the Community Service Team to the partner is a community empowerment program consisting of: (1) providing training on environmentally-based batik waste management processes, (2) providing training on environmentally-based financial reporting, (3) providing training on marketplace utilization for marketing, and (4) planting trees in the partner's environment (indigo trees, mangosteen trees, cinnamon trees, and nutmeg trees). This program will be implemented over six months, from June to December 2024.

The implementation method of this community service is structured in three phases, beginning with the preparation phase. In this phase, coordination is carried out to plan the community service activities with the partner. Once mutual agreements are reached, all necessary materials and resources are gathered for the implementation of the activities. The second phase, the implementation phase, includes three training sessions and tree-planting activities. The final phase, the post-implementation phase, consists of three key activities, such as evaluation, continued assistance, and reporting with the outputs of the community service. Continued assistance is a critical aspect, particularly in the context of using technology and utilizing environmentally friendly raw materials.

The community service activities will be conducted in Hasanudin Gondangan, Beji Subdistrict, Pasuruan Regency. The target participants of this program are approximately 25 housewives in the village of Hasanudin Gondangan.

Community Service Implementation Procedure

Figure 1 is the work procedure for the program by the community service team and partners for six months.

Identify Partner Needs through Initial Discussion

In this community service activity, several stages were carried out based on the needs and issues identified during field surveys. These stages were structured after reaching a mutual agreement with the partner, Ms. Alif Muclisin, who runs a batik fabric business in Hasanudin Gondangan, Beji Subdistrict, Pasuruan Regency. Figure 2 illustrates the steps of the community service implementation.

The process begins with the formation of a community service team, which conducts a preliminary survey with the partner. The survey results are used to identify field problems and formulate the objectives of the community service (Rahmadyanti, 2020). Subsequently, a needs analysis is conducted to prioritize solutions to the identified issues. The next stage involves preparing and implementing training activities by administering pretests and post-tests with the following assessment criteria: (1) participants' awareness of the dangers of batik chemical waste, (2) participants' knowledge of environmentally-based financial reporting, and (3) participants' understanding of marketplaces that can be utilized for marketing. These three criteria include evaluation indicators categorized as low knowledge, aware, and highly aware.

Figure 1. Community service implementation procedure

After the training activities, a review and evaluation process is conducted to assess the overall implementation of the community service. The final step involves preparing reports and outputs, which include tangible results from the activities. All these steps are designed to provide positive impacts and effective solutions to the partner's challenges.

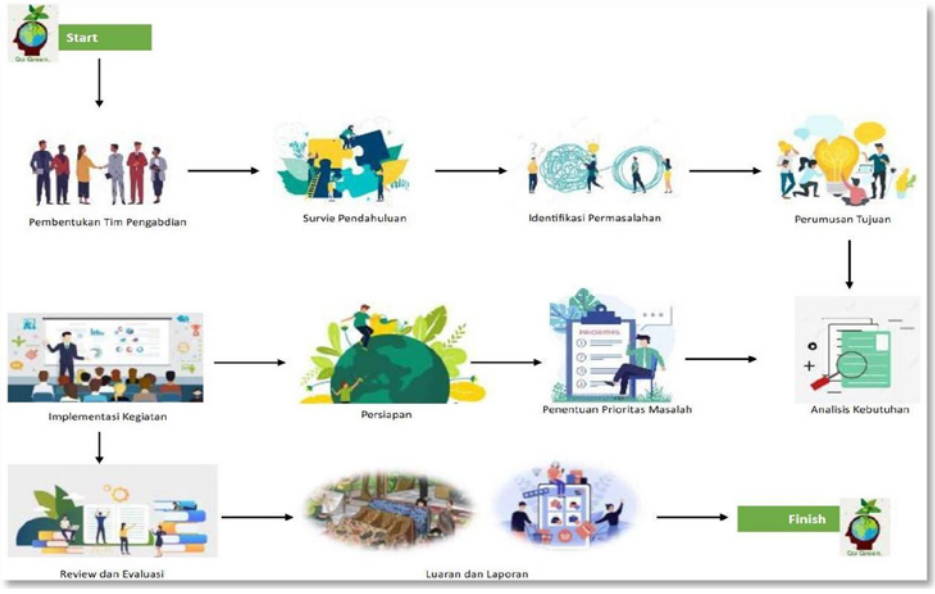

Figure 2. Stages of Community Service Implementation

Designing a Service Program

After identifying community needs during the first meeting, a second meeting was held to design a collaborative program. The results of the needs assessment and community input were thoroughly discussed, focusing on developing a program that supports environmentally friendly batik production while promoting sustainable economic growth. This meeting emphasized the importance of reducing synthetic chemical use in batik production processes by replacing them with safer natural materials. Additionally, the program was designed to enhance community skills in waste management and product marketing through digital platforms, aiming to expand market reach and improve the local community's economic welfare. The goal of this program is to establish a batik production process that not only preserves environmental sustainability but also strengthens the local economy in a sustainable manner.

Program Implementation Stages

The method of implementing this service is structured in several stages from the preparation stage to the implementation and evaluation stages. In detail it is explained as follows.

Preparation stage

At this stage, coordination is carried out to plan community service activities for partners. After mutual agreement, all the necessary needs for the implementation of community service activities are collected.

Implementation and evaluation stage

The implementation phase includes three training activities and a tree-planting activity. The final phase, which is the post-implementation phase, comprises three key activities: evaluation, sustainability mentoring, and reporting along with the outcomes of the program. Ongoing mentoring is a crucial aspect, especially in the context of technology utilization and the use of environmentally friendly raw materials.

The training program evaluation design involves using pre-training and post-training surveys to assess changes in participants' knowledge and attitudes regarding three main aspects of the training: waste management, sustainable raw material calculations, and digital marketing techniques.

The pre-training survey will be conducted before the training begins to measure participants' initial understanding of waste management, including processing and utilization techniques, as well as their knowledge of sustainable raw material calculations and digital marketing. After the training, a post-training survey will be conducted to assess changes in participants' knowledge and attitudes toward these three aspects.

This survey will include the same questions as the pre-training survey to allow direct comparison and impact assessment of the training. Additionally, the post-training survey will evaluate how well participants have applied environmentally friendly waste management techniques, sustainable raw material calculations, and digital marketing strategies learned during the training. By using these surveys, the evaluation will provide a clear picture of the training's effectiveness in enhancing participants' knowledge, skills, and attitudes towards waste management, sustainable raw material use, and digital marketing.

3. RESULTS AND DISCUSSION

Results

The implementation of this community service program lasted for three days, with the main focus on empowering and training women MSMEs in Hasanudin Gondangan Village to support more environmentally friendly batik production and enhance their economic capacity (Figure 3).

In the first training session, participants were given an in-depth understanding of the importance of effective waste management to reduce the environmental impact of batik production. The session began with an explanation of the negative consequences of unmanaged batik industry waste, including water and soil pollution that can harm local ecosystems and cause health problems for surrounding communities.

Participants were then taught various environmentally friendly waste treatment methods. These included techniques such as recycling and reusing waste materials, so that waste produced from the batik production process is not directly discarded into the environment. For example, liquid waste from dyeing can be processed using filtration systems or biological treatment to remove harmful substances before disposal. In addition, participants also learned about composting solid waste, such as fabric scraps and organic materials, which can be turned into fertilizer to improve soil quality.

The training also covered best practices in storing and handling waste during the production process, such as using appropriate containers and safe disposal procedures. Participants were introduced to technologies and tools that can help manage waste efficiently, as well as strategies to minimize the amount of waste generated through better production planning.

By understanding and applying these techniques, participants are expected to reduce the negative impact of batik production waste, maintain environmental cleanliness, and contribute to natural resource conservation efforts. The implementation of effective waste management will support more sustainable and environmentally friendly batik production.

Additionally, participants were encouraged to understand the benefits of planting trees that can be used as sources of natural dyes, which not only reduce dependence on synthetic chemicals but also contribute to preserving the local environment.

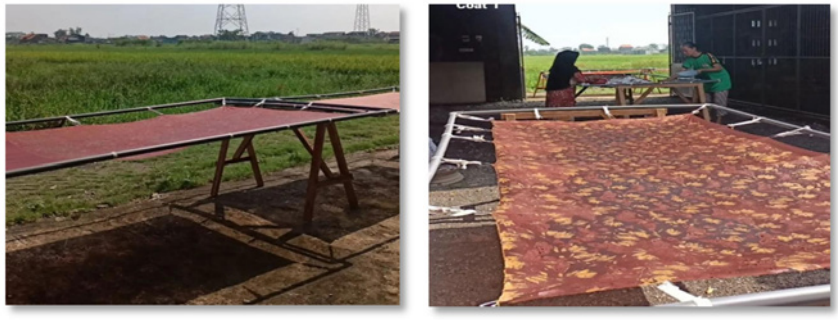

Figure 3. Batik cloth making process

In the second training session, the main focus was on educating participants about sustainable raw material calculation. This session was designed to help participants understand and apply sustainability principles in planning and managing raw materials for batik production.

First, participants were taught how to calculate the raw material requirements while considering sustainability aspects. This included assessing the amount of raw materials needed for each production

process and planning the efficient use of raw materials to avoid waste. This calculation method helps ensure that the materials used are the most suitable and do not exceed actual needs.

The training continued with an explanation of how to plan for the sustainable procurement of raw materials. Participants learned how to select environmentally friendly raw material sources, such as those from renewable sources or materials produced with methods that reduce environmental impact. In addition, they were provided with knowledge on how to build relationships with suppliers who practice sustainability and transparency in their supply chains.

This session also included training on raw material inventory management. The women MSMEs were taught techniques to manage inventory well, including effective storage methods, accurate stock calculations, and ways to anticipate raw material needs to avoid excess or shortages. Proper inventory management is crucial to reduce waste and ensure that materials are available when needed without accumulating unnecessary stock.

Next, participants learned strategies to minimize production waste. This included techniques such as optimal material cutting, reusing material scraps, and production methods designed to minimize waste. By adopting these strategies, participants can reduce the negative impact of production waste on the environment and increase production efficiency.

With a deep understanding of sustainable raw material calculation and planning, participants are expected to implement these practices in their businesses, ensuring more efficient and environmentally friendly batik production. This also supports broader sustainability goals, maintaining ecosystem balance, and conserving natural resources for future generations.

Figure 4. Counseling on recording financial reports and tree planting

In the third session, the training focused on digital-based marketing with the aim of expanding the market reach of batik products. Participants were given in-depth insights into utilizing digital technology in marketing, starting with the use of e-commerce platforms such as Shopee. They were taught how to create and manage accounts, set up store profiles, and upload batik products effectively, including how to create attractive product listings and manage transactions.

Additionally, the training covered effective digital marketing strategies, such as search engine optimization (SEO), pay-per-click advertising (PPC), and email marketing. Participants learned how these techniques could enhance the visibility of batik products on digital platforms. They were also educated on how to leverage social media, particularly TikTok, for marketing. In this session, participants learned to create engaging and relevant content, along with strategies to capture the audience's attention through creative videos.

With these skills, participants are expected to market their batik products more widely, boost sales, and build a strong brand in the digital marketplace. With this knowledge, it is hoped that the women

MSMEs can optimize online business opportunities, enhance product visibility, and reach a broader market, both nationally and internationally.

In addition to the training and empowerment, the service team also provided natural raw materials to the women MSMEs in Desa Hasanudin Gondangan (Figure 5). These raw materials can be directly used to support the implementation of batik techniques with natural dyes that were taught. By providing these raw materials, the team aims to facilitate an easier transition for participants from using synthetic chemicals to natural dyes and ensure that they have enough resources to start producing environmentally friendly batik effectively. The provision of these raw materials is also intended to accelerate the implementation of the knowledge gained during the training, enabling the women MSMEs to immediately apply natural dyeing techniques in their batik production.

Figure 5. Process of providing raw materials and marketplace introduction

With a combination of training, empowerment, and the provision of raw materials, this community service program is expected to drive the transformation of batik production towards more sustainable practices and provide long-term benefits for both economic welfare and environmental conservation. Overall, the program is designed to equip the women MSMEs in Desa Hasanudin Gondangan with the practical skills and knowledge necessary to implement more environmentally friendly, efficient, and sustainable production practices. In addition, the program also aims to empower them to utilize digital technology to expand marketing reach, thereby improving the community's economic welfare in a sustainable manner. Table 1 is the schedule for the 3-session training activities.

This program applies the principles of green economics and leverages digital technology to improve environmental sustainability and enhance the competitiveness of the batik market. Over the course of three days of intensive training, the women MSMEs involved were equipped with knowledge and skills in key areas such as environmentally-friendly waste management, environmentally-based financial reporting, and digital marketing. The training was designed to have a long-term positive impact both environmentally and economically.

In the waste management session, participants were taught various environmentally-friendly techniques that allowed them to reduce the use of synthetic chemicals and switch to natural dyes. This aims to reduce water and soil pollution, often caused by batik waste. The use of natural dyes is expected to reduce negative environmental impacts and improve the surrounding environmental quality. Additionally, the training on environmentally-based financial reporting provided participants with skills to manage and report the financial aspects related to the sustainability of their businesses. This is essential to ensure that batik production can be carried out efficiently and environmentally-friendly, while avoiding unnecessary waste and loss.

Table 1. Training activity schedule

Session 1	
Goals	Explanation of the impact of batik waste management (environmental pollution)
	Explanation of environmentally based batik waste management
	Explanation of the utilization of natural resources
Goals	Increase awareness of the negative impacts of environmental pollution from batik waste.
	Provide knowledge and skills about environmentally friendly waste management techniques.
	Encourage the use of natural dyes and sustainable use of natural resources in batik production.
Session 2	
Activities	Sustainable Raw Material Calculation Explanation
	Sustainable Raw Material Calculation Practice
Goals	Increase understanding of the importance of calculating raw material needs to ensure sustainability.
	Train the ability to calculate raw materials to support environmentally friendly and sustainable production.
Session 3	
Activities	Explanation of digital-based marketing methods
	Practice of creating e-commerce platforms such as Shopee, Tiktok
Goals	Increase understanding of digital marketing strategies to expand market reach
	Train skills in creating and managing online stores on e-commerce platforms to increase sales.

The results of this training show a significant impact in reducing pollution and improving environmental quality. Based on observations and evaluations, the use of natural dyes and more environmentally-friendly waste management has minimized the negative impact on the local ecosystem and public health. As evidence, a direct evaluation test was conducted on the community's knowledge of the environmental hazards of chemical batik dyes. During the pre-test, participants were aware of the dangers, but lacked solutions for alternative batik dyes. After the training, 85 percent of participants reported a significant reduction in the use of synthetic chemicals after applying the natural dye techniques taught. Prior to the training, only 20 percent of participants used natural dyes in their batik production, but after the training, 85 percent of participants began regularly using natural dyes, demonstrating a significant change in their production patterns.

Furthermore, the training on environmentally-based financial reporting also showed positive results. Based on pre-tests and post-tests, there was a significant improvement in participants' knowledge of digital marketing strategies. Before the training, only 5 percent of participants understood environmental financial reporting, and 95 percent did not record finances in a standard or environmentally-based way. After the training, 80 percent of participants understood the concept of environmentally-based financial reporting. The cumulative results from the pre and post-test questionnaires provide quantitative evidence of the success of this training. In the pre-test, only 27 percent of participants were familiar with the three criteria mentioned. After the training, 85 percent of participants felt more knowledgeable about environmentally-friendly waste management techniques. Additionally, 20 percent of participants in the pre-test did not know how to market products digitally, but after the training, 87 percent of participants

felt more confident in creating products using natural materials, independently recording finances in an environmentally-conscious manner, and marketing their products through online marketplaces.

The reflective results from the implementation team and participants revealed that the training method had a positive impact on participants' knowledge improvement. The pretest and posttest results can be seen in Table 2.

Table 2. Pretest and posttest results of training on the dangers of chemical dyes, calculation of production costs and products marketed to the marketplace according to their characteristics

Criteria	Pre-Test		Post-Test	
	N	%	N	%
Knowing the dangers of batik dye waste				
Very knowledgeable	20	80	25	100
Just Know	3	15	0	0
Not Knowing	2	5	0	0
Understanding Environmentally Based Financial Recording				
Very knowledgeable	0	0	20	80
Just Know	2	5	5	20
Not Knowing	23	95	0	0
Marketplace Knowledge				
Very knowledgeable	0	0	20	80
Just Know	5	20	5	20
Not Knowing	20	80	0	0
TOTAL	25	100	25	100

The post-test results for 25 partner employees indicated a significant improvement in the participants' knowledge and skills after the training. The materials covered multiple-choice questions on the dangers of chemical dyes, calculating the cost of production, and marketing products on online marketplaces. The questions were designed as simply as possible to facilitate participants' understanding.

The pre-test results showed that the highest number of correct answers was only 8 out of 20 questions, placing the participants in the low category. This result was linked to a lack of knowledge regarding the dangers of chemical dyes, the calculation of the cost of production, and how to market products online. At the end of the training, participants took a post-test, with the highest number of correct answers ranging from 15 to 17 out of 20 questions, placing them in the high category.

However, despite the positive results of the training, there are still challenges that need to be addressed to ensure long-term success. One challenge is the tree planting initiative as part of the environmental impact mitigation program, which requires regular monitoring. The goal of this tree planting program is to produce natural dye sources and improve environmental quality, but for sustainability, routine monitoring of tree growth and its contribution to environmental impact mitigation is necessary. The results of this monitoring will be used as a reference for the next steps in the program.

Additionally, to ensure the sustainability of the program and the development of the batik MSMEs, continuous support in the form of updated knowledge and skills is also required. Given the rapid development of technology and market trends, follow-up training is needed to ensure that participants can keep up with these changes. Success in applying natural dyeing techniques and digital marketing requires ongoing adaptation to market and technological shifts. Therefore, continuous support and further training will be crucial to ensure that the women MSMEs can keep adapting and maintain environmentally-friendly practices and effective marketing strategies.

Overall, this program is expected to not only provide direct benefits in terms of environmental management and digital marketing but also encourage sustainable economic growth and the overall welfare of the local community. The success of this program could serve as a model for other MSMEs in applying green economics principles and digitalization to address future challenges.

Discussion

The training program conducted for Nona Alif Muclisin has shown significant results in addressing the challenges faced by the company, particularly in waste management and marketing batik products. Based on the pre-test and post-test assessments, there was a clear improvement in participants' knowledge and skills. Before the training, only a small portion of participants understood how to manage waste in an environmentally friendly manner and apply natural dyes, with only 20 percent of participants familiar with these techniques. However, after the training, 85 percent of participants demonstrated a better understanding of how to manage batik waste and reduce the use of synthetic dyes by switching to natural dyes, which can reduce the negative impact on the environment. This indicates that the training materials provided successfully imparted practical and in-depth knowledge regarding waste management and the use of natural dyes.

In addition, the digital marketing aspect also showed positive results. Before the training, 50 percent of participants were unsure about using digital platforms to market their products. After the training, approximately 80 percent of participants showed better understanding and began applying digital marketing techniques, such as search engine optimization (SEO), paid ads (PPC), and promotions through social media platforms like TikTok and Instagram. As a result of this increase, 60 percent of participants reported a rise in online sales, indicating that digital marketing strategies have a direct impact on improving visibility and sales of their batik products.

However, the long-term success of these strategies requires ongoing attention. The maintenance of trees planted as a source of natural dye must be regularly monitored to ensure their sustainability and contribute to reducing environmental impact. Additionally, with the rapid development of technology and market trends, continued training is essential to help participants stay updated and continue to adopt effective and relevant digital marketing strategies. By providing ongoing support, both in terms of environmental care and updates to marketing knowledge and skills, it is hoped that the changes implemented by Nona Alif Muclisin will be sustainable and provide positive long-term impacts. This training program not only offers immediate benefits in terms of environmental management and marketing but also fosters sustainable economic growth for MSMEs and better environmental preservation.

4. CONCLUSION AND RECOMMENDATION

The community service program carried out in Desa Hasanudin Gondangan, Beji District, Pasuruan Regency, has the primary goal of addressing challenges in the batik industry by applying green economy principles and leveraging digital technology. During the three-day training, participants—female entrepreneurs (MSMEs)—were provided with in-depth knowledge and skills in environmentally-based batik waste management, environmentally-conscious financial reporting, and digital marketing. Through this training, participants learned how to reduce the negative impact of synthetic dyes by switching to natural dyes, improve raw material efficiency, and expand their batik product reach through digital platforms. The results of the training show that the implementation of more environmentally friendly waste management methods can reduce pollution and improve the quality of the surrounding environment. The use of natural dyes and effective waste processing techniques are expected to minimize the negative

impact on local ecosystems and public health. Additionally, the digital marketing training equipped participants with the tools needed to market their batik products more widely and effectively, which can ultimately enhance competitiveness and open up global market potential.

However, some challenges remain. The planting of trees as part of the environmental impact mitigation program needs to be followed up with regular monitoring to ensure its success. Moreover, the successful implementation of natural dyeing techniques and digital marketing requires ongoing support and knowledge updates to keep up with technological and market developments.

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