

ENVIRONMENTAL SUSTAINABILITY: FROM TRASH TO FASHION ADORNMENT - GREEN INNOVATION POSSIBILITIES

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ABSTRACT

The purpose of this study is to explore the crafting of fashionable accessories from waste fabric. This aims to equip small scale garment manufacturers with the potential of transforming their waste into valuable fashion adornment. It is based on findings revealed in relation to waste generated by Ghanaian small scale fashion industries and manufacturers and their waste disposal practices. The green innovation and green practice possibilities were adopted to create environmentally sustainable fashion product giving new life to fabric waste. In achieving this green practice, the practice-based-research was employed for the study, this afforded the researchers a practical approach to help create value added green artistic products. The concept of material collaborations was also adopted. The main material that was used for the projects was scraps from African prints. These scraps are pieces of African prints off cuts that are found at garment manufacturers shops. The findings from the studio practice revealed that the fabric off cuts depending on their colour and sizes can be fabricated into green innovated fashion adornments. It was also brought to bear that the supposed trash from the small-scale garment industries could be given new life by transforming them into brooches, flower bouquet, flower accents and other possibilities. The success of the study provided opportunities for small scale garment manufacturers to explore fabric waste materials found on their workshop floor, intend to reduce the amount of waste in the environment.

1. INTRODUCTION

The fashion industry stands out as one of the most thriving sectors globally. As indicated by Lund et al. (2020), its global value reaches into the trillions, providing employment opportunities for over nine hundred trillion individuals. Over recent decades, the industry has consistently expanded, emerging as a foundational pillar of numerous economies. This growth has engendered adverse repercussions on the environment (Opoku, Amankwah & Assibey, 2022). The production of a single kilogram of cotton necessitates a staggering 10,000 liters of water, or roughly 3,000 liters for a single cotton shirt (Mohammed, Shiyani & Ardeshtna, 2018). The dyeing of textiles involves the use of hazardous chemicals that subsequently find their way into our oceans, contributing to approximately 20% of global wastewater (Le, 2020). Further compounding the issue, the fashion industry has been designated by the United Nations as the second most polluting sector, accounting for 8% of all carbon emissions and 20% of global wastewater and it bears responsibility for a significant proportion of carbon emissions (Bailey, Basu & Sharma, 2022). In 2015 alone, the global fashion waste reached a staggering 92

million metric tons, with projections pointing towards a 56 million metric tons increase by 2030 (Stanescu, 2021). The environmental challenges arising from this expanding industry is of paramount importance. The fashion industry has made several actions, such as adopting green design, eco-design, and sustainability-focused design practices to help ease the impact of the industry on the environment, however substantial progress remains elusive. This has led to criticisms from discerning consumers and environmentally-conscious organizations (Opoku et al., 2022).

In the context of the waste generated by Ghanaian small scale fashion industries Safo-Ankama, Sawyerr and Wiredu (2023) notes that the predominant type of waste generated by manufacturers was fabric waste, constituting a substantial majority (82%) of the waste produced. An overwhelming 90% of the fabric waste was comprised of cotton, with a significant proportion being African print fabrics. This trend could be attributed to the popularity of African prints within the Ghanaian market due to their affordability and widespread use for various occasions such as weddings, funerals, and naming ceremonies (Acquaye, Sawyerr & Kusi, 2022). Additionally, studies by Jones-Quartey (2023) revealed that a considerable portion of the

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fabric waste, approximately 60%, was either discarded through disposal methods like throwing away or burning. However, many manufacturers also engage in recycling or upcycling practices of their fabric waste into the creation of diverse items, including pillow filling, “*asasawa*” fabric through the incorporation of fabric pieces, crafting cover buttons, and combining the fabric waste with other materials to manufacture garments (Safo-Ankama et al., 2023). The practice of producing fashion accessories from waste fabric remained unexplored among small scale garment manufacturers in Ghana.

The purpose of this study explores the crafting of fashionable accessories from waste fabric, aiming to equip small scale garment manufacturers with the potential of transforming their waste into valuable products. This approach of converting fabric waste into useful products not only holds the promise of generating additional revenue for manufacturers but also contributes to environmental sustainability by encouraging waste recycling. Outcomes will also help address SDG’s (1 -No poverty), (8- Decent work and Economic growth) and (12 – Responsible consumption and production).

1.1 Everyday fabric economy of Ghanaian small scale garment industries

Textiles and cloth are an important part of the Ghanaian fashion economy. Cotton is the most common material used in the sub-sector, however man-made fibres are also seldomly used. African Prints and home fabrics are the most common cotton-based textiles produced by the industry (Adeloye, Akinbogun & Ogunduyile, 2023). Large and small textile plants produce the colourful ‘fancy prints’ and ‘wax prints’ and contribute to the economy through employment and sales. These prints are produced locally while others are imported into the country (Howard, 2016). It is revealing to share that the majority of the fabric economy of the Ghanaian small scale garment industries manifested great use of African prints. African prints are identifiably traditional to the Ghanaian culture and also customarily referred to as “Ankara fabrics” (Adeloye, 2022). They are cotton fabrics that were initially manufactured in Europe to be sold in West and Central Africa but are now produced in various factories across the African continent. The use of African print in the Ghanaian small scale fabric economy cannot be overstated, they are used for women, men, kids wear and other household items. The African prints can be classified into two types: wax prints and fancy prints, which differ in their manufacturing processes. Wax prints are produced by applying a resin paste on both sides of the cloth, treating it mechanically to create cracking effects, and dyeing it in indigo (Jurkowitsch & Sarlay, 2010). The design concepts and fabric names materialise the philosophies of the culture area, giving it visual communicator character. Comparatively the fancy prints are only printed on one side, using the same design procedure as wax prints, but without resin.

Various scholarly accounts indicate the origin of African prints in West Africa. Acquaye, Sawyerr and Kusi (2022), Ankersmit (2010) and Nielsen (1979) traced the

history of the prints to the late 1800s. They found that a Scottish merchant called Brown Fleming introduced HKM wax prints to the Gold Coast, a former British colony (now known as Ghana), to meet the local demand for high-quality textiles. These prints quickly became popular and spread to other West African countries. It is noteworthy that Indian textiles, which included woven and printed fabrics, were already well-received in West Africa, particularly chintz fabrics that featured small floral motifs that were hand-blocked.

1.2 Characteristics (Visual) of African Prints

African print fabrics involve using wax resins and dyes to machine-print batik-like patterns onto clothing (Akinwumi, 2008). These fabrics are prevalent across Africa and other regions and come in a variety of vivid colours and patterns. According to Nielsen (1979), African print fabrics are available in various designs and styles including tribal prints, geometric shapes, animal prints, flowers, and plants. African printed fabrics also evoke stunning patterns and colour schemes, but these fabrics carry a complex story woven into each “*ntoma*”(meaning “cloth” in “Twi” a Ghanaian Language) through themes and historical cultural values (Omatseye & Emeriewen, 2012). Jurkowitsch and Sarlay (2010) note that besides having the same pattern on each side, there are further elements in wax fabrics that make each piece unique. The colours, intricate patterns, and distinctive aesthetics are defining features of African Prints. These fabrics’ designs, motifs, and hues are carefully chosen to represent the cultural dressing styles and traditions of African people, conveying their cultural values across generations. Dereje, Liu and Zhou (2013) highlight the use of specific techniques to transmit cultural knowledge through the fabrics’ patterns. Halls and Martino (2018) stress that motifs and colours used in African prints are not solely intended for visual pleasure, but also serve as a means of communication for conveying spiritual values and beliefs inherited from ancestors in African societies. The significance of these patterns and colours is deeply ingrained in African culture and often draws inspiration from poems, proverbs, traditional fables, and tales. Colours are also used to symbolize age, marital status, social status, and tribe. In contemporary African prints, Western objects and symbols such as umbrellas, phones, electric fans, cameras, and radios are increasingly incorporated into backgrounds with lines and geometric shapes, as shown in the work of Amankwah and Howard (2013) and Chichi, Howard and Baines (2016).

The meanings of colours are significant in societies as they can be linked with history and possess their own implications. The colours communicate information about happenings, time of day, temperature, and season. Kansamba et al. (2021) note that colours hold philosophical meaning in the African context, representing social status, age, tribal affiliation, and marital status, as well as the stories portrayed in the prints’ patterns that are pertinent to the wearer, such as proverbs, poems, and traditional African fables. Colours are imbued with significant meaning in the African context, and their meanings differ across various ethnic groups, countries etc. (Acquaye et al., 2022). Dereje

et al. (2013) state that the choice of fabric is influenced by the occasion and the dominant colour, making it essential to comprehend the significance of colours in African culture to grasp the deeper aesthetic meanings conveyed through clothing. These characteristics make it a suitable choice for many manufacturers when it comes to the production of garments and other fashion accessories such as brooches, headbands, bracelets.

1.3 Properties of African Prints that makes it suitable to be manipulated into textile products

African Prints are mostly made from cotton fibre, a natural fibre that has been a cornerstone of the textile industry for centuries (Ajila, 2016). Its widespread use is attributed to a unique combination of physical, chemical, and mechanical properties that make it highly suitable for manipulation during textile production (Ismail & Azha, 2018). From spinning and weaving to dyeing and finishing, cotton's versatility allows it to be transformed into a wide range of fabrics, from lightweight apparel to heavy-duty industrial textiles. Below are properties that makes cotton easy to be manipulated into textile products and its selection for the study.

Fibre Length and Strength: One of the most critical properties of cotton is its fibre length, or staple length, which typically ranges from 10 to 65 millimetres. Longer fibres, such as those found in Egyptian or Pima cotton, are particularly prized for their ability to produce smooth, strong, and uniform yarns (Khan et al., 2023). The strength of cotton fibres further enhances their suitability for spinning, as they can withstand the mechanical stresses involved in yarn formation without breaking (Chakraborty, 2012). This combination of length and strength makes it appropriate for the project in that the manipulation processes requires the textile material to be resilient lengthwise and widthwise in order to create the decorative fabric adornment.

Flexibility and Elasticity: Cotton fibres exhibit a moderate degree of flexibility and elasticity, which allows them to be twisted, stretched, and shaped during the manipulation processes to the decorative fabric adornment (Carr et al., 2008). This property is particularly important in ensuring that cotton fabrics retain their structural integrity while being manipulated (Manju, Divakara & Somashekar, 2020).

Smooth Surface: The relatively smooth surface of cotton fibres contributes to their ease of manipulation during adornment creative processes (Manju et al., 2020). It also impacts on the lustre of the finished product.

Softness and Comfort: The inherent softness of cotton fibres contributes to their ease of handling during the manipulative process and ensures that the final product is comfortable for end-users (Khanzada, Khan & Kayani, 2020).

Sustainability and Biodegradability: In an era of increasing environmental awareness, cotton's biodegradability and renewability are significant advantages. As a natural fibre, cotton is biodegradable and can be processed using sustainable methods, such as organic farming and eco-friendly dyes (Fletcher, 2014). This aligns with the growing demand for environmentally responsible textiles

and enhances cotton's appeal as a material for manipulation in sustainable textile production.

These unique properties of cotton make it exceptionally suitable for manipulation in textile production. These properties enable cotton to be manipulated into diverse functional and aesthetic requirements. As the textile industry continues to evolve, cotton's versatility and sustainability ensure its enduring relevance as a material of choice for both manufacturers and consumers.

1.4 Profiles of Artist upcycling African print textiles using different techniques

There are some textile artistes who are making intentional efforts to upcycle textile waste into useful artifacts for interior and outdoor functional spaces. The following are targeted at making statements focusing on sustainability, green innovation with fabric waste and resourcefulness.

1.4.1 Yinka Shonibare

Yinka Shonibare, MBE, an artist based in London, is renowned for his investigation of cultural and national identity, notably within the intricate dynamics between England and Nigeria. Having been brought up in Nigeria subsequent to its attainment of independence, Shonibare characterizes himself as a "postcolonial hybrid," and his artistic portfolio encompasses a diverse array of mediums, including photography, sculpture, film, installation, and performance. His most prominent pieces prominently feature headless mannequins adorned in vibrant attire crafted from Dutch wax fabrics, which, despite their colonial lineage, are frequently interpreted as emblematic of African heritage. Originating from Southeast Asia and disseminated by the Netherlands on a large scale, these textiles captivate Shonibare due to their representation of both manufactured and genuine African cultural elements (Shonibare, 2025).

Style and technique: Renowned for his technical and visual adaptability, Shonibare employs Dutch wax textiles in paintings, sculptures, and intricate costumes designed for performers. Examples of his notable works include "Scramble for Africa" (2003), Wind Sculptures (2013) and Earth Kids (2020). The utilization of Dutch wax fabric in Shonibare's artistic pieces symbolically captures the multifaceted aspects of globalization, authenticity, and cultural interchange within a rapidly evolving global landscape. Some works of Shonibare as presented in Figure 1.

1.4.2 Eva Sonaïke

Eva Sonaïke is a London-based interior designer and entrepreneur who specializes in luxurious textiles and home décor with a vibrant West-African aesthetic. She was born in Germany to Nigerian parents, Sonaïke's passion for interior design stems from her multicultural upbringing and her desire to infuse homes with colour and vibrancy. After working as a journalist, Sonaïke embarked on her entrepreneurial journey, starting with designing fabric for cushions in her own home. Encouraged by the positive response from friends, she launched her business in 2009, facing challenges but persevering to secure prestigious stockists like Selfridges, Liberty, and Fenwick (Sonaïke, 2024).



FIGURE 1: Yinka Shonibare and his work.

Style and technique: Sonaïke's brand has since expanded internationally, offering a range of products including cushions, rugs, wallpaper, and fabrics, all reflecting her unique blend of African heritage and European craftsmanship. Sonaïke's dedication and creative vision have solidified her position in the luxury interiors market, contributing to the growing global interest in African design and textiles. Some of the works of Sonaïke are shown in Figure 2.

1.4.3 Simone Post

Simone Post is a Dutch textile and product designer based in Rotterdam, known for her innovative approach to materials and processes. With a background in textiles and a penchant for experimentation, Post explores the boundaries of design by collaborating with companies and pushing the limits of the industry. Her creations exude optimism while also provoking thoughtful questions about materiality and craftsmanship. She collaborated with esteemed companies like Adidas, Kvadrat, and Hermès, Post is driven by her intrinsic passion to create unique and highly sought-after objects.

Her work has garnered international acclaim, with exhibitions held worldwide and pieces acquired by prestigious museums such as the Vitra Design Museum and the Cooper Hewitt. Post's ability to transform ordinary materials into extraordinary works of art demonstrates her dedication to the craft and her relentless pursuit of innovation (Post, 2024).

Style and technique: She repurposed waste material from Vlisco into new textiles, showcasing her commitment to sustainability and resourcefulness. Post's work spans a wide range of mediums, from refurbished furniture to pleated ceramics, all characterized by bold use of colour, texture, and print. Figure 3 showcase some works of Simone Post.

1.5 Theoretical Basis

The study adopted the green innovation concept as expressed by Kemp and Pearson (2007). Globalization has profoundly reshaped the global landscape and business practices. Over recent decades, production and consumption patterns have undergone substantial changes (Kneipp

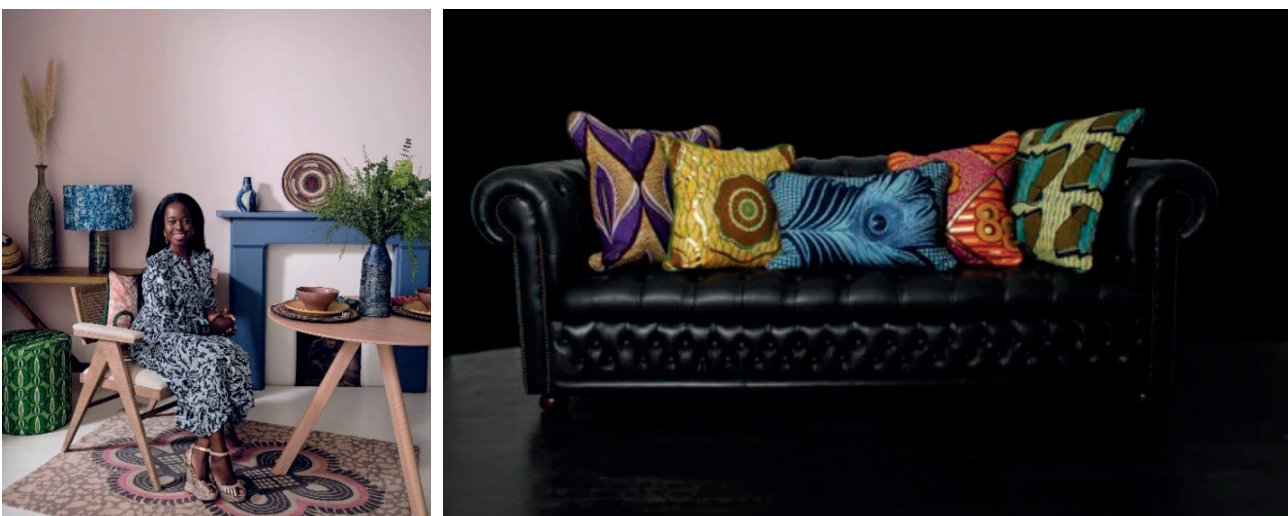


FIGURE 2: Eva Sonaïke and her work.



FIGURE 3: Simone Post and her work.

et al., 2019). This transformation has led to significant challenges, including climate change, overexploitation of natural resources, and biodiversity loss, compromising planetary life (Elimam, 2017; Li, Wang & Wu., 2019). Consequently, various industries, including fashion and textiles, are increasingly focused on mitigating their environmental impact. Evidence suggests that environmental concerns have influenced consumer behavior (Colvin, Witt & Lacey, 2020). While some individuals remain unaware of environmental issues (Afonso et al., 2018), Dyck and Silvestre (2018) contend that societal awareness has generally increased, with more consumers making environmentally conscious choices. Thus, organizations are responding to environmental constraints and consumer demands by enhancing corporate performance and maintaining market competitiveness. Many companies are adopting practices to minimize pollution and utilize resources more efficiently (Bolis, Morioka & Sznclwar, 2017; Mubarak et al., 2021). One such practice is green innovation.

Kemp and Pearson (2007) define green innovation as a novel product, production process, service, or management method that, throughout its lifecycle, reduces environmental risk, pollution, and other adverse impacts compared to traditional alternatives. Similarly, Eiadat et al. (2008) describe green innovations as initiatives aimed at pollution prevention, waste reduction, and the implementation of environmental management systems within organizations. To navigate these challenges and successfully implement green innovation, businesses engage in activities that either incorporate external knowledge to drive innovation or leverage internal knowledge in external markets for profit (Takalo & Tooranloo, 2021). Firms that adopt green innovation strategies are anticipated to command premium prices for eco-friendly products, improve their brand image, market sustainable goods and services, and access new markets (DeBoer, Panwar & Rivera, 2017; Kneipp et al., 2019; Mubarak et al., 2021).

In this study, the green innovation concept was adopted to add value to fabric pieces that are usually a waste product from the tailors and dressmaker's shops. These fabric pieces were transformed into fashion accessories and adornments. Thus, fabric pieces which could have landed in landfills were given new possibilities and new life through green innovative strategies and this could significantly reduce pollution in the environment. The innovative strategy also served as an avenue to create decent work and employment for the youth in achieving economic growth.

2. MATERIALS AND METHODS

In the adoption of green innovation and green practices to create value with waste, the researchers employed a practical-based-research approach to help create value added green artistic products. Practice-based-research is a method, whose result is an artefact created by the researcher (Winter, 2010). Studio based activities were used to execute the projects. Studio activity requires the use of techniques, tools, materials (Mills, 2009) as well as aesthetic analysis to gain new ideas or knowledge through practice to achieve the result of that practice (Candy & Edmonds, 2018). The creative techniques adopted for the execution of the projects included hand stitching, interfacing usage, gluing, pinning, use of templates, stuffing, fixing of fasteners, pressing and starching. The study adopted the concept of material collaborations for some of the green artistic products (Yang, 2013), however the main material that was used for the projects was scraps from African prints. These scraps are pieces of fabric waste which are African prints off cuts and are found at garment manufacturers' shops. The criteria for the selection of fabric pieces were colour, sizes, pattern arrangement, fabric weight among others. Other materials included glue, thread, starch, and fabric stiffeners. The tools used included scis-

sors, tape measure, ruler, pencil, tailors chalk, pressing iron, brush and punch.

The researchers adopted the aesthetico-action research model developed by Marshall (2010) which uses observation, reflection, planning and creation were adapted for the creative studio approach for the project. However, the researchers introduced the concept of green innovation in the development of a new adapted model. The green innovative concept offered the researchers the avenue to introduce new variables that helped in the transformation of the fabric waste. The adoption of the four (4) new phases of the model, green creativity coupled with green value creation and green artistic practices to produce green textile art products facilitated the attainment of the set objectives. This conceptual frame work as shown in Figure 4 is geared towards the concept of sustainability within the textile and garment small scale industries.

The new variables made it possible to make use of fabric wastes in the studio settings with an operational foundation of the aesthetico-action model, which also provides the platform for artistic creation. The operational foundational model provides an extensive platform to observe, reflect, plan and create. However, the green innovation introduced the new variables which includes green creativity, green value creation, green artistic practices which resulted in the green textile art products. These variables are discussed below.

“Green Creativity” refers to the creative process of generating sustainable and innovative ideas, solutions, or products that are ethical, environmentally sustainable and eco-friendly (Chen et al., 2016). It focuses on reducing environmental impact, conserving resources, and on promoting sustainability. Green creativity was adopted as an artistic practice in creating the textile art product to address environmental challenges and contribute to a more sustainable future. “Green Value Creation” denotes the process of producing economic, social and environmental value through eco-friendly and sustainable practices (Brozović, D’Auria & Tregua, 2020). It comprises creating artistic products that contribute positively to the environment and society. This concept aligns with the principles of the circular

economy. “Green Artistic Practices” represent creative artistic processes that prioritize, eco- friendliness, eco-consciousness, and ethical responsibility (Stoltz, 2023). These artistic practices are targeted at minimizing harm to the environment while fostering awareness of ecological issues through art. Green artistic practices reduce the environmental footprint of art and communicates the urgency of sustainability and inspire positive change. “Green Textile Art Products” are eco-friendly textile artworks that prioritize sustainability, ethical production, and environmental friendliness. Their production processes adopt sustainable materials, low-impact processes, and focuses on themes like nature, conservation, or recycling. A sustainable textile product is designed, made, and disposed of with minimal environmental and social harm, while balancing economic, ecological, and social concerns throughout its life cycle (Kumar, 2020).

2.1 Observation

The observation activities were underpinned by green value creation towards the realization of green textile art products. The observation practices being guided by the green value creation afforded the researchers to leverage on internal and external knowledge in green artistic practices and strategies to adopt eco-friendly possibilities. The possibility of using fabric waste to create fashion accessories was assessed based on observing existing accessories produced from malleable materials and other fabric pieces. Observation afforded the researchers to critically through a non-obstructive assess the foundational material to be employed for the creative process. A check was developed by the researchers to aid observation for example selection of fabric off cut, the colours based on the knowledge of colour psychology, sizes of off cuts, pattern arrangement of designs in off cuts, with preference to the concept of engineered designs and fabric weight because the concept of composite creation was considered in the design thinking. This check list was important for the study because the focus was on fashion accessories, majority being accents (brooches, hair pieces, pendants, wrist bands etc.). Accents are small pieces of fashion acces-

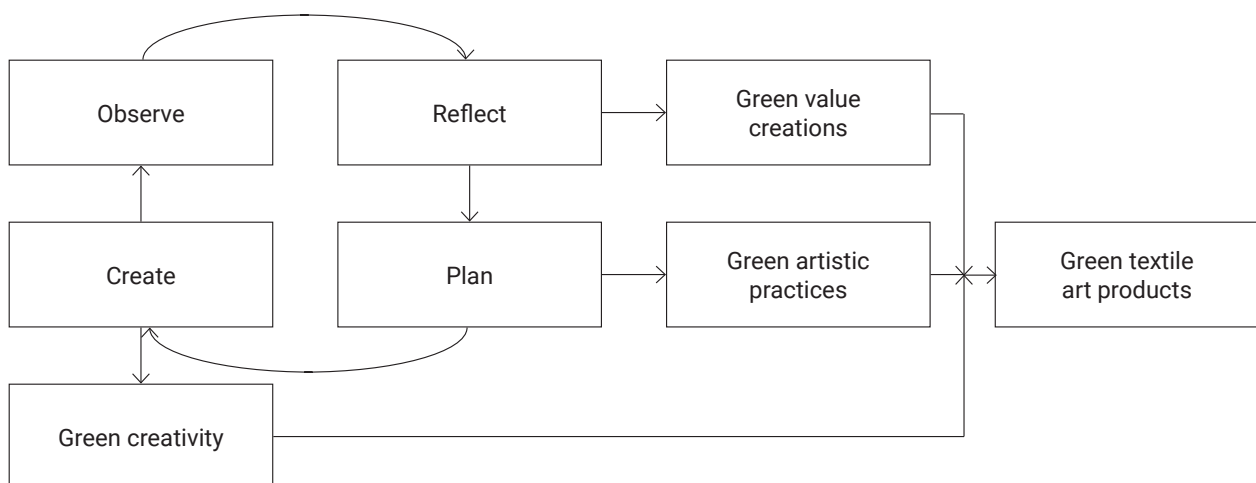


FIGURE 4: Researcher's construct adapted from the Aesthetico-Action Model (2024).

sories that adds colour to the overall outlook of a person. Observation helped greatly; small pieces of fabric were selected because they were to be used to produce accent and therefore should not be large. Light weight fabrics were also selected to make it easy to manipulate. In the fabric selection process, fabric with motif arrangement in all over pattern and abstract motifs were preferred. It was also to be ensured that motifs in engineered designs would not be cut through or distorted during the creation of the accessories. The sizes of motifs and textures in fabrics for specific end uses were also considered. Colour psychology was also considered at this stage because the accessories were not going to be stand-alone items, colour binds, facial complexions etc. were considered. Thus, fabric pieces with colours which could match a lot of colour ranges were considered for selection.

2.2 Reflection

Various ideas and possibilities were generated at this stage having in mind green valve creation and green textile artistic practices and ultimately the green textile art product. Reflective creative thinking was carried out, incubating possible fabric manipulative process like pleats and folds, decorative box pleats, decorative gathering, applied gathering, direct smocking, pleating, tucks and tucks variations, ruffles and frills, hand-tied quilting, trapunto and other creative techniques. The creative thinking also reflected on useful hand stitching techniques like back stitches, blankets, running, blanket and other stay-stitching techniques and fasteners. During the reflection process consideration was given to prints having names with philosophies ramifications to aid the creation of specific accessories. A mood board was created to show the inspiration for the collection, the mood board for the collection was titled “Nhwiren” meaning “flowers” in the Ghanaian ‘Twi’ language. Accents as fashion accessories are to interplay with the environment (and perceived source of light) to produce the intended enhancement. Based on this the researchers considered fabric pieces that could produce good colour relationships when exposed to light. These lights perceived colour illusions and effect that were preferred includes metamerism, bezold effects.

2.3 Planning

The planning stage presented the extensive platform for diverse element to be harmoniously put together as units. The concept of recycling green textile arts product was high on the thinking board for the purpose of environmental sustainability. A material board was created to bring to reality the abstract thinking of the researchers. The planning stage presents illustrations and specifications on how fabrics would be used, its durability and cost effectiveness of the intended green textile products. At this stage the life cycle of the product the fabric pieces were going to be used for were also well-thought-out, this is because the concept of composite material collaborations was to be adopted by using fabric pieces of different weight, texture and different levels of possible degradation. The planning stage placed high emphasis on reproducibility of the accents to be created, this was high on the researchers’ design thinking for

the accents produced to be reproduced easily following the systematic steps discussed. The ease with which the end products could be recycled was also an important factor to consider due to environmentally sustainability. Based on the above, sketches of the various ideas and concepts of different end products were made with details of fabrics and techniques to be used to produced them.

2.4 Creation

Prototypes of the end products thus fashions accessories were produced. They were evaluated to ensure that they met basic quality check such as functionality, easy to wear and remove, size, easy maintenance, safety etc. Where the end product fell short of the specifications after the evaluation, new ideas and changes were made and this was carried out in the final sketches. Finally, a report of all studio practice activities was made to ensure reproducibility. The study adopted the Ghanaian ‘Twi’ language for the titles of the artworks produced. The studio practice activities, material and design notes are captured from Fashion Adornment 1-7.

2.4.1 ‘Banbɔ’ (Protector)

To produce ‘Banbɔ’ (meaning Protector in ‘Twi’ language), fabric piece that could measure 6cm by 6cm was selected. Using a writing tool, ruler, and scissors, twelve (12) fabric squares measuring 6cm by 6cm were precisely cut. Each square was then folded diagonally to form a triangular shape. With the help of a threaded needle, the frayed edges of the triangular fabric pieces were securely stitched together. This stitching process was repeated for all the triangles, creating a continuous chain of fabric pieces resembling suggestive petals. The stitching was intentionally loose to allow for easy manipulation of the petals, forming folds as desired. The chain of continuous triangular fabric pieces was then pulled to create circular loops. Each fabric piece was meticulously arranged, ensuring a seamless connection, and the ends were firmly secured. To complement the design, a plain matching fabric measuring 10cm by 10cm was cut and stitched around its square perimeter using a threaded needle. The resulting square was then filled with latex wool. By pulling the thread tightly, a ball shape was formed. Glue was applied to the uneven surface of the ball and affixed within the space created by the petals. To complete the accessory, latex stiffeners were utilized to cover the base of the rosette. For convenient usage, a brooch pin was attached to the base. The procedure for making fashion adornment one (1) is presented in Figure 5.

2.4.2 ‘Odehye3’ (Royalty)

To produce ‘Odehye3’ (meaning Royalty in ‘Twi’ language) a metallic wire with a length of 12cm was cut and manipulated to create a loop in a form of an oval shape by bending and coiling one side of the wire. This process was repeated until a total of ten (10) metallic wire loop pieces were obtained. The loops were deliberately crafted in various sizes (small, big, and medium) to introduce diversity and prevent monotony in the final piece. To attach the fabric to the loops, glue was applied along the edges and



FIGURE 5: Procedure for making 'Banbɔ' (Protector).

then affixed onto fabric pieces. The fabric and the glued metal loops were allowed to dry for proper bonding. Subsequently, any excess fabric extending beyond the loops was trimmed away. In order to complete the flower, florist tape was wrapped around the stem, which refers to the section of wire that did not form the loop. By bringing together the ten individual petals created through this process, a cohesive flower structure was achieved. The processes involved in making fashion adornment two (2) is illustrated in Figure 6.

2.4.3 'Ahofé' (Beautiful)

To produce 'Ahofé' (meaning Beautiful in 'Twi' language), a medium-sized circular object of 4cm diameter was placed on fabric pieces as template guide to trace the circular shapes. Careful cutting was done to extract these circular pieces from various fabric ends. Each circular piece was then folded in half, creating a semi-circle. This semi-circle was subsequently folded again to form a cone-like shape. This folding process was repeated multiple times, generating several cone-like fabric pieces to achieve

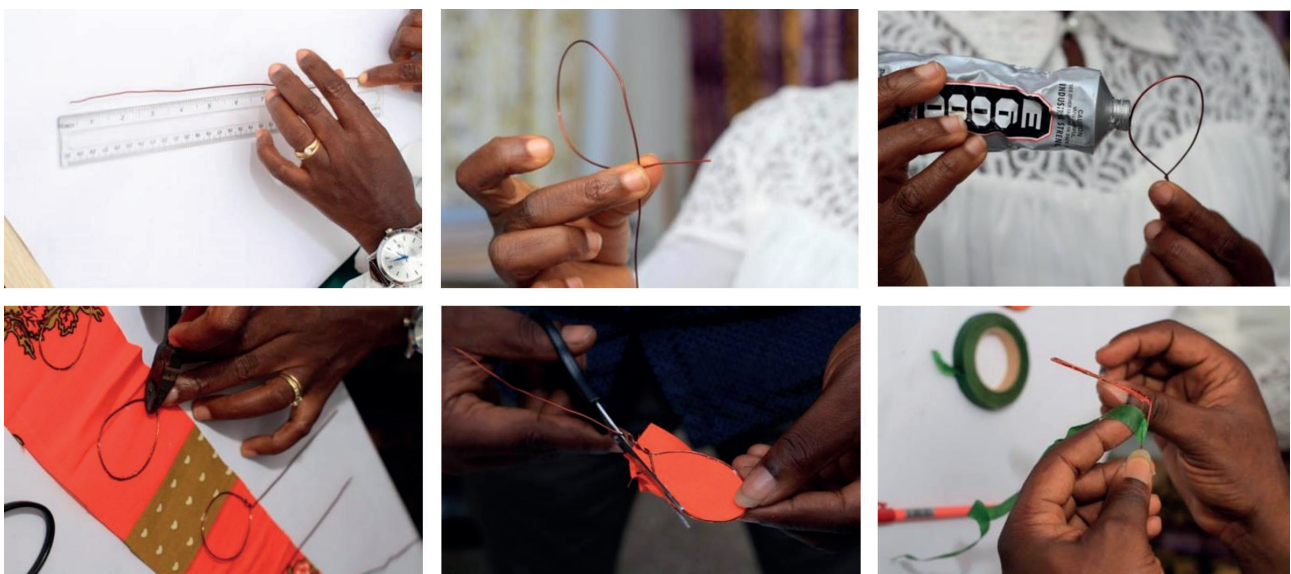


FIGURE 6: Researcher's construct adapted from the Aesthetico-Action Model (2024).

the desired quantities for the final product. To assemble the fabric pieces, felt-base was used as support forming the foundational structure to carry the pile. Fabric glue was employed to secure the cone-like shapes in place. The pieces were strategically arranged in layers, providing a sense of fullness. An accessory was positioned at the center to cover the tips of the fabric pieces. To serve its function as a brooch, a brooch pin was attached to the back of the fabric base. The processes used in making fashion adornment three (3) is presented in Figure 7.

2.4.4 'Nsroma' (Star)

To produce 'Nsroma' (meaning Star in 'Twi' language) a circular cardboard with a radius of 5cm was marked and

cut out, serving as a template. This template was then used to mark and cut out six (6) circular fabric pieces from a chosen material. Each circular piece was folded in half. To join the folded pieces together, a threaded needle was used. Ensure that the stitches were secure yet loose enough to allow the thread to pass through easily. By carefully pulling the thread from one end, a sense of fullness was created through the folds. The threads' ends were brought together and continuously pulled until the inner tops of the fabric pieces became taut, resulting in petal shapes with a round space in the center. To enhance the appearance, a suitable accessory was added to embellish the middle. The procedure for making fashion adornment four (4) is shown in Figure 8.



FIGURE 7: Procedure for making 'Ahofé' (Beautiful).

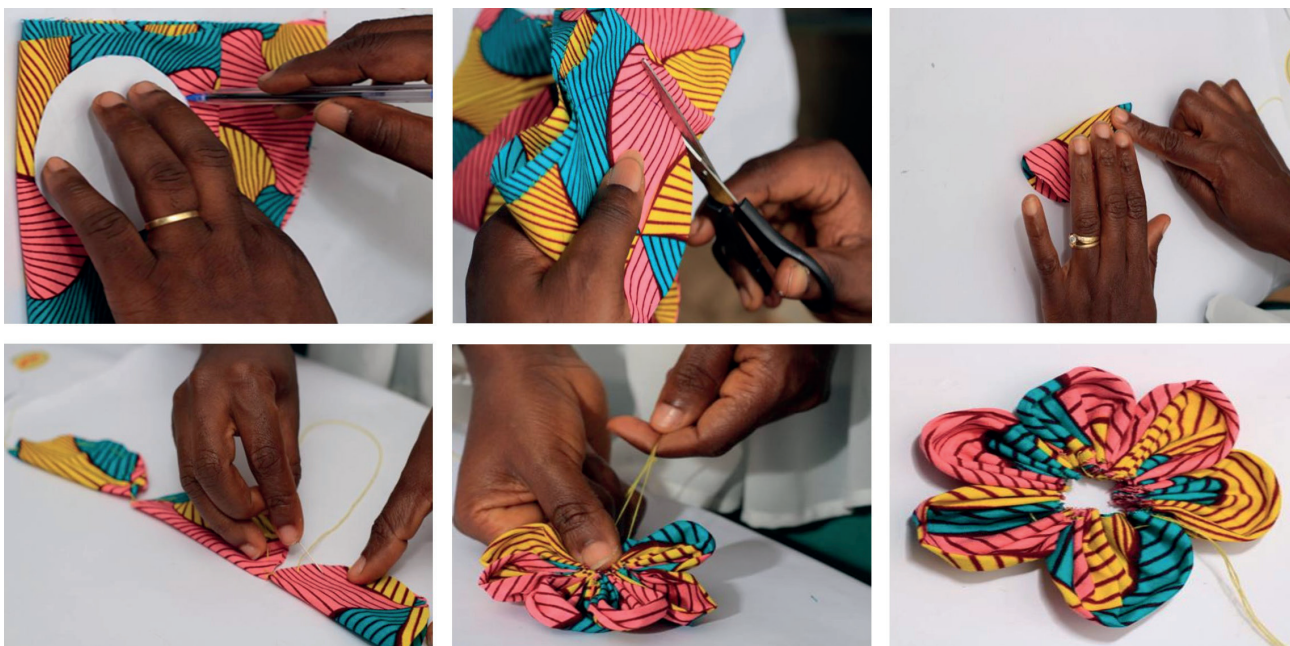


FIGURE 8: Procedure for making 'Nsroma' (Star).

2.4.5 'Anidado' (Hope)

For the construction of 'Anidado' (meaning Hope in 'Twi' language), eight circular pieces were cut out. Each piece was then folded into quarters, creating four sections. These sections were securely joined together by stitching. The ends of the thread were brought together and continuously pulled until the inner tops of the fabric pieces became taut. This process resulted in folds that added a sense of fullness, forming the "petals" of the flowers. To complete the flower, a decorative accessory with a harmonious colour scheme was fixed with the aid of fabric glue to seal the hole created in the center by the pulling process. The process of making fashion adornment five (5) is illustrated in Figure 9.

2.4.6 'Anigye' (Happiness)

'Anigye' (meaning Happiness in 'Twi' language) presents a simple heart shape chosen for the flower petal design. In the construction process, a simple heart shape was drawn on a piece of paper and carefully cut out. This heart template was then placed on a fabric pieces, traced, and cut out. This process was repeated until a total number of 10 heart-shaped fabric pieces of the same shape, were created. Using a threaded needle, the edges of a paired set of heart-shaped fabric pieces were stitched, leaving an approximate 2cm opening. The next step involved filling the interior of the fabric heart with shredded fabrics in the form of linters, creating a padded effect. To secure the structure, a 10cm copper wire was cut and a hook was fashioned at one end. The hooked end was carefully inserted into the padded heart piece, and the filling opening was

sealed by sewing to close up the opening end that aided the filling process. To achieve a neat finish, florist tape was wrapped around the copper wire, covering it completely. This process was repeated until the desired number of heart-shaped pieces were obtained. Figure 10 presents the process of making fashion adornment six (6).

2.4.7 'Nkabom' (Unity)

The construction of 'Nkabom' (Unity) demanded using a fabric piece measuring 2 by 4 inches as a guide, twenty (20) rectangular fabric pieces were cut out. These rectangular pieces were then transformed into triangular shapes by folding the side tips inward and securing them with glue, resulting in the form. Next, a hard stiffener was measured to create a circle with a diameter of 6 inches, which was then cut out. The triangular fabric pieces were coated with glue and affixed onto the stiff base. The pieces were arranged in an overlapping manner to create a star-like pattern. This arrangement continued until the entire surface of the stiff base was covered. To complete the flower, a decorative piece was positioned at the center, providing a finishing touch. Figure 11 shows the procedure for making fashion adornment seven (7).

3. FINDINGS AND DISCUSSION

The study revealed interesting creations as a result of green value creation, green creativity, green artistic practices coupled with manipulation and altering of fabrics through different technique. These creations fall under fashion accessories, accents and brooches. They can be used as standalone accessories or combined with other



FIGURE 9: Procedure for making 'Anidado' (Hope).



FIGURE 10: Procedure for making 'Anigye' (Happiness).

accents to enhance aesthetic sensibilities. The final products were given names that were familiar with Ghanaian fashion consumers so they could relate with them.

3.1 'Banbɔ' (Protector)

'Banbɔ' (Protector) is a fabric rose as shown in Figure 12a which is a suggestive representation of the natural rose flower. It was made out of medium sized fabric pieces (6cm x 6cm). It represents the intricate overlaps of the rose flower. With the use of colourful ankara fabric a simulated rose flower was achieved. Ankara fabric was used because it could easily adapt to the manipulation of the folds associated with the rose flower. The rosette produced has multiple uses, it can be used as a hair piece when a comb is fixed at the base or a brooch when a safety/brooch pin is attached to it.

Based on its design concept and usage the researchers named and refer to it as 'Banbɔ' meaning protector, a suggestive visual analysis presents an artistic description of the fabric rose, depicting the way the petals of the rose flower are arranged revealing a portion of the golden fabric ball in the middle. This name also suggests care and enhancement.

'Banbɔ' relates to safeguarding and defending in the context of environmental sustainability. The concept for the creation of this adornment is hinged on preserving and restoring the natural eco system (Stoltz, 2023). Reducing pollution and advocating for practices that do not deplete resources (Eiadat et al., 2008). 'Banbɔ' (protector) concept looks at the ability to protect the resources for future generation. 'Banbɔ' radiates restoring the depleted habitats and

maintaining biodiversity, conservational efforts and advocacy (Elimam, 2017; Li, Wang & Wu., 2019).

3.2 'Odehye3' (Royalty)

This is a result of fabric pieces manipulated to create decorative petals of different sizes. As seen in Figure 12b, this piece is a suggestive description of the flamboyant flower. It has similar characteristics to the flame tree flower and represents the glow and brightness of the flamboyant flower. Using attractive and luminous ankara fabric pieces through creative manipulations, the fabric-flambo flower was created. Typically, the flamboyant flower petal is supported by a stalk, thus a florist tapped copper wire was used to represent the suggestive stalk of the fabric-flambo flower. It was named and referred to as 'Odehye3' a word in the 'Twi' language of Ghana which means royalty. In African culture, the word "royalty" carries significant meaning and is often associated with power, leadership, and prestige. Royalty is symbolized by individuals who possess regal qualities and are seen as the embodiment of authority and dignity within their communities.

'Odehye3' flower bouquet can be seen as a symbol of pride and beauty, reminiscing the majestic and colorful regalia worn by African royals. Just as African royals would adorn themselves in ornate garments and accessories, this bouquet becomes a visual representation of the opulence and regal nature associated with African traditions. This flower bouquet, which is made from different Ankara fabrics, depicts the concept of flamboyancy which can be related to the rich African culture by the vibrant and bold colours often seen in traditional African textiles and artistic expressions.

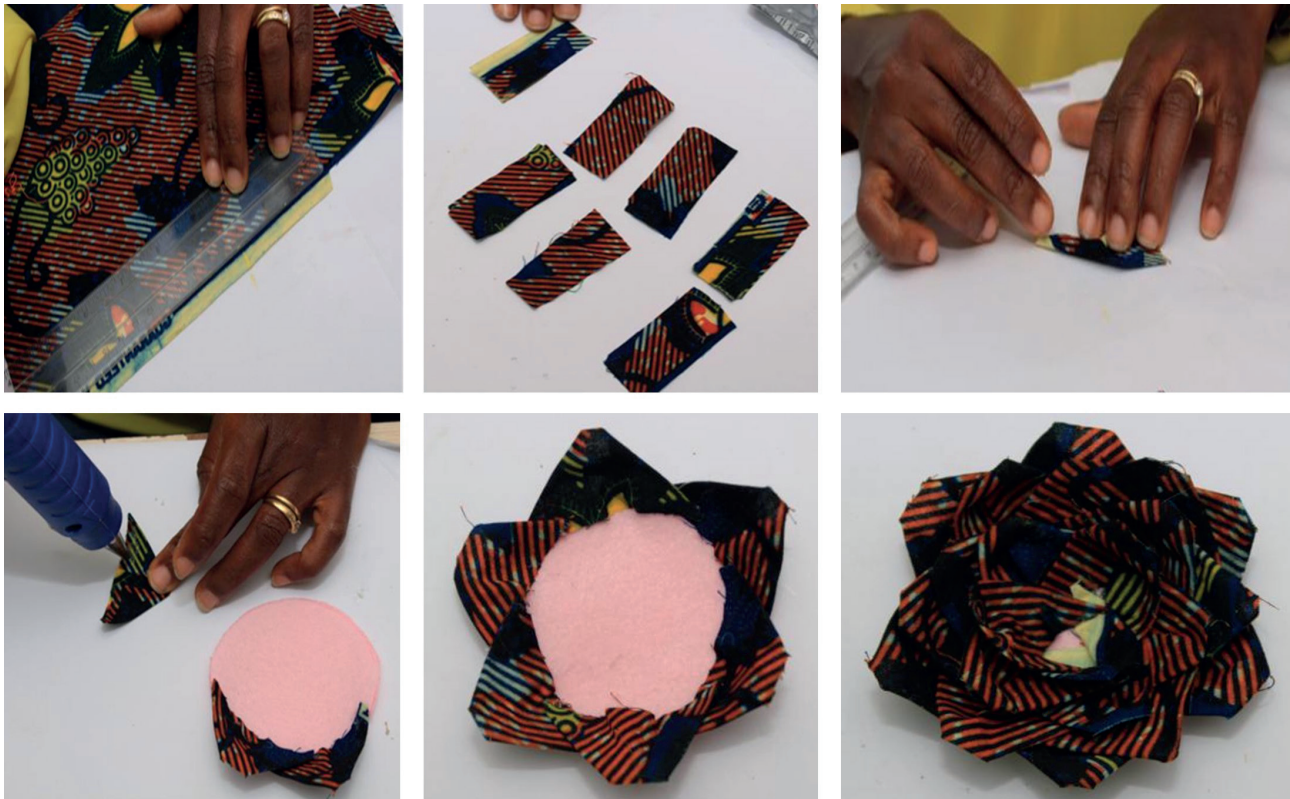


FIGURE 11: Procedure for making Nkabom' (Unity).

'Odehyde3' radiates pride and beauty which interweaves beautifully with environmental sustainability in several graceful ways. 'Odehyde3' advocate as an inspiring motivator for cultural area and communities to care for the environment and practice sustainable activities (Kumar, 2020). Individuals and communities that take pride and beauty as a cherished concepts engage in activities that preserve and enhance the local environment. Beautiful and sustainable environment promotes fascinating aesthetic sceneries and values with eco- friendly designs with aesthetic values (Brozović et al., 2020). This promotes clean air and green spaces with pride.

3.3 'Ahofé' (Beautiful)

The researchers named and referred to the brooch as 'Ahofé' which means 'beautiful' in the 'Twi' language in Ghana. 'Ahofé' as seen in Figure 12c, is a decorative clothing enhancer used as a fashion accessory. It was made from Ankara. The word "beautiful" is closely linked to this fabric accessory looking at its aesthetic appeal, decorative nature, attention to detail, versatility, and ability to enhance the self-confidence of the user. As visual representations of beauty, craftsmanship, and personal style, the 'Ahofé' is an integral part of fashion sensibilities, self-expression and radiates elegance and charm.

'Ahofé' offers a unique opportunity for personalization and individual style as it can be worn in various ways, allowing the wearer to express their personality and taste. Whether pinned to a lapel, attached to a hat or used as a belt buckle, this accessory contributes to the overall aes-

thetic of an outfit, adding a touch of beauty that is distinct and personal. The choice of fabrics, colours, and embellishments are dependent on aura intended to be ignited.

'Ahofé' is a visual representation of beauty and a powerful way to communicate environmental sustainability in a way of preserving our natural local environments, inspiring actions that raise awareness of stunning aesthetics of the environment (Chen et al., 2016). 'Ahofé' hinges on enhancement, focusing on improving and optimising natural and manmade systems to arrive at better environmental outcomes (Kneipp et al., 2019). 'Ahofé' (beautiful) capitalises on concepts like restoration, renewable, sustainable, green approaches circular economy and innovation (Kemp & Pearson, 2007). 'Ahofé' highlights on collection of critical sustainable initiatives to create an enhanced environment.

3.4 'Nsroma' (Star)

The researchers named and referred to the fabric flower as 'Nsroma' which means a star, in the 'Twi' language. This simple flower mimics the phlox flower which is star-shaped, thus the name 'Nsroma' seems appropriate. Stars are a symbol of the cycle of life, representing growth, renewal, and the passage of time. In the African setting, the Phlox flower can be associated with these themes. As the Phlox blooms and blossoms, it represents the growth and renewal of life, echoing the celestial cycles observed in the stars. It is presented in Figure 12d.

The 'Nsroma' adornment can be likened to the concept of blooms and blossoms. This suggestively aligns with



FIGURE 12: Final Products produced from fabric waste: (a) 'Banbɔ' (Protector); (b) 'Odehye3' (Royalty); (c) 'Ahofé' (Beautiful); (d) 'Nsroma' (Star); (e) Anidaso' (Hope); (f) 'Anigye' (Happiness); (g) Nkabom' (Unity).

achieving the environmental sustainability agenda. Blooms relate to creative solutions and initiatives in relation to environmentally sustainable practices (Chen et al., 2016). It manifests a clear understanding of issues of environmentally sustainable practices. 'Nsroma' as a concept is contextualised to focus on habit transformation and renewal from traditional practices. It radiates the awareness of embracing sustainable lifestyles (Dyck & Silvestre, 2018).

3.5 'Anidaso' (Hope)

This piece is a simple sunflower and the researchers named it 'Anidaso' which is a 'Twi' word that means 'Hope'. Sunflowers can be associated with positive emotions, including hope and fulfillments. The morning spread of the

vibrant yellow petals, and sun-facing behavior symbolize optimism, positivity, and a hopeful outlook. 'Anidaso' is a seven-petal brooch with a glittery stud in the centre of the flower. Displayed as a brooch on the bust area of a figure radiates fullness and illusionary creates a fuller bust. Its therapeutic effects psychologically create a feel of convergence and divergent energies that takes the eye away from any figure flaws. 'Anidaso' fabric flower as seen in Figure 12e represents the belief that even in difficult circumstances, there is the potential for growth, renewal, and brighter days ahead.

This concept inspires action. It is powerful and promotes resilience in the actions to achieve sustainable development. 'Anidaso' is a bridging gap between our as-

piration for a sustainable environment and the motivation for a better sustainable future (Takalo & Tooranloo, 2021). 'Anidaso' preaches concepts like empowering, resilience, collaboration, shared responsibility, collective impact, maintaining determination and possible coexistence between human needs and ecological limit (Brozović et al, 2020).

3.6 'Anigye' (Happiness)

The researchers named the heart patterned flower bouquet as seen in Figure 12f. 'Anigye' (happiness) is a Ghanaian 'Twi' word that means happiness. Flowers have long been associated with beauty, and their presence can bring joy and happiness to people. The vibrant patterns and colours of Ankara fabrics leave this bouquet to be visually striking and captivating. The combination of natural beauty and the artistic appeal of Ankara fabrics can evoke positive emotions, uplift spirits, and enhance feelings of happiness. The array of colours manifested by the Ankara adopted resonates the freedom from waste. The fabrics suggestively display a cry out from bondage, embracing a new life of new opportunities, with padded and puffy representation at the top which usually represent the head, the seat of wisdom. The suggestive stem area manifest series of independent stakes being held together by a band to radiate the felling of togetherness and unity. This description connotes the 'Anigye' concept.

'Anigye' (Happiness) as a concept interconnect seamlessly with environmental sustainability. Radiating well-being and quality lifestyle which is premised on quality ecological life and alignment of human lifestyles with ecological balance (Kumar, 2020). A clean environment reduces positive energy, reduces diseases, reduces stress, thereby addressing environmental inequalities and promoting sense of belongingness (Dyck & Silvestre, 2018). 'Anigye' (Happiness) promotes sustainable lifestyle and fosters long term wellbeing for individuals and their environment (Mubarak et al., 2021).

3.7 'Nkabom' (Unity)

The researchers named this artefact 'Nkabom'. It is a Ghanaian 'Twi' word that means unity an ingredient which is essential in the family, community, nation, and race. In designing this Ankara fabric flower, the individual fabric pieces are intricately intertwined producing layered manifestation to form a cohesive whole as shown in Figure 12g. This interconnectedness can symbolize unity, as each fabric piece represents a different part, yet they come together to create a unified and complete flower. The Ankara fabric flower serves as a visual representation of the interconnected nature of individuals within a community, highlighting how unity can be achieved by embracing and appreciating the unique contributions of each person.

This concept talks about partnership and collaboration, referencing SDG 17. It radiates collective action and shared responsibility. The 'Nkabom' (Unity) concept stands for collaboration and cooperation at all levels, design interconnectivity and a dependable eco system (Kumar, 2020). Unity is a crucial ingredient for the attainment of environmental sustainability because its basic focus is on shared

goal, collaboration and interconnectedness to bring a harmonious environment of equal balance of energy (Bolis et al., 2017).

4. CONCLUSIONS

This project has demonstrated how fabric waste from the small-scale garment industries can be reused to help solve the problem of waste management in Ghana. It was revealed that most fabric waste find their ways in the landfill or burnt in the open which causes environmental pollution and are hazardous to humans and the eco system in general. From the study it was also brought to bear that there are opportunities and several possibilities for artists, fashion designers and garment manufacturers to explore knowledge and skills to create useful decorative accents and fashion accessories to enhance garments and create psychological and therapeutic perfect fashion figures and imagery by using recycled and upcycled textile waste materials. The success of this project promotes environmental sustainability and green innovation. Manipulation of materials were made simple to promote replication. Materials employed were basic waste from the small-scale dress maker's shop. It is envisaged that the project outcomes result in skills for alternative employment and job creation. The findings of this research not only create an extensive platform for generating additional revenue for manufacturers but also contributes to environmental sustainability by encouraging waste recycling. Outcomes also help address SDG's (1- No poverty), (8- Decent work and Economic growth) and (12- Responsible consumption and production).

The research explores the potential of material waste management through the creation of innovative textile art pieces, such as brooches, bouquets, fabric flower pins, and floral arrangements. By analyzing the environmental repercussions of incineration and landfilling, the study proposes actionable strategies to mitigate hazards linked to improper fabric waste disposal. Textile artists, Mastercraft persons and their apprentices from the small-scale garment industries can adopt the techniques demonstrated to upskill their green competencies to reduce waste in the environment. Governments and non-governmental organizations can also explore other innovative green innovation approaches to help upcoming garment apprentices and early career garment makers to develop green competencies by adopting green practices to reduce waste in their garment industries.

REFERENCES

- Acquaye, R., Sawyerr, N. O., & Kusi, C. (2022). West Africa prints: Fusion of global textile design traditions in textiles and clothing along the silk roads. In *Textiles and clothing along the silk roads* (pp. 243–255).
- Adeloye, A. A. (2022). Examination of the basic components of African print fabric designs produced in South West Nigeria. *Turkish Journal of Fashion Design and Management (TJFMD)*, 4(2), 89–102
- Adeloye, A. A., Akinbogun, T. L., & Ogunduyile, S. R. (2023). The production of African print fabric designs: A user-centric design approach. *Prithvi Academic Journal*, 6, 32–48. <https://doi.org/10.3126/paj.v6i1.54604>

- Afonso, C., Gavilan, D., García-Madariaga, J., & Gonçalves, H. M. (2018). Green consumer segmentation: Managerial and environmental implications from the perspective of business strategies and practices. In A. Leal-Millan, M. Peris-Ortiz, & A. Leal-Rodriguez (Eds.), *Sustainability in innovation and entrepreneurship* (pp. 137–151). Springer. https://doi.org/10.1007/978-3-319-57318-2_9
- Ajila, K. O. (2016). An appraisal of traditional woven fabric production in south western Nigeria. *European Journal of Sustainable Development*, 5(1), 63–76.
- Akinwumi, T. (2008). The 'African print' hoax: Machine produced textiles jeopardize African print authenticity. *The Journal of Pan African Studies*, 2(5), 179–192.
- Amankwah, A. M., & Howard, E. K. (2013). Technical limitations of African prints and their implications on garment construction in Ghana. *Journal of Science and Technology*, 33(1), 75–83. <http://dx.doi.org/10.4314/jst.v33i1.8>
- Ankersmit, W. (2010). The wax print: Its origin and its introduction on the Gold Coast [Master's thesis, University of Leiden, the Netherlands].
- Bailey, K., Basu, A., & Sharma, S. (2022). The environmental impacts of fast fashion on water quality: A systematic review. *Water*, 14(7), 1073. <https://doi.org/10.3390/w14071073>
- Bolis, I., Morioka, S. N., & Sznclwar, L. I. (2017). Are we making decisions in a sustainable way? A comprehensive literature review about rationalities for sustainable development. *Journal of Cleaner Production*, 145, 310–322. <https://doi.org/10.1016/j.jclepro.2017.01.025>
- Brozović, D., D'Auria, A., & Tregua, M. (2020). Value Creation and Sustainability: Lessons from Leading Sustainability Firms. *Sustainability*, 12(11), 4450. <https://doi.org/10.3390/su12114450>
- Candy, L., & Edmonds, E. (2018). Practice-based research in the creative arts: Foundations and futures from the front line. *Leonardo*, 51(1), 63–69.
- Carr, D., Cruthers, N., Smith, C., & Myers, T. (2008). Identification of selected vegetable textile fibres. *Studies in Conservation*, 53(Suppl. 2), 75–87. <https://doi.org/10.1179/sic.2008.53.Supplement-2.75>
- Chakraborty, J. N. (2012). Strength properties of fabrics: Understanding, testing, and enhancing fabric strength. In P. A. Annis (Ed.), *Understanding and improving the durability of textiles* (pp. 31–58). Woodhead Publishing. <https://doi.org/10.1533/9780857097644.1.31>
- Chen, Y.-S., Chang, T.-W., Lin, C.-Y., Lai, P.-Y., & Wang, K.-H. (2016). The Influence of Proactive Green Innovation and Reactive Green Innovation on Green Product Development Performance: The Mediation Role of Green Creativity. *Sustainability*, 8(10), 966. <https://doi.org/10.3390/su8100966>
- Chichi, C., Howard, E. K., & Baines, E. (2016). Assessment of consumer preference in the use of African wax prints in Ghana. *International Journal for Innovation Education and Research*, 4(10), 67–76.
- Colvin, R. M., Witt, G. B., & Lacey, J. (2020). Power, perspective, and privilege: The challenge of translating stakeholder theory from business management to environmental and natural resource management. *Journal of Environmental Management*, 271, 110974. <https://doi.org/10.1016/j.jenvman.2020.110974>
- DeBoer, J., Panwar, R., & Rivera, J. (2017). Toward a place-based understanding of business sustainability: The role of green competitors and green locales in firms' voluntary environmental engagement. *Business Strategy and the Environment*, 26(7), 940–955. <https://doi.org/10.1002/bse.1957>
- Dereje, D., Liu, J., & Zhou, J. (2013). African textile design and fabric arts as a source for contemporary fashion trends. In 2nd International Conference on Science and Social Research (ICSSR 2013) (pp. 229–233). Atlantis Press.
- Dyck, B., & Silvestre, B. S. (2018). Enhancing socio-ecological value creation through sustainable innovation 2.0: Moving away from maximizing financial value capture. *Journal of Cleaner Production*, 171, 1593–1604. <https://doi.org/10.1016/j.jclepro.2017.09.209>
- Eiadat, Y., Kelly, A., Roche, F., & Eyadat, H. (2008). Green and competitive? An empirical test of the mediating role of environmental innovation strategy. *Journal of World Business*, 43(2), 131–145. <https://doi.org/10.1016/j.jwb.2007.11.012>
- Elimam, H. (2017). How green economy contributes in decreasing the environment pollution and misuse of the limited resources? *Environment and Pollution*, 6(1), 10. <https://doi.org/10.5539/ep.v6n1p10>
- Fletcher, K. (2014). *Sustainable fashion and textiles: Design journeys*. Routledge.
- Halls, J., & Martino, A. (2018). Cloth, copyright, and cultural exchange: Textile designs for export to Africa at the National Archives of the UK. *Journal of Design History*, 31(3), 236–254.
- Howard, E. K. (2016). The external bottlenecks of the Ghana textile industry. *Ghana Journal of Science, Technology and Development*, 4(2). <http://gjstd.org>
- Ismail, S., & Azha, S. F. (2018). Cotton cloth: Diversified applications beyond fashion and wearable cloth. *Current Trends in Fashion Technology & Textile Engineering*, 2(3), 55587. <https://doi.org/10.19080/ctfte.2018.02.55587>
- Jones-Quartey, C. (2023). Fabric waste disposal: The case of small garment manufacturers within Sekondi-Takoradi Metropolis, Ghana [Master's dissertation, Takoradi Technical University].
- Jurkowitz, S., & Sarlay, A. (2010). An analysis of the current denotation and role of wax fabrics in the world of African textiles. *International Journal of Management Cases*, 12(3), 28–48.
- Kansanba, R. F., Okpattah, V., Osei, M. A., Ayesu, S. M., & Asmah, A. E. (2021). Redesign of functional Kaba (blouse) apparel for Ghanaian breastfeeding mothers. *Journal of Textile Science and Technology*, 7(1), 41–54. <https://doi.org/10.4236/jtst.2021.71004>
- Kemp, R., & Pearson, P. (2007). Final report of the MEI project measuring eco innovation. Brussels, DG Research of the European Commission, Eurostat, the European Environment Agency (EEA), and the Joint Research Centre (JRC) of the European Commission.
- Khan, M. R., Dip, T. M., Rashid, M. E., Haque, R. U., Neloy, F. K., Salehin, S. M. M., Sayem, A. S. M. (2023). Comparative analysis of production processes and quality parameters of two different semi-combed yarns. *Journal of Natural Fibers*, 20(1). <https://doi.org/10.1080/15440478.2022.2163333>
- Khanzada, H., Khan, M. Q., & Kayani, S. (2020). Cotton based clothing. In H. Wang & H. Memon (Eds.), *Cotton science and processing technology* (pp. 1–15). Springer. https://doi.org/10.1007/978-981-15-9169-3_15
- Kneipp, J. M., Gomes, C. M., Bichueti, R. S., & Frizzo, K. (2019). Sustainable innovation practices and their relationship with the performance of industrial companies. *Revista de Gestão*, 26(2), 94–111. <https://doi.org/10.1108/REG-01-2018-0005>
- Kumar, S. A., (2020). Bio-Dyes, Bio-Mordants and Bio-Finishes: Scientific Analysis for Their Application on Textiles. *IntechOpen*. doi: 10.5772/intechopen.92601
- Le, N. (2020). The impact of fast fashion on the environment. Princeton University. <https://psci.princeton.edu/tips/2020/7/20/the-impact-of-fast-fashion-on-the-environment>
- Li, G., Wang, X., & Wu, J. (2019). How scientific researchers form green innovation behaviour: An empirical analysis of China's enterprises. *Technology in Society*, 56, 134–146. <https://doi.org/10.1016/j.techsoc.2018.09.012>
- Lund, S., Manyika, J., Woetzel, J., Barriball, E., Krishnan, M., Alicke, K., Birshan, M., George, K., Smit, S., Swan, D., & Hutzler, K. (2020). Risk, resilience, and rebalancing in global value chains. McKinsey Global Institute. <https://www.mckinsey.com/business-functions/operations/our-insights/risk-resilience-and-rebalancing-in-global-value-chains>
- Manju, V. V., Divakara, S., & Somashekar, R. (2020). Studies on structure and elasto-mechanical properties of Suvin cotton fibre. *Journal of Scientific Research*, 12(4), 607–620. <https://doi.org/10.3329/jsr.v12i4.47269>
- Marshall, C. (2010). A research design for studio-based research in art. *Teaching Artist Journal*, 8(2), 77–87. <https://doi.org/10.1080/15411791003618597>
- Mills, M. C. (2009). Materiality as the basis for the aesthetic experience in contemporary art [Doctoral dissertation, University of Montana].
- Mohammed, D., Shiyani, R. L., & Ardesheena, N. J. (2018). Growth dimensions of long staple cotton area, production and yield in Gujarat, India. *International Journal of Current Microbiology and Applied Sciences*, 7(5), 2993–3005.
- Mubarak, M. F., Tiwari, S., Petraitte, M., Mubarik, M., & Raja Mohd Rasi, R. Z. (2021). How Industry 4.0 technologies and open innovation can improve green innovation performance? *Management of Environmental Quality: An International Journal*, 32(5), 1007–1022. <https://doi.org/10.1108/MEQ-11-2020-0266>
- Nielsen, R. (1979). The history and development of wax-printed textiles intended for West Africa and Zaire. In *The fabrics of culture: The anthropology of clothing and adornment* (pp. 467–498).
- Omatseye, B. O., & Emeriewen, K. O. (2012). An appraisal of the aesthetic dimension to the African philosophy of cloth. *Journal of Language, Technology & Entrepreneurship in Africa*, 3(2), 57–67.

- Opoku, J., Amankwah, M. A., & Assibey, G. B. (2022). Advancing unconventional bridal gowns detailing designs through cosmopolitan localism to promote environmental sustainability. *Journal of Science and Technology*, 40(3), 113–127.
- Post, S., (2024). Fest of Movement. <https://www.simonepost.nl/index.php/portfolio/hermes-2-5-2-4-2/> (Accessed April 19, 2025).
- Safo-Ankama, K., Sawyerr, N. O., & Wiredu, C. (2023). The saga of fabric waste disposal: The case of small-scale garment manufacturers in Sekondi-Takoradi in perspective. Conference Proceedings, Faculty of Applied Arts Conference, Takoradi Technical University, Takoradi.
- Shonibare, Y., (2025). Biography. <https://yinkashonibare.com/biography> (Accessed April 19th, 2024).
- Sonaïke, E. (2024). African inspired cushions. <https://evasonaïke.com/collections/cushions> (Accessed April 19, 2025).
- Stanescu, M. D. (2021). State of the art of post-consumer textile waste upcycling to reach the zero-waste milestone. *Environmental Science and Pollution Research*, 28, 14253–14270. <https://doi.org/10.1007/s11356-021-12345-6>
- Stoltz, B. (2023). A Nature Thing: What Does Contemporary Ecological Art Produce? *Arts*, 12(2), 67. <https://doi.org/10.3390/arts12020067>
- Takalo, S. K., & Tooranloo, H. S. (2021). Green innovation: A systematic literature review. *Journal of Cleaner Production*, 279, 122474.
- Yang, X. C. (2013). Green materials - New favourite of fashion innovation. In *Advanced Materials Research* (Vols. 694–697, pp. 3209–3212). Trans Tech Publications, Ltd. <https://doi.org/10.4028/www.scientific.net/amr.694-697.3209>