



Empowering Local Communities Through Circular Economy: Transforming Cement Paper Waste into Eco-Friendly Packaging and Handicrafts

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ABSTRACT

The community surrounding the Indocement factory in Cirebon, particularly women in the assisted villages, faces a lack of skills and limited economic opportunities. Additionally, the factory produces residual paper waste from cement packaging, which is often underutilized. To address these issues, two community engagement initiatives were implemented: (1) crafting eco-friendly "Kotak Mangan" (Mangan boxes) from recycled cement paper waste as sustainable packaging for natural-dye batik products, and (2) training local women to repurpose cement paper waste into marketable handicrafts such as tissue boxes, flower bouquets, and gift boxes. These activities are aligned with the principles of circular economy and supported Indocement's CSR under the Butterfly Diagram framework. The outcomes demonstrated increased environmental awareness, empowerment of women through skill development, and the creation of value-added products from industrial waste, contributing to both economic and ecological sustainability.

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A. INTRODUCTION

The economic and environmental challenges in Cirebon Regency, West Java, are multifaceted, particularly in rural areas surrounding industrial hubs such as PT Indocement Tungal Prakarsa Tbk. The communities here often rely on limited agricultural income, and many women lack access to economic empowerment programs. At the same time, significant volumes of waste, such as cement paper packaging from the production process, are underutilized and often sold off as low-value waste materials. This highlights a missed opportunity for local empowerment through waste transformation initiatives aligned with the circular economy model.

Circular economy frameworks emphasize designing out waste, extending product life cycles, and regenerating natural systems (Anna & Spyros, 2019; Ahmed et al., 2024). These principles have gained increasing attention in Indonesia's community empowerment projects. In a recent study conducted in Cirebon, the integration of waste recycling into community



training—specifically involving women—was shown to improve economic resilience while addressing local environmental issues (Utaminingsih et al., 2024; Mareta et al., 2024). Their PKM project empowered rural women by training them in producing eco-friendly crafts from waste materials, resulting in increased household income and community participation in sustainability efforts.

Building upon these findings, the present community engagement activity focuses on:

1. The creation of eco-friendly packaging (Kotak Mangan) from recycled cement paper for use by Indobatik Ciwaringin (a hand-drawn batik with natural dyes). This batik is produced by the people of Ciwaringin village, which is one of the CSR fostered villages of PT Indocement Cirebon Factory.
2. Training village women to convert waste paper into marketable crafts.

These initiatives not only contribute to Indocement's Sustainability Commitment 2030 (SC2030) and the SDGs—particularly goals 8, 11, and 12—but also demonstrate a practical model for applying the Butterfly Diagram of circular economy (technical cycle) within a corporate CSR framework.

By embedding sustainability into both production and community development, this program supports a holistic transition from a linear to a circular economy at the village level—making it both an environmental and socio-economic solution.

B. METHODS

This community engagement project was grounded in two interrelated methodological approaches: Participatory Action Research (PAR) and Design Thinking for Circular Product Development. Participatory methods have proven effective in circular economy projects that aim to integrate community needs with sustainability goals (Ahmed et al., 2024). Specifically, PAR facilitates active involvement from local participants, encouraging shared problem identification, co-design, and reflective learning (Utaminingsih et al., 2024). Meanwhile, design thinking has been widely applied in eco-innovation settings to guide the iterative creation of user-centered, sustainable products from waste materials (Anna & Spyros, 2019). These methods shaped the project's structure—beginning with needs assessment and collaborative planning, followed by hands-on prototyping of eco-packaging and crafts, and concluding with evaluation and feedback to refine community outcomes.

This community engagement project was implemented from January to March 2023 in two primary locations: Ciwaringin Village and Palimanan Barat Village, Cirebon Regency. The project followed a participatory and collaborative approach involving local community members, Indocement's CSR unit, local SMEs (such as Batik Anugerah), and craft facilitators. The methods used to carry out the activities were structured in four major phases:

1. Needs Assessment and Problem Identification

Initial observations and focus group discussions (FGDs) were conducted with:

- Women in target villages (Desa Ciwaringin and Desa Palimanan Barat)
- UMKM partners such as Batik Anugerah (a cooperative)
- CSR division of PT Indocement
- Local waste management units and BUMDes

This phase revealed two core issues: (a) underutilized paper cement waste with potential for creative reuse, and (b) lack of economic opportunities for women, especially in sustainable craft skills.

2. Planning and Preparation

Based on the assessment results, the team designed two intervention programs:



- Program A: Eco-friendly packaging innovation – making *Kotak Mangan* from dyed cement paper waste
- Program B: Craft training for women – creating functional and decorative items from cement paper waste

The preparation included:

- Collecting and sorting paper waste (cement bags and cores) from Indocement's packaging department
- Selecting natural dyes for eco-packaging in alignment with batik branding
- Coordinating with craft experts for training modules
- Designing visual and hands-on learning materials
- Preparing necessary tools: dyeing tubs, drying racks, cutters, glue guns, rulers, recycled cardboard, etc.

3. Implementation

The execution phase consisted of two tracks conducted over three stages:

3.1. Eco-Friendly Packaging Production (*Kotak Mangan*)

- Dyeing Process: Paper waste was dyed using natural dyes (e.g., indigo, mahogany bark) to align with Batik Anugerah's organic branding.
- Drying Process: Papers were sun-dried in controlled environments to maintain color vibrancy and texture.
- Box Assembly: Participants were trained to cut cardboard frames, wrap them with the dyed paper, and construct sturdy and aesthetic boxes.
- Testing and Feedback: Samples were reviewed by the Batik Anugerah team for suitability, durability, and brand alignment.

3.2. Handicraft Training for Women's Groups

- Introductory Workshop: Introduction to circular economy concepts and inspiration from successful eco-craft projects.
- Hands-on Training: Participants learned to create:
 - Tissue boxes
 - Paper flowers
 - Gift boxes
 - Decorative buckets and trays
- Mentorship Sessions: Craft facilitators provided real-time feedback and quality control guidance.
- Final Product Showcase: Participants presented their work and explored potential markets and pricing strategies.

4. Monitoring, Evaluation, and Reflection

To assess the program outcomes, the following methods were applied:

- Observation and documentation: Photos, videos, and logs were taken during each activity.
- Pre-and post-training surveys: These measured participants' knowledge and confidence levels in eco-craft skills.
- Focus group evaluation: Participants and facilitators reflected on the impact, challenges, and sustainability of the initiative.
- Market readiness review: The feasibility of selling the products at local bazaars and online platforms was assessed.

5. Collaboration and Sustainability Plan

- Partnerships: The project was conducted in close coordination with PT Indocement's CSR and logistics departments, Batik Anugerah, and local waste management groups.



- Follow-Up: Participants were encouraged to form cooperatives or integrate into existing BUMDes initiatives.
- Scalability: Training modules were documented for replication in other CSR target villages.

C. RESULTS AND DISCUSSION

1. Development of Eco-Friendly "Kotak Mangan" for Sustainable Packaging

The initiative to produce *Kotak Mangan* – meal boxes made from dyed recycled cement paper – was implemented to align with the environmental values of the assisted SME *Batik Anugerah*. This UMKM specializes in natural-dye batik products but previously used printed, non-eco-friendly packaging. Through this program:

- Raw Material Recovery: Defective or unused cement paper bags were collected, sorted, and cleaned.
- Natural Dyeing Process: The paper was immersed in eco-friendly dyes (e.g., from indigo or mahogany), then dried in open air to enhance its aesthetic and environmental integrity.
- Box Construction: Local women were trained to assemble the dyed paper into durable, decorative packaging for batik products.

This activity improved brand coherence for *Batik Anugerah* and introduced a cost-efficient, sustainable packaging solution. Moreover, the initiative mirrors previous findings from a similar PKM, where environmentally friendly batik packaging increased perceived product value and customer satisfaction in niche markets (Inggrid et al., 2024).



Figure 1. 'Kotak Mangan' program

2. Craft Training for Local Women Using Recycled Cement Paper

The second major component focused on the social empowerment of village women by turning them into artisans of eco-crafts. Over the course of the program:

- Skills Transfer: Participants were trained in cutting, folding, shaping, and decorating cement paper to create items such as tissue boxes, bouquets, trays, and gift boxes.
- Entrepreneurial Exposure: The women were introduced to pricing strategies, packaging techniques, and online marketing basics.
- Community Collaboration: The training was supported by craft experts and encouraged peer mentoring among participants.

This activity succeeded in diversifying household income sources and building community pride. A similar result was observed in a study by Hastuti et al. (2021) and Winih

et al. (2024), where empowering women through training in reusable and waste-based crafts increased their economic resilience and promoted sustainable living practices.

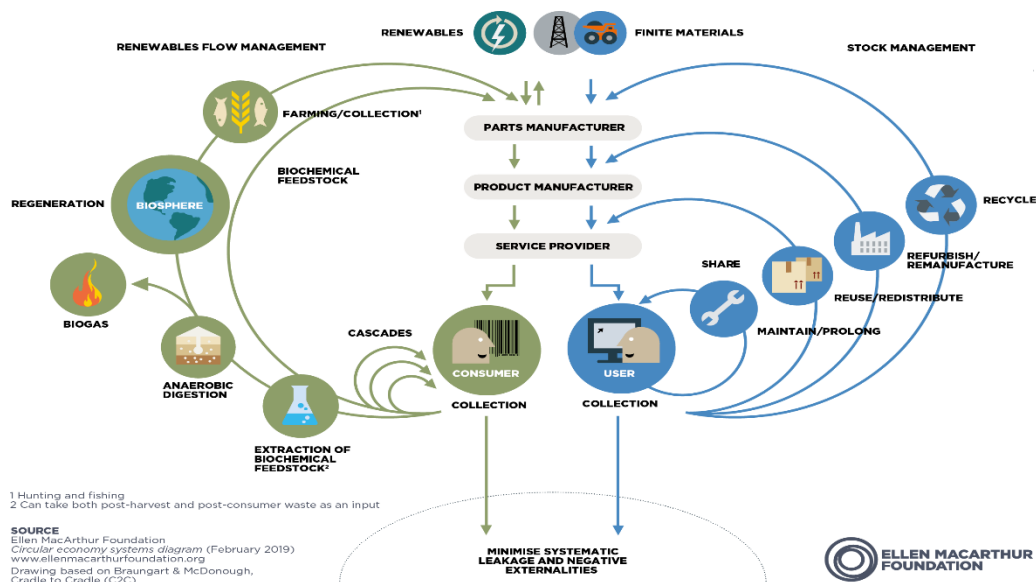


Figure 2. Craft training program

3. Relevance to the Circular Economy Framework

Both activities align directly with the technical cycle of the Butterfly Diagram from the Ellen MacArthur Foundation (Eckelman & Laboy, 2019). Rather than disposing of materials after their initial use (linear economy), the project promoted reuse and upcycling, extending the lifecycle of cement packaging waste.

Diagram 1. Circular economy butterfly



The initiative also applies the principle of Extended Producer Responsibility (EPR), where Indocement indirectly fulfills its duty by ensuring the reuse of product packaging waste within its own CSR framework.

These efforts support the Sustainability Commitment 2030 and the United Nations' SDG 12: *Responsible Consumption and Production*.



4. Observed Impact and Feedback

From direct observation, documentation, and focus group reflections, the outcomes are summarized as follows:

Table 1.

Indicator	Before the Program	After the Program
Craft skills of participants	Very limited	Able to make 3–5 product types
Community awareness of circular economy	Minimal	High; able to explain & apply
Use of eco-packaging in UMKM	0%	100% (at Batik Anugerah)
Household income from crafts	None	IDR 200,000–500,000/month

These outcomes reinforce the effectiveness of craft-based community empowerment as a sustainable development tool, as also evidenced by studies like Nugrahini et al. (2023) and Enu et al. (2023), who used similar waste-to-wealth models to promote environmental education and improve livelihoods in rural Java.

D. CONCLUSION

The implementation of this community engagement project demonstrates a meaningful convergence between industrial sustainability efforts and grassroots empowerment. Through the two focused programs –eco-friendly packaging development using cement paper waste and craft-based training for village women–this initiative has provided a replicable model for applying circular economy principles in rural community settings.

The first program, centered on the production of *Kotak Mangan*, successfully replaced non-sustainable packaging used by a local SME (Batik Anugerah) with innovative alternatives derived from cement packaging waste. The visual and thematic alignment between the natural-dye batik and its new environmentally friendly packaging enhanced not only the product's market appeal but also its environmental branding. This change strengthened the value chain by promoting consistency in sustainable messaging and positioning the product within the green economy segment.

The second program empowered women from CSR-assisted villages to become active agents of environmental and economic transformation. By equipping them with practical skills in upcycling industrial waste into crafts, the project not only opened up new streams of household income but also elevated the community's understanding of sustainability. The use of participatory learning methods and peer mentoring further fostered a sense of ownership and continuity beyond the project's duration.

Both initiatives are deeply rooted in the technical cycle of the Butterfly Diagram, representing best practices in resource recovery and circular product design. Moreover, the activities serve as a practical realization of Indocement's Sustainability Commitment 2030 and several of the United Nations' Sustainable Development Goals – particularly SDG 5 (Gender Equality), SDG 8 (Decent Work and Economic Growth), and SDG 12 (Responsible Consumption and Production).

Ultimately, this PKM initiative has proven that industrial byproducts, when channeled through creative community engagement, can catalyze local innovation, reduce environmental footprints, and enhance social capital. The synergy between corporate CSR



efforts and local ingenuity offers a scalable blueprint for similar interventions across other industrial regions in Indonesia.

To expand its impact, future efforts are recommended to:

- Develop structured product marketing channels for women artisans (online platforms, CSR fairs, local cooperatives).
- Collaborate with other SMEs for broader application of eco-packaging.
- Institutionalize craft training modules into village-level entrepreneurship curricula.

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F.AUTHOR CONTRIBUTIONS

Coordinator of PKM activities and development of manganese box design: Rita Widjaja; Facilitator of craft training and relationship with UMKM: Gunawan Simondinata; Documentation, activity evaluation, and report writing: Harry Ciawi.

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