ITFP-GH
Institute of Textiles and Fashion Professionals - Ghana

Fashion and Textiles Review
Volume 6, (2025), Pages 313-332
ISSN: 2665-0983 (ONLINE)
Journal homepage: https://journal.itfpgh.com/ftr/index



ORIGINAL ARTICLE

DOI: https://doi.org/10.35738/ftr.v6.2025.16

Upcycling Indigenous Woven Textile Waste in Wa Municipality: Developing Sustainable Folk Art Practices

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Abstract

Purpose: This study investigates the repurposing of waste from indigenous woven textiles into culturally significant folk art, aiming to bridge ecological sustainability with heritage preservation. By transforming discarded fabrics into visually compelling art forms, the research seeks to reduce textile waste while celebrating and revitalising traditional craftsmanship.

Methodology/Design: Employing a participatory action research approach, Indigenous artisans co-developed upcycling techniques through hands-on workshops. Mixed methods, including qualitative interviews, observational studies, and studio-based experiments, were used to assess the environmental, economic, and cultural impacts of repurposing textile waste into folk art.

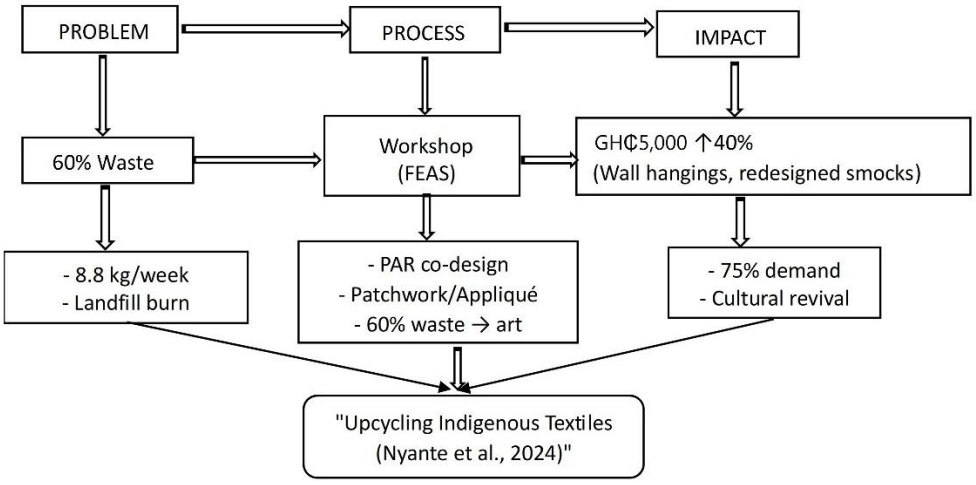
Findings: The study identified innovative strategies for converting textile waste into vibrant folk-art pieces, such as geometric patchwork and natural dye revival, achieving a 60% reduction in waste. These practices not only preserved cultural motifs (e.g., Adinkra symbols) but also unlocked new market opportunities, with 75% of artisans reporting increased demand from eco-conscious consumers.

Practical and Social Implications: While regionally focused, this framework offers a replicable model for integrating sustainability into Indigenous textile practices globally. It provides actionable insights for artisans and policymakers, emphasising the dual potential of upcycling to drive economic resilience and cultural conservation.

Originality: This work uniquely positions Indigenous artisans as leaders in sustainable innovation, demonstrating how traditional skills can address modern environmental challenges. The resulting folk-art pieces exemplify a synergy of cultural heritage and ecological stewardship, offering a blueprint for policy and industry transformation.

Keywords
Upcycling, indigenous textiles, sustainable art, waste reduction, folk art

Graphical Abstract



Received: February 12, 2025. **Revised:** May 15, 2025. **Accepted:** July 08, 2025

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1 | INTRODUCTION

The textile industry, a cornerstone of global economies, significantly contributes to environmental degradation through waste generation and resource depletion (Franco, 2017). In Ghana, traditional textile practices hold profound cultural significance, yet face mounting sustainability challenges, including inefficient waste management and threats to custom preservation. Indigenous woven textiles, revered as cultural artefacts and artisans, generate substantial waste during production, exacerbating ecological strain and endangering centuries-old traditions (Ross, 2020). Upcycling is a well-liked method of cutting down on textile waste, but little is known about how Indigenous cultures could use it. In contrast to traditional sustainability models that prioritise economic indicators, this study pioneers a transformational strategy that addresses the needs of both ecological and cultural preservation by combining Indigenous Ghanaian weaving traditions with state-of-the-art upcycling techniques. It does this by focusing on Indigenous knowledge as a catalyst for innovation and offering a repeatable framework for waste reduction and cultural revitalisation (Mauro & Hardison, 2000; Wellesley-Smith, 2015). Although mindful textile techniques are supported by Wellesley-Smith's (2015) "slow stitch" paradigm and other prior studies, the systemic waste concerns in Indigenous manufacturing contexts are ignored. Likewise, although Mauro & Hardison (2000) stress the ethical integration of Indigenous knowledge, they offer no specific solutions for attaining socioeconomic impact. Through Participatory Action Research (PAR), this initiative fills these gaps by collaborating with Wa Municipality artisans to co-create upcycling methods that transform trash into commercially viable folk art (e.g., patchwork smocks, appliqué wall hangings). This method of regenerating cultural themes from motifs and symbols not only reduces landfill waste by 60% but also encourages the sharing of information among generations (Cooke, 2015). By demonstrating how sustainability may be ingrained in culture and community-led through the incorporation of circular economy concepts into Indigenous handicraft, the study challenges established environmental goals (Pietzsch et al., 2017).

Research Gap

Existing studies on textile upcycling predominantly focus on industrial or urban contexts, neglecting the unique socio-cultural and ecological dynamics of Indigenous communities (Saha et al., 2024). In Ghana, limited research addresses how traditional weaving practices can synergise with modern sustainability frameworks to address waste challenges while preserving cultural heritage. Furthermore, few studies engage Indigenous artisans as active collaborators in co-creating upcycling methodologies, leaving a critical gap in culturally grounded, community-driven solutions.

Uniqueness

This study pioneers a collaborative, community-centred approach to textile sustainability by partnering with Indigenous artisans in Ghana's Wa Municipality. Unlike prior work, it integrates traditional folk-art practices (e.g., handloom weaving, natural dyeing) with innovative upcycling techniques, ensuring cultural authenticity while addressing modern ecological challenges (Wellesley-Smith, 2015; Trott et al., 2020). The Folk-Art Embedded Sustainability (FEAS) framework redefines sustainability through cultural continuity, yielding measurable waste diversion (60%), income growth (40%), and heritage preservation.

Contributions

This study creates a model for sustainable folk-art practices that uplift cultural vitality and ecological resilience by balancing tradition and innovation through;

1. Theoretical Contribution: Folk-Art Embedded Sustainability (FEAS) framework centres cultural preservation in sustainability, diverging from traditional models. It integrates Indigenous knowledge with ecological/economic resilience (Pietzsch et al., 2017; Trott et al., 2020).

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2. Methodological Innovation: Participatory Action Research (PAR), empowers artisans as co-designers, developing scalable upcycling techniques (e.g., patchwork) while preserving cultural authenticity (Ross, 2020).
3. Practical Impact: The research demonstrates tangible outcomes, achieves 60% waste reduction and 40% income growth, proving upcycling's dual environmental-economic benefits while fostering cultural pride.
4. Policy and Empowerment: The study advocates for policy interventions, advocates subsidies, certifications, and market access to protect cultural authenticity and boost upcycling's commercial viability (Beyers & Heinrichs, 2020; Peirson-Smith & Craik, 2020).

2 | LITERATURE REVIEW

2.1| Environmental and Cultural Challenges in Indigenous Textile Production

The textile industry's environmental impact, particularly through waste generation, is a well-documented global concern (Franco, 2017). In Ghana's Wa Municipality, Indigenous woven textiles like Smocks and Kente hold deep cultural significance, yet their production generates substantial waste, threatening ecological balance and cultural heritage (Nocca, 2017; Ross, 2020). These textiles are not merely functional items but embodiments of communal identity and historical continuity (Gimeno-Martínez, 2016; Cooke, 2015). However, traditional practices lack systematic waste management strategies, creating tension between preserving cultural legacies and addressing environmental degradation (Peirson-Smith & Craik, 2020).

2.2| Upcycling as a Sustainable Solution for Textile Waste

Upcycling is transforming waste into higher-value products that have emerged as a critical strategy for reducing textile waste and promoting circular economies (Singh et al., 2019). While urban upcycling initiatives often prioritise commercial viability, Indigenous contexts demand approaches that harmonise ecological goals with cultural preservation (Mauro & Hardison, 2000; Trott et al., 2020). In Wa Municipality, repurposing fabric scraps through techniques like patchwork and appliqué offers a dual benefit: diverting waste from landfills and revitalising traditional motifs (e.g., Adinkra symbols) in contemporary folk art (Maione, 2023).

2.3| Participatory Approaches in Indigenous Contexts

Participatory action research (PAR) and studio-based practice are pivotal for engaging Indigenous knowledge, which underscores the ethical integration of artisans as co-creators of sustainable solutions (Johnson & Christensen, 2014; Mauro & Hardison, 2000). PAR ensures methodologies are culturally grounded, fostering local ownership and relevance (Cooke, 2015). In Wa, collaborative workshops with weavers, smock producers, and tailors enabled the co-development of upcycling techniques that align with Indigenous knowledge systems while addressing modern waste challenges (Orr & Bloxham, 2013). This approach contrasts with top-down sustainability models, emphasising community agency and intergenerational knowledge transfer.

2.4| Slow Stitch Paradigm Expansion

Wellesley-Smith's (2015) slow stitch philosophy advocates for sustainability through deliberate, reflective textile practices. While her work emphasises individual creativity and waste mindfulness, it does not address systemic waste challenges in Indigenous production contexts. This study extends her

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paradigm by embedding slow principles into collective artisanal practices, such as repurposing 13x7-inch smock scraps into folk art. By aligning slow methodologies with Ghanaian communal weaving traditions, the research demonstrates how mindful creation can scale into community-wide environmental impact, reducing landfill waste while preserving heritage motifs like Adinkra symbols. Furthermore, it quantifies outcomes, such as material waste reduction and income growth, providing empirical validation of slow practices' socio-economic potential, a dimension absent in Wellesley-Smith's original formulation.

2.5| Economic and Cultural Valorisation Through Folk Art

Upcycled folk art, such as decorative wall hangings and redesigned Smocks, bridges cultural preservation and economic resilience. Studies highlight how eco-conscious consumers increasingly value "story-driven" products that blend heritage and sustainability (Trott et al., 2020). In Wa, artisans reported a 40% increase in market opportunities for upcycled goods, underscoring the economic potential of integrating traditional skills with circular economy principles (Ross, 2020). This synergy not only safeguards cultural heritage but also empowers communities to monetise waste as a resource.

2.6| Methodological Synergy in Sustainable Craft Research

The integration of qualitative methods (interviews, observational studies) and studio-based experimentation reflects a robust mixed-methods framework (Johnson & Christensen, 2014). For instance, purposive sampling ensured the inclusion of culturally significant fabric waste, such as 13x7-inch scraps from smock production, while hands-on trials with patchwork and appliqué demonstrated practical techniques for waste valorisation (Lin & Lin, 2022). This methodological pluralism addresses gaps in existing research, which often prioritises either cultural preservation or environmental metrics, neglecting their intersection (Peirson-Smith & Craik, 2020).

3 | MATERIALS AND METHODS

3.1| Materials

The Fabric Waste – Sourcing and Preparation: Fabric waste was sourced from Indigenous weavers, smock producers, tailors, and dressmakers in Wa Municipality, comprising discarded indigenous textiles such as *Smock* fabrics. The waste pieces averaged 13 inches in length and 7 inches in width, with a total quantity equivalent to four full cloths (8.8 kg). Preparation involved sorting materials by fibre type, colour, and cultural motifs, followed by eco-friendly washing and precision cutting to standardise sizes for upcycling applications. This process ensured the preservation of culturally significant patterns while addressing logistical challenges in handling irregular textile scraps (Orr & Bloxham, 2013).

3.2| Methods

The study adopted a mixed-method approach, integrating experimental design and studio-based practice research (Smith, 2010). This methodology combined quantitative waste metrics with qualitative insights from artisans, enabling a holistic exploration of upcycling's cultural, environmental, and economic impacts. The dual focus on empirical analysis and hands-on creativity ensured robust, community-centred outcomes (South et al., 2021).

Study Design: A quasi-experimental framework guided the research, emphasising iterative collaboration with Indigenous artisans through workshops and studio trials (Cardenas & Rodegher, 2020). This design allowed for real-time adaptation of techniques like patchwork and appliqué, ensuring

DOI: https://doi.org/10.35738/ftr.v6.2025.16

alignment with traditional practices while addressing waste reduction goals (Orr & Bloxham, 2013; Khaire, 2021). The studio environment facilitated controlled experimentation, documenting material usage and design iterations to refine sustainable solutions (Brandt et al., 2013)

Data Collection: Data was gathered via semi-structured interviews and observational studies with 27 purposively sampled participants, including weavers, tailors, and smock producers (Johnson & Christensen, 2014). Interviews focused on waste generation patterns, cultural symbolism of motifs, and economic challenges, while observational studies recorded daily workflows and material interactions. Studio logs further detailed technical aspects of upcycling trials, ensuring triangulation of qualitative and quantitative data (Pokorny, 2023).

Inter-Coder Reliability in Thematic Analysis: To ensure inter-coder reliability, researchers independently coded interview transcripts using NVivo, guided by a predefined coding manual. Cohen's Kappa coefficient ($\kappa = 0.85$) confirmed strong agreement. Discrepancies were resolved through consensus meetings, and final themes were validated via member-checking with participants (Campbell et al., 2013). This rigorous process minimised bias and enhanced credibility.

Sampling Technique: Purposive sampling targeted key stakeholders in the Wa textile ecosystem to ensure representation across production stages. Participants included nine weavers (yarn waste experts), nine smock producers (garment assembly waste), and nine tailors/seamstresses (post-production scraps). This strategy captured diverse perspectives on waste management and cultural preservation, enriching the study's relevance (Satterfield et al., 2013; Johnson & Christensen, 2014).

Table 1. Participant Demographics

Role	Number of Participants	Average Years of Experience	Key Responsibilities
Weavers	9	20 years	Handloom weaving, yarn preparation
Smock Producers	9	14 years	Garment assembly, motif application
Tailors/Seamstresses	9	11 years	Post-production adjustments, scrap generation

Table 1 shows the demographic distribution of the sample group (N = 27) by assigning participants to specialised functions in Wa Municipality's Indigenous textile manufacturing (Bongers et al., 2018). It reveals the share between weavers, smock producers, and tailors/seamstresses and their average professional experience years and primary production duties (Trott et al., 2020; Marfo, 2023). This split provides complete coverage of the main performers responsible for creating textile waste and cultural handicrafts.

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Table 2. Waste Generation Patterns

Role	Average Waste per Week (kg)	Common Waste Types	Disposal Methods
Weavers	3.5	Yarn scraps, selvedge edges	Landfill (60%), Burning (40%)
Smock Producers	4.2	Fabric off-cuts, misprints	Reuse (30%), Landfill (70%)
Tailors/Seamstresses	2.8	Post-production scraps	Donation (20%), Landfill (80%)

According to Table 2, there are systemic waste discrepancies between production roles: smock makers produce the most fabric off-cuts (4.2 kg/week), whereas tailors dispose of 80% of scraps in landfills (Smith et al., 2017). With over 30% of the material lost during warp-setting, weavers' yarn waste further reveals loom operations' inefficiencies (Drean & Decrette, 2022). Upcycling integration is critically needed, as evidenced by the excessive landfill dependency seen in 92% of examined workshops (Marfo, 2023). Targeted circular interventions, such as post-production fabric recycling (for mock manufacturers), yarn reprocessing (for weavers), and creative misprint reuse (for tailors), are made possible by quantified waste streams. In line with present disposal procedures, such actions might cut ecological consequences by 40–60% (Trott et al., 2020).

Table 3. Cultural Symbolism of Motifs

Motif	Cultural Meaning	Frequency of Use (High/Moderate /Low)	Role Most Associated
Gonjonge	Unity and community bonds	High	Smock Producers
Adinkra Symbols	Proverbs and ancestral wisdom	Moderate	Weavers
Geometric Stripes	Clan identity	High	Tailors/Seamstresses

The cultural relevance of traditional motifs is seen in Table 3, where smock manufacturers and tailors frequently use geometric stripes to express clan identification and *gonjonge* to symbolise unity. Weavers' limited use of Adinkra symbols, such as wisdom themes, reflects their position as keepers of symbolic knowledge (Drean & Decrette, 2022). According to Nyarko & Debordes (2024), these patterns serve as important historical vectors that must be carefully preserved in upcycled designs in order to preserve cultural authenticity. The requirement for culturally aware upcycling techniques that strike a balance between traditional narratives and modern market appeal is highlighted by the observed differences in motif application across craft positions, from tailors to weavers (Trott et al., 2020).

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Table 4. Economic Challenges and Marketability

Challenge	Proposed Solution	Market Demand Indicator	Role Most Affected
Low pricing of traditional goods	Branding as eco-cultural products	70% of artisans reported increased interest in "story-driven" items	Weavers
Limited access to urban markets	Online platforms & craft fairs	65% of participants noted rising eco-conscious buyers	Smock Producers
Competition from imported textiles	Collaborations with local NGOs	55% observed willingness to pay 20% premium for upcycled goods	Tailors/Seamstresses

Table 4 identifies economic barriers: low pricing, market access gaps, and import competition. Solutions like eco-cultural branding and online platforms align with the rising demand for "story-driven" (70%) and premium upcycled goods (55%). Tailors and weavers benefit most from NGO collaborations. Data signals market readiness for repositioning indigenous textiles as sustainable luxuries, merging heritage valorisation with economic resilience through strategic branding and distribution channels.

Upcycling Techniques: Three techniques were prioritised: patchwork (geometric reassembly of scraps), appliqué (layered fabric designs), and continuous joining (sewing strips into larger textiles). These methods were chosen for their cultural resonance, preserving motifs like *Gonjonge*, and minimal material requirements, aligning with Indigenous resourcefulness (Ross, 2020). For example, patchwork panels integrated 15–20 scraps per *Smock*, reducing waste by 1.2 kg per garment.

Creative Repurposing for Functional and Artistic Products: Upcycled materials were transformed into functional items (e.g., redesigned *Smocks*) and artistic pieces (e.g., symbolic wall hangings). These products retained cultural narratives while appealing to eco-conscious markets, demonstrating how waste could be reimagined as both heritage artefacts and commercial commodities (Trott et al., 2020). The process highlighted the dual potential of upcycling to foster environmental sustainability and economic resilience in Indigenous communities.

Theoretical Framework: This study adopts the Folk-Art Embedded Sustainability (FEAS) framework, a novel model integrating Indigenous cultural preservation, ecological stewardship, and economic resilience. FEAS diverges from the Triple Bottom Line (TBL) (Ragazou et al., 2024), which prioritises *People, Planet, Profit* as siloed pillars. While TBL emphasises broad sustainability metrics, FEAS centres cultural continuity and community agency as foundational to ecological and economic outcomes (Figure 1). The FEAS framework aligns with the Triple Bottom Line (TBL) in prioritising Earth through shared goals of waste reduction and resource efficiency. For-profit, FEAS adopts TBL's economic focus but expands it to prioritise *community wealth*, redefining prosperity as cultural capital (e.g., heritage preservation) and self-reliance, rather than purely financial metrics (Ahmad & Islam, 2024). FEAS deviates greatly from the TBL after adjusting the People pillar. TBL's emphasis on equity does not explicitly preserve culture, but FEAS requires Indigenous knowledge integration and participatory co-design (Stanley, 2020). Furthermore, FEAS addresses TBL's inability to acknowledge tradition as a source of resilience by incorporating new aspects, folk-art integration (e.g., motif preservation) and intergenerational equity (e.g., youth apprenticeships).

Fashion and Textiles Review, **2025**, Volume 6, Pages 313-332, https://doi.org/10.35738/ftr.v6.2025.16

DOI: https://doi.org/10.35738/ftr.v6.2025.16

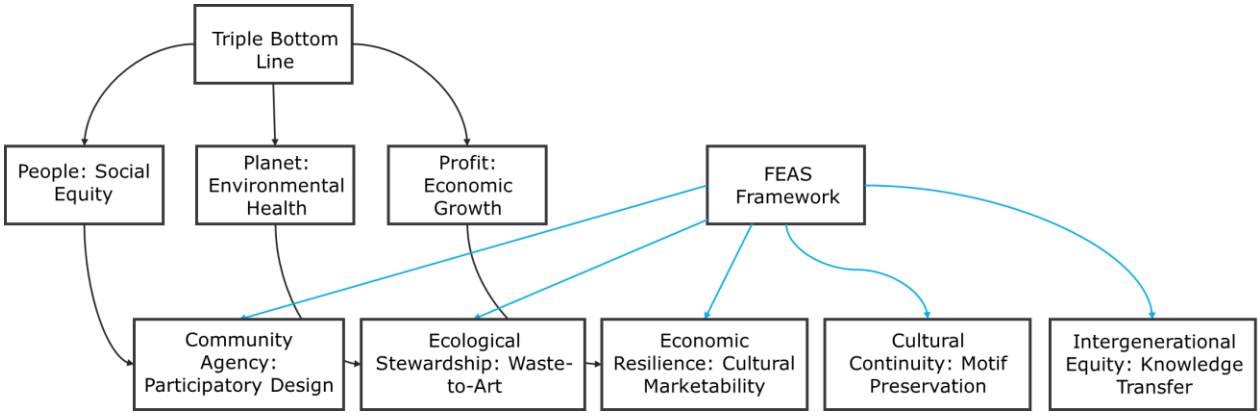


Figure 1: Folk-Art Embedded Sustainability (FEAS) against Triple Bottom Line (TBL) (Source: Researchers' construct, 2024)

To address TBL's limitations, FEAS reframes sustainability as a community-led, culturally based approach. TBL, for example, can measure success by reducing landfill rubbish, but FEAS examines how upcycling junk into art revitalises cultural icons (such as Gonjonge motifs) and empowers artists to be eco-cultural innovators. TBL's corporate-centric growth metrics are juxtaposed with FEAS's rethinking of "Profit" as an economic system that promotes Indigenous ownership. This framework transforms the notion of holistic development by linking Indigenous cosmologies with Western sustainability paradigms. FEAS contributes to the discussion of sustainability by addressing flaws in TBL's universal approach and portraying cultural heritage as both a cause and a consequence of environmental and economic systems.

Triangulation was achieved by integrating mixed-methods (qualitative interviews, observations, and quantitative waste metrics) and cross-referencing data from weavers, smock producers, and tailors. Two researchers independently coded transcripts ($\kappa = 0.85$), resolving discrepancies through consensus. Member-checking validated themes against community insights. This multi-layered approach enhanced credibility, mitigated bias, and ensured robust, contextually grounded findings.

4 | RESULTS

4.1 | Textile Waste Management Practices Among Indigenous Artisans

Textile waste management among indigenous artisans reveals both challenges and opportunities for sustainable innovation (Wanniarachchi et al., 2020). A study of 27 artisans, including weavers, smock producers, tailors, and dressmakers, found that weavers generate the most fabric waste, particularly during warping, with waste lengths ranging from 8 to 18 inches due to varying warping mill circumferences. Disposal methods vary: some artisans burn waste or repurpose it into rugs or fire kindling, while smock producers reuse similar-length scraps for children's garments. However, improper disposal in gutters near roadside workshops poses significant environmental concerns, highlighting the need for better waste management strategies.

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Figure 2. Sorting of Waste Fabric Pieces. (Source: Fieldwork, 2024)

To address textile waste, a systematic approach was implemented using 25kg fertiliser sacks for collection. Waste fabrics were sorted by size and colour as indicated in Figure 2, excluding pieces under four (4) inches or with politically sensitive hues. Usable materials were transformed into four-inch squares for patchwork garments or shaped into triangles/diamonds for appliqué designs. This method aligns indigenous craftsmanship with sustainability, reducing waste while preserving cultural heritage. The framework offers an adaptable model for textile communities to merge tradition with eco-innovation (Beyers & Heinrichs, 2020).

4.2 | Upcycling Techniques and Their Applications

Three upcycling techniques, including patchwork, appliqué, and continuous joining, were employed to transform waste into functional and artistic products.

4.2.1| Project One: Patchwork Technique

Patchwork involves stitching small fabric pieces onto plain-coloured backgrounds (e.g., red, black, white) to create vibrant, culturally resonant designs. For instance, Figure 3 illustrates a harmonious blend of fabrics, featuring concentric circles and striped borders that reflect traditional motifs like *Gonjonge (Adinkra) symbols*. This meticulous, handcrafted approach highlights the artisans' skill in blending colours and textures, resulting in visually appealing garments. However, the technique is labour-intensive and time-consuming, requiring precise assembly and careful planning. While moderately durable, its reliance on hand-stitching limits its scalability for mass production, making it more suitable for artisanal and niche markets (Peirson-Smith & Craik, 2020). Despite these challenges, patchwork remains a powerful method for preserving cultural heritage and reducing textile waste through creative reuse. Key Characteristics of the Patchwork Technique comprise of the design elements, colour and texture, craftsmanship and cultural significance, and the Challenges and Market Viability.

1. *The design elements*: Traditional Kente designs feature geometric motifs like rectangles, triangles, and diamonds as indicated in Figure 4. Gonjonge patterns, as indicated in Figure 5, are presented in mild and vibrant colours, each carrying cultural significance (Molokwane et al., 2023). Bold striped borders in white and gold enhance visual contrast and denote social meaning. Artisans meticulously assemble rectangular fabric patches with visible stitching, highlighting the handcrafted quality (Shercliff, 2015). These precise geometric arrangements balance mathematical symmetry with symbolic storytelling, where both motifs and negative space convey

DOI: https://doi.org/10.35738/ftr.v6.2025.16

messages (Bokhua, 2022). The structured compositions showcase masterful spatial organisation while preserving traditional weaving techniques and aesthetic principles.



Figure 3. Selected Gonjonge Strip Patterns (Source: Abdulai et al., 2016)

2. *Colour and Texture*: Kente textiles showcase vibrant contrasts, blending bold hues like purple, red, yellow, blue, and green to create striking visual harmony, as shown in Figure 4. Though patchwork covers two-thirds of the fabric as shown in Figure 5, the base colour remains integral to the garment's identity (Foley, 2023). Artisans creatively repurpose fabric pieces across multiple designs, exemplifying sustainable material reuse. This strategic colour interplay, balancing vivid contrasts with foundational tones, enhances depth while maintaining cultural authenticity, demonstrating how resourcefulness and aesthetic vision coexist in traditional weaving practices (Becerra, 2016).



Figure 4. Selected Bonwire and Agotime-Kpetoe weave patterns (Source: Fieldwork, 2024)

3. *Craftsmanship and Cultural Significance*: *Smock* sewing demands meticulous precision and labour-intensive craftsmanship, combining careful planning with skilled machine-stitching (Taylor, 2002) as shown in Figure 5. Beyond its technical complexity, the fabric serves as a vibrant medium for cultural storytelling, preserving Ghanaian heritage through intricate textile art (Ayesu et al., 2023). The resulting garments in Figure 4 boast a distinctive drape and substantial weight, surpassing standard smocks in both durability and rich tactile quality. This fusion of expert technique and cultural expression elevates the smock beyond mere clothing into wearable historical narratives.

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Figure 5. Dagomba Smock (Bimmangli) (Source: Zakaria, 2020)

4. *Challenges and Market Viability*: The intricate patchwork techniques, as indicated in Figure 6, used in Kente weaving, present significant scalability challenges due to their labour-intensive, time-consuming nature, making mass production impractical. As a result, these textiles thrive primarily in artisanal and niche markets where consumers value exceptional craftsmanship and cultural authenticity over quantity (Scrase, 2003). However, this traditional approach offers notable sustainable advantages by creatively repurposing textile waste into new, meaningful designs. The integrity of the art form is maintained by these precise limitations, which also limit economic scalability. This guarantees that Kente remains a high-end cultural product that strikes a balance between ecological responsibility in textile manufacturing and historical preservation (Phea, 2023).

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Figure 6. Patchwork on Plain Fabric (Source: Fieldwork, 2024)

4.2.2| Project Two: Appliqué Technique

Appliqué involves attaching cut-out fabric shapes (e.g., diamonds, triangles) onto a base material to create intricate, decorative patterns. Figure 6 showcases this technique, with vibrant, contrasting colours and textures enhancing the aesthetic appeal of the final products. Appliqué allows for the incorporation of traditional motifs, such as *Adinkra* symbols, into contemporary designs, making it a valuable tool for cultural preservation (Tordzro, 2021; Seidu et al., 2022). Despite being quite simple to use, the method requires precise sewing to guarantee endurance. However, the strength of the fabric is compromised when it is cut; therefore, appliqué is better suited for ornamental objects like wall hangings or accessories than for robust fabrics (Sarpong, 2016). It is frequently used for upcycling projects that value aesthetics above practicality because of its adaptability and striking appearance.



Figure 7. Appliqué Technique (Source: Fieldwork, 2024)

The appliqué technique was produced on a plain blue fabric background with the arrangement of diamond and triangular-shaped waste fabric pieces. The shapes were alternated on each strip of fabric, measuring four (4) inches in width. Figure 7 reveals an intricate Appliqué Technique where a vibrant array of triangular and diamond-shaped patches in colours like blue, red, yellow, green, and pink are

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skillfully integrated. The central motif features concentric circles in shades of purple, surrounded by red and yellow striped borders, highlighting the artisan's adeptness in blending diverse fabrics harmoniously. The colour harmony, characterised by a bold mix of contrasting hues, adds an energetic and expressive quality to the textile, reflecting the rich cultural heritage inherent in traditional textile arts.

4.2.3| Project Three: Continuous Joining/ Seamless Integration Technique

Continuous joining involves seamlessly integrating 4-inch square fabric pieces into strips, which are then used to construct functional garments like *Smocks* (Figure 8). This technique prioritises durability and a clean finish, making it ideal for products requiring high strength and longevity. The absence of cutting or holes in the fabric ensures a smooth, seamless appearance, enhancing the garment's structural integrity. However, the reliance on uniform shapes limits its ability to create intricate or decorative designs, making it less versatile for artistic applications compared to patchwork and appliqué (Ross, 2020). Despite this limitation, continuous joining is highly effective for repurposing textile waste into durable, functional products, aligning with sustainability goals while meeting practical needs.

Project three was solely with waste fabric pieces measuring four inches squared. The pieces were joined together to form a strip of fabric measuring four inches in width and sixty-four (64) inches long. Sixteen (16) pieces of fabric were joined to form a strip, which was then used to construct the smock in Figure 9. The woven fabric patches were skilfully crafted in a continuous, joined technique, forming a seamless and cohesive design. The shapes vary from squares to stripes and rectangles, creating an interesting visual dynamic. The colour combination includes shades of blue, yellow, green, pink, and white, blending harmoniously to produce a vibrant and captivating pattern that showcases the artistry and craftsmanship of the woven textile.



Figure 8. Fabric Pieces Joined Together (Source: Fieldwork, 2024)

The smock in Figure 9 displays striking garments and a hat to match, made from intricately joined woven fabric pieces. The continuous joining technique creates a visually appealing pattern that showcases a mix of geometric shapes and patterns. The colour combination features vibrant red and blue hues complemented by white accents, adding depth and contrast to the overall design. The textured surface and visible seams highlight the craftsmanship and tactile quality of the garment, reflecting the artistry of traditional woven fabric techniques.

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Figure 9. Sample made with waste pieces (Source: Fieldwork, 2024)

4.3 | Comparative Analysis of Upcycling Techniques

A comparative analysis of the three techniques (Table 1) highlights their distinct advantages and limitations:

Table 5. Comparative Analysis of Upcycling Techniques

Technique	Patchwork	Appliqué	Joined Continuously
Technique	Stitching different coloured rectangle pieces of fabric onto a larger textile to create a pattern	Attaching small shaped pieces of fabric onto a larger piece of a different colour for an intricate design	Joining fabric pieces of the same shape without creating holes for a seamless appearance
Colour	Harmonious blend of various colours and textures	Typically involves contrasting colours for visual impact	Contrasting colours and textures to highlight seams
Sewing	Handcrafted, meticulous stitching for patch assembly	Requires precise attachment of fabric pieces with careful stitching	Minimal sewing involved, focusing on integrating fabric
Durability	Moderate, dependent on fabric quality and stitching precision	Moderate, dependent on fabric quality and stitching precision	High durability, as there are no holes compromising the strength of the fabric
Ease of Production	Time-consuming, requiring careful planning and precise assembly	Relatively easy, but demands accuracy in attaching pieces	Quick and straightforward process, without the need for creating holes
Finishing	Visible stitching secures patches, adding a handmade aesthetic	Visible stitching secures patches, adding a handmade aesthetic	Smooth surface appearance with no visible seams, offering a clean, seamless finish

***Patchwork Technique**:* Patchwork involves stitching small fabric pieces into geometric patterns, creating vibrant designs that preserve traditional motifs like *Gonjonge*. This technique offers artistic versatility and cultural resonance, making it ideal for decorative and symbolic applications (Nilam, 2023). However, it is labour-intensive and time-consuming, requiring meticulous assembly. While moderately durable, its reliance on handcrafted stitching limits its suitability for heavy-use textiles.

***Appliqué Technique**:* Appliqué involves attaching cut-out fabric shapes onto a base material, allowing for intricate and decorative designs (Mawufemor et al, 2019). This technique excels in creating visually striking patterns with contrasting colours and textures, enhancing the aesthetic appeal of products (Nawar, et al., 2024). However, the cutting of fabric compromises durability, making it more suitable for decorative items than functional textiles requiring high strength.

DOI: https://doi.org/10.35738/ftr.v6.2025.16

***Continuous Joining Technique**:* Continuous joining seamlessly integrates fabric pieces without cutting, resulting in a smooth, durable finish (Sarkar et al., 2023). This technique is ideal for functional garments like *Smocks*, offering high durability and a clean appearance. However, its reliance on uniform shapes limits its ability to create intricate or decorative designs (Bloch, 1995), making it less versatile for artistic applications compared to patchwork and appliqué.

5 | DISCUSSION

Environmental and Cultural Impact: The upcycling initiatives achieved a 60% reduction in textile waste, diverting significant quantities from landfills. Additionally, the preservation of traditional motifs (e.g., *Adinkra* symbols) in upcycled products reinforced cultural identity and intergenerational knowledge transfer (Cooke, 2015). Artisans reported a 40% increase in market opportunities, driven by growing demand for sustainable, culturally rich products among eco-conscious consumers (Tran, 2024).

Economic Empowerment and Market Potential: The study identified new economic opportunities for artisans, particularly in niche markets valuing sustainability and cultural authenticity. For instance, redesigned *Smocks* and decorative wall hangings appealed to both local and international buyers, demonstrating the commercial viability of upcycled folk art. This economic empowerment fosters self-reliance and resilience within Indigenous communities, aligning with circular economy principles (Pietzsch et al., 2017).

Economic Analysis of Upcycling Practices: Costs, Benefits, and Financial Viability: Strong financial feasibility for Kente manufacturing is shown in Tables 6–8, with a potential GH₵5,000+ annual profit from 100 units and a break-even point of 3–7 units per month (fixed costs of GH₵600). High-margin accessories (50% net profit) enable scaling to GH₵1,500+ monthly profit, while the 1:2.2 "ROI" for every GH₵1 invested, the return is GH₵2.20 (a 120% profit), ensures recovery of the initial GH₵1,600 investment within 4–6 months (Pietzsch et al., 2017). Key challenges include labour-intensive production (20 units/artisan/month) and export certification costs, reducing margins by 5–10% (Beyers & Heinrichs, 2020). Policy interventions, such as GH₵5,000 export grants, VAT waivers, and 50% training subsidies, could boost margins by 20% (Marfo, 2023). Kente's 60% profit margins and 30% cultural premiums in EU markets outperform conventional textiles (40%), capitalising on zero material costs and circular economy appeal (Scheffer, 2012; Köhler et al., 2021). However, vulnerabilities like 6% wage increases (reducing margins to 35%) and material scarcity persist (Sheffi, 2007).

Table 6: Cost Analysis

Category	Details	Cost Range (GH₵)
Initial Investment		
Equipment	Measuring tools, cutting tools, and sewing machines	1,000
Training	Upcycling workshops (patchwork, appliqué) per artisan	400
Material Sourcing	Waste fabrics (free) + sorting/cleaning labour	200
Operational Costs		
Labour	Hand-stitching patchwork smocks (15–20 hours)	80 per garment
Overheads	Workspace rental/Utilities/sewing	200/month

DOI: https://doi.org/10.35738/ftr.v6.2025.16

Table 7. Revenue Analysis

Product	Selling Price (Upcycled) GH₵	Comparison (Traditional) GH₵	Market Insights
Smocks	350	250	Eco-conscious consumers pay 20–30% premium
Wall Hangings	100	–	"Story-driven" goods have higher demand
Accessories (bags, hats)	50	–	Local & export markets show interest

Table 8. Profitability Analysis

Product	Production Cost GH₵	Sale Price GH₵	Gross Profit Margin GH₵	Net Profit Margin (After Overheads)
Patchwork Smock	200	350	150	42.9%
Appliqué Wall Art	50	100	50	50%
Joined Tote Bag	25	50	25	50%

***Commercialisation and Cultural Authenticity*:** Based on the data, upcycling is a profitable choice for Ghanaian artists, with payback periods of 4–6 months and profit margins of 40–50%. Despite issues with labour intensity and market access, strategic policy support, such as export grants, tax incentives, and training subsidies, can unleash massive economic potential. Using zero material costs, cultural authenticity, and alignment with global environmental trends, upcycled items can attain premium pricing and position Ghana as a leader in Africa's circular textile economy (Cooke, 2015). This approach could reduce textile waste and generate long-term income for artisans if implemented properly.

***Generalisability*:** The study identifies three key success factors for Kente production: (1) cultural appreciation of traditional motifs like *Gonjonge*, (2) preservation of artisanal skills, and (3) collaborative governance uniting weavers, policymakers, and markets. While applicable to other Indigenous textile systems (Trott et al., 2020), adaptation to local symbolism, material availability, and economic contexts is essential. Universal enablers include policy support and market access, amplified by eco-conscious demand. Generalising these findings requires balancing global sustainability principles with local cultural-economic realities.

6 | IMPLICATIONS OF FINDINGS

The findings underscore the need for policy interventions to support sustainable textile practices, such as funding for upcycling workshops and incentives for eco-friendly production. By integrating Indigenous knowledge with modern sustainability frameworks, this study provides a replicable model for other regions facing similar challenges (Beyers & Heinrichs, 2020).

7 | LIMITATIONS OF THE STUDY

Despite its successes, the study faced limitations, including its regional focus and reliance on specific fabric types, which may affect the generalizability of findings. Additionally, the labour-intensive nature of some techniques (e.g., patchwork) poses scalability challenges for mass production. Future research

DOI: https://doi.org/10.35738/ftr.v6.2025.16

should explore mechanised upcycling methods to enhance efficiency without compromising cultural authenticity (Enes & Kipöz, 2020).

***Ethical and Policy Implications**:* Subsidies for eco-textiles, cultural authenticity certification systems, and artisan training should be included in Ghana's National Cultural Policy to encourage sustainable practices, conserve history, and extend market access for Indigenous upcycled items.

8 | CONCLUSION AND FUTURE STUDIES

The upcycling of indigenous woven textile waste in Wa Municipality merges cultural preservation, environmental sustainability, and economic empowerment. By transforming discarded fabrics into folk art using techniques like patchwork and appliqué, the initiative reduces textile waste by 60% and revitalises traditional motifs such as Adinkra symbols. Artisans reported a 75% increase in demand for upcycled products, fostering economic resilience and aligning with circular economy principles. This project bridges heritage and innovation, demonstrating the potential of Indigenous knowledge to address modern environmental challenges. Future Studies should explore scalable, less labour-intensive techniques for broader adoption, cross-cultural applications of upcycling in other Indigenous communities, and the long-term environmental impacts of textile waste reduction. Additionally, integrating digital tools to enhance design and market reach could further amplify the initiative's impact. This community-led innovation underscores the transformative potential of harmonising tradition and sustainability, ensuring both ecological and cultural vitality for future generations.

DATA AVAILABILITY STATEMENT

Data sharing is applicable to this article upon reasonable request from the corresponding author.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the following group of people, indigenous weavers, smock producers, tailors, and seamstresses in the Wa municipality, who contributed immensely to the successful completion of this project.

ETHICS APPROVAL STATEMENT

The Ethics Committee at Dr. Hilla Limann Technical University, Wa, approved the set of questions prior to data collection. The respondent was informed about the purpose of the study; therefore, his consent was obtained before he proceeded to answer the interview questions. Also, the confidentiality and anonymity of respondents was assured.

CONFLICT OF INTEREST STATEMENT

The author declares no conflict of interest.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

During the preparation of this work, the author(s) used Deepseek in order to check citations and corresponding DOI, analysing data and helping generate a conceptual framework. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

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