Textile Waste Recycling: An Innovative Creativity for Entrepreneurial Sustainability in Nigeria.

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Abstract

Waste management is a global discuss due to its devastating effects on the environment. Human and industrial waste are always diverted to landfill which on the other hand has deteriorated the ecosystem. Waste, which is categorized under solid, liquid and gas, is drawn from all angels of the industrialization and thus industries can be termed “the mother of waste”. Report has shown that textile and clothing manufacturing industries are ranked to be one of the most polluting industries in the world. The pollution comes in not only during textile processing and production but also under the consumption of textiles. The fact that textile waste generation is highly influenced by the production of textile goods, means that more waste will continually be generated as more of these goods find their way to the society every day. In combating this problem, textile industry has taken some measures in the form of Reuse, Reduce and Recycle (3R). Although these to an extent brought a measure of relief to landfill, it is still not enough to tackle the obvious overpowering effect of textile waste. This research, traces how textile waste is managed from pre – post textile production as creative innovation. It focuses on exploration and experimentation into the various waste in the creation of artistic items through innovative creative methods which will enhance the reduction of textile wastes as well as change these wastes to wealth and most importantly divert these wastes from landfill. To this fact, innovative methods using braiding, weaving, patchwork, crocheting, stitching and or their combinations were explored using some of these textile waste to produce artistic pieces in form of tapestry, mobiles, rugs, hangings and more attention will be towards solid waste management as an entrepreneurial sustainability in Nigeria.

Keywords*: Innovation, Landfill, Textile waste, Recycling, Reuse and Reduce*

Introduction

The devastating effects of textile waste on the environment all over the world has been for long an issue that is so worrisome due to its contribution in the global climate warming. Global warming refers to the gradual increase in the temperature of the Earth's surface, atmosphere and oceans as a result of greenhouse gases. deforestation and burning fossil fuels create a barrier that traps the sun's heat on the Earth causing the planet to warm up (get.smarter.com 2015). Investigations by fiber2fashion.com (2015) reveals that, the thickening layer of carbon-dioxide and other gases trap the heat of the atmosphere and

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than 80 percent of global warming. It is a general knowledge that global warming has such a negative impact on lives at various levels right from atmosphere, to economic, environmental and health of all living beings.

The occurrence of constant flooding due to the increase of sea level caused by the continual melting of ice as a result of increased heat is one of many significant impact of global warming. Others such as the forceful heat wave may result to wildfire and droughts. Deforestation and burning fossil fuel, very prominent in Africa generally and particularly Nigeria create the danger of desertification that came from disintegration of soil particles due to the reduction of Soil Organic Matter (SOM) and the subsequent emission of gas into the atmosphere consequently causing leaching of the soil. This consequently will bring about the disruption of the ecosystem which may put some species to extinction. Health wise, diseases may spread across the globe, for instance disease like meningococcal meningitis which is most commonly found in West Africa is believed to have been caused by dry and dusty environment. In 1996, an outbreak of this disease recorded 250,000 cases and 25, 000 deaths in Nigeria (WHO, 2003). Textile industries negative contribution in this climate change comes from the intensive use of different varieties of chemicals ranging from dyes to transfer agents during the production of textile goods. For this, textile industry have been accused of being one of the most polluting industry. Waste generation is not only during production but also at consumption level which always find their way to landfill.

In some developed countries such as America, a total of 13.1 million tons of textile and clothing are discarded and only about 15% were reclaimed while the rest were dumped in landfill (Wallander, 2012). Research has shown that decomposing clothing releases methane, a harmful greenhouse gas and a significant contributor to global warming. There are dyes and chemicals in fabric and other components of clothing and shoes that can leach into the soil, contaminating both surface and groundwater. To this effect, individuals, government and non – governmental organizations are involved in various research to proffer solution to this global problem. Landfills are waste disposal sites for solid waste from human activities. Diverting these wastes from landfills has become one of the sustainable issues facing the industry a success of which can help minimize land, water, and air pollution. Textile industry on the other hand has taken some measures in the form of reuse, reduce and recycle (referred to as 3R) through the use of technology in combating this problem.

Textile Recycling - Reuse, Reduce and Recycle.

Textile waste generation is highly influenced by the production of textile goods. This means that more waste will continually be generated as more of these goods find their way to the society every day. Tanya and Katty (1997) identified three categories of textile and apparel waste in textile waste lifecycle as post-producers waste generated by manufacturers, pre-consumer waste generated by retailers, and post-consumer waste generated by the public. In combating this problem, textile industry has taken some measures in the form of reduce, reuse, and recycle all termed recycling. Recycling is the act of using or reusing of some objects or materials that has already been used so that it can be used again. According to Wang in Gwari, and Zuwahu (2009) there is an increasing amount of waste that is being generated each year from textile (including carpets and clothing). Merriam Webster (2016) described recycling as a process in order to regain or reuse material and this definition is the focus of this research. Recycling is one out of many measures the textile industries all over the globe use to combat the negative contribution imposed by the production of textile goods. This

measure consists of reuse as well as reproduction. Reuse allows materials in their original form to be used severally or pass those materials to others who could use them instead of discarding under one use. Reduce involves limiting purchases and accumulation; consequently reducing the amount of waste produced. Recycling generally refers to processing, treating or converting an object into reusable materials. Although these to an extent will bring a measure of relief to landfill, it is still not enough to tackle the obvious overpowering effect of textile waste. This paper therefore will investigate various innovative methods of translating these waste into wealth using solid waste management in creation of especially decorative household materials for self-sustainability and development.

Textile Waste

Textile has been defined as "all materials that can be or have been formed into yarns or fabricated into cloth" (Udeani, 2002). Idoko (2011) also defined textile as any material produced through the process of interlacing of fabrics. Therefore, textile is mainly concerned with fabrics and the materials from which they are made. These materials are so termed either in processing of their raw materials into yarn or in their method of construction such as knitting, braiding, felting, bonding or by lamination. Generally therefore, textile can be described as any material which method of production involves one or a combination of the aforementioned processes. Waste on the other hand has been defined from many different angles ranging from leftover, surplus, excess, unused, unwanted, discarded or even as remainder or spare. Tanya and Kathy (1997) defines it as the left over or superfluous, as excess material or by – products, anything rejected or useless, worthless or unwanted. It has also been defined as any product or substance that has no further use or value for the person or organization that owns it, and which is, or will be discarded (waste management, 2006 in Caulfield, 2009).Although if thoroughly examined, waste can be redefined to be a potential reusable resource for others in that an item discarded by one party may be useful or of much value to another.

The Environmental Protection Authority (EPA, 2009) while re-examining waste standard terminology status of industries came up with varying definitions as it concerns various industries. It defined the solid waste generated by the glass fibre manufacturing industry as any discarded, rejected, abandoned, unwanted or surplus matter, whether or not intended for sale or for recycling, reprocessing, recovery or purification by a separate operation from that which produced the matter or anything declared by regulation (after consultation under section 5A) or by an environment protection policy to be waste, whether of value or not as defined in the EPA Act of 1993.Business dictionary evaluated and described waste in line with market value. It defined it as unwanted material left over from production process, or output which has no marketable value (businessdictionary.com, 2015)**.** It also further described waste as material discharged to, deposited in, or emitted to an environment in such amount or manner that causes a harmful change. Waste definition has been extended to processes or materials that does not (from viewpoint of the consumer) add value to a good or services and waste generation as quantity of materials or products that enter a waste stream before composting, incinerating, landfilling, or recycling. Essentially to this study, waste will be looked at in line with Tanya and Katty (1997)'s definition which is left over or superfluous, as excess material or by – products, anything rejected or useless, worthless or unwanted.as this is highly generated in textile. The above understanding creates forum for a simple definition of textile waste.

Textile waste therefore is textile material that is deemed unsuitable for its original purpose by the owner and is therefore unwanted and discarded. Textile waste can include fashion and textile industrial waste

created during fiber, and clothing production and consumer waste created during use and disposal. It has been reported that about 10 – 20% of all textiles in the fashion industry are estimated to be waste. About 15% of fabric intended for clothing ends up on the cutting room floor. To this fact, textile waste occupies nearly 5% of all landfill space (Textile Exchange, 2015). It is also reported that although textile products and consumer goods produce huge waste, about 95% of these wastes are recyclable (wastes2015.org), but out of which only 15% has been recycled.Fiber2fashon (2015) industrial report states that more than 1 million tons of textile are thrown away each year out of which 50 percent are recyclable. The fact that more than 50% of textile waste is recyclable means a huge opportunity for millions of job seekers. Waste from textile and clothing industries originates from the community through several means such as fibre, garment and shoe manufacturing industry, consumers, the commercial and service industries. The categorization by Tanya and Katty (1997) created a good ground for the in-depth study of textile waste in form of pre-consumer, post-consumer and post-producer or industrial textile waste.

Pre-consumer textile waste is manufacturing waste that has not reached the consumer. It is in fact a waste generated by textile retailers. According to Caulifield (2009) it is manufacturing waste that is generated by processing fibre, (natural or synthetic) and the production of finished yarn and textiles, technical textiles, non-woven garments and footwear, including cut-offs, selvages, shearing's, rejected materials and or B-grade garments. Fiber2fashion (2015) described pre-consumer waste as the by-product materials from the textile, fibre and cotton industries that are remanufactured for the automotive aeronautic, home building furniture mattress, coarse yarn, home furnishing, paper, apparel and other industries. Pre-textile waste is usually 'clean waste'. Most often pre-consumer waste is referred to as waste generated in the fashion supply chain before the textile reached the consumer. Technically, waste has been analyzed by some authors as an indication of inefficient design, production and consumption patterns (Steinbring and Rucker 2003, Agrawal, Barhanpurkar and Joshi, 2013, Textile Exchange, 2015). With this analogy, the following wastes emanate from pre-consumer waste that is of great importance to this study. Such are;

i) Textile swatch waste – is left over textile sample.
ii) Cut-and- saw textile waste – is textile scraps generated during garment manufacturing.
iii) End- of- roll textile waste- is factory surplus textile waste left over on the textile rolls from garment manufacturing.
iv) Sampling yardage waste- is factory surplus sample textile that have been left over from sample manufacturing.
v) Damaged textile waste- is unfinished textiles that have been left over from textile sampling manufacturing which has been damaged by either colour or print defects.
vi) Clothing sampling waste- is part-finished or finished clothing sample from the design and production of clothing which have not been worn by consumers.
vii) Finished clothing waste- is unsold finished clothing that has not yet been worn.

In Nigerian textile waste seem to be the major item in the landfill. This is due to the huge number of bales of second hand clothing that find their way into the country needless to say the wastes from our tailors' and seamstress's shops. Gwary and Zuwahu (2009), reported that visiting our tailor's shops one finds a lot of littered pieces of waste fabric of assorted patterns. They suggested that these waste fabrics can be converted into products like pillows

and pillow cases, duvet local rugs/foot mats, collage, puffs or bean bags.
This research will therefore involve mostly the recycling of pre-consumer textile wastes especially the textile scraps generated during garment manufacturing (cut and sew textile waste) to demonstrate innovative creativity for entrepreneurial sustainability in Nigeria.

Materials and Methods
The method used in carrying out this research is innovatively creative and experimental method which is highly explorative in an artist's studio. Conversion of textile waste to new products (recycling) is the major problem the entire textile, clothing and shoe industries are facing presently. It is a glowing feeling that lot has been done on this issue as almost 75 % of the pre-consumer textile waste that is generated is diverted from our landfills and recycled. Companies use methods like shoddy and mongoose for knitted and woven fabrics respectively to convert textile waste to new products. These are methods used to breakdown fabrics to fibre through cutting, shredding, carding and other mechanical processes.

Entrepreneurially, artistic creations can be done within the immediate environment through innovative means. Instead of reprocessing waste textiles into fibers, these wastes are selected, assembled and arranged into artistic objects or pieces using traditional methods or techniques. This study investigates this practical experiences of using innovative creative methods of translating cut off wastes from tailor's shops into artistic and household items through studio explorations and experimentations. The exploration and experimentation was achieved using textile technique of braiding / knotting, weaving, patchwork and crocheting or a combination of two or more of the techniques. These techniques were employed in making textile waste an essential sustainable products. The following basic working methods and materials were used in the execution of this projects.

Weaving
According to Colchester (1993) and Chetwynd (1975) in Alau, (2000), connotes the traditional technology of producing any web material, embracing fabric construction, matting and basketry. The dictionary of Thesaurus (2016) defines weaving as a means of forming (objects)bycombiningvariouselementsordet ailsintoaconnectedwhole.In the textile industry, weaving is one of the commonest, oldest and universal methods of fabric production through which man satisfies his needs of clothing, furnishing, and ritual expressions. According to Alau (2000), textile weaving provides fabrics for clothing and furnishing. It is the process of producing fabrics through the use of looms which may be hand, motorized or non-motorised looms on which warps and wefts are manipulated. This is achieved through interlacing them into webs. Weaving in this study was mainly out of loom practice.

Braiding
Braiding or plaiting involves twisting threads together into cloth. Knotting involves tying threads together and is used in making macramé. In braiding, various methods are used.

Crocheting
This involve interlacing loops of yarn, which are formed on a crochet hook, together in a line. The processes is different from knitting in that knitting has several active loops at one time, on the knitting needle waiting to interlock with another loop, while crocheting never has more than one active loop on the needle.

Patchwork
This technique involves sewing together small pieces of cloth in different designs, colours, or textures into one whole. This method was used mainly in the production of household items.

Tools and Materials for the study

A number of tools and materials are needed for effective execution of this study. The following are essential

a) Fabrics- For this study, scraps and cut-offs from tailoring shops makes up this item. This will be cut and joined together to form stripes for braiding.
b) Sewing Machine for joining the scraps together in long continuous chain.
c) Sewing thread – for holding the braids together to form shape.
d) Jude bag – This will be used for backing after stitching the work together.
e) Needles and thread - Used to pass yarn through the braids.
f) Scissors – For trimming off excess yarn and fabric and also for cutting scraps for joining.
g) Adhesives – This will be used to hold down the materials before stitching with needle and thread.
h) Dyes and dyeing accessories – This may come handy if there is need to add personal touch.
i) Acrylic yarn – handy for pile effects

Basic Working Method was used for artistic productions which are seen in form of textile sculpture, tapestry, mobiles, wall hanging and more. **Textile sculpture** is a technique of producing textile art in three dimensions which was described by Barbara Kasten in Waller 1977 in Udeani (2009) as a marriage of fiber and dimensionality. This technique is also referred to as the merging of voluminous forms of sculpture and tactile effects of textiles (Wallar in Udeani, 2009). **Tapestry** is a fabric consisting of a warp upon which colored threads are woven by hand to produce a design, often pictorial, used for wall hangings, furniture coverings, etc. **Mobile** is a hanging sculpture or decoration whose parts are balanced to move in response to air currents (Encarta, 2009)**.** Mobile executed using the tactile effects of textile is also referred to as textile mobile which most often are sculptural textiles. **Wall hanging** is a drapery or tapestry hung against the wall for decoration.

Result and Discussions

The experimentation and exploration into textile waste using creative innovative method resulted in many different artistic pieces as well as circular home items that can be sustained to make a respectable living. The artistic works are mostly decorative, laden with meanings while the household items are made with utmost consideration to comfort and usage. Artistic Results from Textile waste are in form of tapestry, mobiles, wall hanging and textile sculpture. Household items are in form of foot mat/local rug, floor mat, table mat, table cover, and more.

Some of the art pieces derived from textile waste include *A Cry for Help* (plate 9) (2006) which was created with yarn waste. The concept of this piece of work was derived from the head of a kola nut *"isinwaoji"* and the concentric circle *"okirikiri"* which are so important in Igbo belief system. The Marquette is a metal construction of "*okaraisinwaoji*" (half of kola nut head) and *"okirikiri"* (circle) covered with a network of weaves. The Marquette was constructed in a way to face every angle in a complete three dimensional form. The piece is highly symbolic which borders on global issues where hunger and starvation, natural deserter, economic and financial meltdown, war and peace deliberation is the other of the day. Generally, it is obvious that every part of the globe has one ill or the other and needs a special attention in its own way. In the mixed of social vices, insecurity and terrorism, Internal displacement of citizen are inevitable and we are all beckoned to response to this call. in Udeani, (2014), plates 1 and 4 were explored and extensively discussed.*"Where you Stop I Stop"* (plate 2) (2002) is a relief

soft sculpture executed with cut offs of plain, batik fabrics with jute material and cotton cords. This piece has to do with our self -actualization of our goals in life. How far do we push or encourage ourselves to make real our dreams? This piece tells us that life is a continuous series of endlessness just like elastic spring which tensile strength is its breaking point. The interwoven nature of life and the interdependence of every soul or everything that exist is depicted in *"Hang on, on me"* (plate 5) (2002). A mixed media work consisting of jute fabric, pieces of cotton and silver cords, pine cone, acrylic yarns, beads, copper wire and pigments. *"The new birth"* is all about the cyclic nature of life, death and reincarnation. Philosophically, one can say, "what goes around, comes around". It was achieved using braiding and weaving techniques. *"Unidentified knots"* (plate 6) (2002) stresses the fact that man is only but a face lift being as the thoughts of every man is but his own secret open to him alone and to whom he wishes to reveal himself to. Other works are "Trinity" and wall hanging created using crocheting and knotting techniques respectively. Both are decorative textiles.

The household items of plates 10a and b (patch work cushion), 11a and b (braided foot mat), 12*"mixed feelings"* (tapestry), 13a and b (center table mat), and 14 (flower vase) are works produced from cut and sew fabric waste. Plate 10 is a mixture of locally made Fulani fabric and industrially made fabric while the tapestry (plate 12) (2011) is a conglomeration of various Ankara fabrics and dyed jute material used in patch work formation to give the piece great enhancement. Patch work and braiding is the major technique used in the execution of the household products. The products are not limited to these or those suggested by Gwary and Zuwahu (2009) but encompasses a host of many ideas that a designer or artist can create.

Conclusion and Recommendation

Textile waste recycling is an ongoing project which is taking place all over the world to reduce the constant use of landfill and channel the waste into usefulness through reduce, reuse and recycle. Channelling textile waste to as many but not limited to the products mentioned in this paper will greatly contribute to this global project. Textile waste recycling encourages transition of used or discarded textiles into circular economy which is news presently in every parts of the world. Engaging in textile recycling and any other recycling means walking towards control of global warming which is a treat to our present world. Chemically recycling textile waste means creation of another waste as more chemicals are still involved. Therefore channelling the waste to the aforementioned and more may present at least a terminal relief.

Textile recycling is a sustainable entrepreneurial activity if well harnessed will create jobs for many unrestful youths especially those that are unemployed. The Internally Displaced People (IDP) recovering from the trauma of terrorist actions and other interested members of the society may find textile recycling as an escape route to creativity as it open up a new expressive medium as well as an outlet for self- expression. Engaging in recycling especially of textiles will relieve our land from being more polluted.

A. Art Piece from Cut-and-sew Fabric Waste



Plate 1: *Authority Symbol* (Relief Applique)



Plate 2: *Where You Stop I Stop*



Plate 3: The New Birth (Mixed Media)



Plate 4: *Royalty* (Mixed Media)

B. Art pieces From Textile Yarn Waste



Plate 5: *Hang On, On Me* (Braiding)



Plate 6: *Unidentified Knot* (Weaving, from Yarn waste)



Plate 7: *Trinity* (Crocheting)



Plate 8: Wall hanging (Knotting)



Plate 9: *A Cry for Help*
(Textile Sculpture: a combination of knotting and yarn networking)

A. Household Items from Cut and Sew Fabric Waste



Plate 10a: Patch Work Cushion Cover



Plate 10b: Detail of Plate 10 a



Plate 11a: Braided Foot Mat (Student's work)



Plate 12: *Mixed Feelings* (Tapestry)



Plate 13a: Centre Table Mat



Plate 13b: Detail of plate 13a



Plate 14: Flower Vase (Student's work)

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