

Waste Management by Small-Scale Textile Industries in Ghana

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Abstract: Batik and Tie-dye have become popular Ghanaian dyed fabrics which are worn to different occasions. The fabric comes with exquisite designs for a range of outfits including shirts, trousers, *boubous*, *agbada* as well as chair backs, table cloth, curtains, bed sheets and kitchen napkins. These fabrics have contributed to Ghana's economy in terms of foreign exchange. Not only has the production of these fabrics helped in boosting our economy but the colours, designs and styles speak volumes of our cultural heritage as a country. Batik and Tie-Dye fabrics are produced using various resist materials such as wax, starch, twines and chemical substances in the form of dye liquor. These materials, after use must be disposed of tactfully in order to prevent pollution of the environment. In Ghana are two vibrant dyeing Centres known as Vegus and Anointed Batik and Tie-Dye Centres. These Centres have produced unique fabrics to meet the high demands of Ghanaians and neighbouring countries like Togo and La Cote d'Ivoire. However, a cursory look at their waste management practices leaves much to be desired hence the need to conduct this research. The study employed the descriptive (qualitative) research and the purposive sampling technique with questionnaire, observation and interview as the research instruments. A major finding of the study is that most of the waste management methods being employed by the two Centres are not environmentally friendly. The study therefore recommends that a more befitting and environmentally friendly waste management method such as an incinerator and liquid segmentation method are adopted by the two Centres to forestall any harmful effect that their activities might have on the environment.

Keywords: Anointed, Environment, Batik, Waste Management, Textiles, Tie-dye and Vegus

1. Introduction

In Ghana, the increasing rate at which waste is generated in the cities is alarming. [1] The textile industries in Ghana are no exception. The various processes involved in the manufacture of fabrics create waste such as toxic chemicals, fabric, fibre, dye and oil wastes. The waste produced depends on the rate of fabric production. Commercially, textile waste generation is influenced by the production of textile goods, higher the production, the greater the amount of waste. [2]. According to [3], wet treatment processes such as dyeing, finishing and printing, are major sources of toxic emissions. [4] suggest that greenhouse emissions, water use, toxic chemicals and waste are the main environmental issues facing the textile industry.

A group of textile industries which is equally guilty of waste production and worth studying about are the fast developing

small-scale textile industries which are involved in the production of Batik and Tie-dye fabrics. Their activities are becoming rampant and ubiquitous in the country due to the high demand for such fabrics. Their production processes require the use of twines, raffia, wax, fabric, dyes, various corrosive chemicals and any local material that could help in design creation. [5] Opines that cloth dyeing has been confirmed to be a major cause of pollution because the dyes used contain some substances which are injurious to humans and their environment. According to the Director of Vegus Batik and Tie-dye Centre [6], there are two major categories of waste generated by the small scale textile industries in Ghana. These are liquid and solid waste. The liquid waste is the dye liquor (made up of dyes and chemicals) mostly used to dye fabrics. The solid wastes include fibres, fabric fragments, wax, remnants of twines, raffia, polyethylene bag, rubber tie and many others.

Waste management is one of the greatest challenges facing humanity in modern times. In spite of the numerous efforts by various governments all over the world to arrest it, technology has not been able to effectively control waste generated in communities worldwide. [7]. Waste management as a social problem has neither spared the developed nor developing nations as statistics have shown that some developed nations are seriously grappling with this bane [8]. According to [9] Waste management or Waste disposal is all the activities and actions required to manage waste from its inception to its final disposal. This includes amongst other things, collection, transport, treatment and disposal of waste together with monitoring and regulation.

Waste generation in the small-scale textile industries cannot be avoided so long as there is demand for local textiles. The waste can only be controlled and managed through innovative ways to prevent pollution of river bodies, contamination of food, choking of drainage systems and the destruction of fauna by the dyes and chemicals. A case in point is the recent reportage on social media in October 2017 which stated that a river in Koforidua near Nsukwao in the Eastern region of Ghana had allegedly turned bloody. There were a lot of outcries about this strange happening by residents and all well-meaning Ghanaians alike and some even read superstitious meanings into it. But it later came out that the river was polluted by red dyes from a nearby Batik Producing Centre. One could imagine the fear and chaos not to mention the health problems consumers of such water will be predisposed to. [10]

There are numerous Batik and Tie-Dye Centres in the Ho Municipality of Ghana. However, this study focuses on activities at Vegus and Anointed Batik Centres. A visit to the study areas in Ho reveal some bad sanitation practices which ought to be addressed if the Sustainable Development Goal 6 (SDG 6) is to be realized. The [11] reveals that the colour of a popular stream in Ho has changed to blue-black and the beauty of the environment had been destroyed due to the activities of Batik and Tie-Dye producers. According to the above source, the stream produces a rotten egg smell whenever liquid waste from batik, tie and dye producers are discharged into it. The GNA further revealed that, residents were forced to stay in-doors or leave their homes during the day and return home to sleep at night to avoid inhaling the unpleasant smell.

This study is therefore aimed at examining the sanitation practices of the two Batik Centres holistically, and to reveal any bad sanitation practices that may exist.

2. Methodology

This section of the study presents the research methods and instruments adopted to collect, collate, interpret and analyze data. It describes the systematic procedures employed by the researchers to synthesize data so as to arrive at a logical conclusion. This section is therefore subdivided into Research Design, Population of Study, Sampling Techniques and Data Collecting Instruments.

2.1. Research Design

The qualitative (descriptive) research approach was used for the study. This method was used extensively to collect and interpret data.

2.2. Brief Historical Overview of Study Areas

2.2.1. Vegus Batik and Tie-dye Centre

The impetus to establish Vegus Batik and Tie-dye Training Centre came after the realization of the presence of a high number of school drop-outs in our community and the need for vocational training for these unplaced youth from the primary and secondary education cycles. Realizing the contribution of small-scale enterprises as well as the needs of the young school leavers being trained in these set-ups and in order to provide relevant practical vocational training, Vegus Batik and Tie-Dye Centre was established in 1999. Since its inception, it has trained over 500 youth from all parts of the country, including students from the surrounding schools who also come for their Industrial attachment training. Presently, Vegus is located in Ho opposite the Pensioners Centre.

2.2.2. Anointed Batik and Tie-Dye Centre

Anointed Batik and Tie-Dye Centre was established some 25 years ago. This Centre was formally commissioned in August 1993 to train school drop-outs at the same time fulfil the fabric needs of Ho and its environs. The Centre which started with a staff strength of 7 has trained over 1000 of youths in Batik and Tie-Dyeing. Originally, the Centre was located at Fiave in Ho but due to some unforeseen circumstances, it had to be relocated to Akoefe. Currently, there are about 51 apprentices, 3 senior apprentices and 1 director.

2.3. Population of the Study

The Population of the study is made up of 45 workers of Vegas Batik Centre and 55 workers of Anointed Batik Centre. At Vegus, there are 42 apprentices, 2 senior apprentices and 1 director while at Anointed Batik Centre; there are 51 apprentices, 3 senior apprentices and 1 director. In all, the Population stands at 100 workers.

2.4. Sampling Techniques

Considering the nature of the study and limited resources, the researchers decided to use Purposive Sampling Technique. Purposive sampling (also known as judgment, selective or subjective sampling) is a sampling technique in which the researcher relies on his or her own judgment when choosing members of population to participate in the study.

Purposive sampling is a non-probability sampling method and it occurs when “elements selected for the sample are chosen by the judgment of the researcher. Researchers often believe that they can obtain a representative sample by using a sound judgement, which will result in saving time and money” [12].

Purposive Sample was therefore used to select 80 respondents for the study because the researchers consider them to be the best persons to give reliable information on the

topic under discussion.

2.5. Data Collecting Instruments

The Research Instruments used for the study include interview, questionnaire and observation. These instruments were used to collect and collate relevant primary data for the study.

2.5.1. Interview

Interview which is more or less an oral questionnaire was employed by the researchers to extract pertinent information from workers of the two study areas that could neither read nor write. It was observed by the researchers that a negligible number of the respondents (2.0% of 120 respondents) mostly apprentices who had factual information relevant to the study could neither read nor write. In view of this, the researchers adopted the oral approach to forestall any such occurrences of shallow data collection. This was done by preparing an interview guide which was interpreted in *Ewe* when the need arose. The questions centered on the historical background of the two Centres, work force, the products churned out at the Centres, raw materials used, production processes, finishing and waste disposal. This allowed the researchers to have a face-to-face interaction with resource persons and at the same time establish a rapport between them and the interviewee.

2.5.2. Observation

For a study such as this, the observational approach is indispensable. [13] Explains that certain types of information can best be obtained through direct observation. The researchers therefore adopted the participant observation method which enabled them to undertake on-the-spot observation of the production processes of Batik and Tie-Dye at the study areas. This tool was also used to obtain information concerning the possible destruction of the environment and pollution of water bodies. The observational approach was complemented by the use of electronic gadgets such as digital camera and mobile phone to record relevant information. Information gathered from the employment of this tool was very useful in drawing logical conclusions.

2.5.3. Questionnaire

The descriptive survey can best be carried out by administering questionnaires. A questionnaire allows the respondents adequate time to provide answers to questions asked. Therefore to obtain a more reliable data for the study, a 3-page well-structured questionnaire was designed and administered to (120) respondents. The questions bothered on their knowledge about materials used for dyeing, frequency of dyeing, the quantity of fabrics dyed per session, types of waste generated, ways of waste disposal by the particular batik centres and effects of improper waste disposal. The next section of the study will discuss and analyze the results obtained through the administration of questionnaires.

3. Results and Discussions

This part of the study presents the results and discussions of findings of the study. Data collected for the study were

analyzed statistically using pie charts, bar charts and tables. The analysis was based on the demographic description of respondents such as age, gender and educational level as well major responses to questions posed to respondents.

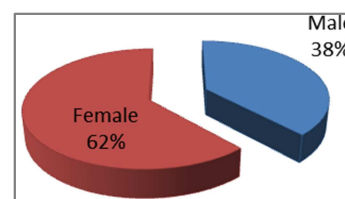
Demographic Description of Respondents

Table 1. Age Distribution.

Age range	Frequency	Percentage (%)
15-25	35	43.8
26-35	23	28.6
36-45	17	21.3
46 and above	5	6.3
Total	80	100

Source: Field Data February, 2018

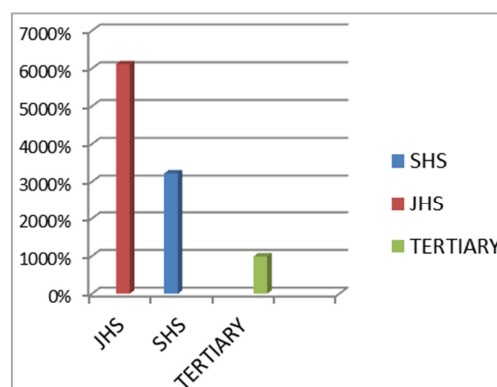
Table 1 above displays the age distribution of respondents. It is clear from the results that majority of respondents (43.8%) fell within the age range of (15-25 years). This is indicative of the high number of youth (school drop-outs) who are willing to learn a trade. Additionally, 23 respondents representing 28.6% of the sample population fell within the age range of 26-35 years. This adds up to the number of youth who are involved in commercial dyeing. However 5 respondents representing 6.3% of the sample population were within the middle age range. Only 17 respondents representing 21.3% of the sample population fell within the age range of (36-45).



Source: Field Data February, 2018

Figure 1. Gender Distribution.

The Pie Chart above presents the gender distribution of respondents. It is evident from the figure that most of the respondents (62%) are female while only 38% of the respondents are male. This is not surprising because most youth who take interest in learning Batik and Tie-dye trade are young girls and middle-aged women.



Source: Field Data February, 2018

Figure 2. Level of Education.

The Educational Level of respondents is illustrated in the figure above. In the figure, as many as 60% of the respondents are Junior High School leavers while 31% are Senior High School leavers but only 9% of the respondents attended a Tertiary Institution. The result points clearly to the fact that majority of the respondents who participated in the study are Junior High School and Senior High School leavers which falls within the youthful age.

Table 2. Testing respondents' level of proficiency in dyeing.

Responses	Frequency	Percentage (%)
Very High	16	20.0
High	62	77.5%
Low	0	0.00
Average	2	2.5
Total	80	100

Source: Field Data February, 2018

Table 2 above presents the results obtained after testing respondents' level of proficiency in dyeing. As per the results, most of the respondents (77.5%) have a high level of knowledge and competence in dyeing. Only 20% of the respondents have very high knowledge in dyeing while 2.5% of the respondents have average knowledge in dyeing. However, no respondent has low knowledge on the subject matter.

Table 3. Materials used for dyeing.

Responses	Frequency	Percentage (%)
Dyes, Hydros, Caustic Soda	17	21.3
Dyes, Hydros, Caustic Soda, Wax, Raffia	28	35.0
Dyes, Raffia, Wax	19	23.8

Table 5. Disposal of Solid Waste at both Centres.

Centre	Method of Disposal	Frequency	Percentage (%)
Vegus	Burning of solid waste, recycling	25	31.3
	Throwing of solid waste into dust bin (public waste disposal)	10	12.5
Anointed	Burning, public waste bin disposal,	32	40.0
	Burying of solid waste, recycling.	13	16.2
Total		80	100

Source: Field Data February, 2018

From table 5 it can be observed that the solid waste disposal method of both Vegus and Anointed Batik Centres have been assessed. The results reveal that at Vegus, 25 respondents representing 31.3% of the sample population stated that they dispose of their solid waste such as twine, fabric fragments, rubber band, raffia and twigs by burning while the wax is recycled by scooping from waste water. Additionally, 12.5%

Table 6. Disposal of Liquid Waste at both Centres.

Centre	Method of Disposal	Frequency	Percentage (%)
Vegus	Pouring of liquid waste into man-hole, recycling	20	25.0
	Pouring of liquid waste on the ground.	15	18.8
Anointed	Disposal into septic tank, disposal into a polytank	28	35.0
	Recycling of dye	17	21.2
Total		80	100

Source: Field Data February, 2018

Responses	Frequency	Percentage (%)
Raffia, Rubber Band,	10	12.5
Hydros, Caustic Soda, twine	6	7.4
Total	80	100

Source: Field Data February, 2018

The table above displays the results obtained after quizzing respondents to mention the materials they use for dyeing. Thirty-five percent (35%) of the respondents mentioned dyes, hydros, caustic soda, wax and raffia while 23.8% mentioned dyes, raffia and wax. 21.3% of the respondents mentioned dyes, hydros and caustic soda. Meanwhile 12.5% of the respondents listed raffia and rubber band. Also, 7.4% of the respondents mentioned hydros, caustic soda and twine.

Table 4. Frequency of Dyeing at Venus and Anointed.

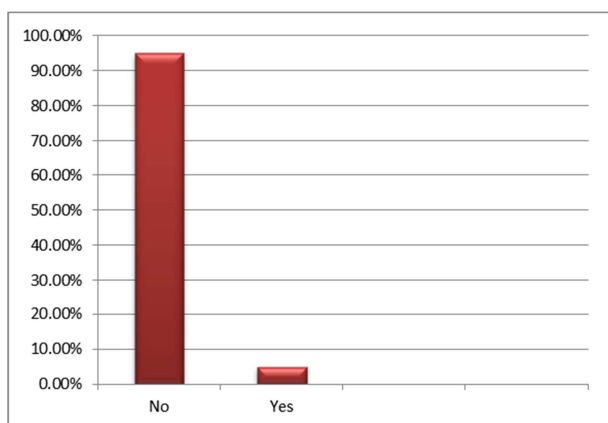
Centre	Time	Frequency	Percentage (%)
Vegus	Weekly	35	43.8
Anointed	Daily	45	56.2%
Total		80	100

Source: Field Data February, 2018

Table 4 above presents the test results obtained after quizzing respondents on how frequently they do dyeing. At Vegus Batik Centre, all the 35 respondents which provided answers to the questionnaire stated that they do dyeing on weekly basis. They however intimated that this is dependent on the availability of raw materials. At Anointed Batik Centre, 45 respondents representing 56.2% of the sample population stated that they do dyeing on daily basis.

of the respondents from Vegus revealed that they throw the solid waste into public bin. At Anointed Batik Centre, 32 respondents representing 40% of the sample population also mentioned burning and public waste bin disposal as methods they adopt in managing solid waste. Meanwhile, 13 of the 45 respondents who answered the questionnaire at Anointed mentioned burying and recycling of solid waste.

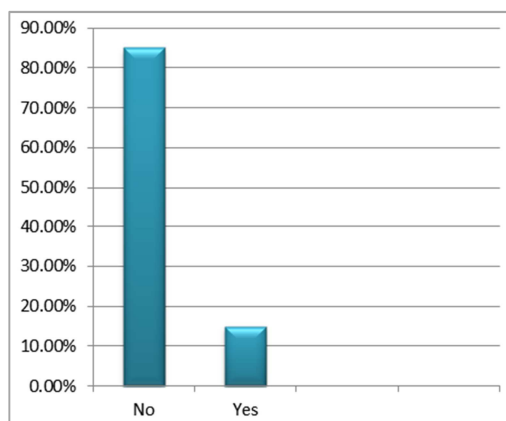
Table 6 above provides a statistical overview of waste management techniques adopted at both Vegus and Anointed Batik Centres to manage liquid waste. In all, 80 respondents answered the question on liquid waste disposal. 20 respondents from Vegus stated that they dispose of their liquid waste by pouring into a man-hole as well as re-use of dye liquor when the need arises. Additionally, 15 of the 35 respondents at Vegus Batik Centre mentioned that they pour the waste water onto the ground. However at Anointed Batik Centre, as many as 28 of the 45 respondents revealed that they dispose of their liquid waste into a septic tank or poly tank which is emptied by Zoom Lion from time to time. Furthermore, 17 respondents at Anointed stated that they re-use their dye liquor as a way of savings.



Source: Field Data February, 2018

Figure 3. Measuring the Satisfaction and Dissatisfaction Levels of the Methods of Waste Disposal at Vegus.

Figure 3 above presents the results obtained after questioning respondents at Vegus Batik Centre about the satisfaction and dissatisfaction of the methods they adopt in disposing of their solid and liquid wastes. The result as shown in the figure indicates that 95% of the respondents at Vegus are not satisfied with the methods they use at their outfit to dispose of waste. On the contrary, 5% of the respondents appear to be satisfied with the methods.



Source: Field Data February, 2018

Figure 4. Measuring the Satisfaction and Dissatisfaction Levels of the Methods of Waste Disposal at Anointed.

From figure 4 above, presents the results obtained after questioning respondents at Anointed Batik Centre about the satisfaction and dissatisfaction of the methods they adopt in disposing of their solid and liquid wastes. The result as shown in the figure indicates that 85% of the respondents at Anointed are not satisfied with the methods they use at their outfit to dispose of waste. However, 15% of the respondents appear to be satisfied with the methods.

Table 7. Proposed Methods of Waste Disposal by Respondents.

Centre	Method	Frequency	Percentage (%)
Vegus	Incinerator	22	27.5
	Sewer system	13	16.2
Anointed	Waste water treatment plant	39	48.8
	Gutter	6	7.5
Total		80	100

Source: Field Data February, 2018

In table 7 above, the views of respondents at both Centres regarding better and proper ways of waste disposal of textiles waste have been collated. At Vegus Batik Centre, 22 respondents representing 27.5% of the sample population suggested an incinerator while 13 of the respondents representing 16.2% of the sample population suggested sewer system. At Anointed Batik Centre however, as many as 39 respondents representing 48.8% of the sample population suggested that a waste treatment plant be procured for them. Meanwhile only 6 of them suggested that a gutter is constructed for them to dispose of liquid waste.

4. Summary of Findings

For the purpose of clarity, the following findings of the study have been summarized:

1. Most of the respondents who participated in the study are female.
2. The educational level of most of the respondents is pegged at JHS and SHS.
3. Majority of respondents, who constituted the population of the study, belong to the youthful age.
4. Dyeing is more regular at Anointed Batik Centre than Vegus.
5. Both Centres have devised some ways of waste disposal.
6. Some of the waste disposal methods adopted by the two Centres are not environmentally friendly.

Most workers at both Centres are not very satisfied with the waste disposal methods their outfit employs and have called for newer and more environmentally friendly methods to be adopted.

5. Conclusion and Recommendations

Tie-dye and batik production are resist methods of dyeing in which certain portions of a fabric are prevented from absorbing dye liquor through knotting, binding, folding or sewing and application of molten wax onto the fabric while the open areas of

the fabric readily absorb dye. These crafts have been practised from very early times by people in many parts of the world. [14] The resist materials used basically include: starch, wax, raffia, twine, rubber band or any other material that can resist dye. The resisted areas which are commonly known as positive areas create interesting patterns throughout the fabric. To colour the fabric, different types of synthetic dyes such as Vat dyes, Reactives, Disperse, Azoic and Acetate dyes may be employed. To ensure good fastness and solubility of these dyes, they are mixed with the necessary chemicals which form the dye liquor. It is this solubilized dye liquor that has affinity to dye the fabric. As a matter of fact, the liquor contains chemicals that are very toxic and corrosive. This was confirmed by [15] when they opined that Caustic Soda and Sodium Hydrosulphite are potentially carcinogenic and allergenic to humans and that they also cause environmental pollution which contributes to the depletion of the eco-system when disposed of indiscriminately.

Maximum care and tactfulness are therefore required to dispose of such a chemical solution. Aside this liquid effluent, the solid left-overs such as the waxes, twigs, twines and fabric fragments must also be properly disposed of in order to prevent the pollution of the immediate environment which may lead to the outbreak of diseases. This study which was conducted to unearth the waste management practices of the two study areas has come out with some very interesting findings as above (in 5.0) and based on the findings, it can be concluded that the waste disposal methods being practised at Vegus and Anointed Batik Centres leave much to be desired. The methods have the tendency to pollute the environment and water bodies. This study is therefore recommending that a more befitting and environmentally friendly waste management method or methods be adopted by the two Centres to forestall any harmful effect that their activities might have on the environment. In view of this, the researchers who conducted this study are in talks with the Mechanical Engineering Department of Ho Technical University to design and manufacture a waste disposal machine or device for the two Centres which will provide a dual service of managing both solid and liquid wastes. Funds will be sought for through a proposal in that respect.

References

- [1] Kyere R., Addaney M. & Akudu J. A., (2019). Decentralization and Solid Waste Management in Urbanizing Ghana: Moving beyond the Staus Quo, IntechOpen Ltd.
- [2] Bhattacharjee A. (2018). Waste Management in Textiles Industry, Fibre 2 Fashion.com, West Bengal Serampor.
- [3] Gustav S. & Greg P. (2018). Environmental impact of Textile Reuse and Recycling-A Review, Journal of Cleaner Production, Elsevier.
- [4] Allwood, J. M., Laursen, S. E., de Rodríguez, C. M., Bocken, N. M. P., (2006). Well Dressed?the Present and Future Sustainability of Clothing and Textiles in the United Kingdom. University of Cambridge, Institute for Manufacturing, Cambridge, UK.B.
- [5] Katz, M. I. (1981). "Can making art be hazardous to your health", Art News, Vol. 80 No. 4, pp. 68-76.
- [6] Attah (personal communication, June 13 2018).
- [7] Adu-Boahen, K., Atampugre, G., Antwi, K. B., Osman, A., Osei, K. N., Mensah, E. A. and Adu-Boahen, A. O. (2014). "Waste management practices in Ghana: challenges and prospect, Jukwa Central Region", International Journal of Development and Sustainability, Vol. 3 No. 3, pp. 530-546.
- [8] Chazan, D. (2002), "A World drowning in litter", BBC. Retrieved from full text data base", available.
- [9] Wikipedia.org/wiki/Waste management, accessed 8th July 2018.
- [10] Nsromamedia.com (2017), <https://www.shadibna/shoieleshin/impact-pf-textiles-sector-on-environment/>, accessed 2nd June 2018.
- [11] Ghana News Agency (2013), "Batik tie and dye industry destroying the HO environment", available at: www.ghananewsagency.org/science/-batik-tie-and-dye-industry-d-destroying-the-ho-environment-55963 (accessed 7 July 2018).
- [12] Dudovskiy J. (2018). the Ultimate Guide to Writing Dissertation in Business Studies: A Step by Step Assistance, Research Methodology.
- [13] Best J. W (1981). Research in Education, Prentice Hall, Inc, Englewood, New Jersey, p. 106.
- [14] Gbadegbe R. S., Vigbedor D., Quashie M. & Asemro B. (2019). The Decline of Tie-Dye and Batik Centres in the Ho Municipality of Ghana, American Journal of Art and Design, pp 1.
- [15] Howard E. K., Frimpong C. & Kanyire S. R (2019). *Risk assessment of attitudes and practices of students and practitioners toward studio dyeing in Ghana*, Research Journal on Textiles and Apparel.