

Environmental Sustainability Through Textile and Apparel Upcycling

Beatrice MANTYI-NCUBE¹, Simanga JUBA²

¹*University of Botswana, Department of Family and Consumer Sciences
Textiles and Clothing, Gaborone, Botswana, mantyibea@gmail.com*

²*Bulawayo Polytechnic, Institute of Applied Art & Design, Bulawayo, Zimbabwe
jubasimanga@gmail.com*

ABSTRACT: The textile industry is among the most essential consumer goods industry; however, it is accused of being one of the most polluting industries due to production and consumption of textiles. The affluent segment of society through its “make-use-and-throw” approach gives rise to large scale manufacturing and pressure of disposing of used clothing. The textile industry, therefore, has made attempts to counter this problem through recycling. Yet another method, textile upcycling, is taking ground as a sustainability measure; an important technique that enables prolonging of textiles lifecycles and slowing down unnecessary textile production. Up-cycling is not a new concept, it originated from the 1930-40s, during the World Wars, times of little economic ability and material resources. In developing countries, up-cycling is a way of life especially, in rural areas due to expensive raw materials; hence, they use what is available to create handicrafts, clothing, etc. Given that up-cycling makes use of already existing pieces, it is a way of keeping ‘unwanted’ items out of the waste stream by creatively/innovatively reusing materials that may otherwise end up in landfills, a step towards achieving zero waste. Recycling requires energy and resources to gather, sort and process the waste while benefits of up-cycling include resource conservation and less carbon footprints. The study performed an evaluation of textile waste generated by fashion designers, suggesting ways in transforming both consumer waste and post-consumer waste into fashionable apparel. Five apparel up-cycling solutions were explored through redesigning and reconstructing of textile waste converting them into fashionable products.

KEYWORDS: textile industry, textile waste, redesign, recycling, upcycling, sustainability

Introduction

‘Fashion calls for constant change which urges consumers to indulge in purchasing garments to keep track with the latest trends. These practices result in large consumption patterns of clothing while the non-use of fashion apparels is hidden truth. Clothes that are purchased with intense interest lie idle either in the wardrobe or in the landfill. The textile industry is among the most essential consumer goods industry; however, it is accused of being one of the most polluting industries due to production and consumption of textiles’ (Radhakrishnan 2020, 59).

Around 1.8 million tonnes of clothing waste is generated annually in the UK accounting for around 5% of total UK household waste, with the lifetime of many garments unduly short (Cooper, Hughes, and Claxton 2015, 73). With reference to the environmental challenges resulting from the textile industry it is, therefore, imperative there is increased focus and effort for sustainable textile and apparel production and consumption practices, for a cleaner and more environmentally friendly and safer continent. Given the Sustainable Development Goals (SDGs) that are a pertinent topic, many researchers are looking into the problem of sustainability from different perspectives as illustrated in the following statement:

“The increased need to consider sustainability in the field of apparel is gaining awareness among designers, producers, marketers, and consumers who are currently considering their next moves in the arena of apparel products, design, and innovation. The paradox of fast fashion and the pursuit of modernity, alongside the need to care for the earth’s resources in a sustainable manner that includes social, economic, and environmental impacts, is a difficult dilemma” (DeLong et al. 2017, 48).

It has been observed that it takes about one year for natural fibres like wool to decompose and it even takes longer for man-made fibres to decompose. However, their manufacture creates pollution and they are hard to recycle with nylon taking 30 to 40 years to decompose (Challa 2007). As they decompose, they release gases into the atmosphere and some chemicals to the soil. These gases are inhaled by humans as polluted air and they also consume animal and plant product. However, their manufacture creates pollution and they are hard to recycle (with nylon taking 30 to 40 years to decompose).s infected with diseases from toxins. There is, therefore, a dire need for research and to assess ways in which environmental sustainability can be fostered through textile up-cycling in order to prevent catastrophic ecological degradation that threatens the existence of humanity. Thus, it is important that the fashion industry considers the uptake of environmentally friendly technologies.

Literature Review

Around 1.8million tonnes of clothing waste is generated annually in the UK, accounting for around 5% of total UK household waste, with the lifetime of many garments unduly short. Over the last 15 years, fashion has become faster and cheaper. The concern is that ‘fast fashion leads to fast landfill’ (Cooper, Hughes, and Claxton 2015, 73-74). The impact of textiles and clothing industry on the environment goes beyond emissions. Dyes used to produce toxic chemicals pollute waterways. Materials gathered for wood-based fabrics like rayon and viscose adversely contribute to deforestation (Schipani 2019).

Designers and product developers are taking greater responsibility for the problems presented by the inefficient and unsustainable systems used to create new fashion items. The culture of transience, newness, and conceived obsolescence, so prevalent in the fashion industry, has led to growing over-consumption and consequently high volumes of waste. Clothing is often disposed of with as much as 70% of its lifetime still left (Han, Tyler, and Apeagyei 2015, 130).

Landfill Emissions and Global Warming

‘The Ellen Macarthur Foundation, reported, textile production produces 1.2 billion tonnes of greenhouse gas every year. The United Nations estimates that 10 percent of total global emissions come from the fashion industry’ (Schipani 2019). In decades prior landfills were put in place, anything and everything was dumped and buried underground. This waste then overtime decompose releasing toxic toxins and chemicals, e.g. methane, a potent greenhouse gas that contributes to global warming. As a potent greenhouse gas, methane traps up to 20 times more heat in the atmosphere compared with carbon dioxide the Environmental Protection Agency (EPA) states Landfills have a distinctive effect on air pollution, nature, land, and humans. Soil in the area may be saturated with chemicals or hazardous substances. As rain falls on landfill sites, organic and inorganic constituents dissolve, forming highly toxic chemicals leaching into groundwater (Newton 2018).

In their study, DeLong et al (2017) indicated that, since Industrial Revolution, the fashion industry's impact on earth's resources has grown to such an extent that has led to social, environmental, and economic consequences that must be addressed. In support of gravity of the problem of textile waste, other studies show that there is a great need for effective garment waste reducing, recycling and disposal management which is motivated by increasing cost and decreasing availability of landfill space, a dumping area for textile waste (Jahan 2017, 266; Kavitha & Manimekalal 2014). Hence, the move towards sustainable strategies by the fashion industry. Furthermore, the authors (2017) noted that, according to EPA 2012, in 2010, an estimated 13.1 million tonnes of textiles were generated in the US; while the recovery rate for recycling for all textiles was only 15%, that is 2.0 million tonnes, with 11 tonnes dumped in landfills across the country (US Environmental Protection Agency 2012). Dyes and chemicals in fabric and other components of clothing and shoes leach into the soil, thereby contaminating both the surface and ground water.

Studies have shown that decomposing clothing releases methane, a harmful greenhouse gas which is a significant contributor to global warming. Notwithstanding that there is a great demand for second-hand clothing, in developing countries, there is need to motivate people to move from 15 percent recycling to 100 percent (Wallander 2012). The fashion industry is amongst lots of other industries which are sources of greenhouse gas emissions as it accounts for 10 percent of global carbon emissions and remains the second largest industrial polluter, second to the oil industry (Conca 2015).

Can Fashion Stop Climate Change?

The fashion industry greatly contributes to warming the planet, 1.7 billion tonnes of carbon dioxide in 2015. This translated to almost 5% of manmade CO² emissions more than aviation and shipping combined, with an increase to 8% in 2018. Efforts to get zero net greenhouse gas emissions requires drastic changes in the way clothes are produced and consumed. That is starting from the raw material wherein polyester accounts for 65% of all fabric production and cotton with 21% industry emissions. Fast fashion trend greatly contributes to carbon emissions as people are buying more clothes than ever, wearing them fewer times, repairing the garments less, also disposing them sooner. The fashion industry, therefore, must adopt and carry out practices that would help in reversing its harmful practices. The Fashion Industry Charter for Climate Action, launched in 2018 under the auspices of United Nations, had goals set to help curb fashion industry pollution e.g. engage in set commitments for the reduction of 30% greenhouse gas emissions by 2030. Switching fabrics e.g. from virgin polyester to recycled material can reduce carbon footprints of polyester by 40%. Hence, use of more sustainable fabrics would greatly reduce the climate impact of fashion in the future (Common Objective 2019).

Sustainability and Environmental Issues in the Fashion Industry

Sustainability deals with procedures and practices aimed at reducing environmental pollution and it has far-reaching implications. It encompasses many areas, and with those pertinent to the fashion industry as; materials use, production, consumption, disposal, and recycling. Full life cycle analysis (LCA) of a product, is an involved process yet an important aspect currently gaining ground; and, it examines the way production, use, care, and disposal of a product affects the people who use it and their environment. Hence LCA, therefore, encompasses everything from raw materials used, through to the treatment of the

generated waste during production, processing; and the impacts resultant from consumer use, care/cleaning through to disposal or recycling of the product. With reference to textile products, consumers face many difficult choices in decision-making of the better product from available products. Success on what is available in the market is dependent on consumers demanding “green” eco-friendly, recycled, or sustainable products. Whilst the LCA is a desired approach to sustainability in the fashion industry, ‘identifying the complete environmental ramifications of the production, distribution, use, care, and disposal of textile products is a complex multi-dimensional problem’ (Kadolph 2014). Environmental issues affect the processing of raw materials to the production and distribution of the final product and its disposal.

Recycling and Up-cycling

The affluent segment of society through its “make-use-and-throw” approach gives rise to large scale manufacturing and pressure of disposing of used clothing. The textile industry, therefore, has made attempts to counter this problem through recycling. Yet another method, textile up-cycling, is taking ground as a sustainability measure; an important technique which enables prolonging of textiles lifecycles and slowing down of unnecessary textile production. Given that the goal of up-cycling is to prevent wasting potentially useful materials by making use of existing ones; it is therefore, one good strategy to protect ecosystems (DeLong et al. 2017).

Up-cycling is not a new concept, it originated from the 1930-40s, during the World Wars, the times of little economic ability and material resources. In developing countries, up-cycling is a way of life especially, in rural areas due to expensive raw materials; hence, they use what is available to create handicrafts, clothing etc. (Dsouza n.d.). Up-cycling, therefore, has an inherent stake in other sustainable activities such as design for reuse, reduction of carbon and water footprints, reduction of air pollution (greenhouse gases) etc. Recycling and up-cycling play a major role in the sustainability criteria of economic, environmental, and social dimensions. Recycling in the fashion sector, contributes to textile waste elimination through reuse of materials and finished garments, environmental conservation especially the reduction in landfill and pollution through redirection of waste to alternative uses (Kellock 2014).

‘Up-cycling used clothing could transform textile waste into raw materials for new fashion items’ (Janigo, Wu, and DeLong 2017, 254). Up-cycling is the newest sustainability trend within the retail industry and focuses on reusing discarded objects or materials to create a product of higher quality or perceived value than the original. Through up-cycling, cloth and textile waste are reduced by reusing deadstock or gently used fabric to create new garments and products. Up-cycling can use pre-consumer or post-consumer waste or a combination of the two (Petro 2019). Thus, up-cycling is a process that involves amending, restyling or creation of a completely unrelated product to clothing. Up-cycling also implies application of high design and craft techniques with a finished product often of a higher retail price than it could have been as the original (Kellock 2014).

Sustainability and Fashion Designing

‘The fashion industry is the backbone of textile and apparel production as all endeavors start with the design phase. Designers today have a different motto, and they work for long-lasting sustainable designs which in turn will promote sustainable consumption and production patterns among end users. The role of sustainable design development brings into realization the attainment of the 12th goal (Responsible Consumption and Production) of the UN Sustainable Development Goals.

Many studies and reports have shown that consumers are aware of the problems related to fast fashion and are looking out for sustainable products. Sustainable design formulation calls for assurance of a long-term product which satisfies the need of the customer' (Radhakrishnan 2020, 59).

Researchers have brought to the fore the awareness of the widespread recognition of the fashion industry's current practices, which have proved to have an adverse environmental, economic, and social impact. Fashion designers are, therefore, key to the transformation to a sustainable fashion industry by developing products with consideration of the environment, economic, and social issues throughout the products lifecycle (Kozłowski, Bardecki, and Searcy 2019). Consumers' need for fashion novelty and newness has driven them to purchase new and diverse apparel products frequently, which, at most times are underutilised, hence end up being disposed of. Fast fashion, low cost clothing collections is by its very nature, a fast-response system that encourages and speeds up consumers' acquisition of more styles of lower prices, thereby encouraging more purchases resulting in increased landfill waste. High street retailers entice their customers into coming back by sourcing and introducing new trends on a weekly basis as they introduce new items and replenish stock (Joy et al 2012, 275).

Transformed apparel designs provide an alternative option of changing to different styles without purchasing new products; a venture that requires, a good understanding of garment construction quality, technical knowledge, and skills. Unfortunately, it has been observed that there are critical skill gaps in the fashion industry and evidenced in the classroom where students show lack of confidence in experimenting with construction skills (Allsop & Cassidy 2019, 1).

Materials and Design Brief

This study, therefore, is based on a design project that explored available opportunities that can be used to design garments that lessen the impact on the environment, while addressing the social, economic, and ethical concerns. The sustainable design collection of ladies' ready-to-wear apparel was complemented by accessories such as a clutch purse, shoes, necklace, and bracelets; and exhibited an appeal and quality to convince mainstream consumers that sustainable fashion can be the norm. The selected pinafore dress, as an emerging trend, is a versatile design that can be used to create various looks when worn with different tops. Back straps of the outfit resemble suspenders giving it a casual look. Though pinafore dresses are on the casual side, but the design can be dressed up, with a detachable overskirt as has been added to the pinafore design to create a perfect out to dinner look (Figure 1). The chosen design, though labour intensive was the most outstanding. The pinafore dress has simple square patch works complemented by a cape that can be transformed into an overskirt if the occasion calls for it. Templates were used to cut pieces of fabric from fabric scraps, into square and rectangle shapes for the skirt and triangles for the layered overskirt respectively; and thereafter, arranged as patchwork into rows and columns and sewn together.

Geometric patchwork should be very carefully made as the slightest inaccuracy throws them out of balance and pieces will not fit together. This is time consuming and labour intensive requiring a lot of hand work in joining the pieces. The medium-sized triangle patchworks are ideal for repurposing scrap fabrics, but not easy to sew, as they utilise a lot of leftover material and are time consuming. A lot of expertise is needed to join the pieces of triangular shapes.


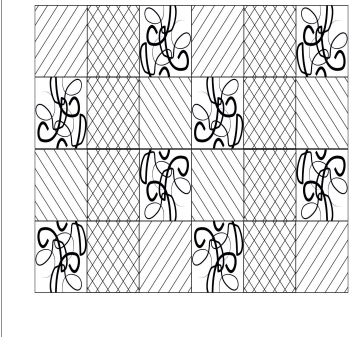
Final Design - Pinafore and overskirt	
Pinafore dress with multi-coloured patchwork overskirt	Patchwork arrangement for pinafore skirt
 <p>FRONT</p> <p>BACK</p>	

Figure 1. Technical Illustrations [Pinafore dress and Patchwork]



Pinafore dress with strip-lacy cape	Pinafore dress over T-shirt
	

Figure 2. Pinafore dress designs from fabric scraps with complementary shoes



Figure 3. Shoe design covered with suede fabric scraps

Conclusion, Implications and Recommendations

This study serves to demonstrate that implementing the up-cycling method in the design process significantly decreases the environmental impact of a garment, by providing a solution to the problem of textile waste, and thereby, reducing the use of new material.

People are aware that off-cuts thrown into landfills or burnt are harmful to the environment. Decomposing clothing and textile releases methane, harmful greenhouse gas and a significant contributor to global warming. Like other wastes, textile waste disposal through landfill and incineration is responsible for global warming. Textile waste material in the form of post-consumer waste, pre-consumer waste, and production waste, are all essential in implementing up-cycling. The three types of textile waste can be used in fashion design, each, however, requires a different technique when used as an input material, depending on the objective and functionality of the designed product. Up-cycling with production waste can be most efficiently used within the production company itself, by sending all generated waste back to the production process; and designing patterns for side products to be easily made of the textile leftovers.

Fashion conscious or not, clothes are a necessity, and today's fashion industry is faced with one of the biggest challenges of how to create fashion for a growing world population at the same time protecting the planet by ensuring that fashion waste headed for the landfill can be turned into something creative. Creating less waste goes back to pattern design. Zero waste must be incorporated into design before cutting out the fabric. Pattern makers should create garments where pieces of fabric resemble an interlocking jigsaw puzzle, thus resulting in fewer left over scraps. Textile waste, an increasingly critical issue in the fast fashion industry, is causing devastating harm to our environment. It is therefore important that the fashion industry in putting itself on the frontline of the battle against waste, makes "Zero waste pattern making" a major consideration and practice in its manufacturing enterprises. Given that Americans discarded 13.1 million tonnes of textiles in 2010, with 11 million tonnes dumped in landfills (DeLong et al. 2017), it is important that steps be taken to decrease textile waste for recycling and up-cycling.

Textile recovery and recycling are important and beneficial to the environment as they reduce the need for landfill space. The fashion industry must promote sustainability of the environment through promoting the up-cycling concept. It is, therefore, prudent that the long-ago practice of repairing clothes for extended use be encouraged. This could be infused into the curriculum together with recycling and up-cycling concepts for a beneficial contribution towards a sustainable environment. The hope being that the Zimbabwean fashion industry, freelance designers, and entrepreneurs could optimise this concept; and thereby, contribute to a sustainable environment, free from the negative impacts of global warming. This would be a positive step towards the global fight against climate change that is devastating the world.

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