UNIVERSITY OF CAPE COAST

QUALITY FEATURES OF LOCAL AND FOREIGN-MADE PRINTED FABRICS

CHRISTIANA DORA BANNERMAN MENSAH

2021

UNIVERSITY OF CAPE COAST

QUALITY FEATURES OF LOCAL AND FOREIGN-MADE PRINTED FABRICS

BY

CHRISTIANA DORA BANNERMAN MENSAH

Thesis submitted to the Department of Vocational and Technical Education of the Faculty of Science and Technology Education, College of Education Studies, University of Cape Coast, in partial fulfillment of the requirements for the award of Master of Philosophy degree in Home Economics

DECEMBER 2021

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is as a result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: .... Date............................

Name: Christiana Dora Bannerman Mensah

Supervisors' Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's Signature: .... Date.............................

Name: Ms. Doreen Tetteh Cofie

ABSTRACT

In examining the purchasing habits of Ghanaians regarding foreign fabrics, it often seems that these materials are viewed as being of higher quality than those made locally. The research sought to evaluate the performance characteristics of three local and three foreign wax cotton printed fabrics. The properties of these fabrics were compared against the standards established by the Ghana Standards Authority (GSA) to identify which type of fabric shows better quality. The criteria evaluated included weight, yarn count, colourfastness, breaking strength, and dimensional stability, using experimental methods for assessment. For selecting sample specimens for this research, both stratified and simple random sampling techniques were employed. An analysis of the data was carried out utilizing version 25 of the Statistical Package for Social Sciences (SPSS), wherein an independent samples t-test was applied to evaluate the significant differences between the two types of fabric.

The findings indicated that there were no notable differences in the features examined, and all the textiles studied met the wax print standards established by the Ghana Standards Authority for the characteristics analysed. However, ATL, Printex, and Sanhe did not pass the strength test in the weft direction. Notably, Printex was the only fabric to pass the weft yarn count test, while the others did not. Thus, it can be concluded that foreign fabrics excel in terms of fabric weight, yarn count, and colourfastness, whereas local fabrics are superior in tensile strength and dimensional stability. This investigation should be expanded to include more textiles and parameters to better assess fabric compliance with specified standards for particular end-uses.

KEYWORDS

Quality

Dimensional stability

Colourfastness

Tensile strength

Yarn count

ACKNOWLEDGEMENTS

The success of this work can be attributed to the grace of God Almighty and the encouragement of numerous individuals. Foremost, I want to convey my heartfelt gratitude to God for the strength and wisdom granted to me. I am also deeply grateful to my supervisor, Ms. Doreen Tetteh Cofie, for her exceptional guidance. Her steadfast dedication to meticulously reviewing every aspect of this literature has been instrumental in achieving this significant goal. She helped me, and for that I am grateful. Additionally, I extend my gratitude to the staff of the Textile Department at the Ghana Standards Board, as well as to all my friends, who have served as a continuous source of motivation throughout my research. I also wish to acknowledge the unwavering support from the C.D.B Mensah and Associates family during this journey.

DEDICATION

To the Christ Divine Blood Missionaries.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

ATL	Akosombo Textile Limited
GTP	Ghana Textile Printing
GSA	Ghana Standards Authority
ISO	International Organisation for Standardization

CHAPTER ONE

INTRODUCTION

According to Bhatnagar (2012), everyone should be familiar with textiles because they have a significant impact on our daily lives. Textiles of various varieties have been used for covering or modesty, warmth, personal ornament, displaying personal riches, and even biomedical and technical functions for a long time. Food, shelter, and clothing are among the basic requirements of everyone, according to Sayed (2013). The usage of textiles improves the comfort and attractiveness of our homes and apparel.

According to Kadolph, (as cited in Hallik 2015) the textile industry is extremely competitive and to stand out there must be something special about the products. He proposed that, given the importance of quality as a benchmark in the textile industry, it is essential for companies to uphold product quality to thrive in a fiercely competitive environment. According to Ozo, Egele, and Udu (2018), a quality firm meets the majority of consumers' needs the majority of the time. However, according to Kotler (as stated in Ozo, Egele, and Udu, 2018), it is critical to distinguish between conformity and performance quality. Conformance quality refers to how well a product adheres to specified specifications, whereas performance quality refers to how well it meets the needs of consumers.

According to Palash (2013), there are several quality metrics in various forms of fabric, as well as numerous flaws in various types of fabric that affect the fabric's quality. If high-quality printed fabric is to be produced, he added, quality testing is an integral aspect of quality management. As a result, laboratory testing is beneficial to textile mills, producers, exporters, and retailers in ensuring that their products match their quality standards as well as the criteria of their target markets.

Every textile product and its use must be tested according to government requirements as well as voluntary, industry-driven standards that represent the company's goal for quality for a variety of reasons. Previous research on the subjective quality of textiles was conducted, with just one on the objective quality. It is now necessary to assess the standards of these textiles in terms of whether they possess or lack the required intrinsic attributes. The goal of this work is to compare and contrast the quality standards of locally made textile print (ATL, GTP, and Printex) and foreign textile prints (Hitarget, Sanhe, and Hollantex) concerning grammage, yarn count, colourfastness to crocking, colourfastness to staining, dimensional stability and tensile strength by testing, using the Ghana Standards Authority specification as the standard.

Background to the Study

Textile fabric in the form of fashion is among the three basic needs of man, from historical evidence, it has been found that prehistoric people knew how to weave over 3000 years ago. According to Ghuznavi (2017), the historical context of Fabric or "textile" is from the Latin word "texere" meaning "to weave". Fabric is traditionally sourced from the natural world through raw materials such as fibre and coloured with substances like insects, plants and minerals. Generally, yarns are created by processing fibres, while many fabrics can be created by converting fibres directly. He goes on to say that the length, strength, and kind of the textile's fundamental fibres influence the textile's overall worth.

Fibres are a contributing component to fabric performance, according to Kadolph (2010), and they also influence production, aesthetics, durability, comfort, appearance retention, and care. Fabric qualities, according to Obiana (2011), are those aspects of a textile that determine its ease and performance during use. These two widely accepted phenomena are affected by many attributes which can also be assessed either subjectively or by an objective measurement. Fabrics meant for fashion clothes must also meet properties such as durability, strength, colour fastness, aesthetics, and so on, according to Venkatraman (2015). These characteristics are required for the daily use and upkeep of fashion clothes.

Fashola, Giwa and Orivri (2012) further established that the way fabric performs is based on the mixture of intrinsic fibre possessions as well as upon the geometrical preparation of fibres which vary greatly according to the construction of the fabrics and the types of fibres used and other factors introduced by weaving. Physical structure, chemical structure, and molecular organization are the key determinants of fibre qualities, according to Nilsson and Lindstam (2012). They concluded that elements such as hand and performance, as well as the procedures utilized, the fabric's appearance and functionality throughout use and care, are influenced by the type of yarn and its structure.

According to Nilsson and Lindstam (2012), quality can be used to gauge excellence or indicate whether something is manufactured without errors, defects, or significant variances. Quality, in their opinion, is attained by strict adherence to predetermined guidelines that create product uniformity and satisfy particular customer needs. Quality was also defined by Diaz (2014) as conformity to specifications. That is the extent to which a product satisfies all of a customer's expectations and adheres to design guidelines. He goes on to say that products are developed and regulated in accordance with widely accepted normative standards, ensuring that they can demonstrate compliance with the specified requirements during an examination by a regulatory authority.

For Glock and Kunz (2005), quality is regarded as the essential characteristic of an entity, denoting excellence, a distinctive or inherent attribute, refinement, or a perceived degree of worth. It is understood that quality represents an intrinsic value that is manifested in various objects, including products. Kadolph (as cited in Hallik 2015) suggests that “product quality is presented by the total of a set of precise and measurable characteristics or components of a finished product”. Given this, quality can thus be defined as a distinguishing characteristic, an attribute by which a product ought to be identified. The specific attributes perceived as features of quality should be integrated into a product, reflecting the preferences of the customers. Glock and Kunz (2005) proposed a broad definition of quality that may be broken down into three subcategories: intrinsic, extrinsic, and perceived attributes. According to them, intrinsic quality is formed throughout the creation and manufacture of a product, which is influenced by materials, methods, and processes. Extrinsic quality refers to everything that surrounds a product, including the brand, store, price, merchandising, marketing, and retailer response. The internal and extrinsic quality are combined to provide perceived quality. Hu (2008) distinguished between perceived and functional quality in his study. Perceived quality, in his opinion, enhances the corporate image, generates curiosity, and leads to purchase. The supplier, on the other hand, is responsible for functional quality, which includes make, size, and performance.

According to Hu (2008), the term "standard" is frequently used in product testing. It can be ambiguous to him at times because it can refer to the actual test techniques or the minimal acceptable level of performance on a specific test. He goes on to say that any testing on a product must be done using standard test techniques that allow every conceivable variable inside the test method to be accurately controlled. This is because reproducibility must be guaranteed at all times. Kadolph (as cited in Hallik, 2015) also added that specifications serve to delineate the resources, methodologies, parameters, and efficiency of a said product. They are essential for material procurement, detailing the nature and features of the products, their required quality standards, and anticipated outcomes. It could be deduced that standards and specifications aim at achieving the same goal.

Fabric testing has recently shifted from subjective to objective assessment methodologies, according to Hu (2008). He goes on to say that the objective fabric dimension of mechanical, geometrical, surface, and big deformation properties is a very effective instrument for fabric industrial, finishing, and improving quality control. Ghosh and Mal, (2019) also added that textile testing is an essential procedure within the textile industry, ensuring that products undergo systematic evaluation prior to their release into the market. Without testing, the processes of quality control and assurance lose their significance. A robust testing framework is crucial for preventing many defective materials from being overlooked before they are identified. Stakeholders in the global textile industry agree that fast, automated, and accurate product testing using cutting-edge technology tools is imperative given the increasing levels of globalisation and competition.

Made in Ghana wax print fabric according to Adikorley (2013) is an overall term used by Ghanaians to comprise wax-published fabrics inspired by batik making that are woven, and printed in Ghana using resins, dyes, and wax processes to achieve a distinctive indigenous design. Made in Ghana fabrics are historically made from cotton, silk, and rayon, and are produced by both traditional producers and modern fabric enterprises, according to her. These fabrics, among other things, depict Ghanaian identity, interests, art, and history. Wax and Java Prints, often referred to as 'Mummy Cloth' or African Prints in Ghana, are cotton fabrics produced through machine printing. These fabrics are characterized by their vibrant colours, thematic designs, intricate patterns, and distinctive names., according to Bayuko and Peligah (2014). These characteristics distinguish the fabrics in both Ghanaian and foreign populations, making them easily recognisable.

Dosi, Pavit and Soete (as cited in Obiana 2011) noted that the existence of original designs from Hong Kong, and Batiks from Indonesia could adversely affect the local products. To them, these foreign products exhibit superior quality regarding colour retention and longevity. For Olugbemisola & Kalilu (2013), wax-printed cloths inspired by the Indonesian art of batik are technologically produced following a resist-dye system. Wax and dye are used in both procedures to create designs on cotton textiles. They have a major communicative value, displaying wealth or prestige and delivering messages as a kind of non-verbal communication. Imported wax print textiles from other Western countries are known as foreign wax print fabrics.

According to Jurkowitsch and Sarlay (2010), colour fading has been a major problem threatening the choice of Ghana wax print fabrics. According to Corbman (as mentioned in Obiana 2011), the attractiveness of a fabric's colour is of little price to the user unless the dyes are regarded fast under the conditions in which it will be utilized. He asserts that the colour must withstand various challenges, including washing, ironing, steaming, perspiration, exposure to intense light, and dry cleaning. Kwame (2012) confirmed that, despite their attractiveness and durability, most Ghanaian printed cotton fabrics deteriorate in colour and strength faster over time because of poor washing ethos and how the fabrics are cared for.

Egu (2009) indicates that observers of the textile industry, including the Ministry of Trade and Industry, contend that the significant decline of the textile sector in Ghana can be linked to the trade liberalization policy. They believe that this liberalization has resulted in a surge of textile imports from China and other nations. These imported textiles are generally more affordable than those manufactured in Ghana, thereby creating insurmountable competition for local producers. Again, Sutton and Kpentey (2012), noted that the significant expenses associated with inputs and the competition posed by imported garments, including second-hand clothing, represent the primary challenges facing the textiles industry. Additionally, the surge of imported textiles, which often encroach upon local brands, is a substantial issue, while restricted access to financing remains a critical obstacle for domestic enterprises.

The textile printing sector in Ghana has undergone significant transformation. What was once a thriving industry is now perceived as virtually non-existent (Quartey 2006). Due to this, the Ghanaian government is making concerted efforts for Ghanaians to patronize made-in-Ghana goods including fabrics. Thus, according to the Ghana News Agency (Nov. 12, 2004), the government introduced the "National Friday Wear Programme," an initiative designed to promote a distinct Ghanaian identity by encouraging the widespread adoption of local fabrics and designs in business attire. The President's Special Initiative, the Ministry of Trade and Industry, and the business sector encourage public servants and workers in the private sector to wear locally designed clothing manufactured from materials that are produced domestically on Fridays. Tsekpo (2020) further noted that successive governments have implemented various strategies to address the situation; however, these efforts have not yielded favourable results. One of these strategies involved designating the Takoradi port as the sole entry point for foreign textiles into Ghana.

Nevertheless, these measures have not alleviated or resolved the issue at hand. The challenges encountered by the country have resulted in the downfall of several textile printing companies. The primary threats include the influx of inexpensive textiles from Asia, particularly from China, and the increasing availability of used and second-hand clothing within the Ghanaian market (Quartey, 2006; Sarpong, Howard & Osei-Ntiri, 2011). Egu (2009) has identified that these issues stem not only from internal constraints but also from various external factors affecting the entire operational spectrum of the factories, from raw material procurement to sales. According to Tsekpo (2020), the significant obstacles facing the local textile industry include a lack of documentation, insufficient policy frameworks, a lack of commitment, and unfavourable governmental policies. The 1980s foreign exchange shortages limited the subsector's ability to acquire raw materials, causing it to operate at a minimum capacity. To make matters worse, quantitative trade restrictions were discouraged by the trade liberalisation policies of the Structural Adjustment Programs (SAP) of the 1990s.

It can be inferred from the works of Quatey (2006), Egu (2009), Sarpong, Howard, and Osei-Ntiri (2011), as well as Tsekpo (2020), that several factors have contributed to the decline of local textile factories in Ghana, resulting in significant unemployment. These include the influx of foreign textiles, the industry's high volume of imports compared to low exports, the affordability of foreign prints in comparison to local alternatives, the ubiquity of illicit trade or textile smuggling, the replication of local print designs, the lack of a policy framework for Ghanaian textile production, the lack of funding for the textile sector, insufficient capital investment in the textile sub-sector, and a lack of cooperation between relevant institutions and industry stakeholders. Additionally, Sarpong, Howard, and Osei-Ntiri (2011) highlighted that the influx of low-cost clothing and textiles from Asian markets, the importation of used clothing from Europe and America, a lack of financial resources, knowledge, and essential skills, as well as low and unstable income, are the major challenges faced by Ghanaian fashion producers.

In their research, Daddah, Dogbey, Osei, and Dedume (2015) identified that the primary reason for the selection of specific wax prints for various ceremonial events is the communicative aspect of fashion. They observed that consumers tend to favour high-status and relatively more expensive wax prints for occasions such as outdooring and weddings while opting for lower-status and less costly prints for funerals.

Similarly, Chichi, Howard, and Baines (2016) conducted a related study and found that consumer preferences for printed fabrics have evolved in response to the dynamic nature of contemporary fashion trends and consumer demands. Key factors influencing these preferences include brand reputation, quality, colour schemes, pattern dimensions and arrangements, as well as the symbolism, cultural significance, and versatility of print designs across different fashion styles. Therefore, the knowledge of how a fabric will perform during its life as it undergoes washing, drying, exposure to sun; and exposure to detergent will help the consumer, when choosing clothing to choose rightly according to intended end use. It will also help the consumer take proper care of her garments, save money that would have been used to replace easily worn-out garments due to improper care give the consumer the satisfaction he desires from her money's worth and finally help in the family's financial management. Also, proper care helps to extend the length of service of the garment to users. The most important thing consumers put into consideration when buying and taking care of fabric is how best to reduce or eliminate fading from occurring.

Statement of the Problem

The researcher observed that special concerns have emerged about the quality performance of wax print fabric bought from our Ghanaian market. There were lots of complaints from friends, relatives and even from personal experience, on how disappointed they felt on a wax print fabric bought and sewn and only on a first or subsequent wash, losing the aesthetic appeal that made them purchase it in the first place. This observation about the relatively poor quality of wax print fabrics in the market affects consumers in diverse ways. Most Ghanaian women spend a lot of money on clothing because the ones they buy do not last, they fade after some time and they would have to replace them. Below are pictures of dresses made from wax print fabric which deteriorated after the first wash by the researcher.

Original fabrics **Dresses after washing**

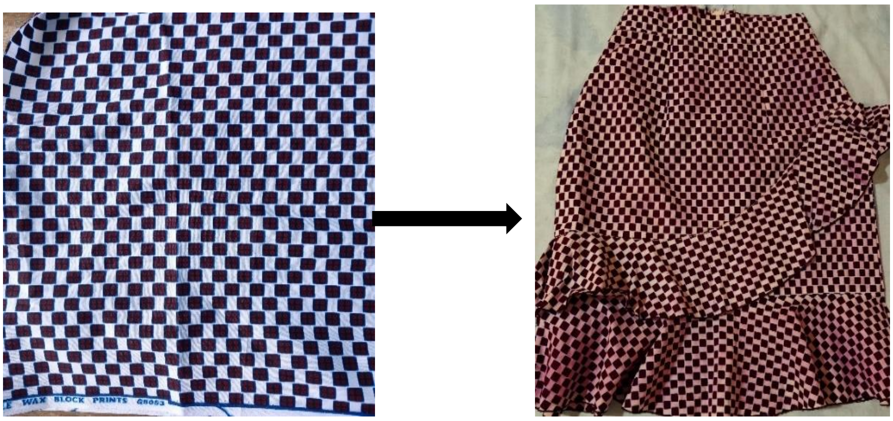


Figure 1: Discoloured skirt made from wax print fabric

Figure 2: Faded dress made from wax print fabric

Figure 3: Faded skirt made from wax print fabric

Following the introduction of the Trade Liberalization Policy, the local textile industry faced a lot of competition from imported brands (Quartey, 2006). Not much awareness has been given to the consequence of this competition on the quality of these textile fabrics produced by the local industry and also that of the imported brands. According to a subjective survey (Akorli & Opoku, 2009), the two most vital reasons for Ghanaian shoppers' choice of foreign items are greater quality and consumer taste. Foreign-made products are seen as having superior quality and value than domestic brands. In comparison to foreign goods, Ozo, Egele, and Udu (2018) found that customers' perceptions and attitudes toward domestic items were often negative or unfavourable. Due to these differences in perception and attitude, consumers tend to favour and purchase a greater quantity of imported goods, attributing a favourable image to products manufactured abroad.

Conversely, Quartey and Abor (2011) discovered that a majority of consumers favour textiles produced domestically rather than those imported, with over fifty percent of individuals who prefer locally made fabrics asserting that these textiles are of superior quality. According to Aboagyewaa-Ntiri and

Mintah (2016), if locally manufactured textiles and prints are favoured over foreign imported ones, demand for local products should increase, sustaining the sector. Due to these contradictory views, the researcher saw the need to test these fabrics to find out which of them was of good quality. This is aimed at finding lasting solutions to the above-stated problems with the view of guiding consumers in the wise print fabric selection. It will also help them to know better how to take proper care of their clothing. It will again create more consumer satisfaction from performance end use and provide lasting peace in family clothing financial management.

Purpose of the Study

The reason for the investigation is to compare and contrast the quality features of locally made textile prints (ATL, GTP and Printex) with foreign prints (Hitarget, Sanhe, Hollantex) with regards to grammage, yarn count, colourfastness to crocking, colourfastness to staining, dimensional stability and tensile strength using Ghana Standards Authority specification as the standard and the degree to which these textile fabrics meet national textile quality standards.

Research Objectives

The aims of the study are as follows:

General Objective: The objective of this study is to analyse and compare the quality standards of locally made textile prints (ATL, GTP and Printex) with foreign prints (Hitarget, Sanhe and Hollantex) with regards to grammage, yarn count, colourfastness to crocking, colourfastness to staining, dimensional stability and tensile strength using Ghana Standards Authority specification as the standard.

Specific objectives: The study aims to achieve specific objectives which include:

1. compare the grammage of locally made and foreign-made printed fabrics as per the standard authority's specification.
2. assess and compare the yarn count of locally-made and foreign-made printed fabrics as per the standard authority's specification.
3. test and compare the colourfastness of locally-made and foreign-made printed fabrics as per the standard authority's specification.
4. examine the dimensional change between locally-made and foreign-made printed fabrics as per the standard authority's specification.
5. assess and compare the tensile strength of locally-made and foreign-made printed fabrics as per the standard authority's specification.

Hypotheses

H_0: There is no significant difference in the quality features of local and foreign-made textile prints as per the standards authority's specifications.

1. H_1: There would be differences in the quality features of local and foreign-made textile prints as per the standards authority's specifications.

Significance of the Study

Fabric is valued not only for its appearance but also for its serviceability and end-use performance. These criteria are influenced by several complex properties such as washability, handle, dimensional stability, and tensile strength. All of these are amongst the properties that determine the performance quality and ease of care of a fabric. This research will be of help to the following people in the following ways.

It will help the consumer to know which of the fabrics on the market is of good quality in terms of performance. It will also better educate and remind consumers on how to adequately care for their garments so that they will last longer. This will boost their satisfaction with the garment. It will also assist Ghanaian producers in identifying their strengths and weaknesses in terms of product quality. This will aid in identifying the specific aspects of their product that need enhancement in order to satisfy customer demands and maintain a competitive edge both locally and internationally, ensuring their continued relevance in the market.

Given that the Ministry of Trade and Industry oversees trade and policy matters for all commercial activities in Ghana, this research will hold significant value for the Ministry. It will play a crucial role in helping them reformulate strategies aimed at increasing the market share of Ghana's textile sector. Ultimately, the study will enrich It will be used as a starting point for subsequent research into textile-related topics. It will also act as a repository of information for students, academics, and lecturers.

Delimitation of the Study

The choice of study will cover printed fabrics from Akosombo Textile Limited (ATL), Ghana Textile Print (GTP), Printex, Hitarget, Sanhe, and Hollantex. Grammage, yarn count, colourfastness, dimensional stability and strength of fabrics would be tested, using Ghana Standards Authority Specification as the standard.

Limitations of the Study

Among the many locally and foreign-made textile fabrics, the study is narrowed to fabrics from three local manufacturing companies and three foreign companies. This may affect the likelihood of generalizing the outcome for the entire textile cotton prints. Again, the study would be narrowed to five performance indicators of textile fabrics. That is to say, how well a fabric performs could be deliberated concerning a lot of indicators, but the research work focuses on just five. This may limit the judgement on the performance of the fabrics as they go through tests to just the five measures. The acquisition of additional fabrics and the necessary testing were limited by constraints related to time and financial resources.

CHAPTER TWO

LITERATURE REVIEW

This section analyses similar literature on the empirical and theoretical studies which are fundamental to the research work. The analysis comprises fibre, fabrics, properties or performance, fabrics classification, construction and finishes, the concept of quality and quality standards, quality characteristics or parameters of woven fabrics, influences touching making and sales of textiles, and a summary of review of related literature.

Fibre, Fabrics, Properties/ Performance

Textiles and materials are ubiquitous in our environment, and their applications are often quite apparent. Everybody expects a shirt to be made from fabric. Fibres are used for rope, cording, and fishing lines. Clothing, food and shelter are the basic needs of everyone. Textile Science and Care (2012) goes on to say that textiles are so vital in our daily lives that everyone should be aware of them. People have utilized textiles of various forms for covering or modesty, warmth, personal decoration, displaying personal riches, and even for biomedical and technical purposes from the beginning of time.

Weber (as cited in Obiana 2011) defined fibre as the basic unit from which fabric is made. He stated that a fibre for use in fabric should have four essential properties, that is, a fibre must be fairly strong or it is worthless, the fibre must be pliable or able to bend without breaking otherwise it cannot be warped into a yarn and then woven or knitted into fabric, the fibre must have some elasticity, or ability to stretch and return to shape and the fibre must be long enough to be able to be spun into yarn. He highlighted that gaining knowledge about fibers and fabrics offers numerous advantages to the consumer. According to Textile Science and Care (2012), textile fibres are visible fundamental units from which fabrics are made and they differ in size, colour, texture, source and many other properties. Some are long & others are short, some are scaly and some have crimp.

Brooks (2012) defines fibre as any substance made up of a thread-like tissue that may be spun or woven, whether it comes from an animal, a vegetable, or a mineral. According to Nonyelum (2017), fibres are the fundamental hair-like components of raw materials employed in the manufacturing of yarns and textiles. It is the tiniest unit of a textile product that can be seen. Fibre is a "pliable" hair-like strand with an extremely small diameter in comparison to its length, according to them. Fibers serve as the fundamental components of textile yarns and ultimately contribute to the formation of fabric. Fibres are thus the fundamental components and basic units, and they are a necessary component in the production of yarns.

The end use of any fabric, whether for garments or home decorating and décor, is firm by the value of the fabric in terms of strength and durability (Marshal, Jackson and Stanly 2000). Okewole and Akanbi (2003) defined fabric as the actual material woven from a variety of yarns. According to Muscato (2019), textile production relies heavily on fibres, but it's crucial to note that not all fibres are suitable for use in textiles. Textile fibres have qualities that allow them to be spun into yarn or turned into fabric directly. This implies they must be strong enough to maintain their shape, flexible enough to be moulded into a fabric or yarn, elastic enough to stretch, and long-lasting.

Fabric attributes refer to the features of fabric that determine its comfort and performance while in use, such as strength, drape, and so on. The performance of fabrics is influenced by their qualities and properties, as noted by Weber (cited in Obiana 2011). The behaviour of textiles during use is contingent upon the utilization of the fibres, the process of transforming those fibres into fabric, and the treatments given to the final product. Weber further stated that the characteristics of cloth are the distinguishing features that differentiate one textile from the other. Key considerations include the type of construction, texture, hand feel, and weight. Venkatraman (2015) defines a fabric property as an essential attribute of a material that enables its satisfactory use in a specific application. In essence, this can be understood as the requirement for a particular textile material to fulfil a designated function.

As noted by Anyakoha and Eluwa (2010), cellulose-based fibres are primarily derived from wood pulp and cotton linters, requiring minimal chemical processing. Notable examples of these fibers include rayon, acetate, and triacetate. In contrast, nylon and polyester represent fabrics produced from non-cellulose fibres, which originate from molecules obtained from petroleum, natural gas, air, and water. Morton and Hearle (as referenced in Obiana, 2011) emphasize that the length of individual fibres significantly influences the characteristics of each individual fibre. They assert that yarns crafted from longer fibres exhibit greater smoothness and durability compared to those made from shorter fibres. Furthermore, they indicate that both silk and synthetic fibres are produced as continuous fine filaments rather than short strands.

Natural and synthetic fibres fall into these two main types (Nemr, 2012). Mineral, vegetable, and animal fibres are examples of natural fibres that come from living things. In contrast, synthetic fibres are produced from cellulosic and non-cellulosic polymers. Additionally, fibres can also be created from mineral sources, metals, and rubber. The characteristics of fibres, for example, their length, measurement, density, cross-sectional shape, yarn crimp, strength, and elongation, significantly affect the performance of the resulting fabrics. Fabric handles, along with surface and mechanical qualities, are essential variables impacting the quality of fabric and clothes, according to Sun (2018). The physical attributes and performance characteristics of clothing influence its quality. Rice and Brown (as cited in Sun 2018).

Fabric hand, as defined by Bicerano (2018), is a term used in the textile business to describe the quality of fabric as determined by the response to touch. The characteristics of elasticity (ranging from pliable to stiff), compressibility (from soft to hard), extensibility (stretchable versus non-stretchable), resilience (from springy to limp), density (compact to open), surface contour (rough to smooth), surface friction (harsh to slippery), and thermal properties (cool to warm) all perform a vital role in determining the hand of the fabric, as noted by the author. According to Jintu, Yu, and Hunter (2004), the performance of textile fabrics is assessed based on their functional attributes, which include strength, mechanical properties, and surface characteristics. Among the various fabric qualities that can be analyzed are dimensional stability (shrinkage or stretch), resistance strength, and physical mass per unit area (weight).

Fabrics Classification, Construction and Finishes

According to Obiana (2011), textiles can be grouped according to their bases or origins. For example, fibres produced from organic materials like plants, animals, and minerals, are known as natural fibres and others that result from scientific experimentation and development of manufactured fibres are man-made fibre or synthetic fibres. Fibres can also be classified by their generic names such as cotton, wool, nylon, rayon and polyester. Vegetable fibres, such as cotton, flax, and ramie, are made from plants. Animal fibres, such as wool, silk, and others, are obtained from animals. These are made of protein. The wool comes from sheep, and silk is spun by silkworms. Other animal hair fibres include cashmere, camel mohair etc.

Nkeonye (as cited in Obiana 2011) explained that the cotton plant is a shrub that reaches a height ranging from 1 to 6 meters and is indigenous to many sub-tropical countries. He further explained that it is one of the most useful and versatile of fibre and it is used for an extensive diversity of fabrics for both dress and home finishing. Wax print fabrics are made of 100 % cotton fibres. Ashraf (2014) indicated that cotton is a tender and furry staple fibre that grows in a cover around the seeds of cotton plants belonging to the family "Gossypium". He noted cotton is strong, absorbent, comfortable to wear, and washable. However, he observed that cotton wrinkles easily and can shrink, is easily attacked by mildew and is inflammable. He finally stated that special finishes can be applied to cotton fabric for wrinkle resistance, shrinkage control, mildew resistance and flame retardance.

According to Textile Science and Care (2012), Cotton is a seed hair derived from the pod of the cotton plant that belongs to a malvaceous family and class Gossypium. Cotton fibre is considered to possess medium strength, with its tenacity varying between 3.0 and 5.0 grams per denier. A distinctive characteristic of cotton is its enhanced strength when it is wet. According to Ashraf (2014), cotton is classified as a moderately strong fibre, exhibiting a tenacity range of 3.0 to 4.9 grams per denier, with its strength being influenced by moisture regain and fibre length. Cotton fibres maintain stability, exhibiting neither shrinkage nor stretching due to their unicellular structure. Nonetheless, fabrics may experience shrinkage as a result of tensions encountered during the manufacturing process. To mitigate shrinkage during usage, pre-treatment is necessary.

Since every fibre and fabric has desirable and unwanted properties, substances must be put into fabrics to improve their appearance. Finishes, according to Weber (as described in Obiana 2011), are compounds added to cloths to improve their texture, appearance and performance. According to Haque (2014), finishing refers to the process of transforming woven or knitted fabrics into a functional material. More specifically, it encompasses any techniques applied after the dyeing of yarn or fabric, aimed at enhancing the appearance, performance, or tactile quality of the final textile or garment.

Fabric finishes, as noted by Anyakoha and Eluwa (2010), refer to the various treatments applied to fabrics during their production process to enhance their properties in multiple ways. They identified several key finishes, including lustre or sheen finishes, easy-care treatments, shrink-resistant finishes, water-repellent finishes, waterproofing treatments, and flame-resistant finishes. Furthermore, Iheaturu, Aharanwa, Chike, Ezeamaku, Nnorom, and Chima (2019) describe finishing as encompassing both chemical and mechanical processes applied to fibres, yarns, or fabrics to improve their appearance, texture, or overall performance. They concur that finishes are utilized to mitigate undesirable characteristics while enhancing favourable ones.

Concept of quality and quality standards

According to Primentas (2001), quality control techniques and textile quality assessment have grown in relevance and are crucial for manufacturers and customers alike. He added that several consumers with much knowledge of textiles have firm demands on specific performance behaviour and longer-life textile goods, in addition to the numerous advances in technology, have made a better understanding of other properties of fibres, yarns and fabrics.

Quality is described by Rahman, Bara, Chowdhury, and Khan (2009) as the level of acceptance of goods or services. The assessment of product quality in the textile and clothing industry is based on various factors, including the quality and standards of fibres, yarns, fabric construction, colourfastness, patterns, and the final products produced. Fabric quality is determined by its physical properties as well as its performance characteristics. The fibre content of a fabric has an impact on its overall qualities. Understanding the fabric's components and quality can help you get the best performance out of that product. Testing is the only way to have a complete understanding of the elements that lead to enhanced fabric performance (Algulakshmi, Subhathra, Vanitha 2020).

Elshaer (2012) observed that although the word "quality" is frequently employed by academics and practitioners alike, there is no one definition of the term that is recognised by everyone since different people have different ideas about what quality is and how it applies to different situations. Quality has been characterized in numerous ways, including as excellence (Tuchman, 1980), value (Feigenbaum, 1951), adherence to specifications (Shewhart, 1931; Levitt, 1972), compliance with requirements (Crosby, 1979), suitability for use (Juran, 1974; 1988), desirable product attributes (Leffler, 1982), avoidance of loss (Taguchi, 1987), and fulfilment of customer expectations (Ryall and Kruithof, 2001; ISO 9000, 2005). He emphasized that a universally accepted definition of quality is lacking for several reasons. For instance, broad definitions can be challenging to implement effectively, particularly in terms of meeting expectations and achieving excellence. Conversely, narrower definitions, such as adherence to specifications and loss avoidance, fail to fully encompass the depth and intricacy of the idea (Reeves and Bednar, 1995).

According to Das and Hunter (2015), quality is characterized as the capacity to meet, and ideally surpass, customer expectations while maintaining a competitive cost in the marketplace. Quality, they believe, is the backbone of any garment manufacturing, exporting, or trading organization, with a quality pipeline process and product being critical for the timely delivery of items to wow the customer and obtain future orders. As a result, testing is a critical component of quality assurance and management.

Garvin's framework for assessing quality is widely recognized (Garvin, 1984). He delineates five complementary methods for defining quality: the transcendental approach, the product-oriented approach, the user-oriented approach, the manufacturing-oriented approach, and the value-oriented approach. Garvin asserts that these five concepts emerged independently across various disciplines, including philosophy, economics, marketing, operations management, and finance. Each method encapsulates a unique facet of quality; however, none offers a complete perspective when considered in isolation. To achieve a holistic understanding of quality, it is essential to consider all five approaches collectively, but this study focused on three.

The definition of a product-based approach is articulated as follows: Garvin (1984) posits that this approach emphasizes quantifiable attributes rather than individual preferences. He identifies eight criteria or "dimensions" through which consumers assess product quality, including performance, characteristics, reliability, adherence to standards, durability, functionality, aesthetic appeal, and perceived value. These criteria encompass both objective and subjective elements. Claessens (2018) further asserts that the product-based approach regards quality as a specific and quantifiable measure. Differences in the amount of a specific component or feature present in a product are blamed for variations in quality. The general value of a good is thus determined by the quantity of its components or attributes.

In the context of the production-based approach, often known as the "manufacturing approach" (Garvin, 1984), quality is described as "conformance to requirements." Anything differing from the criteria established by the user adversely affects the quality within this framework. The production-oriented approach, in contrast to the user-oriented approach, does not take into account individual perceptions. Instead, this method aims to evaluate impartially how well a good or service satisfies predetermined standards. Claessens (2018) agreed with Garvin, noting that while the user-oriented approach to quality emphasizes the subjectivity of consumer preferences, the production-oriented approach, as indicated by its name, focuses on internal factors, when products are created and manufactured to meet specific requirements.

The value-based approach, as articulated by Garvin (1984), assesses superiority by analysing the relationship between costs and benefits: a product or service is deemed more valuable when its advantages significantly exceed its costs. The quality of offerings is thus gauged by their perceived value. Consequently, a product or service that performs exceptionally well may not necessarily convey the greatest value and, therefore, may not represent the highest quality. Claessens (2018) further elaborated that this approach interprets quality through the lens of pricing. He posits that a consumer's perception of value is a cognitive evaluation that balances the price paid against the perceived quality or benefits received.

As stated by Kavitha (2013), a quality standard is a documented procedure designed to regulate work processes, ensuring a high level of excellence (quality). The extent of control inherent in the standard is fundamental to its selection for achieving that desired quality level. The American Society for Quality (2021) further defines standard quality as documentation that outlines criteria, requirements, regulations, or characteristics that can be reliably employed to assess the suitability of materials, products, processes, and services for their intended purposes. They assert that standards equip organizations with a cohesive vision, understanding, procedures, and language necessary to meet the expectations of their stakeholders. Furthermore, standards offer a consistent and authoritative framework for businesses and clients globally, facilitating effective communication and transactions by providing precise definitions and terminology.

Nilsson and Lindstam (2012) assert that a quality standard serves as a fundamental tool in the processes of product development, preparation, and manufacturing within a company. They argue that this standard embodies the inherent quality level of the organization, and the primary purpose of setting excellence criteria is to maintain uniformity among products and across different batches of the same item, thereby preventing significant variations.

Standardization is characterized as the structuring of essential principles for enterprises aiming to enhance their competitiveness in the international market. Variation in the market as a result of growing economic integration, increased competitiveness, and global specialisation has made it vital that business be conducted according to particular norms. Although it is simple to compare prices nowadays, judging the quality of a product is considerably more difficult. Today, as in other areas of production, all testing and evaluations in the manufacturing of textile products, from the fibre to the finished product, are carried out by standards that have previously been established in these fields.

According to Atilgan (2007), standards in the textile industry can be classified as test and inspection standards, standards related to terms, definitions, categories, degrees, and standards applied to processes and products, such as fibres, threads, cloths, dyeing, finishing, and finished product performance, organizational standards related to company functions and their relationships, and standards related to customer health, security, and privacy. A textile company should employ intra-company standards, business standards, and national and international standards, and undertake controls based on those standards to assure excellent output. While acknowledging that quality may be viewed from a variety of views, the focus of this thesis was on the product's perspectives.

Quality characteristics/parameters of woven fabrics

Dimensional Stability

The evaluation of the dimensional characteristics of textile fabrics holds significant importance and is typically conducted by customers prior to purchase. Commonly assessed attributes include length, width, thickness, and shrinkage of the fabrics. As noted by Babu (2019), dimensional stability relates to the capacity of a cloth to retain its original dimensions or shape during its intended applications, such as dyeing, finishing, washing, or other processes. Following any finishing treatment, alterations in the fabric's length and width are observed. Thus, in conclusion, "the changes resulted in fabric dimensions (length and width) after finishing expressed in the term of percentage is called dimensional stability of the fabric". It exhibits a robust determination in both the warp direction (length) and the weft direction (width) independently.

Nilsson and Lindstam (2012) assert that tension, along with its intensity, plays a crucial role in influencing dimensional stability. They further explain that tensions arise when yarns are maintained in a stretched state and when the fabric is subjected to moisture, leading to potential dimensional alterations in the fabric. The extent of these dimensional changes during the relaxation process is influenced by the type of weave, considering both the warp and weft, as well as the overall shrinkage. Fabrics with a high thread count or that are extremely compact are more stable. Dimensional stability is highly influenced by parameters such as yarn count and construction, kind of material, yarn twist, weave, and grams per square meter, according to Babu (2019).

Fabric density, according to Venkatraman (2015), has a significant impact on performance; for example, a large number of fabric counts has good dimensional stability, but a low fabric count has low stability, resulting in shrinking. Babu (2019) also stated that the fabric's construction has a significant impact on its dimensional stability. The following example demonstrates the effect of the construction: Assume you have two textiles, A and B. The GSM, warp count, weft count, yarn material, and threads per square inch are all the same in both textiles. Fabric A exhibits a greater number of ends per inch compared to Fabric B; however, it has a lesser number of picks per inch. Consequently, Fabric A is expected to experience less shrinkage at the weft side (width-wise) than Fabric B, while it will undergo greater shrinkage in the warp direction than Fabric B.

A fabric's dimensional stability is one of its most important features. When applied over a substrate, a fabric's measured dimensional stability determines if it can recall its initial shape and continue stable, indicating that it will not bubble or droop with time, as well as its suitability for a certain usage (Kiron 2014). The dimensional stability of a fabric, as described by Ghosh and Mal (2019), refers to its ability to maintain its original dimensions (length and width). It is generally advantageous for textiles to exhibit high dimensional stability. A reduction in size is referred to as shrinkage, whereas an increase in size is termed growth. Several factors contribute to the shrinkage of textiles when apparels are being produced and laundered, including the relaxation of fibres or yarns, fibre swelling, and felting.

According to Wikipedia (2020), shrinkage is a change in fabric dimensions throughout the length and width after washing, usage, and when subjected to the relaxing of materials. There are two forms of shrinking. One is negative shrinkage, whereas the other is plus shrinkage. Along with shrinkage, skew (twisting of the vertical grains) is noticed. Non-conformity is sometimes defined as abnormal twisting. According to Wikipedia (2020), the type and percentage of fibres are determined by their composition and content. Synthetic fibres shrink more than natural fibres. Because of their crystalline and thermoplastic structure, synthetic fibres are more stable. Natural fibres, on the other hand, are more prone to shrinking due to greater amorphous sections in their fibre structure that allow for more water absorption.

The dimensional stability of a fabric, as noted by Kiron (2015), refers to its ability to maintain its original dimensions following the manufacturing process. An important factor that influences this stability is shrinkage, which poses a challenge to the fabric's overall dimensional integrity. According to Babu (2019), the type of material employed in the fabric has an impact on the fabric's dimensional stability to some extent. The yarn will have superior dimensional stability if it is spun with fine and long staple fibres. Polyester fibre has superior dimensional stability than cotton fibre. The weight of fabric per square meter significantly affects the percentage of shrinkage observed after washing. Fabrics with a lower weight per meter tend to experience greater shrinkage compared to those with a higher weight. This phenomenon occurs because low-weight fabrics contain more open space, or air space, which allows the ends and picks to draw closer together during the washing process. Such closeness is achievable only when the fabric possesses this open space.

Colourfastness

A coloured textile may interact with various agents throughout its lifespan, leading to potential fading or bleeding of colour onto adjacent uncoloured or lightly coloured items (Nayak and Padhye, 2015). The authors indicate that this colour loss occurs due to the migration of loosely bound dye molecules from the fibre. During laundering, other materials may become stained as a result of this colour loss, which is affected by the ratio of coloured to uncoloured items, the fibre composition of other fabrics, and the conditions of use. Ghosh and Mal (2019) further elucidate the concept of colour fastness, which refers to the extent to which a textile is prone to colour alteration or fading under specific treatments. Textiles are often enhanced with colours through dyeing or printing to elevate their visual appeal. Nevertheless, these added colours may diminish due to various environmental influences, including abrasion, exposure to light, seawater, chlorine, and water.

According to Deshwal and Khambra (2006), the level of colour bleeding in dyed cotton textiles can be a result of either the inorganic qualities of the soap (such as sodium hydroxide and calcium hydroxide) or the fabric's qualities (such as yarn thickness, weight, and thread counts). According to Kiron (2014), colourfastness is a feature of a dye or print that allows it to maintain its depth and shade across the product's wear life. Wear and use, washing, exposure to sunlight, bleaching agents, perspiration, and other factors can all affect the colour of a textile product. Consumers wash their fabrics at some point during their lifetime. Changes in colour or staining of the washed article are normally seen instantly which influences consumer decisions.

Edegbe (2014) identified that a coloured item may interact with various agents throughout its lifespan, any of which could lead to the fading of its colour or the transfer of colour onto an adjacent uncoloured or light-coloured item. These factors vary based on the intended use of the product. Outstanding colour retention refers to a material that exhibits minimal to no colour fading due to different cleaning techniques and environmental conditions, while the opposite is true for those that do. In addition to the alteration in the textile's colour, evaluating color staining is crucial, as textiles frequently come into contact with one another, particularly during activities such as rubbing, washing, and dry cleaning. Nonetheless, the evaluations of fabrics mentioned above are primarily qualitative. As a result, two sets of standard grey scales are used to quantitatively assess colour fading and discolouration in textiles: the "grey scale for colour change or fading" and the "grey scale for colour staining" (Kuramoto, Yoshihisa, Kitaguchi, and Sato, 2017). To enhance the objectivity of the results, Kiron (2021) further noted that staining and colour variations are quantitatively evaluated by comparing the changes to two different sets of standard grey scales, one set for staining and the other for colour change.

According to McCafferty (2022), greyscale testing is a method of evaluating the colourfastness of materials subjected to accelerated weathering conditions. The outcomes of this testing yield a Greyscale score or rating, which reflects the degree of alteration in the material's appearance. This rating is significant not only for comparing colourfastness but also because a dependable colourfastness can signify other important attributes of the material. The greyscale for change is utilized in the evaluation of colour alterations in fastness tests, as specified in ISO 105-A02, while the greyscale for staining assesses the extent of staining on adjacent undyed fabrics during fastness tests, as detailed in ISO 105-A03.

McCafferty (2022) noted that the greyscale serves as a method for assessing the loss of colour in a sample by assigning a half-step rating that ranges from 5 (indicating no visual change) to 1 (indicating significant visual change). This scale is composed of pairs of grey colour swatches, where one swatch remains a consistent shade of grey while the other swatch becomes progressively lighter. Each pair demonstrates the shading difference between a control sample and a test sample, with the various pairs corresponding to the half-step ratings of 5, 4-5, 4, 3-4, 3, 2-3, 2, 1-2, and 1. Consequently, the

Greyscale ratings establish a grading system for colourfastness. This system allows for nine potential values between 1 and 5. In evaluating colour change, the difference between treated and untreated fabrics is analysed in relation to the contrast of the grey pairs corresponding to each rating under standardized conditions. A textile categorized as grade 5 if no observable colour change occurs. Conversely, if a colour change occurs because of the treatment, the difference which occurs between the treated and untreated textiles is compared to the contrast of the grey pairs on the scale, resulting in an assigned grade. A grade of 5 indicates no colour change, while a grade of 1 signifies a severe colour change.

During the course of treatments, handling, or usage, the dye from a textile may transfer and cause staining on other textiles. The phenomenon of colour staining is quantitatively evaluated through a specific set of grey scales referred to as the 'greyscale for staining'. In this evaluation process, a multi-fibre white woven fabric, composed of six distinct fibres, is stitched to the textile and subsequently subjected to treatment. The stained fibres of the multi-fibre fabric are then compared to the untreated fibres of a white multi-fibre fabric to assess colour staining, utilizing a grey scale. Similar to the grey scale used for colour change, the grey scale for discolouration also comprises five pairs of grades.

Grade number 5 consists of two indistinguishable white materials, while grade number 1 features a white material alongside a grey one, creating the highest level of contrast. Samples numbered 4, 3, and 2 each contain a combination of grey and white materials, representing intermediate levels of contrast that gradually increase between the extremes of grade 5 and 1. For the evaluation of colour staining, the contrast between the white and stained fabrics is assessed in relation to the grey and white pair associated with each sample number on the grey scale under standardized conditions. A grade of 5 is assigned when there is no staining present. Conversely, if the white fabric exhibits staining due to colour migration from the textile, the contrast between the white and stained fabrics are compared to the grey scale of the white and grey pair, resulting in a corresponding grade. A grade of 5 indicates no discolouration, while a grade of 1 signifies severe staining.

During the assessment of colour fading and staining, D-65 lighting is employed to facilitate the comparison of colour contrast between treated and untreated fabrics in relation to the grey scales. The specimen is positioned on a flat, uniform surface against a grey background. The plane of the specimen is set at a 45° angle to the horizontal. The original and tested specimens, or undyed and stained adjacent fabrics, are arranged side by side in the same plane and oriented in the same direction throughout the evaluation process.

Colourfastness to Rubbing/Crocking

In the assessment of colourfastness to rubbing or crocking, Edegbe (2014) indicated that the extent of colour transfer from one dyed textile to another through rubbing is evaluated. A textile exhibiting inadequate colour fastness will easily release its dye onto other fabrics, resulting in staining. This evaluation is conducted using a Crockmeter. The test sample, which is the coloured fabric, is fastened to the Crockmeter's platform and given 10 rubs with a weighted finger that is wrapped in a conventional white cotton impression cloth. Usually, two separate tests are carried out, one using a moist rubbing cloth and the other a dry one. In the grey scale of colour staining, the variations between the rubbed cloths and the untreated fabric are compared to a pair of white and grey, and a grade is then given. A higher grade indicates superior colour fastness.

According to Babu (2019), the amount of colour moved from the superficial of dyed or printed textile material to another surface by rubbing is called the rubbing fastness of the textile material. In the test of colour fastness to rubbing, under-regulated settings, the test specimen is rubbed with a white crock test cloth. By comparing the quantity of colour transferred to the white crock test fabric to the greyscale, the amount of colour transferred to the white crock test cloth is determined.

Colour Fastness to Washing

This colour fastness evaluation examines both the fading of colour in the dyed textile and the transfer of colour to other fabrics during laundering, as outlined in ISO 105-C06 2010. To begin, a multi-fibre fabric is sewn onto the test specimen. The laundering process is conducted using a Launder-Ometer machine, which features closed stainless-steel canisters that rotate within a water bath. Various parameters, including washing temperature and duration, can be precisely controlled. The composite sample, consisting of the test specimen and the multi-fibre fabric, along with the appropriate detergent solution and stainless-steel balls, is enclosed within the canister, and the water bath is heated to the specified temperature.

Stainless steel spheres are utilized to agitate the water, simulating the action of hand or machine washing. After a predetermined duration, the sample is removed from the Launder-Ometer, rinsed with water, and allowed to dry in a shaded area. The washed fabric is then compared to the stained multi-fibre fabric using grey scales to assess colour fading and staining, respectively, and appropriate grades are assigned. A higher grade for both the coloured and multi-fibre fabrics post-washing signifies superior colour fastness properties. Conversely, a lower grade indicates inadequate dye fixation, necessitating measures to enhance the fixation of dyes and pigments.

The colour of a textile may sometimes fade and transfer stains to other fabrics that are in close contact, not necessarily as a result of the washing process, but simply due to exposure to water. To evaluate the degree of colour fading and potential cross-discoloration that can occur when garments are subjected to moisture, a test for colour fastness to water is performed (ISO 105-E01 2013; Saville 1999). For instance, consider a lightweight, water-resistant jacket featuring a red brand logo on the chest. Such jackets are typically worn as outerwear during light rain. If the jacket is worn in the rain and then folded while still damp without being dried promptly, the logo may transfer onto adjacent areas of the jacket. Over time, this could lead to the logo being completely removed from the chest area and appearing on other sections of the garment. This issue arises from the inadequate colour fastness to water of the logo's dye.

In this examination, a composite sample is created by combining a coloured textile with a multi-fibre fabric through stitching. The composite sample is saturated with refined water at ambient temperature. Subsequently, the wet sample is positioned in a per-spirometer equipped with an accurate mechanical weight and subjected to a controlled temperature and duration in an oven. After this process, the sample is removed from the per-spirometer, dehydrated, and assessed for colour fading and staining on the neighbouring multi-fibre fabric using grey scales.

Fabric strength

According to Edegbe (2014), the second most important property of all textile textiles is strength. All fibres must have this characteristic to be useful. The strength must be sufficient for spinning into a yarn and then weaving into a cloth. Fibre strength varies, and strength within a fibre is not always consistent. As a result, he defined a fibre's strength as its ability to endure stress, which is measured in grams per denier. Venkatraman (2015) added that performance is significantly impacted by fabric density; for example, a high fabric count provides reasonable strength. A strong fibre is durable, has better tear strength and resists sagging and pilling. The strength of a fabric is a crucial characteristic that determines its longevity. There are three primary types of fabric strength: tensile strength, tearing strength, and bursting strength (Kothari 1999).

Edegbe (2014) notes that the ductile asset test is employed to evaluate the breaking strength and elongation of textile fabrics when a load is applied along either the length or width of the material. He further explains that the tensile strength of a fabric is characterized by its 'breaking load' and 'breaking elongation.' The term 'breaking load' refers to the maximum force that causes the fabric to rupture, while 'breaking elongation' is defined as the percentage ratio of the fabric's extension at the point of breakage to its original length. Conversely, Babu (2019) describes fabric tensile strength as the amount of stretching force (load) that initiates the fabric's failure under tension.

In their investigation, Malik, Hussain, and Ali (2009) found that increasing the fabric count in one direction or both directions increases the tensile strength of the fabric in both directions. However, the relationship between fabric counts and tensile strength is not strictly linear. The better the yarn strength is transferred into fabric strength, the higher the fabric count. Synthetic fabrics have a higher tensile strength than natural materials, according to Babu (2019). Fabrics made from fine and long-staple fibres exhibit superior tensile strength compared to those made from coarse and short-staple fibres. When two fabrics possess identical warp and weft counts, the fabric with a higher thread density per square inch will demonstrate enhanced tensile strength. A study conducted by Cano-Glu, Geultelin, and Yeukselo-Glu (2004) revealed that after five wash cycles, the stretchy force values of fabrics in both the weft and warp directions decreased, with a significant reduction observed in the weft direction.

Factors Affecting Production and Sales of Textiles

Following the mandatory removal of protectionist measures, known as Trade Liberalization, in the early 1980s, Ghana's textile industry experienced significant decline. Since that time, there has been a lack of targeted government policies or public investments that could have supported the textile sector (Hoefter, 2001). As noted by Howard (2013), several critical factors impact textile production globally. Among the main elements influencing this industry are outdated capital stock, trade liberalization, the influx of imported Second-Hand Clothing (SHC), and textiles.

Hoefter (2001) indicates that the productivity and output capacity of Ghana's textile sector is only 50% of that of China. The outdated machinery has hindered producers from achieving economies of scale and producing the large volumes necessary for export, leading to an inability to compete with imported fabrics due to high prices. Korley (2011) concurs that Ghana's textile industries are inadequately equipped to effectively compete with global rivals. Asare (2012) identifies the elevated costs of inputs and limited access to capital for workers in the textile sector as the main factors contributing to the decline of the industry in Ghana. Furthermore, Tsekpo (2020) notes that the industry has become uncompetitive due to high borrowing costs and the absence of long-term funding to support textile production.

Egu (2009) indicates that observers of the textile sector, including the Ministry of Trade and Industry, attribute the decline of Ghana's textile industry to the nation's trade liberalization policies. Consequently, it is believed that such liberalization has led to a surge of textile imports from China and other nations. These imported textiles are more affordable than those produced locally, thereby hindering the competitiveness of Ghanaian manufacturers. Tsekpo (2020) went on to say that some foreign products are made to appear as if they were made in Ghana due to the Ghanaian motives they employ. This makes it difficult for consumers to tell the difference between these products and those created in Ghana, according to Tsekpo. Again, Ghanaian retailers would go for foreign brands because they are cheaper and they sell very quickly.

According to a survey done by Quartey (2006), 15% of 40 textile manufacturers blamed their poor routine on the arrival of copycat items from elsewhere, mainly Asia. Smuggling and dumping were noted by others (7%). Tsekpo (2020) noted that the garment and textile sector, once a thriving manufacturing industry in the nation and a significant source of employment for many, is currently facing a downturn. This decline is attributed to the rising influx of counterfeit and pirated textiles from abroad, leading to the shutdown of numerous production lines within the industry.

Theoretical Framework

The research work was directed by two theories, which are the basic fibre and Comparative advantage theories.

Joseph proposed the fundamental fibre theory in 1988. This hypothesis posits that the characteristics of textile fibres act as a benchmark for key aspects of fibre performance. According to the concept, fibre attributes are categorized into primary and secondary qualities. Tensile strength, flexibility, spinning quality, homogeneity, and a significant length-to-width ratio are considered primary properties. On the other hand, secondary properties include physical shape, density or specific gravity, colour, lustre, moisture regain and absorption, elastic recovery and elongation, resilience, thermal characteristics, resistance to biological agents, and durability against various environmental influences and chemicals.

The characteristics and qualities of textile fabrics, as outlined by Hearle and Morton (2008), play a crucial role in determining their performance regarding usage and maintenance. This means that when textile materials with varied fibre qualities are put through the same strain test, the results are likely to be different. The idea was utilized to look at the physical qualities of the materials and see how changes between the six fabrics affected their performance.

David Ricardo described comparative advantage as an economic theory in 1817 when he explained the concepts of political economics and taxation. He demonstrated his argument by referencing the cases of England and Portugal. Ricardo noted that Portugal had the ability to produce both wine and textiles. Consequently, it was logical for England to export textiles while importing wine from Portugal. When a country can produce goods or services at a lower opportunity cost than another, it is said to have a comparative advantage. Because of this, the nation can manufacture at a lesser cost than its competitors. According to the theory of comparative advantage, nations' total economic well-being will increase if they focus on producing items for which they have lower opportunity costs.

Absolute advantage, which concentrates on the costs associated with producing a good, is not the same as comparative advantage. A country may excel in the production of all goods compared to another; however, both nations can still gain from trade as long as their relative efficiencies vary (Ricardo, 1821). This hypothesis is significant in this investigation because it enables us to compare Ghana's textile sector to those of other countries. This will aid in determining which country has a comparative advantage and, as a result, has obtained a competitive edge in the textile sector, as well as how this affects competition.

Empirical Studies

Studies on fabric qualities and consumer attitudes of domestic and international textile fabrics have also been conducted.

Elebiyo (2000) performed a comparative analysis, both subjective and objective, of locally hand-woven fabrics and wax prints. He employed experimental methods to assess the properties of the fabrics and conducted a survey to explore how locally hand-woven fabrics could effectively compete with wax prints. The findings from the experiment indicated that while many Nigerian hand-woven fabrics are visually more appealing than wax prints, their limitations in terms of end-use performance characteristics and their rough texture, which can lead to discomfort, have significantly restricted their daily application.

Orivri (2005) also did comparison research on the qualities of a few different international and locally created furnishing textile fabrics. The results reveal that different materials have distinct features and personalities that may be tailored for certain applications. The textiles are prized for their versatility, performance, and aesthetic appeal. The findings indicate that domestic textiles outperform foreign fabrics in several aspects, including wash fastness, fabric shrinkage, air permeability, and abrasion resistance. Conversely, foreign fabrics excel in areas such as crease recovery, drape-ability, tensile properties, wet ability, crimp, thickness, flammability, soil retention, fabric sett weight, light fastness, and overall fabric handle.

The findings indicate that the warp and weft text counts are equal, with the warp count consistently exceeding the weft count. The research conducted by Elebiyo (2000) and Orivri (2005) shares similarities with the current study, as both have objectively assessed the characteristics of particular fabrics, making their results useful for the discussion of the present research. Nonetheless, this study differs from the aforementioned ones in that it employed distinct samples of furnishing fabrics and focused solely on comparing their properties. It did not compare the quality characteristics of these fabrics and also, and it also studied Nigerian fabrics and not Ghanaian fabrics which the present study worked on.

A study was undertaken by Malik, Hussain, and Ali (2009) to explore how fabric count influences the tensile strength of polyester and cotton-blended fabrics. In the investigation, two different sets of fabrics were developed. One with an increase in ends and picks at the same time, and the other with an increase in picks/25mnz while keeping the ends/25mnz constant. After that, the impact of increasing the number of ends and picks was quantified. They discovered that increasing the fabric count in one way or both upsurges the tensile forte of the cloth in both ways. However, the relationship between fabric counts and tensile strength is not severely linear. The more fabric counts there is, the better the strength of the fabric.

This research bears similarities to the current study as it involved an experiment to examine the effect of cloth count on the strength of fabrics. However, it differs in that the previous study focused on a comparison between locally hand-woven fabric and wax print, whereas the present research aims to compare Ghanaian-made wax print with imported print fabrics.

Obiana (2011) carried out a study on the result of washing on Nigerian and imported wax print fabrics. Six wax print fabrics were used in this research, three made in Nigerian (Nichem, UNTL and Quali wax) and three foreign-made made namely Hitarget, Deluxe and Hollandiase Vlisco. The samples were procured from the open market and were chosen to represent the variety of print options and quality that are commercially available in the Nigerian market. An experimental research design utilizing laboratory methods was implemented. A factorial approach was adopted for data collection. The gathered data underwent statistical analysis, employing mean, standard deviation, and percentage mean deviation to evaluate the research questions.

The investigation revealed that differences exist in the abrasion resistance, wrinkle recovery, drape, tensile asset, wash fastness and light fastness properties between Nigerian and imported wax print fabrics after laundering but the differences were not statistically significant. Synthetic detergent, high concentration of washing power, and direct sunlight fade the wax print fabric. The researcher therefore concludes that foreign wax print fabrics are better in some properties like colour fastness to washing and light while Nigerian wax print fabrics are better in some properties like abrasion resistance and tensile strength when exposed to the same washing conditions.

This research shares similarities with the present study as it employed a laboratory experiment to examine if there exists a significant difference in colourfastness, durability, and the general quality between local and foreign textile fabrics, but it differs in that it compared Nigerian wax print with a foreign print fabric, whereas the current study would compare Ghana made wax print with foreign print fabrics.

Quartey and Abor (2011) conducted a study to determine whether consumers exhibit a preference for textiles produced locally as opposed to those that are imported, and to explore the reasons behind such preferences. To address this issue, the research analysed survey data collected from various stakeholders, including industry representatives, merchants, and consumers. The results indicated that a majority of consumers favour textiles manufactured locally over imported alternatives. More than half of the respondents who opted for locally produced textiles cited superior quality as a key reason. Additionally, some participants noted that these textiles are more cost-effective and visually appealing, while a minority mentioned that local fabrics tend to be less expensive. These findings seem to challenge the established country-of-origin effect and are at odds with results from previous studies conducted in Africa and other developing nations. There were also discussions on the implications for traders, governments, and local industries.

This reading is similar to the present study because the study examined whether customers prefer home-made textiles to smuggled ones or vice versa and what books they choose but is dissimilar in that they used only a subjective method to assess the level of acceptability but the present research wishes to use an objective laboratory experiment to determine quality by assessing the fastness to crocking, staining and other variables between local and foreign wax print fabrics.

Fashola, Giwa, Iliya, and Orivri (2012) conducted a comparative analysis of the quality and performance of various international and domestically produced furnishing fabrics. The study examined several parameters, including fabric weight, sett, thickness, yarn crimp, linear density, wettability, flammability, shrinkage, handling, drape, wash fastness, light fastness, tensile strength, soil retention, crease recovery, air permeability, and abrasion resistance. The findings indicate that these fabrics possess characteristics that align with their intended applications. Domestic fabrics demonstrated superior wash fastness, shrinkage resistance, air permeability, and abrasion resistance, whereas foreign fabrics excelled in crease recovery, drapability, tensile strength, wettability, crimp, thickness, flammability, soil retention, fabric sett, weight, light fastness, and handling properties. Additionally, the locally produced fabrics offer distinct advantages.

Nilsson and Lindstam (2012) conducted a study to determine what components are important for high-quality jeans, as well as what procedures and factors influence the pants' intrinsic quality. In light of this, statistics on reclaim were gathered, and interviews along with quality assessments were conducted to determine whether maintaining high-quality standards is essential for the production of premium jeans and for minimizing the volume of complaints. According to the findings, excellent quality could be the key to ensuring high-quality jeans manufacture. Nevertheless, given the complexity of the issue, the approach to minimizing claims and ensuring the delivery of high-quality products must involve alternative strategies or elements of a broader solution. This principle applies to any organization seeking to comprehend the fundamental quality attributes and base its decisions on that understanding.

Asanovic, Cerovic, Mihailovic, Kostic, and Reljic (2014) conducted a study examining the comfort properties of various woven garment materials, focusing on electro-physical characteristics, air permeability, and compression attributes. The research involved plain, twill, satin, and basket weave fabrics crafted from cotton and cotton/polyester fibre blends. The findings revealed that cotton fabrics exhibited lower volume resistivity, air permeability, and compressive resilience compared to those made from cotton or PES fibre blends; however, they demonstrated higher effective relative dielectric permeability and compressibility.

Research indicates a significant linear correlation between the air permeability and porosity of woven fabrics, evidenced by a high linear correlation coefficient of 0.9807. Furthermore, the study revealed that factors such as the composition of raw materials, the type of weave, and the surface condition of the fabric play a crucial part in figuring out comfort levels. The findings were applied to a ranking methodology to assess the quality of woven fabrics based on their comfort characteristics. It was concluded that fabrics made from cotton provide a greater degree of comfort compared to those made from a cotton/PES blend.

This research is connected to the ongoing study as both employed objective laboratory experiments to assess the quality of cotton fabrics. However, it differs in that the previous study did not include wax printed fabrics and focused on comfort attributes, including electro-physical properties, air permeability, and compression characteristics. In contrast, the goal of this paper is to look into and compare the quality of printed fabrics based on factors such as colour, weight, yarn count, strength, and dimensional stability.

Edegbe (2014) investigated the critical aspects influencing the greater quality of woven brocade fabric that are coloured, including the switch of dye to adjacent materials or skin, likewise the various processes and factors that may impact the fabric's intrinsic quality in his research on colour fastness and the mechanical and physical properties of coloured woven brocade fabric. Various studies and quality testing were undertaken based on these findings to examine if high-quality criteria are necessary for making high-quality coloured fabrics. In this study, seven coloured woven brocade fabrics that were dyed in Batik, Printed and Tie & dye methods were evaluated for the Colour fastness to crocking, washing and perspiration. Furthermore, Thickness, Air permeability, Weight, Abrasion Resistance, Crease Recovery, Drape, Tensile strength, and Tear strength were also evaluated according to standard test methods.

The study is connected to the present research work in the following ways: it is a study on the quality of woven fabrics just like the present research. But it is dissimilar in the following ways. The above study aimed at examining thickness, air permeability, abrasion resistance, crease recovery, and drape of woven brocade fabrics while the present study aims at examining and comparing the quality of printed fabrics in rapports of weight, yarn count, colour, strength and dimensional stability.

The objective of Halik's (2015) thesis was to justify the selection among three types of fabrics to benefit KSL, while also taking into account the perspective of the customer. This was achieved by juxtaposing client expectations with the specifications of the fabrics. Significant emphasis was placed on the subjective evaluation and feedback from KSL customers. To support this assertion, more objective laboratory tests and theoretical analyses were employed. The investigation revealed that the attributes most appreciated by KSL customers regarding loungewear fabrics include comfort, aesthetics, durability, proper fit, and functionality. It assessed which fabrics met the customers' expectations concerning these properties. This research bears similarities to the current study as it also explored and compared consumer expectations with fabric specifications, utilizing both subjective and objective methodologies to evaluate the level of acceptability.

Ozo, Egele, and Udu (2018) researched to see if there is a substantial difference in design, colourfastness, and durability features, as well as overall quality, between domestic and imported textile materials. The study used both exploratory and descriptive research designs. A questionnaire was used to obtain primary data from 312 female respondents in nine zones within Abakaliki Urban. Frequencies, percentages, and averages were utilized to analyse the data, while the Kruskal-Wallis rank test and the Z-test were used to evaluate the hypotheses.

The conclusions derived from the data analysis indicate that domestic wrappers exhibit deficiencies in durability, colourfastness, texture, fabric strength, and weight, whereas imported wrappers demonstrate superior quality. Notably, certain domestic brands, such as Nichem Wax and Nigerian Wax, were recognized for their high quality, while others, including Super Print, Top Wax, Ankara, and Veritable Real Wax, were noted for their tendency to lose colour during washing. These results imply that domestic textile companies ought to reassess their marketing strategies and initiatives. It is recommended that these companies engage in product modification, integrate product innovation into their strategic frameworks, gather essential customer insights through ongoing research, and remain attuned to prevailing trends within the textile market and industry under review.

This study is similar to the current one in that it looked at whether there was a substantial difference in colourfastness and durability properties, as well as overall quality, between domestic and imported textile textiles but is dissimilar in that they used only subjective method to assess the level of acceptability but the present research wishes to use an objective laboratory experiment to determine quality by assessing the fastness to crocking, staining and other variables between local and foreign wax print fabrics. Again, the study compared Nigerian wax print with foreign print fabric while the present research would compare Ghana-made wax print with foreign print fabrics.

In order to evaluate the performance characteristics of four Real Wax cotton printed textiles and determine if they met the standards established by the Ghana Standards Authority (GSA) for comparable materials, Danquah (2018) conducted a thorough analysis. Using experimental methodologies for in-depth examination, the study focused on several important factors, including dimensional stability (shrinkage), colourfastness, breaking strength, weight, and yarn count. The performance characteristics of the fabrics, including yarn count, weight, and strength, were determined as averages. The results revealed that, apart from the Ghanaian fabrics, which fully complied with the GSA's standard specifications for wax prints, all other fabrics assessed surpassed the GSA's defined specifications in every parameter analysed.

Summary of Review of Related Literature

The reviewed literature above highlighted the various definitions of fibres and fabrics by different authors and presented so many properties of textiles. The literature has also reviewed studies on the classification of fibres produced from natural, man-made or synthetic blends of fibres. Understanding the different methods of fabric construction will help the consumer to identify closely woven cloth and loosely woven fabric and as such help in evaluating the quality of fabrics and clothing. The knowledge of fabric finishes will help a consumer identify when a particular finish is used to camouflage an undesirable characteristic in fabrics. The application of temporary finishes such as starching enhances the visual appeal of textile fabrics and can also contribute to their durability and functionality. This study will offer extensive insights into the quality characteristics of six wax print fabrics, both locally produced in Ghana and imported, that are accessible in the Ghanaian market.

CHAPTER THREE

RESEARCH METHODS

Introduction

The goal of this research work is to inspect and compare the quality standards of local and foreign fabrics using Ghana Standards Authority specifications as the standard. The methodology is based on the approaches that were selected to achieve the aims and objectives listed in the preliminary part of the study. The chapter comprises:

- ❖ Research Design
- ❖ Sampling Method
- ❖ Data Gathering Tools
- ❖ Data Collection Procedure
- ❖ Data Processing and Analysis
- ❖ Chapter Summary

Research Design

A study design, as articulated by Akuezuilo and Agu (2003), constitutes a systematic or scientific framework for research that delineates the procedures the researcher must adhere to respond to the research enquiries. The term "research design" encompasses a series of critical decisions that must be made prior to the collection of data. According to Kirshenblatt-Gimblett (2006), research design is the all-encompassing approach selected to rationally and cogently integrate the many elements of a study, thus solving the research challenge. It also acts as a framework for the measurement, analysis, and data collection procedures. Furthermore, Amadehe and Gyimah (2018) describe research design as the comprehensive methodology employed by a researcher to obtain answers to research inquiries or to evaluate the study's hypotheses. It serves as a detailed plan or framework that outlines how data pertinent to a specific issue should be gathered and analysed.

For this research work, an experimental research design using the laboratory method was employed. Experimental design refers to the systematic approach employed in research to ensure objectivity and control, thereby enhancing precision and enabling the derivation of specific conclusions related to a hypothesis statement, as noted by Bell (cited in Zubair 2022). In order to assess the impact on one or more dependent variables, this scientific method involves changing one or more independent variables and then applying the modified variables to one or more dependent variables. The investigator endeavours to regulate all factors that could potentially influence the experimental outcomes, aiming to ascertain or forecast the results of the investigation. Therefore, it was of great necessity to adopt this method of research to have purposeful and practical information on the outcome of the study.

Population

A study population, according to Castillo (2008), is a sizeable group of people or things that serve as the main subject of a scientific investigation. The aim of conducting research is to benefit this population. A study population, according to Alzahrami (2012), is a well-defined gathering of humans or things that have common features. A common binding attribute or trait can be found in all individuals or things within a group. A group may be considered finite if its elements can be counted, whereas it is deemed infinite if the elements cannot be determined.

The population (objects) for this research comprises three locally printed wax fabrics; Akosombo Textiles Limited (ATL), GTP, Printex and three foreign printed wax fabrics; Hitarget, Sanhe and Hollantex. Six yards of each fabric was obtained from the market from which the samples were obtained and from each of the prints, a total of 40 specimens was obtained. 36 specimens were obtained from the white unprinted fabric and the entire sample frame was 276 specimens from six selected fabrics and the white fabric. The overall number of specimens for the test is derived as a result of what the GSA (GS 124:2019) standards state.

Data Collection Instruments

This research involved conducting experimental procedures at the Ghana Standards Authority's textile laboratory. According to Jen (2004), a research instrument is a device or tool that assists a researcher in gathering, recording, or measuring data that is needed to answer research questions or test hypotheses. Fact-finding strategies, according to Annum (2017), are research instruments. The questionnaire, interview, observation, experiment, and reading serve as examples of tools for data collection. It is crucial for the investigator to confirm that the chosen tool is reliable and authentic. Any research project's validity and reliability are greatly influenced by how well-suited these tools are. Regardless of the data collection method employed, it is essential to conduct a thorough evaluation to ascertain its potential to yield the intended results.

Materials

The washing machine, also referred to as the wash-wheel, was employed for the cleaning of the specimens. A tensile testing apparatus, specifically the Hounsfield H5K-5, was utilized to assess the strength and elongation at the point of break for the pieces. An Adams equipment weighing balance was used to ascertain the weight of the fabrics prior to washing. Scissors were employed for cutting the specimens. A crock meter was utilized to evaluate colourfastness to rubbing, while a geometric grey scale was applied to measure any colour changes in the specimens. For testing dimensional changes, hand needle and thread were used to stitch the specimens. Additionally, a notebook and camera were employed for documentation purposes. The Ghana Standards Authority (GSA) uses these tools to examine textile prints for approval, guaranteeing their dependability.

In this research, six (6) wax print cotton fabrics were used. The fabrics were divided into two, made in Ghana (A, B, C) and foreign fabrics (D, E, F) and white fabric (G). The samples evaluated include three made-in-Ghana wax prints namely ATL, GTP, and Printex and three foreign wax prints namely Hitaget, Sanhe and Hollantex. The samples used in the study were purchased on the open market. The textiles chosen were indicative of the print and quality ranges that are commercially available in Ghana. The researcher conducted measurements of the two fabrics to confirm that each was precisely six yards in length. This was done to guarantee uniformity in measurements and to maintain an equal quantity of samples. Additionally, the researcher chose a single colour—green—for all the fabrics to facilitate a fair comparison. The standard utilized for this study was GS 124:2019.

Identification and Collection/ Sample and Sampling Procedure

To be able to identify the different cotton wax print fabrics for the study, the researcher went to the Makola Market in Accra known for the sale of textiles. The researcher used the observation method to identify cotton wax print fabrics both Ghanaian and foreign-made ones. The method of collection employed in this study was derived from the suggestion and emphasis made by Kogi (1997), that one of the processes of obtaining information on materials required going to the field to find the appropriate material and the desired quantity. Below are the pictures of local and foreign print fabrics used for the study.

Figure 4: ATL wax print fabric

Figure 5: GTP wax print fabric

Figure 6: Printex wax print fabric

Figure 7: Hitarget wax print fabric

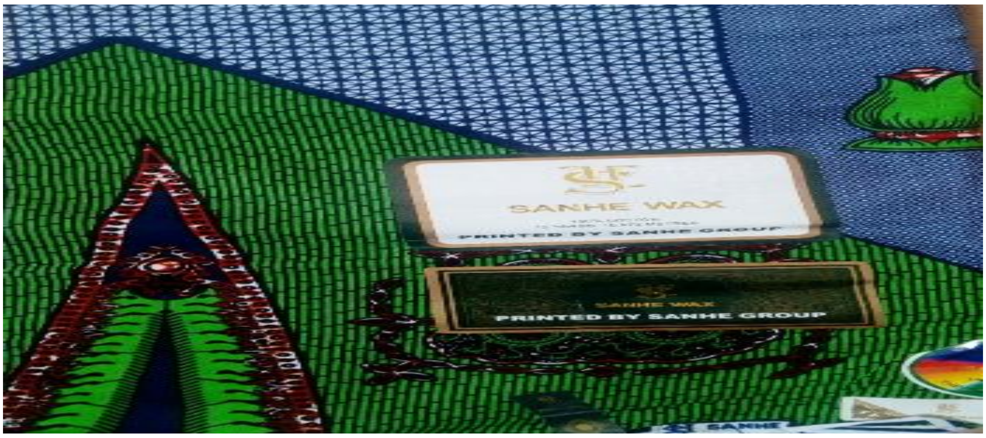


Figure 8 Sanhe wax print fabric

Figure 9 Hollantex wax print fabric

The research employed both stratified and simple random sampling techniques. Stratified sampling entails the segmentation of the population into several homogeneous groups or strata, as noted by Amadahe and Asamoah (2018). Each stratum comprises subjects with comparable characteristics from which a sample is subsequently drawn. On the other hand, Gay (2012) defines simple random sampling as the process of choosing a sample in which each member of the specified group has a fair and equal opportunity of being included in the sample. The goal of this approach is to guarantee that the chosen people fairly represent the general population. Consequently, the researcher utilized simple random sampling to select specimens, indicating that every green local and foreign cotton wax print fabric was eligible for selection as a specimen. Cresswell (2012) asserts that each individual possesses an equal probability of being chosen as a participant.

A total of 660 specimens were gathered for the experiments out of the six yards of each fabric that was purchased. Following the recommendations made by Krejcie and Morgan (1970), a population of 660 requires a sample size of 243 in order to be considered representative. Nevertheless, 240 pieces were selected to facilitate the distribution of samples across the various experiments conducted in accordance with the specifications of the Ghana Standard Authority. For the 40 white fabrics, 36 specimens will be required. A stratified sampling method was employed to select 110 specimens from each fabric, from which 40 random specimens were selected from every layer. Consequently, the total of 660 pieces was categorized into six groups: GTP, ATL, Printex, Hitarget, Sanhe, and Hollantex.

The lottery sampling method was employed to create a comprehensive list of all the fabrics, which were subsequently assigned unique numbers. These numbers were inscribed on individual pieces of paper, which were then placed into a container and thoroughly mixed. Without peering into the container, one piece of paper was drawn at a time. The number on the selected paper was noted and returned to the container prior to the selection of the next paper. The procedure was done severally till the desired number (240) was recorded. Samples and Specimens were labelled as follows:

Table 1: Labelled Samples and Specimens

Samples	Specimens
ATL (A)	A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11, A12, A13, A14, A15, A16, A17, A18, A19, A20, A21, A22, A23, A24, A25, A26, A27, A28, A29, A30, A31, A32, A33, A34, A35, A36, A37, A38, A39, A40, A41, A42, A43, A44, A45, A46, A47, A48, A49, A50, A51, A52, A53, A54, A55, A56, A57, A58, A59, A60, A61, A62, A63, A64, A65, A66, A67, A68, A69, A70, A71, A72, A73, A74, A75, A76, A77, A78, A79, A80, A81, A82, A83, A84, A85, A86, A87, A88, A89, A90, A91, A92, A93, A94, A95, A96, A97, A98, A99, A100, A101, A102, A103, A104, A105, A106, A107, A108, A109, A110.
GTP (B)	B1, B2, B3, B4, B5, B6, B7, B8, B9, B10, B11, B12, B13, B14, B15, B16, B17, B18, B19, B20, B21, B22, B23, B24, B25, B26, B27, B28, B29, B30, B31, B32, B33, B34, B35, B36, B37, B38, B39, B40, B41, B42, B43, B44, B45, B46, B47, B48, B49, B50, B51, B52, B53, B54, B55, B56, B57, B58, B59, B60, B61, B62, B63, B64, B65, B66, B67, B68, B69, B70, B71, B72, B73, B74, B75, B76, B77, B78, B79, B80, B81, B82, B83, B84, B85, B86, B87, B88, B89, B90, B91, B92, B93, B94, B95, B96, B97, B98, B99, B100, B101, B102, B103, B104, B105, B106, B107, B108, B109, B110.
Printex (C)	C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31, C32, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C58, C59, C60, C61, C62, C63, C64, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C97, C98, C99, C100, C101, C102, C103, C104, C105, C106, C107, C108, C109, C110.
Hitarget (D)	D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12, D13, D14, D15, D16, D17, D18, D19, D20, D21, D22, D23, D24, D25, D26, D27, D28, D29, D30, D31, D32, D33, D34, D35, D36, D37, D38, D39, D40, D41, D42, D43, D44, D45, D46, D47, D48, D49, D50, D51, D52, D53, D54, D55, D56, D57, D58, D59, D60, D61, D62, D63, D64, D65, D66, D67, D68, D69, D70, D71, D72, D73, D74, D75, D76, D77, D78, D79, D80, D81, D82, D83, D84, D85, D86, D87, D88, D89, D90, D91, D92, D93, D94, D95, D96, D97, D98, D99, D100, D101, D102, D103, D104, D105, D106, D107, D108, D109, D110.

Table 1: Cont'D

Sanhe (E)	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, E11, E12, E13, E14, E15, E16, E17, E18, E19, E20, E21, E22, E23, E24, E25, E26, E27, E28, E29, E30, E31, E32, E33, E34, E35, E36, E37, E38, E39, E40, E41, E42, E43, E44, E45, E46, E47, E48, E49, E50, E51, E52, E53, E54, E55, E56, E57, E58, E59, E60, E61, E62, E63, E64, E65, E66, E67, E68, E69, E70, E71, E72, E73, E74, E75, E76, E77, E78, E79, E80, E81, E82, E83, E84, E85, E86, E87, E88, E89, E90, E91, E92, E93, E94, E95, E96, E97, E98, E99, E100, E101, E102, E103, E104, E105, E106, E107, E108, E109 and E110.
Hollantex (F)	F1, F2, F3, F4, F5, F6, F7, F8, F9, F10, F11, F12, F13, F14, F15, F16, F17, F18, F19, F20, F21, F22, F23, F24, F25, F26, F27, F28, F29, F30, F31, F32, F33, F34, F35, F36, F37, F38, F39, F40, F41, F42, F43, F44, F45, F46, F47, F48, F49, F50, F51, F52, F53, F54, F55, F56, F57, F58, F59, F60, F61, F62, F63, F64, F65, F66, F67, F68, F69, F70, F71, F72, F73, F74, F75, F76, F77, F78, F79, F80, F81, F82, F83, F84, F85, F86, F87, F88, F89, F90, F91, F92, F93, F94, F95, F96, F97, F98, F99, F100, F101, F102, F103, F104, F105, F106, F107, F108, F109 and F110.
White fabric (G)	G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12, G13, G14, G15, G16, G17, G18, G19, G20, G21, G22, G23, G24, G25, G26, G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38, G39, and G40.

Data collection Procedures

The samples were extracted from various locations, particularly those areas where green is predominant in the fabric, to ensure an accurate representation of the entire material. Prior to testing, all samples for the study were conditioned to achieve moisture equilibrium in an environment with a level of temperature of 20ºC±2ºC and a relative humidity of 65%±2% for a duration of twenty-four hours, as specified by GS 124:2019. All procedures outlined in this study regarding the selection, preparation, and testing of the samples were conducted in accordance with established procedures for testing by the Ghana Standards Authority for the experiments performed.

The white cotton material for the composite was also de-sized to remove the finishing treatment before use. Four judges were selected for the assessment of alteration in colour using the Grayscale instrument for evaluating change in colour and stain for the analysis of the six wax print fabrics. The researcher used only the experimental group for both fabrics (Ghanaian and foreign) The researcher, with the help of the laboratory attendant, who is a trained laboratory technician conducted the practical experiments for a period of three weeks.

The following were the experiments that the researcher conducted in this study. The six fabric samples were evaluated for:

i. The difference in their weight and yarn count
ii. Fading effect of rubbing and washing with standard soap on textile fabrics
iii. The dimensional change of the fabrics after washing
iv. The tensile strength of fabrics

Experiment I: Considering Fabric Weight in Grammage and Yarn Count

Each fabric type specimen is placed individually on the weighing balance (Adams equipment), and the measurements are documented for every type of fabric. The thread count in the two fabric kinds' warp and weft sides was determined by counting the threads three times (three counts for warp and three counts for weft) and recorded accordingly. The textile department specialists of the Ghana Standards Authority assisted in the conduct of the experimental procedures.

Experiment II: Colour Fastness to Washing and Staining

A fabric's attractiveness is worthless unless the dye is fast. In the use of coloured textiles, the resistance of a dye to heat, water, soap, synthetic detergent, and mechanical action as used in domestic laundry is an important property (Obiana, 2011). Therefore, the wash fastness test aims to determine the wash fastness characteristic. Trials were carried out to assess the fastness characteristics of the wax print fabric samples upon washing. The tests were carried out in a wash–wheel.

Procedure: Three specimens, each measuring 10 cm by 4 cm, were extracted from each fabric type. A multi-fibre fabric of identical dimensions was then affixed and sewn end-to-end to each specimen. Fabric samples were washed in a washing solution containing 5g of standard soap per litre of water. The fabrics were thoroughly rinsed and dried. The grey scale was used to evaluate the undyed fabric's colour change and level of discolouration. Below is a picture of how the stitching was done.

Figure 10: Printed and white fabrics stitched together for colourfast test

Experiment III: Testing for Colourfastness to Crocking

The crock meter is attached to a sample fabric, which is then rubbed on a white test cloth. There are two methods for doing this test: using a dry test cloth first, and then a wet test cloth afterwards. The test cloth's level of colour transfer is evaluated by contrasting it with the Grey Scale, thereby determining the amount of colour that has been transferred.

Procedure: Cut 9" (warp) X 3" for the sample (weft). Before testing, samples were conditioned in a control chamber for at least 4 hours to achieve moisture equilibrium.

Loading Crock meter: (Dry Run) A 9" X 3" strip of fabric was taken and secured into a fabric holder, with the technical face facing down and a pull. The technical face of the holder was facing upwards when it was inserted into the Crock meter. The machine was loaded with a white test cloth that had been attached. To start the cycle, the lid was lowered and the start button was pressed. The machine was programmed to massage the fabric in a 20-turn pattern. The white test cloth was removed and examined according to the instructions.

(Wet Test)**:** Wet white test cloths and place them on the machine in the same manner as the dry test. Similar to how it was done in the dry test, the cloth was put into the holder. After 20 full rotations, the machine's lid was closed. The white test cloth was removed and examined according to the instructions**.**

Expression of Results

The result of the findings or changes were expressed in the following format: Change in colour

1 = Much change in colour (Fading)

2 = Considerable change in colour

3 = Slight change

4 = Negligible change

5 = No change

Staining Change

1 = Heavily stained

2 = Considerable stained

3 = Slightly Stained

4 = Negligible stained

5 = No stain

Experiment IV: Examining the Dimensional Stability of Fabrics

A 15cm×15cm measurement was used to cut fabric into specimens, a 10cm x10cm area was sewn within the specimens. Fabric samples were washed in a washing solution containing 5g of standard soap per litre of water. After a thorough rinsing, the clothes were dried. A tape measure was used to measure the specimens in both directions in order to quantify the change in fabric dimensions. The 10cm x 10cm indicated lines were remeasured after washing in order to evaluate shrinkage that occurred from the process. The dimensions of the stitched areas were also evaluated to ascertain any changes in size (shrinkage). A positive dimensional variation shows that the length or width of the object has increased. A negative value indicates a decline and, as a result, shrinkage. Three measurements were recorded for dimensional changes after the specimens were washed, considering both the warp and weft sides.

Experiment V: Tensile Strength Test

In order to assess the strength of the fabrics, a total of 60 specimens were utilized, comprising 10 samples from each fabric type, with 5 samples oriented at the warp side and 5 at the weft side. Specimens were cut to dimensions of 30cm×7cm using scissors and subsequently frayed along the length. Following the fraying process, a test specimen measuring 30cm×5cm was prepared for the strength tests. A universal tensile tester working at 100 mm per minute with a gauge length of 200 mm±1 mm was used for the testing, in compliance with ISO 13934-1 (2019), an international standard from the Organisation for Standardisation (ISO). Each specimen's breaking point was noted for both the weft and warp directions. The load elongation parameters were recorded as each specimen underwent axial elongation until failure occurred under the imposed load. For both the warp and weft sides, five measurements were made, and the average value was computed. The difference in tensile strength was measured and recorded.

Data Processing and Analysis

The data was processed using SPSS version 25, a statistical package for social science. If $p<0.05$, the hypothesis testing findings would be significant. The information was organized and presented in tables and a narrative format. Coding, organizing, describing, analysing, cross-tabulating, and making conclusions were all part of the analysis. The investigation was carried out in two stages. The comparison with the GS ISO standards was the subject of the first step of investigation. Where applicable, the data was synthesized and translated into tabular form to indicate relative proportions.

Inferential statistics were included in the second step. The independent sample t-test was employed in inferential statistics. The observed prediction that was significant to the dependent variable was tested at a significance threshold of 0.05. This method was used to present and analyse the data in this thesis. The research assumptions were evaluated using the independent samples t-test. This statistical technique determines whether the means of two unrelated groups differ significantly from one another. Textile features, as defined by the standards authority, were the dependent variables, whereas textiles were the independent variable (local and foreign prints).

CHAPTER FOUR

RESULTS AND DISCUSSION

The drive of the research work is to compare and contrast the quality features of locally made textile prints (ATL, GTP and Printex) with foreign prints (Hitarget, Sanhe, Hollantex) with regards to grammage, yarn count, colourfastness to crocking, colourfastness to staining, colourfastness to washing, dimensional stability and tensile strength using Ghana Standards Authority specification as the standard and the degree to which these textile fabrics meets national textile quality standards.

The data gathered from the study is analysed and discussed in this chapter. For every test, the standard and degree values were noted in accordance with the guidelines provided by the Ghana Standards Authority. The data from the study was then examined using version 25.0 of the Statistical Package for the Social Sciences (SPSS) for Windows. Means and standard deviations were computed in order to answer the study objectives and provide detailed structural and dynamic features of the fabrics. An independent t-test at 0.05 alpha levels was especially used in inferential statistics to assess the hypotheses.

This section of the work is prearranged under the following headings/observations:

1. Fabric Weight (Grammage)
2. Yarn count in the warp and weft direction
3. Colourfastness to dry and wet crocking/rubbing of the fabrics
4. Colourfastness to washing of the fabrics
5. Colourfastness to staining of the fabrics
6. Tensile strength (warp and weft direction) of the fabrics

7. Elongation (break distance) warp and weft direction of the fabrics

8. Dimensional stability (warp and weft direction) of the fabrics

Table 2*:* Fabric weight (Grammage)

	Observations				
Fabric	**1^{st} (g/m²)**	**2^{nd} (g/m²)**	**3^{rd} (g/m²)**	**Average ×100**	**GS ISO Value** (107 g/m²)
ATL	1.4311	1.4639	1.4280	**1.4410 × 100**	**144.1**
GTP	1.3115	1.3328	1.3129	**1.3190 × 100**	**131.9**
Printex	1.2514	1.2413	1.2474	**1.2467 × 100**	**124.67**
Hitarget	1.4378	1.4734	1.4533	**1.4548 × 100**	**145.48**
Sanhe	1.3265	1.3265	1.3825	**1.3452 × 100**	**134.52**
Hollantex	1.4430	1.4475	1.4526	**1.4477 × 100**	**144.77**

Source: field survey, 2021 (GS ISO Standard = 107g/m^2)

Concerning GS ISO 3801 with a minimum value of 107g/m^2, it can be seen from Table 2 that all the various fabrics had passed the weight test. A critical look at the GS ISO values of the various fabrics shows that, although they all passed the minimum value, there are still differences between them. Printex has the lowest weight value of 124.67 g/m^2, followed by GTP with a value of 131.9 g/m^2, Sanhe comes next with a value of 134.52 g/m^2, ATL also with a value of 144.1 g/m^2, Hollantex comes second with a value of 144.77 g/m^2, and Hitarget leads with 145.48 g/m^2 as its weight value.

Testing the significant difference between local and foreign fabric concerning the average weight

An independent sample t-test was undertaken to determine mean differences in average weight depending on local and foreign fabrics. Fabric (both domestic and imported) was the independent variable, whereas average weight was the dependent variable. Tables 3 and 4 exhibit group statistics and independent samples t-test findings, respectively.

Table 3: Group statistics for fabric weight

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	133.55	9.82
Foreign	3	141.59	6.13

Table 4: Difference in local and foreign fabric based on average weight

Levene's Sig	t	df	Sig.(2-tailed)	Mean difference
.480	-1.20	4	.296	-8.03
	-1.20	3.35	.307	-8.03

Table 4 displays the outcomes of the independent sample t-test. Assuming equal variances based on Levene's test for equality of variance, the results of the independent t-test tables show that there is no significant difference between the means of local and imported cloth based on their average (p=.480). The table's t (4) = -1.20 and p >.05 indicate that there is no statistically significant difference between the average of domestic and imported fabrics. When the p-value is higher than 05, the null hypothesis is not rejected. Upon comparing the six materials' weights, it was discovered that the foreign fabrics weighed more than the Ghanaian ones. The fabric count provides an explanation for this. All the materials, however, exceeded the Ghana Standards Authority's minimum requirement of 107g/m2 for Real Wax printed cotton fabrics.

Table 5: Yarn count in warp and weft direction

Fabric Type		Number of Specimens	Mean (per inch)	Specification GS 124:2019
	warp	**3**	**83.82**	68-80 per inch
ATL	weft	**3**	**55.88 ***	64-72 per inch
	warp	**3**	**76.20**	
GTP	weft	**3**	**53.34 ***	
	warp	**3**	**81.28**	
Printex	weft	**3**	**71.12**	
	warp	**3**	**83.82**	
Hitarget	weft	**3**	**22.88 ***	
	warp	**3**	**83.82**	
Sanhe	weft	**3**	**48.26 ***	
	warp	**3**	**86.36**	
Hollantex	weft	**3**	**53.34 ***	

Source: field survey, 2021 (GS ISO 7211-2) * fabrics that failed the yarn count weft test

Looking at the observations, all fabrics passed the minimum warp direction value of GS ISO 7211-2 between 68-80 per inch. Hollantex came first with the highest count of 86.36 per inch, followed by ATL, Hitarget and Sanhe with a count of 83.82 per inch. Printex follows with 81.28 per inch and GTP comes up with the lowest count of 76.20 per inch. With GS ISO 7211-2 between 64-72 per inch as the minimum yarn count in the weft direction, it can be observed from Table 5 that only Printex passed the test with 71.12 per inch. ATL, GTP, Hollantex, Sanhe and Hitarget failed with 55.88 per inch, 53.34 per inch, 53.34 per inch, 48.26 per inch and 22.88 per inch respectively.

Testing Significance Difference between local and foreign fabric concerning yarn count average in Warp Direction

An independent sample t-test was undertaken to determine mean differences in yarn count average in Warp Direction based on local and international fabrics. Fabric (both domestic and imported) was the independent variable, whereas yarn count Average in Warp Direction was the dependent variable. Tables 6 and 7 exhibit group statistics and independent samples t-test findings, respectively.

Table 6: Group statistics for yarn count in warp direction

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	80.43	3.87
Foreign	3	84.66	1.46

Table 7: Difference in local and foreign fabric based on yarn count average in Warp Direction

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.184	-1.76	4	.152	-4.23
	-1.76	4	.191	-4.23

99/125 Words

Table 7 displays the outcomes of the independent sample t-test. Assuming equal variances based on Levene's test for equality of variance, the results of the independent sample t-test tables show that there is no significant difference between the averages of local and foreign fabric based on yarn count average in Warp Direction (p=.148). The table shows that t (4) = -1.76, p >.05. The average yarn count in the Warp Direction does not significantly differ between local and international fabrics since p >.05. When the p-value is higher than 05, the null hypothesis is not rejected. Hence, both local and foreign fabrics have the same yarn count average in Warp Direction.

Testing Significance Difference between local and foreign fabric concerning Yarn Count Weft Direction

An independent sample t-test was undertaken to determine mean differences in Yarn Count Weft Direction based on local and international materials. Fabric (both domestic and imported) was the independent variable, whereas Yarn Count Weft Direction GSISO was the dependent variable. Tables 8 and 9 exhibit group statistics and independent samples t-test findings, *respectively*.

Table 8: Group statistics for yarn count in the weft direction

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	61.11	9.09
Foreign	3	41.49	16.31

Table 9: Difference in local and foreign fabric based on Yarn Count Weft Direction

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.238	1.81	4	.143	19.62
	1.81	3.13	.163	19.62

Table 9 shows the outcomes of the independent sample t-test. Based on Yarn Count Weft direction, the independent sample t-test tables show that, when equal variances are assumed, as per Levene's test for equality of variance (p=.238), there is no significant difference between the means of local and imported fabric. Based on the table, t (4) = 1.81. The Yarn Count Weft Direction of domestic and foreign materials does not significantly differ from one another because p >.05. For a p-value larger than .05, the null hypothesis is not rejected. For this reason, the Yarn Count Weft Direction of materials from abroad and locally is the same. The yarn counts of the local fabrics were greater in the weft direction compared to the warp directions of the foreign fabrics. Nonetheless, they all complied with the 68–80 in the warp direction and 64–72 in the weft direction as specifications set by the Ghana Standards Authority.

Table 10: Colour fastness to dry and wet crocking/rubbing

Fabric Type		Number of Specimens	Mean	Specification GS 124:2019
	Dry	**3**	4-5	4 Minimum
ATL	Wet	**3**	4	3 Minimum
	Dry	**3**	4-5	
GTP	Wet	**3**	3-4	
	Dry	**3**	4-5	
Printex	Wet	**3**	3	
	Dry	**3**	5	
Hitarget	Wet	**3**	4	
	Dry	**3**	4-5	
Sanhe	Wet	**3**	3-4	
	Dry	**3**	4-5	
Hollantex	Wet	**3**	3-4	

Source: Field survey, 2021 (GS ISO 105-X12 minimum value of 4)

Colourfastness, as articulated by Mokhtari, Nouri, and Sarli (2011), refers to the capacity of a textile fabric to endure various conditions such as washing, exposure to bright light, gas, and friction while maintaining its dye integrity. The authors further note that prolonged exposure to water, heat, and strong alkaline solutions can significantly impact the colour fastness of dyed cotton fabrics. In addition, the chemical makeup of the soap (such as calcium and sodium hydroxide) and the intrinsic qualities of the fabric (yarn thickness, weight, and thread count) may have an impact on how much colour bleeding occurs in these fabrics (Deshwal & Khambra, 2006). Consequently, it is likely that the physical properties of textile fabrics will exhibit varying responses under different manipulative conditions.

It is noticed from Table 10 that Hitarget performed excellently with an average of 5 during the dry rubbing and the rest of the fabrics with averages of 4-5 each. All fabrics in Table 10, passed the GS ISO 105-X12 minimum value of 4. It is again noticed from the table that ATL and Hitarget performance were very good having an average score of 4 for the wet rubbing. GTP, Sanhe and Hollantex also scored an average of 3-4 whereas Printex had the least average score of 3.

Testing Significance Difference between local and foreign fabric concerning colour fastness to dry rub average

An independent sample t-test was undertaken to determine mean differences in colour fastness to dry rub average based on local and international materials. Fabric (both domestic and foreign) was the independent variable, while colour fastness to dry rubbing average was the dependent variable. Tables 11 and 12 exhibit group statistics and independent samples t-test findings, respectively.

Table 11: Group statistics for colourfastness to dry rubbing

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	4.00	.00
Foreign	3	4.33	.57

Table 12: Difference in local and foreign fabric based on colour fastness to dry rubbing average

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.116	-1.00	4	.374	-.33
	-1.00	2.00	.423	-.33

Table 12 provides a summary of the independent sample t-test results. The results show that there is no discernible difference between domestic and imported materials' average colour fastness to dry rubbing. Levene's test, which produced a p-value of.116, confirmed that the assumption of equal variances is the foundation for this result. The reported t-value is t(4) = -1.00. It is possible to conclude that local and international materials show equal average colour fastness to dry rubbing because the p-value is larger than.05. As a result, the null hypothesis is upheld, showing that the p-value is in fact higher than the significance level of.05.

Testing Significance Difference between local and foreign fabric concerning colour fastness to wet rubbing average

An independent sample t-test was undertaken to demonstrate mean differences in colour fastness to wet rubbing average based on local and international materials. Fabric (both domestic and foreign) was the independent variable, while colour fastness to wet rubbing average was the dependent variable. Tables 13 and 14 exhibit group statistics and independent samples t-test findings, respectively.

Table 13: Group statistics for colourfastness to wet rubbing

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	3.50	.500
Foreign	3	3.66	.288

Table 14: Difference in local and foreign fabric based on colour fastness to wet rubbing average

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.561	-.50	4	.634	-.166
	-.50	3.20	.649	-.166

Table 14 presents the results obtained from the independent sample t-test. Using equal variances as per Levene's test for equality of variance, the findings from the self-determining t-test tables show that, when it comes to colourfastness to wet rubbing average, there is no significant difference between the means of domestic and foreign fabrics (p =.561). Table t (4) = -.50 indicates this. Since p >.05, it can be said that domestic and foreign materials' colourfastness to wet rubbing averages is not significantly different from one another. The null hypothesis remains accepted when the p-value exceeds .05. Consequently, both domestic and imported fabrics exhibit similar average colourfastness to wet rubbing. However, foreign fabrics demonstrated superior mean values of 4.33 for dry crocking after being subjected to rubbing.

The performance differences observed between the two types of materials may be attributed to their distinct characteristics. Hearle and Morton (2008) propose that different textile materials with varied structural characteristics may perform differently in the same strain test. Consequently, weight variations may be related to the discrepancy in colour performance between the two materials. Heavier fabrics tend to resist colour fading more effectively than lighter ones (Hearle & Morton, 2008). Laboratory measurements revealed that the mean weight of the foreign fabric samples was 141.6g/m², surpassing the mean weight of the local samples, which was 133.5g/m². This suggests that foreign fibres exhibited superior performance compared to domestic fabrics due to their enhanced durability. The present discovery is consistent with the findings of Deshwal and Khambra's (2006) study, which suggests that the properties of textile materials, specifically the weight and thickness of the yarns, impact their ability to withstand stress.

Table 15: Colourfastness to washing

Fabric Type	Number of specimens	Mean	Specification GS 124:2019
ATL	3	4-5	
GTP	3	4-5	**4 minimum**
Printex	3	4-5	
Hitarget	3	4-5	
Sanhe	3	4-5	
Hollantex	3	4-5	

Source: field survey, 2021 (GS ISO 105-C10 minimum value is 4)

In table 15, it can be observed that all fabrics scored 4-5 which is a very good score given that the GS ISO 105-C10 minimum value is 4. This means that both local and foreign wax print fabrics have the same colourfast after the fabrics were washed with standard soap. In terms of colourfastness to washing for cotton fabrics printed with wax, all of the fabrics satisfied the Ghana Standards Authority's minimum criteria of 4.

Table 16: Colourfastness to staining of fabric

Fabric	Wool	Acrylic	Polyester	Nylon	Cotton	Acetate	**Specification GS 124:2019**
ATL	4-5	4-5	5	4-5	4	4-5	**4 minimum**
GTP	4	4-5	4-5	4-5	4-5	4-5	
Printex	4-5	4-5	4-5	4-5	4	4-5	
Hitarget	4-5	4-5	5	4-5	5	4-5	
Sanhe	4-5	4-5	5	4-5	5	4-5	
Hollantex	4	4-5	4-5	4-5	4	4	

Source: Field survey, 2021 (GS ISO 105 A03 minimum value is 4)

The minimal value for each fibre type on the grey scale for colour staining is 4 (GS ISO 105 A03), with 5 being excellent. Excellent performance receives a score of 4, whereas good performance, moderate performance, and poor performance are denoted by scores of 3, 2, and 1. Table 16 depicts the results of colour staining, ATL, Hitarget and Sanhe performed excellently on Polyester and Hitarget and Sanhe on Cotton with an average value of 5 after being washed with standard soap. This means that they will not cause colour staining when they come into contact with polyester and cotton fabrics. On acrylic and nylon, all the printed fabrics' performance were very good with a value of 4-5.

Table 17: Tensile strength warp and weft direction

		Number of Specimens	Mean	Specification GS 124:2019
	warp	5	509	240N min
ATL	weft	5	174 *	220N min
	warp	5	446	
GTP	weft	5	275	
	warp	5	407	
Printex	weft	5	207 *	
	warp	5	411	
Hitarget	weft	5	229	
	warp	5	308	
Sanhe	weft	5	209 *	
	warp	5	368	
Hollantex	weft	5	225	

Source: field survey, 2021 * fabrics that failed the tensile weft test

The strength of a fabric is influenced by factors such as the arrangement of the threads, the type of weave employed, and the overall weight of the fabric, as noted by Ozdil, Ozdogan, and Oktem (2003). Textile materials' quality and performance safeguard the superiority of textile fabrics and serve as a benchmark for comparison and mutual contracts between buyers and sellers. An examination of Table 17 reveals that every fabric surpassed the minimum threshold of 240N in the warp direction. ATL, Printex and Sanhe however did not conform to the standard in the weft direction which had figures below the minimum value of 220N.

Testing Significance Difference between local and foreign fabric concerning tensile strength warp direction

A self-governing sample t-test was undertaken to determine mean differences in tensile strength warp direction average based on local and foreign fabrics. Fabric (both domestic and foreign) was the independent variable, whereas tensile strength warp direction was the dependent variable. Tables 18 and 19 exhibit group statistics and independent samples t-test findings, respectively.

Table 18*: Group statistics for tensile strength warp direction*

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	454.00	51.46
Foreign	3	362.33	51.73

Table 19*: Difference in local and foreign fabric based on tensile strength warp direction average*

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.984	2.17	4	.095	91.66
	2.17	4	.095	91.54

Table 19 displays the findings of the independent sample t-test. The results of the independent t-test tables show that, when equal variances are assumed based on Levene's test for equality of variance, there is no significant difference between the means of local and foreign fabric based on tensile strength warp direction average (p=.984). The table shows that the tensile strength warp direction average of local and foreign materials does not differ significantly because t (4) = 2.17 and p >.05. In favour of the null hypothesis, the alternative hypothesis is rejected. Hence, both local and foreign fabrics have the same tensile strength in the warp direction.

Testing Significance Difference between local and foreign fabric concerning tensile strength weft direction

An independent sample t-test was undertaken to determine mean differences in tensile strength weft direction based on local and foreign fabrics. Fabric (both domestic and foreign) was the independent variable, while tensile strength weft direction was the dependent variable. Tables 20 and 21 exhibit group statistics and independent samples t-test findings, respectively.

Table 20: Group statistics for tensile strength weft direction

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	218.66	51.50
Foreign	3	221.00	10.58

Table 21*:* Difference in local and foreign fabric based on tensile strength weft direction

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.095	-.077	4	.942	-2.33
	-.077	2.16	.945	-2.33

Table 21 presents findings from the independent sample t-test. Based on the tensile strength weft direction, the results of the self-governing t-test tables show that, when equal variances are assumed, there is no significant difference between the means of local and foreign cloth (p=.095). According to the table, t (4) = -.077, p >.05. The average tensile strength in the weft direction of domestic and foreign fabrics does not differ statistically significantly because p >.05. Table 21 presents findings from the independent sample t-test. When comparing the means of local and foreign cloth based on tensile strength weft direction, the results of the independent sample t-test tables show that there is no significant difference. Because p >.05, there is no statistically noteworthy alteration in the tensile strength weft direction of domestic and foreign fabrics. With p > .05 null hypothesis is not rejected. Hence, both local and foreign fabrics have the same tensile strength weft direction.

Local fabrics fared better in the warp direction, while foreign fabrics performed better in the weft direction. All of the fabrics, on the other hand, exceeded the Ghana Standards Authority's basic requirements for such fabrics. The claim made by Cano-Glu et al. (2004) that the warp yarn orientation is the strongest part of the fabric supports the idea that domestic fabrics are more robust than imported ones.

Table 22*: Elongation (break distance) warp and weft direction*

Fabric Type		Number of Specimens	Mean	Specification GS 124:2019
	warp	5	19.54	
ATL	weft	5	64.76	
	warp	5	13.98	
GTP	weft	5	39.72	
	warp	5	13.80	
Printex	weft	5	51.90	
	warp	5	12.48	
Hitarget	weft	5	58.94	
	warp	5	16.36	
Sanhe	weft	5	57.82	
	warp	5	13.08	
Hollantex	weft	5	54.18	

Source: field survey, 2021

Ultimate elongation is the percentage of length that a material increases before breaking under tension. According to Fabric Link (2006), fibre strength and elongation (extension at break) occur gradually. A significant part is played by genetic and environmental factors. When stress is applied, a material's degree of elongation is mostly dictated by the fibre properties of the fabric.

Testing Significance Difference between local and foreign fabric concerning the elongation warp direction

A self-governing sample t-test was undertaken to determine mean differences in elongation warp direction based on local and international fabrics. Fabric (both domestic and foreign) was the independent variable, whereas elongation warp direction average was the dependent variable. Tables 23 and 24 exhibit group statistics and independent samples t-test findings, individually.

Table 23: Group statistics for elongation warp direction

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	15.77	3.26
Foreign	3	13.97	2.08

Table 24: Difference in local and foreign fabric based on elongation warp direction

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.295	.805	4	.466	1.80
	.805	3.40	.473	1.80

Table 24 presents findings from the independent sample t-test. According to Levene's test for equality of variance, the results of the self-governing t-test tables show that, when equal variances are assumed, there is no noteworthy distinction between the means of local and foreign fabric based on elongation warp direction (p=.295). According to the table, t (4) = -.077, p >.05.

The warp orientation of domestic and foreign fabrics does not differ statistically significantly in terms of elongation since p >.05. For a p-value larger than 05, the null hypothesis is not rejected. As a result, both domestic and foreign fabrics have the same average elongation warp direction.

Testing Significance Difference between local and foreign fabric concerning elongation weft direction

To find mean changes that exist in elongation weft direction average based on local and foreign fabrics, a t-test on an independent sample was performed. The elongation weft direction average was the dependent variable, and the fabric (both local and foreign) was the independent variable. The group statistics and the self-determining samples t-test findings are displayed in Tables 25 and 26, in that order.

Table 25: Group statistics for elongation weft direction

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	52.12	12.52
Foreign	3	56.98	2.48

Table 26: Difference in local and foreign fabric based on elongation weft direction average

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
.188	-.658	4	.546	-4.85
	-.658	2.15	.574	-4.85

Table 26 displays the self-regulating sample t-test findings. The findings of the self-regulating t-test tables demonstrate that there is no important change amid the means of local and foreign fabric based on elongation warp direction when the same variances are presumed using Levene's test for equality of variance (p=.188). t (4) = -.077, p >.05., according to the table. Because p >.05, there is no statistically significant difference between the elongation warp direction of domestic and foreign fabrics. When the p-value is more than 05, the null hypothesis is not rejected.

The elongation noted at the point of failure in weft yarns was greater than that in warp yarns for both textiles after they were subjected to standard soap washing. This occurrence can be attributed to the higher thread density found in warp yarns compared to weft yarns across both types of fabric. In essence, the increased thread density in the warp direction enhances the ability of warp yarns to withstand tensile stress. This observation aligns with the claim made by Cano-Glu et al. (2004) that warp yarn orientation constitutes a stronger component of a fabric.

Table 27: Dimensional stability (warp and weft direction)

Fabric Type		Number of Specimens	Mean	Specification GS 124:2019
	warp	3	-3	5% maximum
ATL	weft	3	-3	5% maximum
	warp	3	-2	
GTP	weft	3	-2	
	warp	3	-2	
Printex	weft	3	-2	
	warp	3	-3	
Hitarget	weft	3	-3	
	warp	3	-2	
Sanhe	weft	3	-2	
	warp	3	-2	
Hollantex	weft	3	-3	

Source: field survey, 2021 (GS ISO 5077 maximum value 5%)

Testing Significance Difference between local and foreign fabric concerning dimensional stability warp direction

To establish mean differences that exist in dimensional stability warp direction average based on local and foreign fabrics, a t-test for independent samples was performed. The independent variable was fabric (local and foreign) while the dependent variable was dimensional stability warp direction average. The results of the independent samples t-test and group statistics are displayed in Tables 28 and 29, in that order.

Table 28*: Group statistics for dimensional stability warp direction*

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	-2.33	.57
Foreign	3	-2.33	.57

Table 29*: Difference in local and foreign fabric based on dimensional stability warp direction*

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
1.00	.00	4	1.00	.00
	.00	4.00	1.00	.00

Table 29 displays the findings of the independent sample t-test. When equal variances are assumed based on Levene's test for equality of variance (p=1.00), the results of the self-governing t-test tables show that there is no significant difference between the means of local and foreign fabric based on dimensional stability warp direction. The table shows that t (4) =.00, p >.05. The warp direction of local and international materials does not significantly differ from one another in terms of dimensional stability since p >.05. When the p-value exceeds 05, the null hypothesis is not ruled out. Hence, both local and foreign fabrics have the same dimensional stability warp direction.

Testing Significance Difference between local and foreign fabric concerning dimensional stability in the weft direction

A self-governing sample t-test was undertaken to verify the mean variations in dimensional stability in the weft direction based on local and international fabrics. Fabric (both domestic and foreign) was the independent variable, whereas constancy of dimensions in the weft direction was the dependent variable. Tables 30 and 31 exhibit group statistics and self-governing samples t-test findings, individually.

Table 30*: Group statistics for dimensional stability weft direction*

Fabric	N	Mean (M)	Std. Deviation (SD)
Local	3	-2.33	.57
Foreign	3	-2.66	.57

Table 31*: Difference in local and foreign fabric based on dimensional direction weft direction average*

Levene's Sig.	t	df	Sig.(2-tailed)	Mean difference
1.00	.707	4	.519	.33
	.707	4.00	.519	.33

Table 31 displays the outcomes of the independent sample t-test. Assuming identical variances based on Levene's test for equality of variance (p=1.00), the results of the independent sample t-test tables show that there is no significant difference between the means of local and foreign fabric based on dimensions' orientation in the weft direction. Because t (4) =.707 and p >.05, there is no significant difference between the dimensional stability in the weft direction of local and foreign fabrics, according to the table. When the p-value is more than .05, the null hypothesis is not rejected. As a result, both domestic and imported fabrics shrink in the weft direction.

Regarding dimensional stability after laundering (shrinkage), the findings indicate that both textiles experienced identical shrinkage in the warp direction. However, the foreign fabrics showed a greater degree of shrinkage in the weft direction, recording a level of 2.7 percent in comparison to the local fabrics' 2.3 percent. Nevertheless, all fabrics demonstrated shrinkage measurements that remained below the maximum allowable threshold of 5% set by the Ghana Standards Authority for comparable materials. A summary of all the findings is provided below.

Table 32*: *Comparison with GS ISO Standards

Parameters	Fabric type					
	ATL	GTP	Printex	Hitarget	Sanhe	Hollantex
Weight 107(g/m^2)	144.1	131.9	124.7	145.5	134.5	144.8
Yarn count warp 68-80	83.82	76.20	81.28	83.82	83.82	86.36
Yarn count weft 64-72	55.88	53.34	71.12	22.88	48.26	53.34
Colourfastness to crocking dry 4	4-5	4-5	4-5	5	4-5	4-5
Colourfastness to crocking wet 3	4	3-4	3	4	3-4	3-4
Colourfastness to washing 4	4-5	4-5	4-5	4-5	4-5	4-5
Tensile strength Warp 240N	509	446	407	411	308	368
Tensile strength Weft 220N	174	275	207	229	209	225
Dimensional stability warp 5%	-3	-2	-2	-3	-2	-2
Dimensional stability weft 5%	-3	-2	-2	-3	-2	-3

Table 33: Group statistics

Parameters	Fabric type	
	Local	foreign
Weight 107(g/m^2)	133.55	141.59
Yarn count warp 68-80	80.43	84.66
Yarn count weft 64-72	61.11	41.49
Colourfastness to crocking dry 4	4.00	4.33
Colourfastness to crocking wet 3	3.50	3.66
Colourfastness to washing 4	4-5	4-5
Tensile strength Warp 240N	454.00	362.33
Tensile strength Weft 220N	218.66	221.00
Dimensional stability warp 5%	-2.33	-2.33
Dimensional stability weft 5%	-2.33	-2.66

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

A thorough summary of the entire investigation is provided in this chapter, along with conclusions on the major discoveries and suggestions for enhancing the performance, durability, and handling of printed fabrics. The section also includes suggestions for how to improve the production of high-quality printed fabrics.

Summary

Most Ghanaians believe that locally-made wax print fabrics are of poor quality as compared to foreign ones. The study examined the quality features of locally made wax prints (ATL, GTP and Printex) and foreign wax prints (Hitarget, Sanhe and Hollantex) in terms of their grammage, yarn count, colourfastness to crocking, colourfastness to staining, dimensional stability and tensile strength by testing, using the Ghana Standards Authority specification as the standard. The research evaluated the performance characteristics of six printed wax cotton fabrics and examined their properties in accordance with the standards established by the Ghana Standards Authority (GSA) for this type of fabric. Version 25 of the Statistical Package for Social Science (SPSS) was used to examine the data that were gathered for the research.

If $p<0.05$, the hypothesis testing findings would be significant. The information was organized and presented in tables in a narrative format. Coding, organizing, describing, analysing, cross-tabulating, and making conclusions were all part of the analysis. The investigation was carried out in two stages. The comparison with the GS ISO standards was the subject of the first step of investigation. Where applicable, the data was synthesized and translated into tabular form to provide relative proportions. Inferential statistics were included in the second step. The independent sample t-test was employed in inferential statistics. The observed prediction that was significant to the dependent variable was tested at a significance threshold of 0.05.

Key Findings

Comparing Fabric Weight and Yarn Count

The six textiles were entirely composed of 100 percent cotton and featured a plain weave that adhered to the wax print specifications set forth by the Ghana Standards Authority. When using the conventional method, the researcher discovered that there were no significant changes in their weight. This means both fabrics conform to the standard but differences were observed concerning the individual fabric weight where Hitarget had the highest, followed by Hollantex, ATL, Sanhe, and GTP and the least was Printex. Certain differences noted may be ascribed to the quantity of yarns in both directions, while others may stem from the size of the yarn, as suggested by Glock and Kunz (2005). The finding for the weight of the fabrics is consistent with what Danquah (2018) found that the weight of foreign textile fabrics was greater than the locally made fabrics.

The analysis revealed that all tested fabrics exhibited more yarn count on the warp side than on the weft side. According to Pizzuto (2012), this characteristic contributes to increased strength along the length of the fabric.

While foreign fabrics demonstrated superior yarn counts at the warp side, local fabrics outperformed them at the weft side. Nonetheless, all samples complied with the Ghana Standards Authority's warp specification of 68-80. In terms of weft count, only Printex conformed to the required specification of 64-72.

Testing for colourfastness

The foreign fabrics had better mean values of 4.33 for dry and 3.66 for wet rubbing after rubbing than the local fabrics, which had 4.00 for dry and 3.50 for wet rubbing. While all the fabrics met the Ghana Standards Authority's minimum requirements of 4 and 3 for colourfastness to crocking in waxed print fabrics, the fabrics from abroad surpassed these minimal standards. This means that when foreign fabrics are rubbed, their colour will not transfer to other fabrics.

After being washed, both domestic and imported wax print fabrics exhibited the same colourfastness. All of the fabrics matched the Ghana Standards Authority's minimum criteria of 4 in terms of colourfastness to washing for wax-printed cotton fabrics. This can be attributed to the fabrics having the required weight as indicated by Hearle & Morton (2008), that fabrics with higher weight can withstand colour fading better than those with less weight. This finding challenges the conclusion drawn by Orivri (2005) that fabrics produced locally exhibit greater wash fastness.

For colour staining, ATL, Hitarget and Sanhe performed excellently on Polyester and Hitarget, Sanhe on Cotton with an average value of 5 after being washed with standard soap. This means that they will not cause colour staining when they come into contact with polyester and cotton fabrics respectively. On acrylic and nylon, all the printed fabrics' performance were very good with a value of 4-5. All the fabrics met the criteria established by the Ghana Standards Authority. The test results indicate that each fabric exhibits excellent colourfastness to both washing and rubbing, ensuring that they will retain their colour throughout their usage. This according to Danquah (2018) could be attributed to the use of good-quality dyes by manufacturers.

Examining the Dimensional Change

Regarding dimensional stability following laundering (shrinkage), the findings revealed that both textiles experienced equivalent shrinkage in the warp direction. However, the foreign fabrics demonstrated a greater degree of shrinkage in the weft direction, recording a shrinkage rate of 2.7 percent, in contrast to the local fabrics, which exhibited a shrinkage of 2.3 percent. Nevertheless, all fabrics displayed shrinkage values less than the acceptable threshold of 5% established by the Ghana Standards Authority for comparable materials. According to Nilsson and Lindstam (2012), high thread counts are more stable in terms of dimensional change but this was not seen in the case of the foreign fabrics. Even though they had a higher count in warp direction, they had the same shrinkage level as the local fabrics.

Assessing the Tensile Strength

When it came to strength, every cloth exceeded the minimal requirements set by the Ghana Standards Authority. Nevertheless, when analysing their averages, the local fabrics exhibited superior performance at the warp side, whereas the foreign fabrics excelled at the weft side. Malik, Hussain, and Ali (2009) suggested that an increase in yarn count correlates with improved transfer efficiency of yarn strength to fabric strength. This research did not confirm this view as foreign fabrics which had a better yarn count in the warp direction could not have better strength in the warp direction. It rather performed better in the weft direction.

Conclusions

The study's findings indicated that there were no notable differences across all evaluated criteria between the local and foreign wax print fabrics examined. They did however, all meet the criteria laid down by the Ghana Standards Authority for the characteristics evaluated except for ATL, Printex and Sanhe which failed in the weft direction when tested for their strength and also all fabrics failed the weft yarn count except Printex. In terms of weight, warp yarn count, colourfastness to dry and wet crocking, and weft tensile strength, foreign fabrics performed better than local fabrics. Local fabrics also performed better in terms of weft yarn count, warp tensile strength and weft dimensional stability. It can be inferred that foreign textiles exhibit high quality regarding fabric weight, yarn count, and colourfastness, whereas local textiles also demonstrate quality in terms of tensile strength and dimensional stability.

Recommendation

Local fabric manufacturers specializing in printing should enhance the physical characteristics of their products, particularly by increasing the yarn count in the weft direction, as this will contribute to improved tensile strength.

Suggestion for Further Studies

More fabrics and parameters should be included in future research to determine fabric compliance to defined quality and specifications for a particular end-use.

REFERENCES

Aboagyewaa-Ntiri, J., & Mintah, K. (2016). Challenges and opportunities for the textile industry in Ghana; A study of Adinkra Textile Sub-sector. *International Business Research, 9*(2). ISSN1913-9004 E-ISSN1913-9012. Canadian Centre of Science and Education

Adikorley, R. (2013). *The textile industry in Ghana: A look into tertiary textile education and its relevance to the industry*. Retrieved May 26, 2020 from http://www.researchgate.net

Akorli, P.A.K., & Opoku, R.A. (2009). The Preference Gap: Ghanaian Consumers' Attitudes toward Local and Imported Products. *African Journal of Business Management, 3*(8), 350-357.

Akuezuilo, E.O., & Agu, N. (2003). *Research and statistics in education and social sciences; methods and application*. Akwa: Nuel Centi Publishing and Academic Press Ltd.

Alagulakshmi, V., Subhathra, K. & Vanitha, S. (2020). *Quality system for garment manufacture*. Retrieved September 30, 2019 from https://www.fibre2fashion. com

Alzahrani, I. (2012). *Evaluate Wiki Technology as an E-Learning Tool from the Point View of Al-Baha University Students: A Pilot Study with Undergraduate Students in Both Faculties of Science and Education.* Retrieved November 25, 2019 from http://www.files.eric.ed.gov

Amadehe, F. K., & Gyimah, A. (2018). *Introduction to Research Methods in Education*. College of Distance Education, University of Cape Coast. CoDE Publications.

American Society for Quality (2021). *What are quality standards?* Retrieved July 5, 2021 from: https://www.asq.org

Annum, G. (2017). *Research instruments for data collection.* Retrieved September 28, 2021, from http://campus.educadium.com/newmediart/file.php/1/giilmadstore/UgradResearch/acaResearch_index.htm

Anyakoha, E. U., & Eluwu, M. (2010). *Home management for schools and colleges.* Africana First Publishers Limited.

Asanovic, K. A., Cerovic, D. D., Mihailovic, T. V., Kostic, M. M., & Reljic, M. (2014). *Quality of Clothing Fabrics in terms of their Comfort Properties*. Retrieved May 6, 2020 from https://www.researchgate.net/publication/ 287546963

Asare, I. T. (2012). Critical success factors for the revival of the textile sector in Ghana. *International Journal of Business and Social Science, 3*(2), 307-310.

Ashraf, R. (2014). *Cotton fibre structure and its properties. National Textile University Manawala, Faisalabad.* Retrieved July 23, 2020 from http://www. academia.edu/6667052/cotton

Atilgan, T. (2007). *Acceptable quality levels in the textile sector and their effect on the level of competition*. Retrieved July 14, 2020 from: http://www.fibtex. lodz.pl/2007/1/16.pdf

Babu, S. (2019). *Dimensional stability of woven fabric, properties of woven fabric*. Retrieved January 6, 2021 from http://www.textileadvisor.com

Babu, S. (2019). *Tensile strength of woven fabric, fabric strength, properties of woven fabric*. Retrieved January 6, 2021 from http://www.textilead visor.com

Bamfo, B.A. (2012). Consumer attitude toward products made in Ghana. *Global Journal of Business Research, 6*(1). Retrieved July 8, 2020 from https://www.research gate.net

Bayuko, T. M., & Peligah A. Y.S. (2014). *Wax and Java Prints of Ghana: Usage, Form, Names and Meanings.* Retrieved December 6, 2020 from http://www. semanticsscholar.org

Bhatnagar, P. (2012). *An introduction to textiles (physical analysis).* Amazon 1st edition. Retrieved November 13, 2020 from http://www.research gate.net

Bicerano & Associates (2018). *Objective evaluation of fabric hand.* Retrieved from https://www.polymerexpert.biz

Brooks, M. M. (2012) *Identifying fibres and fabrics*. Retrieved from: https://www.dressandtextilespecialists.org.uk/wp-content/uploads/2021/08/Identifying-Fibres-and-Fabrics.pdf

Cano-Glu, S., Geultekin, B. C., & Yeukselo-Glu, S. M. (2004). Effect of ultrasonic energy in the washing of medical surgery gowns. *Ultrasonics, 42,* 113-119.

Castillo, J. (2008). *Research Population.* Retrieved from: http://www. experiment-resources.com/research-population.html

Chichi, A. C., Howard, E. K., & Baines, E. (2016). *Assessment of Consumer Preference in the Use of African Wax Prints in Ghana*. Retrieved July 6, 2020 from http://www.researchgate.net

Claessens, M. (2018). *Definition of product quality-different approaches to quality.* Retrieved from: https://www.marketing-insider.eu/definitions-of-product-quality/

Crosby, P. B. (1979). *Quality Is Free: The Art of Making Quality Certain*. New York: McGraw Hill.

Daddah S., Dogbey R, Osei J., & Dedume V. (2015). *Consumers' Preferences for Wax Prints for Ceremonial Occasions in the New Juaben Municipality.* Retrieved from http://www.iiste.org

Daiz, E. (2014). *What is your definition of quality?* Retrieved from http://www.gbnews.ch

Danquah, P. M. (2018). Comparison of selected performance characteristics of Ghanaian and imported real wax cotton printed fabrics. *The International Journal of Science & Technology*

Das, S., & Hunter, L. (2015). Fabric quality issues related to apparel merchandising. *Research Journal of Textiles and Apparel (RJTA), 19*(1), 25-35

Deshwal, R., & Khambra, K. (2006). *Effects of soaps and detergents on bending length of cotton fabric*. Bombay: Colour Publications.

Edegbe, C. O. (2014). *Evaluation of colour fastness, physical and mechanical properties of coloured woven brocade fabric*. A thesis submitted to the Postgraduate School Federal University of Technology, Owerri.

Egu, F. K. (2009). *Trade liberalization and the Ghana textile industry.* Retrieved from http://www.Ghanaweb

Elebiyo, G.M.A. (2000). *Comparative study of wax print fabric versus hand woven Nigeria fabrics.* B.Sc. dissertation A.B.U. Zaria

Elshaer, I. (2012). *What is the meaning of quality?* Suez Canal University, Management Department, Egypt. Retrieved from: https://mpra.ub.uni-muenchen.de/57345/1/MPRA_paper_57345.pdf

Etikan, I. Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics, 5*(1), 1-4 Retrieved from https://article.sciencepublishinggroup.com/html/10.11648.j.ajtas.20160501.11.html

FabricLink (2006). *Frequently asked fabric care questions.* Retrieved from http://www.fabriclink.com/care/carefaq.

Fashola, K. O. Giwa, A. Iliya E. B. & Orivri, D. O. (2012*). Assessment of quality and performance of some selected furnishing fabrics*. Retrieved from https://www.researchgate.net/publication/264853394

Feigenbaum, A. V. (1951). *Quality control: Principles, practice, and administration*. New York: McGraw Hill.

Garvin, D. A. (1984). What does "product quality" really mean? *Sloan Management Review*, *26*(1), 25-43

Ghana Standards Authority (2013). Retrieved January 15, 2020 from http://www.aboutus.org.

Ghana Standards Board (2010). Retrieved January 15, 2020 from http://www.businessghana.com.

Ghosh, A., & Mal, P. (2019) *Testing of fibres, yarns and fabrics and their recent developments.* Retrieved May 16, 2021, from https://www .researchgate.net/ publication/335038934

Ghuznavi, R. (2013). Rangeen: Colours of life. *Magazine of the Arts*, *65*(2), 28-37. Retrieved from https://www.search.ebschost.com

Glock, R.E., & Kunz, G.I. (2005). *Apparel Manufacturing – Sewn Product Analysis*, 4th Edition. Upper Saddle River, N. J., United States of America: Pearson Education, Inc.

Hallik, A. (2015). *Determination of fabric quality of loungewear product on the example of Kriss Soonik Loungerie*. Retrieved from http://www. azslide.com

Haque, H. (2014). *Textile finishing.* Retrieved from: https://www.academia. eEdu/20026997/TextileFinishing

Hearle, J. W. S., & Morton, W. E. (2008). *Physical properties of textile fibres* (4th ed.). Cambridge: Woodhead Publishing Series.

Hoefter, F. A. (2001). The Competitiveness of Ghana's Industry. *Dissertation*, 151-158.

Hossain, M.M., Datta, E., & Rahman, S. (2016). A Review on Different Factors of Woven Fabrics' Strength Prediction. *Science Research,* 4(3) 88-97. doi: 10.11648/j.sr.20160403.13

Howard, E.K. (2013). *Challenges and prospects of selected large-scale textile factories in Ghana.* Kumasi: Doctorate Thesis, Kwame Nkrumah University of Science and Technology. Institute of Statistical, Social and Economic Research (ISSER, Legon, Ghana).

Howard, E. K., Aboagye, I., & Quarcoo, J. N. (2016). Cause and Effects of the Dwindled State of the Ghana Textile Industry. *International Journal of Advanced Scientific Research & Development (IJASRD), 03*(04/I), 01 – 12. Retrieved from http://www.researchgate.net

Howard, E. K., & Amankwah, A. M. (2013). Technical limitations of African prints and their implication on garment construction in Ghana. *Journal of Science and Technology*, *33*(1), 75-85. Retrieved from http//www. dx.doi.org/10.4314/

Hu, J. (2008). *Fabric testing. Cambridge, England: Woodhead Publishing Limited.* Retrieved from http//www.182.160.97.198

Iheaturu, N. C., Aharanwa, B. C., Chike, K., Ezeamaku, U. L., Nnorom, O. O., & Chima, C. C. (2019). Advancements in textile finishing. *Journal of Polymer and Textile Engineering*, *6*(5), 23-31. Retrieved from: http://www.researchgate.net

International Organization for Standardization. EN ISO 9004: (2009). *Managing for the sustained success of an organization - A quality management approach.* p. 4.

Jen, (2004), *Fundamental of Research Method*. 2nd Edition Yola Nigeria.

Jintu, F., Yu, W. and Hunter, L. (2004). *Clothing appearance and fit: science and technology*. Cambridge: Wood- head Publishing in association with The Textile Institute.

Juran, J.M. (1974). *Quality Control Handbook.* New York: McGraw-Hill.

Jurkowitsch, S. H. & Sarlay, A. (2010). An analysis of the current denotation and role of wax and fancy fabric in the world of African textiles. *International Journal of Management Cases*, *22*(3), 28-48. Retrieved from http://www.researchgate.net

Kadolph S. J. (2010). *Textiles* (11th ed.). Upper Saddle River, N.J.: Prentice Hall.

Kavitha, S. (2013). *Apparel quality standard and implementation*. (School of Distance Education) Bharathiar University Coimbatore

Kiron, M. I. (2014). *Dimensional stability to washing of a dyed fabric. (B.Sc. in Textile Engineering) Noakhali Textile Engineering College.* Retrieved July 16, 2020 from: http://www.textilelearner.net

Kiron, M. I. (2015). *How to measure fabric shrinkage in the textile and apparel industry*. (B.Sc. in Textile Engineering) Noakhali Textile Engineering College. Retrieved April 20, 2020 from: http://www.textilelearner.net

Kiron, M. I. (2021). *Greyscale for colour change and colour staining.* (B.Sc. in Textile Engineering) Noakhali Textile Engineering College. Retrieved February 20, 2024, from: http://www.textilelearner.net

Kirshenblatt-Gimblett, B. (2006). *What is research design? The context of design. Performance studies methods course syllabus*. New York University.

Kogi, D. B. (1997). *Utilization of Locally Extracted Gum – Resins from Ataxcantha (L) Khanrya (L), and Cactus Latex to Serve as Binder for Mixing Pigment for Textile Printing*. Unpublished M.A Thesis, Industrial Design A.B.U Zaria.

Korley, H. (2011). *An investigation into strategies and policies to expand the textile industry in Ghana: A case study using Akosombo Textile Limited (ATL) and Ghana Textile Product (GTP).* Ashesi University College.

Kothari, V. K. (1999). *Testing and quality management.* IAFL Publication. Retrieved from: https://www.worldcat.org

Krejcie, R., V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement, 30*, 607-610.

Kuramoto, K., Yoshihisa, M., Kitaguchi, S., & Sato, T. (2017). *Visual colour fastness assessments for multi-coloured fabrics*. 17th World Textile Conference AUTEX. Retrieved July 1, 2021, from https://www.researchgate.net/publication/320951094

Kwame, S. A. (2012). *Effects of locally manufactured soaps on colour, strength and elongation of some selected Ghanaian printed fabrics.* (Masters' thesis, University of Cape Coast)

Leffler, K. B. (1982). Ambiguous Changes in Product Quality. *The American Economic Review, 72*(5), 956.

Malik, M. H., Hussain, T., & Ali, Z (2009). *Effect of fabric count on the tensile strength of blended woven fabrics.*

Marshal, S.G, Jackson H.O., & Stanley M.S (2000). *Individuality in Clothing Selection and Appearance* (6th ed.). New Jersey: Prentice Hall Inc.

McCafferty, P. (2022). *What is the greyscale and why is it important? Fundermax North America Blog.* Retrieved March 2, 2024 from https://blog.fundermax.us

Mokhtari, J., Nouri, M., & Sarli, M. A. (2011). Dyeing of cotton/polyester fabric with selected reactive/dispersed dyes under neutral conditions. *Journal of Colour Sciences and Technology, 4,* 143-148.

Muscato, C. (2019). *Textile Fibres: Definition, Properties & Types.* Retrieved from http://www.study.com

Nayak, R. K., & Padhye, R. (2015). *The care of apparel products.* Retrieved January 11, 2020, from http://www.sciencedirect.com

Nemr, A. E. (2012). *From natural to synthetic fibres. National Institute of Oceanography and Fisheries*. Retrieved February 20, 2024, from https://www.researchgate.net

Nilsson, C., & Lindstam, E. (2012). *Assessing Denim Quality. Bachelor Thesis in Textile Technology, Swedish School of Textiles*. Retrieved from http://www.diva-portal.org

Nonyelum, A. B. (2017). *Utilization of Nigerian-made fabrics for garment making among academic and non-academic female staff in Enugu State. University of Nigeria, Nsukka.* Retrieved from: http://dspace.unn.edu.ng

Obiana, V. U. A. (2011). *Comparative Effect of Laundering on the Properties of Nigerian and Foreign Made Print Fabrics.* Ahmadu Bello University, Zaria. Retrieved from http://www.kabunni.abu.edu.ng

Okewole, L.F., & Akanbi (2003). *Textile and Clothing Maintenance.* Immaculate-city Akunlemu, Oye Nigeria.

Oliver, P. (2006). *The SAGE Dictionary of Research Methods.* London: SAGE Publication Ltd.

Oliver, P. (2013). Purposive sampling. In V. Jupp (Ed.), *The SAGE Dictionary of Social Research Methods*. Retrieved from http://srmo.sagepub.com /view/the-sage-dictionary-of-social-research-meth

Olugbemisola, M., & Kalilu, R. O. R. (2013). *Paradigmatic appraisal of technical and technology of Adire in the last five decades*. Department of fine and applied arts, Ladoke Akintola University of Technology. Ogbomosho Nigeria. Retrieved from http//www.iiste.org

Orivri, D. P. (2005). *Studies on the properties of foreign and locally made finishing fabrics*. B.Sc. Research project of A.B.U. Zaria.

Ozdil, N., Ozdogan, E., & Oktem, T. (2003). Effects of enzymatic treatment on various spun yarn fabrics. *Fibres and Textiles in Eastern Europe*, *4*(43), 58-61.

Ozo, J. U., Egele, A.E., & Udu, A. A. (2018). *The Quality Factor in Consumers' Preference of Textile Fabrics: A Comparative Evaluation of Consumer Preference for Domestic and Imported Textile Fabrics (Wrappers) in Abakaliki, Ebonyi State, Nigeria*. Retrieved from http://www.ajol.info

Palash, S. S. (2013). *Quality Parameters of woven, knitted and non-woven fibres, Uttara Engineering College, Dhaka*. Retrieved from http://www.textilelearner.blogspot.com

Primentas, A. (2001). Puncture and tear of woven fabrics. *Journal of Textile and Apparel, Technology and Management*. Retrieved from: https://www.sciencedirect

Quartey, P. (2006). The textile and clothing industry in Ghana. In H. Jauch, & R. Traub-Merz, (Eds.), *The future of the textile and clothing industry in Sub-Saharan Africa, Germany*. Bub Bonner Universitats-Buckdruckerei.

Quartey, P., & Abor, J. (2011). *Do Ghanaians prefer imported textiles to locally manufactured ones?* Retrieved from http://www.researchgate. net

Rahman, M. F., Bara, L. M., Chowdhury, A. M., & Khan, A. N. (2009). *Quality management in the garment industry of Bangladesh.*

Reeves, C. A. Bednar, D. A. (1995). Defining quality: Alternatives and implications. Academy of Management. *The Academy of Management Review*, *19*(3). 419.

Ricardo, D. (1821). *The Principle of Political Economy and Taxation.* Dent, London

Ryall, J., & Kruithof, J. (2001). *The Quality Systems Handbook*. Australia: Consensus Books.

Sarpong, G. D., Howard, E. K., & Osei-Ntiri, K. (2011). Globalization of the Fashion Industry and its effects on Ghanaian independent fashion design. *Journal of Science and Technology 31*(3), 97-106.

Saville, B. P. (1999). *Physical testing of textiles. Woodhead Publishing Series in Textiles.* Retrieved from: https//www.elsevier.com

Sayed, A. (2013). *What are textiles: Definition and meaning?* Retrieved December 23, 2019 from https://www.textileapexblogspot.com

Shewhart, W. A. (1931). *Economic Control of Quality of Manufactured Product.* New York: Van Nostrond.

Showkat, N., & Parveen, H. (2017). *Non-probability and Probability sampling.* Retrieved from https://www.researchgate.net

Sun, D. (2018). *Fabric handle as a concept of high-performance apparel.* Heriot-Watt University UK. Retrieved from https://www.researchgate. net

Sutton, J., & Kpentey, B. (2012). *An enterprise map of Ghana*. IGC, London

Taguchi G. (1987). *Introduction to quality engineering: designing quality into products and processes.* Japan: Asian productivity organization.

Textile Science and Care (2012). *Introduction to Textiles, Terminology used in Textiles*. Retrieved from http://ecoursesonline.iasri.res.in/course/ view. php?id=235

The New Charter Ghana Standards Board. Retrieved from http://www.gsb.gov.gh.pdf

Tsekpo, P. (2020). *Challenges in the promotion of the made-in-Ghana textile prints on the contemporary Ghanaian market.* Retrieved from https://www.researchgate.net

Tuchman, B.W. (1980). *The decline of quality*. New York: Times Magazine, 2 November, pp. 38- 47.

Venkatraman, P. (2015). *Fabric properties and their characteristics*. Retrieved January 2, 2020 from www.e-space.mmu.ac.uk

Wikipedia (2020). *Dimensional stability (fabric).* Retrieved November 25, 2020,from:https://en.wikipedia.org/wiki/Dimensional_stability_(fabric)

Zubair, A. M. (2022). *Experimental Research Design-type and process.* Department of Peace and Conflict Studies. University of Dhaka. Retrieved March 12, 2024, from https://www.researchgate.net

APPENDICES

APPENDIX A

OBSERVATIONAL GUIDE

SECTION A

Pre-Test (each test would be conducted three times and recorded accordingly)

Sample A

1. What is the weight of the sample?
   - 1st weight…………………
   - 2nd weight………………...
   - 3rd weight………………...
2. What is the yarn count in the warp direction of the sample?
   - 1st count…………………
   - 2nd count………………...
   - 3rd count………………...
3. What is the yarn count in the weft direction of the sample?
   - 1st count…………………
   - 2nd count………………...
   - 3rd count………………....
4. What is the weave type of the sample?
   - 1st observation………………
   - 2nd observation……………...
   - 3rd observation………………...
5. what is the fibre type of the sample?
   - 1st observation………………
   - 2nd observation……………...
   - 3rd observation………………...

Sample B

6. What is the weight of the sample?
   - 1st weight…………………
   - 2nd weight……………….……..
   - 3rd weight………………...

7. What is the yarn count in the warp direction of the sample?
   - 1st count…………………
   - 2nd count………………..
   - 3rd count………………...
8. What is the yarn count in the weft direction of the sample?
   - 1st count…………………
   - 2nd count………………..
   - 3rd count………………...
9. What is the weave type of the sample?
   - 1st observation………………
   - 2nd observation………………..
   - 3rd observation………………...
10. what is the fibre type of the sample?
   - 1st observation………………
   - 2nd observation………………..
   - 3rd observation………………...

Sample C

11. What is the weight of the sample?
   - 1st weight…………………
   - 2nd weight………………..
   - 3rd weight………………...
12. What is the yarn count in the warp direction of the sample?
   - 1st count…………………
   - 2nd count………………..
   - 3rd count………………...
13. What is the yarn count in the weft direction of the sample?
   - 1st count…………………
   - 2nd count………………..
   - 3rd count………………...
14. What is the weave type of the sample?
   - 1st observation………………
   - 2nd observation………………..
   - 3rd observation………………...

15. what is the fibre type of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...

Sample D

16. What is the weight of the sample?
    - 1st weight…………………
    - 2nd weight………………...
    - 3rd weight………………...
17. What is the yarn count in the warp direction of the sample?
    - 1st count…………………
    - 2nd count………………...
    - 3rd count………………...
18. What is the yarn count in the weft direction of the sample?
    - 1st count…………………
    - 2nd count………………...
    - 3rd count………………....
19. What is the weave type of the sample?
    - 1st observation………………
    - 2nd observation……………...
    - 3rd observation………………...
20. what is the fibre type of the sample?
    - 1st observation………………
    - 2nd observation……………...
    - 3rd observation………………...

Sample E

21. What is the weight of the sample?
    - 1st weight…………………
    - 2nd weight………………...
    - 3rd weight………………...
22. What is the yarn count in the warp direction of the sample?
    - 1st count…………………
    - 2nd count………………...
    - 3rd count………………...

23. What is the yarn count in the weft direction of the sample?

- 1st count…………………
- 2nd count………………...
- 3rd count……………….....

24. What is the weave type of the sample?

- 1st observation………………
- 2nd observation……………...
- 3rd observation………………...

25. what is the fibre type of the sample?

- 1st observation………………
- 2nd observation……………...
- 3rd observation………………...

Sample F

26. What is the weight of the sample?

- 1st weight…………………
- 2nd weight………………...
- 3rd weight………………...

27. What is the yarn count in the warp direction of the sample?

- 1st count…………………
- 2nd count………………...
- 3rd count………………...

28. What is the yarn count in the weft direction of the sample?

- 1st count…………………
- 2nd count………………...
- 3rd count……………….....

29. What is the weave type of the sample?

- 1st observation………………
- 2nd observation……………...
- 3rd observation………………...

30. what is the fibre type of the sample?

- 1st observation………………
- 2nd observation……………...
- 3rd observation………………...

SECTION B

Test

Sample A

1. What is the test for colourfastness to crocking (wet) of the sample?
   - 1st observation………………
   - 2nd observation………………..
   - 3rd observation………………...
2. What is the test for colourfastness to crocking (dry) of the sample?
   - 1st observation………………
   - 2nd observation………………..
   - 3rd observation………………...
3. What is the test for colourfastness to washing of the sample?
   - 1st observation………………
   - 2nd observation………………..
   - 3rd observation………………...
4. What is the force at the break at the warp direction of the sample?
   - Force at 1st break………………
   - Force at 2nd break………………..
   - Force at 3rd break………………...
   - Force at 4th break…………………
   - Force at 5th break…………………
5. What is the force at break at the weft direction of the sample?
   - Force at 1st break………………
   - Force at 2nd break………………..
   - Force at 3rd break………………...
   - Force at 4th break…………………
   - Force at 5th break…………………
6. What is the extension at break at the warp direction of the sample?
   - extension at 1st break………………
   - extension at 2nd break………………..
   - extension at 3rd break………………..
   - extension at 4th break………………..
   - extension at 5th break………………..

7. What is the extension at break at the weft direction of the sample?
   - extension at 1st break………………
   - extension at 2nd break………………..
   - extension at 3rd break………………..
   - extension at 4th break………………..
   - extension at 5th break………………..
8. What is the dimensional stability of the sample in warp direction?
   - After the first period of washing…………..
   - After the second period of washing…………
   - After the third period of washing……………
9. What is the dimensional stability of the sample in the weft direction?
   - After the first period of washing…………..
   - After the second period of washing…………
   - After the third period of washing……………

Sample B

10. What is the test for colourfastness to crocking (wet) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
11. What is the test for colourfastness to crocking (dry) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
12. What is the test for colourfastness to washing of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
13. What is the force at break at the warp direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………

14. What is the force at break at the weft direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
15. What is the extension at break at the warp direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
16. What is the extension at break at the weft direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
17. What is the dimensional stability of the sample in warp direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………
18. What is the dimensional stability of the sample in the weft direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………

Sample C

19. What is the test for colourfastness to crocking (wet) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...

20. What is the test for colourfastness to crocking (dry) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
21. What is the test for colourfastness to washing of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
22. What is the force at break at the warp direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
23. What is the force at break at the weft direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
24. What is the extension at break at the warp direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
25. What is the extension at break at the weft direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..

26. What is the dimensional stability of the sample in warp direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………
27. What is the dimensional stability of the sample in the weft direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………

Sample D

28. What is the test for colourfastness to crocking (wet) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
29. What is the test for colourfastness to crocking (dry) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
30. What is the test for colourfastness to washing of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
31. What is the force at break at the warp direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
32. What is the force at break at the weft direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………

33. What is the extension at break at the warp direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
34. What is the extension at break at the weft direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
35. What is the dimensional stability of the sample in warp direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………
36. What is the dimensional stability of the sample in the weft direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………

Sample E

37. What is the test for colourfastness to crocking (wet) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
38. What is the test for colourfastness to crocking (dry) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
39. What is the test for colourfastness to washing of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...

40. What is the force at break at the warp direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
41. What is the force at break at the weft direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
42. What is the extension at break at the warp direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
43. What is the extension at break at the weft direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..
44. What is the dimensional stability of the sample in warp direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………
45. What is the dimensional stability of the sample in the weft direction?
    - After the first period of washing…………..
    - After the second period of washing…………
    - After the third period of washing……………

Sample F

46. What is the test for colourfastness to crocking (wet) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
47. What is the test for colourfastness to crocking (dry) of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
48. What is the test for colourfastness to washing of the sample?
    - 1st observation………………
    - 2nd observation………………..
    - 3rd observation………………...
49. What is the force at break at the warp direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
50. What is the force at break at the weft direction of the sample?
    - Force at 1st break………………
    - Force at 2nd break………………..
    - Force at 3rd break………………...
    - Force at 4th break…………………
    - Force at 5th break…………………
51. What is the extension at break at the warp direction of the sample?
    - extension at 1st break………………
    - extension at 2nd break………………..
    - extension at 3rd break………………..
    - extension at 4th break………………..
    - extension at 5th break………………..

52. What is the extension at break at the weft direction of the sample?

- extension at 1st break………………
- extension at 2nd break………………..
- extension at 3rd break………………..
- extension at 4th break………………..
- extension at 5th break………………..

53. What is the dimensional stability of the sample in warp direction?

- After the first period of washing…………..
- After the second period of washing…………
- After the third period of washing……………

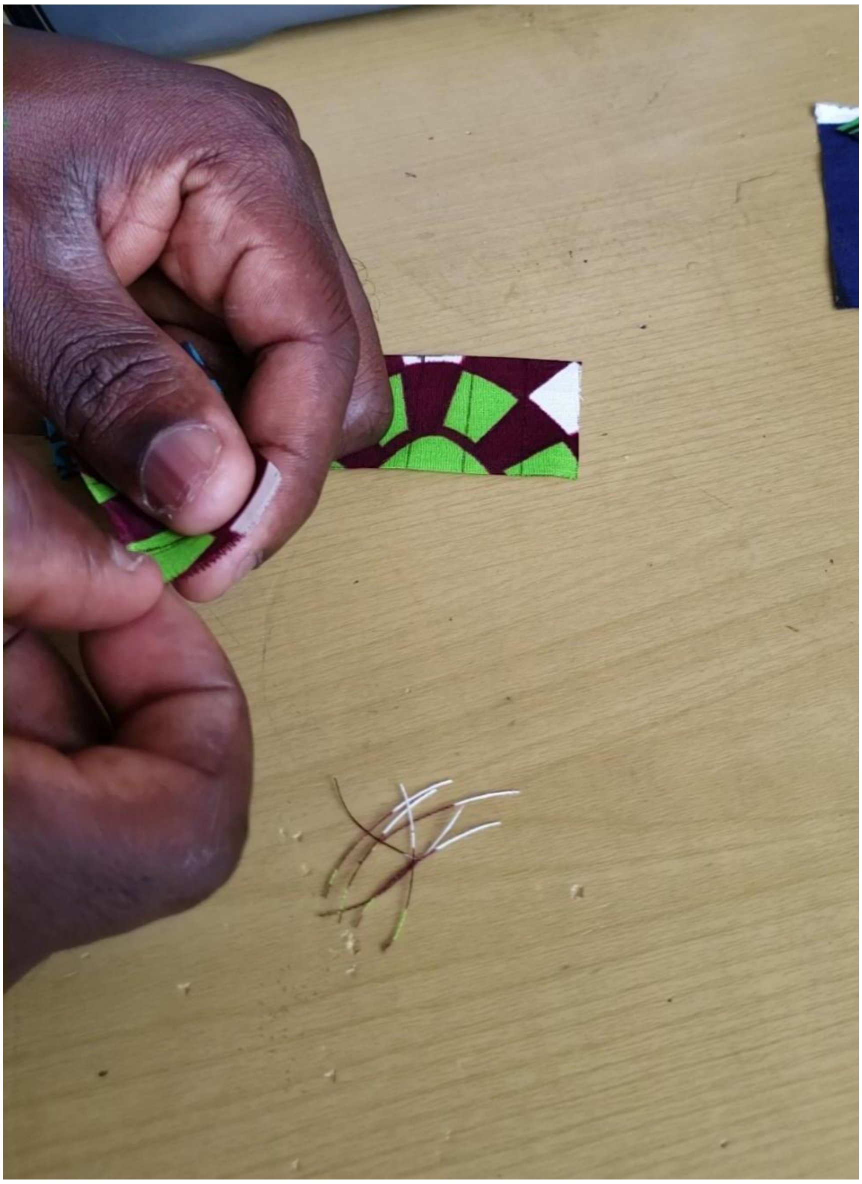
54. What is the dimensional stability of the sample in the weft direction?

- After the first period of washing…………..
- After the second period of washing…………
- After the third period of washing……………

APPENDIX B

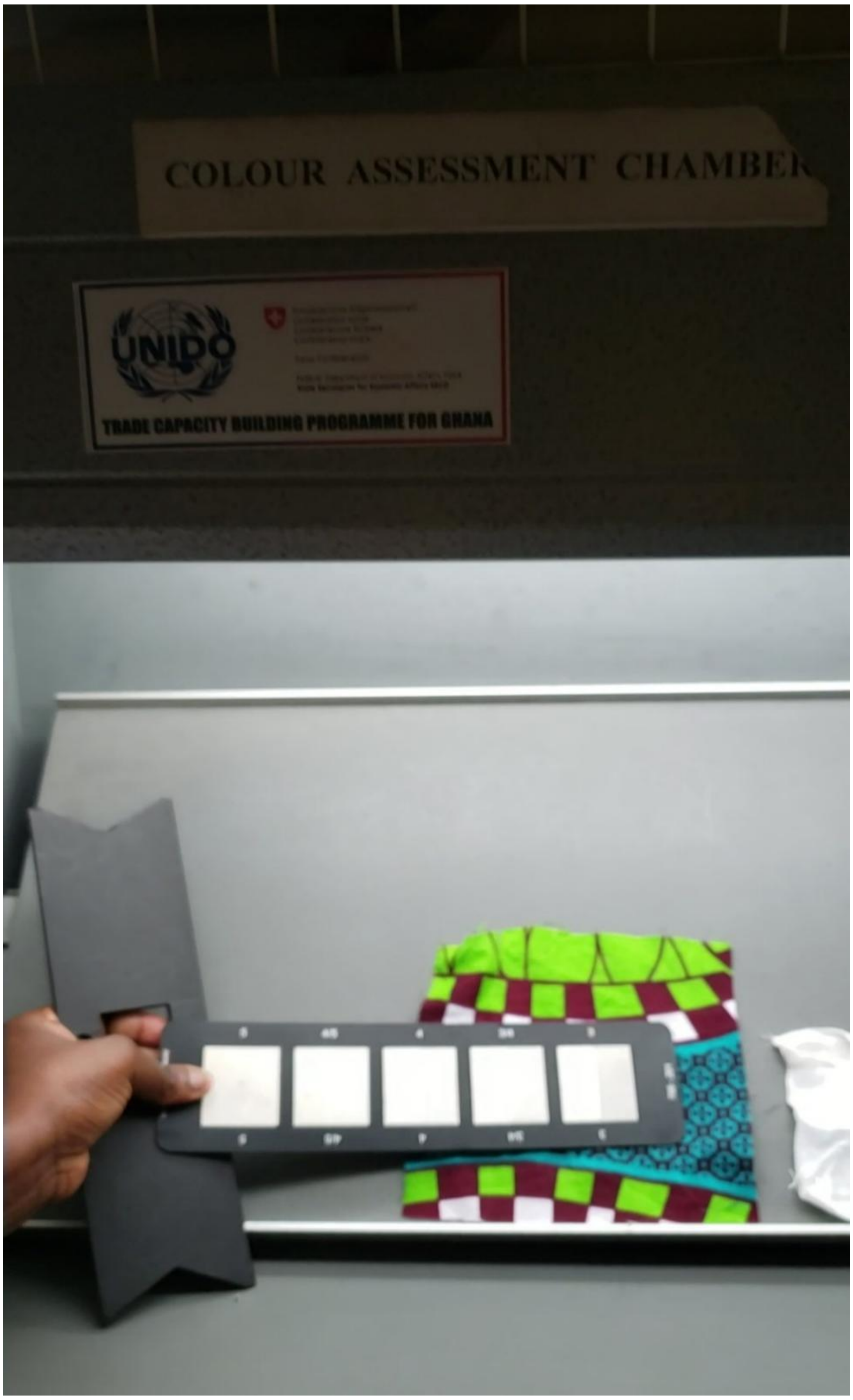
INSTRUMENTS AND MATERIALS USED FOR THE STUDY

Weighing balance for measuring the weight of the specimen (Adams equipment)

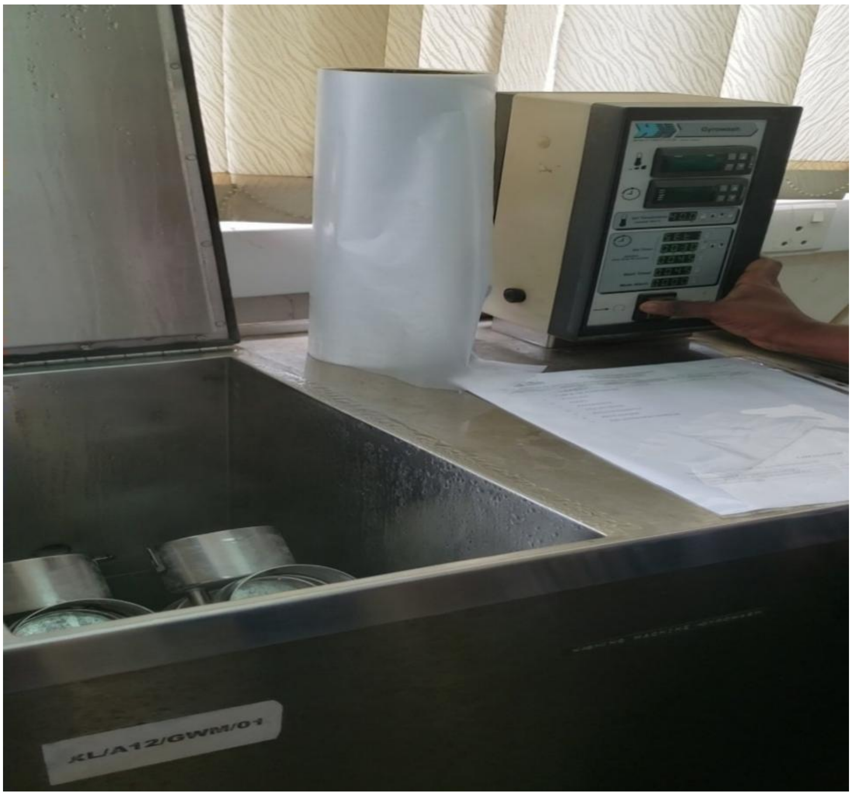


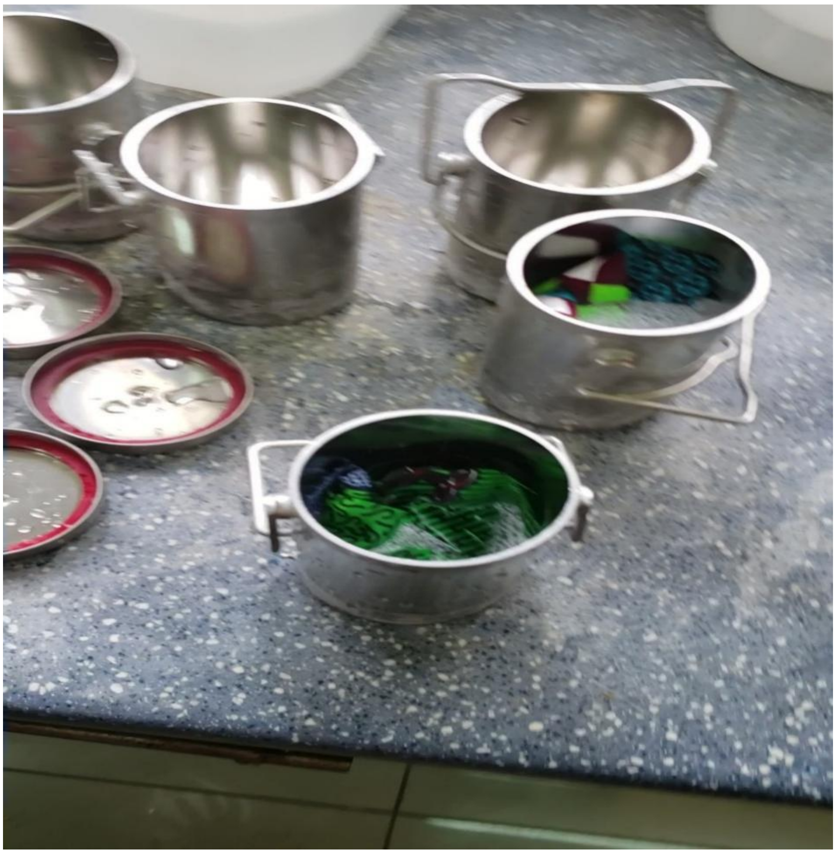
Picking ends for yarn count

Crockmaster for checking colour staining through rubbing



Grey scale for assessing colour change





Washing machine (Standard launder-Ometer, Gyrowash 315) and canister (cylinders)

Fabric being measured for tensile strength testing

Tensile Strength Machine (Hounsfield H%K-S)

APPENDIX C

FORMULAS USED BY GSA

1. Fabric weight (GS ISO 3801)

    Average weight × 100

2. Yarn count (GS ISO 7211-2)

    Average count × 2.54

3. Dimensional stability (GS ISO 5077)

$$\text{Percentage shrinkage} = \frac{\text{Original length} - \text{Final length}}{\text{Original length}} \times 100$$

APPENDIX D

ETHICAL CLEARANCE

UNIVERSITY OF CAPE COAST

INSTITUTIONAL REVIEW BOARD SECRETARIAT

TEL: 0558093143 / 0508878309
E-MAIL: irb@ucc.edu.gh
OUR REF: UCC/IRB/A/2016/1044
YOUR REF:
OMB NO: 0990-0279
IORG #: IORG0009096

10TH AUGUST, 2021

Ms. Christiana Dora Bannerman Mensah
Department of Vocational and Technical Education
University of Cape Coast

Dear Ms. Mensah,

ETHICAL CLEARANCE – ID (UCCIRB/CES/2021/60)

The University of Cape Coast Institutional Review Board (UCCIRB) has granted Provisional Approval for the implementation of your research titled **Examining and comparing Quality Standards of Local and Foreign Made Wax Printed Fabrics.** This approval is valid from 10th August, 2021 to 9th August, 2022. You may apply for a renewal subject to submission of all the required documents that will be prescribed by the UCCIRB.

Please note that any modification to the project must be submitted to the UCCIRB for review and approval before its implementation. You are required to submit periodic review of the protocol to the Board and a final full review to the UCCIRB on completion of the research. The UCCIRB may observe or cause to be observed procedures and records of the research during and after implementation.

You are also required to report all serious adverse events related to this study to the UCCIRB within seven days verbally and fourteen days in writing.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours faithfully,

Samuel Asiedu Owusu, PhD
UCCIRB Administrator

ADMINISTRATOR
INSTITUTIONAL REVIEW BOARD
UNIVERSITY OF CAPE COAST