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Application of Natural Dyeing Technology through Eco-print for Eco-Friendly Textile Production in the Bantul Region

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ABSTRACT

Background: Bantul Regency in Indonesia has strong potential to develop a sustainable creative economy through local crafts. However, many MSMEs still use synthetic dyes that harm the environment. This program aimed to introduce Eco-print, a natural dyeing technique using local leaves and flowers.
Contribution: The initiative raised awareness about sustainable production, built technical skills, and encouraged home-based creative enterprises. It supported the community in adopting local resource-based innovations while promoting environmental responsibility and cultural expression.
Method: This program using a Community Development approach, with six stages: needs assessment, collaborative planning, Eco-print training, mentoring, and evaluation. Training activities included plant identification, motif design, and natural dye fixation, conducted with the KSS *Berkah Bersama* community.
Results: Post-training assessments showed a significant improvement in knowledge and skill, with test scores increasing from 40–50 to 80–90. Participants produced eco-friendly tote bags and expressed interest in continuing independent production and marketing efforts.
Conclusion: The program effectively built sustainable textile skills, empowered community members through practical innovation, and supported inclusive local economic development rooted in environmental values and cultural identity.

1. Introduction

Bantul Regency is one of the regions in Indonesia with significant potential for developing a creative economy based on local crafts. The presence of MSMEs (Micro, Small, and Medium Enterprises), creative communities such as environmental activists, and the availability of natural resources in the form of natural dye plants position Bantul as a strategic area for the development of sustainable textile products. To date, most home-based textile and craft entrepreneurs still rely on conventional dyeing techniques that use synthetic chemical substances [1]. While synthetic dyes can produce strong and consistent colors, they pose serious environmental risks, particularly regarding water and soil pollution due to hazardous waste [2].

Another pressing issue is the lack of education and limited access to environmentally friendly alternative technologies. Yet, consumer demand and attention to environmental products have driven increased interest in sustainable practices in the textile sector over the past few years [3]. Many MSME actors and the public remain unaware of natural dyeing techniques such as Eco-print. This method has gained popularity in the creative industry, with artisans increasingly interested in product innovation using natural dyes [4], [5]. These dyes are often derived from waste leaves and flowers. However, much of this organic waste is discarded without added value. Meanwhile, local communities, especially housewives and productive youth, need new skills that can improve household economies while preserving the environment. This imbalance underlines the urgent need for intervention through the development of Eco-print technology.

The primary aim of this community engagement initiative is to empower local communities in Bantul Regency through the introduction and application of Eco-print as an environmentally sustainable textile dyeing technique. This program seeks to raise awareness about the environmental hazards posed by synthetic dyes and to promote the use of natural alternatives that are safer and locally sourced. By providing practical training in Eco-print methods using indigenous plants, the program aims to develop community skills that can translate into viable economic opportunities. In doing so, it supports the creation of unique, high-value textile products that reflect local cultural identity and ecological awareness. Additionally, the initiative strives to foster environmentally responsible entrepreneurship, especially among women and youth, by encouraging self-reliance through sustainable and creative business practices. Ultimately, the program is designed to build a cleaner, more inclusive, and community driven ecosystem for textile production, one that aligns with both environmental preservation and the promotion of local wisdom.

Eco-print is a fabric dyeing technique that utilizes natural pigments from leaves, flowers, and other plant parts, using pressing and steaming methods to transfer the natural patterns onto fabric surfaces [3], [4], [6]. This technique is environmentally friendly as it eliminates the need for synthetic dyes and harmful chemicals [7]. Moreover, Eco-print offers uniqueness in

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each product, as no two motifs are ever exactly alike imparting high artistic value and exclusivity to the textiles.

Eco-print holds significant value for individuals and communities. It can serve as a form of self-expression, as demonstrated in a 2025 community service program by Misratul Aisyah, where Eco-print was shown to support artistic and fashion expression while raising sustainability awareness [8], [9]. In addition, Eco-print fosters creativity and entrepreneurship [10]–[12] Given its association with environmentally friendly product innovation, Eco-print has strong market potential. It can also contribute to community independence by reducing reliance on limited employment sectors [13]. Thus, this program is designed to equip communities with sustainable Eco-print skills, create new economic pathways, and instill an environmentally conscious entrepreneurial spirit. Furthermore, the initiative supports environmental preservation and increases awareness of the importance of responsibly utilizing natural resources [14], [15].

Bantul is potential various plant species ideal for Eco-print, such as teak, ketapang, castor, and mahogany leaves. However, this potential remains underutilized due to limited technical training, lack of tools, and minimal knowledge of color fixation and the use of natural mordants. Therefore, a community empowerment program is essential not only to introduce Eco-print but also to integrate simple, energy-efficient, and accessible appropriate technologies for broader adoption.

Through this program, Eco-print training was conducted for the "KSS *Berkah Bersama*" in Lemahdadi, Bangunjiwo, Bantul Regency. The training included identifying local plants, motif printing techniques, and using simple equipment. As a result, Eco-print emerges as a practical solution for KSS members to produce eco-friendly textile products with high commercial value, thereby supporting sustainable economic development.

By optimizing Eco-print technology, the program aims to create a cleaner, more creative textile production ecosystem rooted in local wisdom. This will not only encourage the growth of environmentally conscious MSMEs but also educate communities about the importance of responsible economic practices. Ultimately, Eco-print contributes not only to the creation of eco-friendly products but also to the preservation of local culture and the improvement of community welfare through inclusive and sustainable approaches.

2. Method

This community service activity adopts a Community Development approach, which emphasizes participatory, collaborative, and sustainable community empowerment processes [16]–[18]. The primary goal of this approach is to facilitate change from within the community by leveraging local potential, strengthening community capacity, and building self-reliance in managing Eco-print-based microenterprises. The implementation process of this community engagement program was structured into six main phases:

Community Problem and Potential Identification (Participatory Rural Appraisal) The service team conducted field observations, interviews, and focus group discussions with

key community stakeholders such as MSME actors, housewives, youth, and creative groups in the Bantul area. This stage aimed to identify community challenges, explore the availability and types of local plants suitable for Eco-print, and assess the community's readiness to adopt the proposed technological intervention. The data gathered served as the foundation for the subsequent planning phase.

a) Collaborative Program Planning

Based on the initial assessment results, the team developed a detailed action plan and designed a training module tailored to the needs, interests, and characteristics of the community. The planning process involved active consultation with the target beneficiaries to ensure contextual relevance and ownership.

b) Eco-print Training and Technology Transfer

Training sessions employed a learning by doing approach through hands-on workshops. Key activities included: Education on the principles of Eco-print and its environmental benefits [1], Identification of locally available leaves suitable for dyeing [2], Practical demonstrations on fabric pre-treatment [3], leaf arrangement, and natural color fixation, Simple product creation, such as eco-friendly tote bags [4].

c) Community-Based Mentoring

Following the training, mentoring sessions were conducted to assist the "KSS *Berkah Bersama*" group in forming a self-managed production unit. The group received guidance on team role distribution, workflow organization, and business management. The Community Development approach ensured that all members were actively involved in decision-making, planning, and ongoing program evaluation.

d) Participatory Evaluation

Evaluation was carried out using questionnaires and group discussions to assess skill improvement and overall impact. Social reflection with the partner community helped identify key challenges, success factors, and future action plans. The evaluation process was conducted transparently to foster a sense of shared ownership and commitment to long-term development.

3. Results and Discussion

The community service activity titled "Optimization of Natural Dyeing Technology through Eco-print as a Sustainable Production Solution" was conducted in collaboration with the KSS *Berkah Bersama* group in Lemahdadi, Bangunjiwo, Bantul. The program aimed to enhance the community's understanding and skills in eco-friendly dyeing techniques using natural materials from local plants. This initiative also served as a means of empowering the community to develop environmentally based local creative economies.

The participants consisted of housewives and members of the KSS *Berkah Bersama* community, many of whom had limited knowledge or experience with Eco-print techniques. Prior to the training, a local potential identification process was carried out. The results showed that most participants did not yet understand the technical differences between natural and

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synthetic dyes or their environmental impacts [19], [20]. To measure the effectiveness of the training, the service team employed a pre-test and post-test evaluation method. The pre-test was conducted before the delivery of the training materials to assess participants' initial knowledge of Eco-print techniques, types of natural dye plants, and technical production processes. Pre-test results indicated that the majority of participants scored in the 40–50 range (on a scale of 100), reflecting insufficient prior knowledge. The one-day training adopted a participatory and hands-on approach, focusing on the basics of eco-print, its environmental benefits, and the potential of local plants such as teak, ketapang, castor, and mahogany leaves [21], [22]. Figure 1 can see practical sessions included fabric pre-treatment, leaf arrangement, and color fixation techniques.

Figure 1. Practical session for this community service

During the practice session, participants showed high enthusiasm and were able to follow each step effectively. Some even began exploring new and creative patterns. The final products were tote bags made from fabric, with naturally dyed leaf patterns that had high aesthetic value, demonstrating that participants successfully applied their new skills. A post-test was conducted after the training to assess knowledge improvement. The results showed a significant increase in scores, with the average post-test score ranging from 80 to 90. Participants could accurately answer technical questions regarding the Eco-print process, types of leaves used, and why Eco-print is more environmentally friendly compared to synthetic dyes [21], [23].

The comparison of pre-test and post-test scores on Eco-print knowledge among 25 participants reveals a significant improvement in understanding can see in Figure 2. Prior to the training, most participants scored between 40 and 50, indicating limited knowledge of Eco-print techniques and concepts. This highlights the need for educational interventions to build foundational awareness, especially in areas related to sustainable textile practices. Following

the training, post-test scores shifted dramatically to the 80–90 range. Participants demonstrated a strong grasp of key topics, including the stages of the Eco-printing process, the types of leaves suitable for printing, and the environmental benefits of Eco-print compared to synthetic dyes. This outcome confirms the effectiveness of the program in enhancing technical knowledge and promoting eco-friendly practices through hands-on learning.

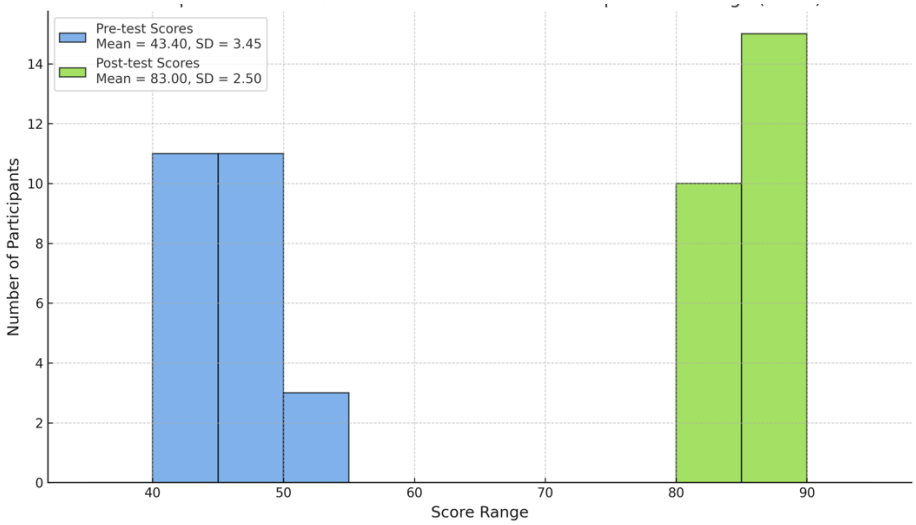

Figure 2. Comparison of pre-test and post test scores on Eco-print Knowledge

Figure 3. Eco-print product results on tote bags

Beyond knowledge acquisition, the training also improved participants' practical skills and creativity. Many expressed increased confidence to continue practicing at home. The team provided leftover materials such as fabric and leaves to support independent practice. Figure 3 can see the results product for Eco-print. Some participants immediately experimented with new motifs using leaves from their own gardens. Another key aspect was the expansion of

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participants' entrepreneurial insight based on natural products. A group discussion was held post-training on how Eco-print could become a home-based business opportunity. Participants were introduced to marketing strategies using social media platforms like Instagram and WhatsApp, as well as accessible online marketplaces. Several participants expressed interest in developing community-based enterprises [24].

Follow-up mentoring was carried out over two weeks post-training by whatsapp to monitor the progress of independent Eco-print activities. The findings revealed that some participants had started replicating the production process and made modifications based on their training experience. This demonstrates a successful and sustainable transfer of technology [25], [26]. Overall evaluation shows that the program succeeded in enhancing three key aspects: (1) knowledge of natural dyeing technology, (2) Eco-print technical skills, and (3) entrepreneurial spirit within the community. Participants gained applicable and economically beneficial skills while developing awareness of environmentally responsible production practices [27]–[30]. The use of a community development approach proved effective in building trust, encouraging active participation, and fostering a sense of ownership among participants. Their involvement in each phase of the activity resulted in more meaningful and long-term outcomes. Moreover, the community began to transform into agents of change in their respective environments.

The successful application of Eco-print in this context underscores the importance of aligning environmental practices with cultural traditions and economic incentives. By focusing on hands-on training, community-led planning, and the use of local plant species such as teak, ketapang, castor, and mahogany, the initiative harnessed local wisdom in a modern, market-driven format. Eco-print emerges as a practical solution for KSS members to produce eco-friendly textile products with high commercial value, thereby supporting sustainable economic development.

4. Conclusion

This community engagement has effectively introduced Eco-print as a sustainable textile dyeing technique that promotes both environmental conservation and economic empowerment in Bantul Regency. By applying a participatory Community Development approach, the program successfully enhanced local knowledge, practical skills, and entrepreneurial capacities among community members, particularly women and youth. The significant improvement in post-training test scores and the creation of high-quality, marketable Eco-print products demonstrate the impact of hands-on learning and localized innovation. The use of natural materials such as teak, ketapang, castor, and mahogany leaves not only reflects ecological sensitivity but also elevates the cultural value of the products created.

The program cultivated a strong sense of ownership and sustainability within the community by involving participants in every stage from problem identification to post-

training mentoring. This inclusive model proved effective in building trust, encouraging creative expression, and fostering eco-conscious entrepreneurship. The findings highlight the relevance of integrating sustainability education, appropriate technology, and local resources in rural development strategies. As a replicable model, this initiative offers valuable insights for future efforts aiming to develop green creative economies rooted in local wisdom and community participation.

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References

[1] N. L. Ramadhani and P. Pandansari, "Utilization of Eco-print Techniques as an Environmentally Friendly Fashion Business Opportunity," *J. Teknol. Busana*, 2024, [Online]. Available: https://journal.unnes.ac.id/journals/teknobuga/article/view/6474.

[2] U. Laili, R. Rohmawati, S. N. Hasina, Y. Septianingrum, and E. P. Rahayu, "Eco Printing as an Environmentally Friendly Effort in Malaysia," *Amalee Indones. J. Community Res. Engagem.*, vol. 5, no. 1, pp. 493–501, Jun. 2024, doi: 10.37680/amalee.v5i1.3986.

[3] A. D. Pranta and M. T. Rahaman, "Extraction of eco-friendly natural dyes and biomordants for textile coloration: A critical review," *Nano-Structures & Nano-Objects*, vol. 39, p. 101243, Sep. 2024, doi: 10.1016/j.nanoso.2024.101243.

[4] Y. P. Sari, "Ecoprint Batik Opportunity as an Environmentally Friendly Business (Case study: HR. Ambar Batik. Bayat, Wedi, Klaten)," *Enrich. J. Manag.*, 2022, [Online]. Available: http://www.enrichment.iocspublisher.org/index.php/enrichment/article/view/733.

[5] O. Adiyanto, M. Faishal, and E. Utami, "Pengolahan sampah plastik menjadi ecobrick sebagai upaya pemanfaatan kembali sampah plastik," *J. Pembelajaran Pemberdayaan Masyarakat*, 2024, doi: 10.33474/jp2m.v5i2.21793.

[6] B. B. Ahire, S. M. Kasabe, A. B. Mali, and V. R. Jadhav, "Development of a Sustainable Dyeing Process for Cotton fabric Utilizing Natural Dyes from Punica granatum L. and Curcuma Longa," *Current World Environment*. researchgate.net, 2024, doi: 10.12944/CWE.19.1.12.

[7] R. A. Oetopo, R. Despriliani, and F. Al Hazmi, "The application of natural dyes from rambutan skin for eco-printing on tanned leather," *J. Bhs. dan Seni*, 2024, doi: 10.17977/um015v51i12023p107.

[8] W. Fatihah and A. A. K. Astuti, "Ecoprint: Alternatif Pendidikan Karakter Pada Pokok Bahasan Kimia Hijau Dan Pembangunan Yang Berkelanjutan," *LENSA (Lentera Sains) J. Pendidikan IPA*, 2025, [Online]. Available: https://www.jurnallensa.web.id/index.php/lensa/article/view/567.

[9] R. N. Firdaus, and N. Andrianto, "Pola Komunikasi Guru Terhadap Metode

Pembelajaran Anak Tuna Grahita Di Sma Kertajaya Surabaya," *Pros. Seminar Nasional Mahasiswa Komunikasi*, 2025, [Online]. Available: https://conference.untag-sby.ac.id/index.php/semakom/article/view/5291/2924.

[10] P. S. Sinaga, L. S. Marimpan, M. M. E. Purnama, and R. H. Sipayung, "Pelatihan Pembuatan Ecoprint Untuk Mendorong Kreativitas Berwirausaha Bagi Pemuda Gereja Ebenhaezer Matani," *J. Hum. and Education (JAHE)*, 2025, doi: 10.31004/jh.v5i2.2299.

[11] G. E. Fauziah and M. M. Asna, "Pelatihan Edukasi Kreatif Melalui Teknik Ecoprint Pada Siswa Siswi Mi Dwi Dasa Warsa Sebagai Upaya Peningkatan Keterampilan," *JIK-PkM J. Inov. dan Kreat. Has. Pengabdian kepada Masyarakat*, 2025, [Online]. Available: http://jurnal.iaih.ac.id/index.php/JIK-PKM/article/view/1293.

[12] I. Saukani, S. Sulistyono, Z. Irfin, A. Zaini, and D. E. Poernawati, "Efisiensi energi produksi ecoprint untuk meningkatkan produktifitas hasil usaha," *SELAPARANG: J. Pengabdian Masyarakat Berkemajuan*, 2025, [Online]. Available: https://journal.ummat.ac.id/index.php/jpmb/article/view/28729.

[13] E. Erwantiningsih, P. M. Dewi, and E. E. Febrianti, "Pelatihan Batik Eco Print Sebagai Upaya Menuju Kemandirian Masyarakat Pesisir Di Kelurahan Panggungrejo Pasuruan," *Panrita Abdi-Jurnal*, 2025, [Online]. Available: http://journal.unhas.ac.id/index.php/panritaabdi/article/view/34214.

[14] O. Adiyanto, F. M. Farid, and A. Hopid, "Assessing the optimal compressive strength of eco-friendly bricks using full factorial design," *Sustain. Eng. and Innovation*, 2024, doi: 10.37868/sei.v6i1.id286.

[15] O. Adiyanto, E. Mohamad, Irianto, R. Jaafar, and M. Faishal, "Optimization of PET Particle-Reinforced epoxy resin composite for Eco-Brick application using the Response Surface methodology," *Sustainability*. mdpi.com, 2023, doi: 10.3390/su15054271.

[16] N. Purnasari, A. F. Dardiri, and J. R. Prasetiyo, "PkM Pengolahan Produk Susu dengan Pendekatan Asset-Based Community Development (ABCD) di Kawasan Penghasil Susu Boyolali Jawa Tengah," *GUYUB: Journal of Community*. core.ac.uk, 2023, [Online]. Available: https://core.ac.uk/download/pdf/578411167.pdf.

[17] S. I. P. Yuwana, "Pemberdayaan dan Peningkatan Kualitas SDM Masyarakat dengan Menggunakan Metode Asset Bassed Community Development (ABCD) di Desa Pecalongan Kec. Sukosari Bondowoso," *Sasambo J. Abdimas (Journal Community Serv.*, vol. 4, no. 3, pp. 330–338, Aug. 2022, doi: 10.36312/sasambo.v4i3.735.

[18] F. Faizal, "Diskursus pemberdayaan masyarakat," *Ijtimaiyya: Jurnal Pengembangan Masyarakat*. ejournal.radenintan.ac.id, 2015, [Online]. Available: https://ejournal.radenintan.ac.id/index.php/ijtimaiyya/article/download/861/740.

[19] J. Sawant, R. Guru, D. Grewal, S. C. Talekar, and S. P. Kulkarni, "Sustainability In Textiles: A Critical Review Of Eco – Friendly Practices And Materials," *ShodhKosh J. Vis. Perform. Arts*, vol. 5, no. 2, Jul. 2024, doi: 10.29121/shodhkosh.v5.i2.2024.891.

[20] R. Kant, "Textile dyeing industry an environmental hazard," *Nat. Sci.*, vol. 04, no. 01, pp. 22–26, 2012, doi: 10.4236/ns.2012.41004.

[21] L. D. Ardila-Leal, R. A. Poutou-Piñales, A. M. Pedroza-Rodríguez, and B. E. Quevedo-Hidalgo, "A Brief History of Colour, the Environmental Impact of Synthetic Dyes and Removal by Using Laccases," *Molecules*, vol. 26, no. 13, p. 3813, Jun. 2021, doi: 10.3390/molecules26133813.

[22] C. C. Okafor, C. N. Madu, C. C. Ajaero, and J. C. Ibekwe, "Sustainable management of textile and clothing," *Clean Technol*. academia.edu, 2021, [Online]. Available:

https://www.academia.edu/download/109073169/ctr-01-01-004.pdf.

[23] M. V. Eitzel, "Sustainable development as successful technology transfer: Empowerment through teaching, learning, and using digital participatory mapping techniques in Mazvihwa, Zimbabwe," *Dev. Eng.*, vol. 3, pp. 196–208, 2018, doi: 10.1016/j.deveng.2018.07.001.

[24] K. Yılmaz, I. O. Aksu, M. Gocken, and T. Demirdelen, "Sustainable Textile Manufacturing with Revolutionizing Textile Dyeing: Deep Learning-Based, for Energy Efficiency and Environmental-Impact Reduction, Pioneering Green Practices for a Sustainable Future," *Sustainability*, vol. 16, no. 18, p. 8152, Sep. 2024, doi: 10.3390/su16188152.

[25] N. Kangana, N. Kankanamge, C. De Silva, A. Goonetilleke, R. Mahamood, and D. Ranasinghe, "Bridging Community Engagement and Technological Innovation for Creating Smart and Resilient Cities: A Systematic Literature Review," *Smart Cities*, vol. 7, no. 6, pp. 3823–3852, Dec. 2024, doi: 10.3390/smartcities7060147.

[26] E. Sulaiman, "Go Green Products Using Ecoprint Techniques," *Indones. J. Community Serv. Cel*, vol. 1, no. 1, pp. 56–62, Jun. 2022, doi: 10.70110/ijcsc.v1i1.8.

[27] M. T. An, "Present status of the natural resource of camellias in Guizhou Province," *Guizhou For. Sci. Technol*. 2005.

[28] N. K. Putri and M. Mustakimah, "Pemanfaatan Bahan Alam untuk Meningkatkan Kreativitas Anak melalui Kegiatan Ecoprint," *Aulad J. Early Child.*, vol. 8, no. 1, pp. 31–40, Jan. 2025, doi: 10.31004/aulad.v8i1.893.

[29] A. P. M. Sholikhah and W. Widowati, "Kualitas Hasil Ecoprint Motif Daun Jenitri dengan ZWA Daun Ketapang menggunakan Mordan Tawas, Tunjung dan Kapur Tohor," *Fash. Fash. Educ.*, 2024, doi: 10.15294/ffej.v13i1.76046.

[30] B. Mushtaq, Y. Nawab, S. Ahmad, and F. Ahmad, "An eco-friendly enzymatic treatment to prepare spinnable banana fibers as an alternative to cotton for textile applications," *Int. J. Biol. Macromol.*, vol. 278, p. 134630, Oct. 2024, doi: 10.1016/j.ijbiomac.2024.134630.

https://doi.org/10.12928/spekta.v6i1.13688