

**UNIVERSITY OF EDUCATION, WINNEBA  
COLLEGE OF TECHNOLOGY EDUCATION**

**ASSESSMENT OF THE EMERGING DESIGNING TECHNOLOGIES IN THE  
CLOTHING INDUSTRY: THE PERCEPTION OF FASHION DESIGNERS  
WITHIN ADENTAN MUNICIPALITY**



**ROSEMARY ENYONAM AMEKO**

**JUNE, 2022**

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**THIS DISSERTATION IS PRESENTED TO THE DEPARTMENT OF FASHION  
AND TEXTILES DESIGN EDUCATION, FACULTY OF VOCATIONAL  
EDUCATION OF UNIVERSITY OF EDUCATION, WINNEBA, COLLEGE OF  
EDUCATION, KUMASI IN PARTIAL FULFILLMENT OF AWARD OF  
MASTERS OF TECHNOLOGY EDUCATION IN FASHION AND TEXTILES.**

**JUNE, 2022**

## DECLARATION

### STUDENT'S DECLARATION

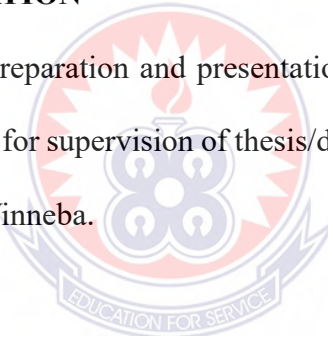
I, ROSEMARY ENYONAM AMEKO declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is part or whole, for another degree elsewhere.

SIGNATURE:.....

DATE:.....

### SUPERVISOR'S DECLARATION

I/We hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis/dissertation/project as laid down by the University of Education, Winneba.



DR. JOSEPHINE NTIRI

Signature:.....

Date:.....

## **DEDICATION**

This work is first and foremost dedicated to my father Mr. Abert Kojo Ameko and sweet mother Florence Ameko and my husband Reverend Isaac Korsi Nukporfe who took keen interest in my education.



## ACKNOWLEDGEMENT

The process involved in research and thesis writing really entails a lot. There is therefore the need for much guidance and direction. To this end, I express my thanks to the Almighty God through whose guidance this thesis finally saw the light of the day. A number of people helped me directly or indirectly and it will be most inappropriate if I fail to acknowledge their valuable assistance. I am greatly indebted to my supervisor, Dr. Josephine Ntiri for her advice and valuable suggestions. As my supervisor, she proved to be tolerant and dealt with issues amicably, which might otherwise have marred the completion of this work. She read my scripts many times and made countless number of necessary corrections. This approach helped me a great deal to work towards my objectives. I owe her a debt of gratitude that I cannot pay and cannot repudiate. Without her, this thesis might not have seen the light of day. Also, thanks to all persons and individuals who gave me audience to interview them. I thank them for their valuable information. Without them, I could not have written anything for the Chapters 4 and 5. Additional thanks also go to all colleague graduate students in the Department for their invaluable inputs to this work during the usual seminars. Finally, to my husband Reverend Isaac Korsi Nukporfe, I say God bless you.

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## ABSTRACT

The aim of this study was to investigate the emerging production technologies in clothing production in Ghana - the perception of customers within Adentan Municipality. The research design adopted was mixed method. The researcher used mixed research approach for the study. Population studied was fashion designers in the Adentan Municipality. The study population was 120 fashion designers. Random sampling was used to select 80 fashion designers for the study. Questionnaire, interview guide and focus group workshop were the main instrument used to gather primary data. Descriptive statistics was used to analyze data. The study results indicated that the emerging designing technologies in clothing industry were ranked as Computer-aided design (CAD) representing first (1<sup>st</sup>) in the likert ranking order, Automated inspection (AIN) ranked 2<sup>nd</sup>. Automated material handling devices (AMHD) ranked 3<sup>rd</sup>. The study shows that more than half of the respondents indicated that fashion designers use automated inspection machines to perform product inspection. Also, a little more than half of the respondents agreed that that fashion designers use systems capable of automatically loading, unloading, and sorting out. Moreover, more than half of the respondents agreed that Fashion designers use a form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols. The study concluded that in order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea. The study recommended that fashion designers must be encouraged to reduce the amount of solid and hazardous waste in their packaging. Fashion designers should creatively re-think, customize or re-design an existing design concept.

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the Study

Fashion change is essential, today's fashion is being shaped by technology and globalization. Jarrow and Dickerson (2017) asserted that, globalization is having a tremendous impact on the fashion industry; the textiles design through to the design conception to production. There have been various revolutionary technologies used in the fashion industry in the developed countries but Ghana seems to be crawling in the use of these technologies. Although tertiary education for fashion design and textiles in Ghana has a requirement for students to study technologies such as Computer Aided Designing (CAD) and Computer Aided Manufacturing (CAM), very little is ever done on the teaching of these rather influential technologies (Jones, 2018).

Herman (2012) states, although there is no shortage of talent in textile tradition or even industrial textiles, what is lacking in Africa and Ghana for that matter is a policy dealing with fashion as a major sector in the industry. Hines and Bruce (2017), also asserted that the shift in the production poles to developing and emerging economies like China has made it possible for high earned brands to be easily copied at affordable prices for fashion conscious youth across the globe who want to be at speed with trends and yet have poor buying power especially in the third world countries.

The need for fashion technology in Ghana is very eminent and there is the need for the industry to consider introducing these technologies to boost production in the various sectors of the industry. The Ghanaian fashion industry has over the years, taken care of designing, production and sales of fashion products usually with afro-centric ideologies by the various designers and manufacturers. The Fashion industry plays a keen role in the socio-economic development of every nation by helping generate income for living and it

is a means through which people acquire their clothing needs as well as exhibit the various cultures of designers as well (Herman, 2012).

Dickerson (2019) asserted that the fashion industry is not exempted from the globalization process, since the business of fashion is now a global economy. The striking effect is that, fashion designers, manufacturers, merchandisers and marketers are expanding their umbrellas throughout the whole world with the use of fashion technology in their various units and departments. Today in Ghana, most manufactures use basic technology whiles the rest of the world keeps evolving its technological systems to achieve maximum results in designing, production and retail. In view of this the various specific objectives have been generated to derive answers from the Ghanaian fashion industry (Dickerson, 2019).

The fashion world in Ghana has been slow to embrace computation and electronic technology as aesthetic elements in the clothing itself. Perhaps due to a lack of knowledge about new technologies, or the absence of motivation to augment an already abundant repertoire of resources for the creation, the use of electronics has generally been limited to tools for the construction of garments, practical applications in novelty clothing. Technology has been seen to influence the Ghanaian fashion industry to some extent though many rewards have not been realized yet (Jones, 2018).

While developed countries like China and the USA are earning valuable foreign exchange and building their wealth from the exportation of fashion products (Sarpong, 2010), Ghana's income is still very low. Evidently, globalization is associated with technological advancement that facilitates the movement of people and goods worldwide. It can therefore be stated that globalization is the key means through which manufacturers produce and distribute their economic wealth in exchange for economic gains (Bird et al., 2016).

Dickerson (2019) commented that the fashion industry is not exempted from the globalization process, since the business of fashion is now a global economy. The striking effect is that, fashion designers, manufacturers, merchandisers and marketers are expanding their umbrellas throughout the whole world. Fashion manufacturing being labour intensive, has migrated from high wage developed world to developing countries; India, China, Indonesia, Bangladesh, and other Asian countries are generating valuable foreign exchange through exportation of clothing and textiles products to U.S.A., Europe and developing countries like Ghana and others (Jones 2018; Bird et al., 2016, Bheda et al., 2013).

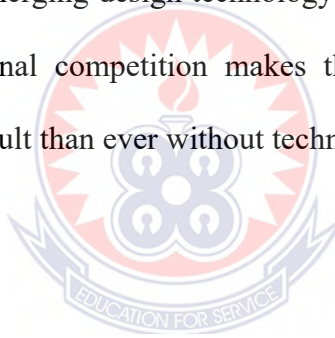
While developing countries like China, India and Hong Kong are earning valuable foreign exchange and building their wealth from exportation of Fashion products (Bird et al., 2016), Ghana's income generated from fashion production is very low. Fashion education has also been improved; it is now being studied at the tertiary level of Ghana's educational institutions, where graduates are expected to acquire quality demand driven employable and marketable skills that will make them take their roles in the industrial sector, work and be economically productive (Amankwah, 2017).

Yet the fashion businesses in Ghana are still dominated by abundant roadside dressmakers whose market value is very low. Their main production is based on "custom-made" items. The main Ghanaian fashion export destinations comprising of EU countries, U.S.A. and some parts of the ECOWAS have declined due to competition with other African countries and poor finishing of products which make products not able to conform to standards required (Quartey, 2016). This study would assess the emerging production techniques in clothing production in Ghana- the perception of Fashion designers within Adentan Municipality.

## **1.2 Statement of the Problem**

Over the years, fashion centers have collapsed and housing garment manufacturers who do not utilise emerging designs Technology to their full capacity (Quartey, 2016). Yet the industry is still dominated by dressmakers whose method of production and incomes are very low. The fashion designer must possess a range of skills, and these abilities fall into one of two areas, namely 'creative' ability and 'technical' ability. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea (Jackson, 2016).

Though there are a lot of promising fashion houses in Ghana in tune with technology like Computer Aided Design (CAD) and there is still the need to introduce, educate and encourage designers to use emerging design technology in their designing and production systems. Increased international competition makes the development of a financially successful product more difficult than ever without technological know-how.



## **1.3 Purpose of the Study**

The aim of this study is to investigate the emerging designing technologies in the clothing industry in Ghana - the perception of fashion designers within Adentan Municipality.

## **1.4 Objectives of the Study**

The main objectives of this research are:

1. To find out the emerging designing technologies in clothing industry.
2. To assess the usage of various designing technology among the fashion designers in Adentan Municipality.



3. To organise a training workshop on the emerging designing technologies with the fashion houses in Adentan Municipality.

### **1.5 Research Questions**

1. What are the emerging designing technologies in clothing industry?
2. What are the various designing technology being used among the fashion designers in Adentan Municipality?
3. What kind of designing technology training workshop should be organised for fashion designers in Adentan Municipality?

### **1.6 Significance of the Study**

Primarily, this research has been designed to ascertain and identify the use of emerging techniques in the Ghanaian fashion design and manufacturing industry amongst fashion businesses and the following benefits will be achieved at the end of this research. The study may make a significant contribution to the body of knowledge in the field of fashion. It may help in identifying specific fashion engineering that are being used in the industry by major industry players in Ghana. Also, it may serve as a point of reference by other researchers and in the near future to assess and investigate the use emerging design techniques in the Ghanaian fashion industry using the global market as a yard stick. Finally, it may provide evidence and a benchmark in for policy makers of the industry to improve and expand the emerging fashion designs systems of the fashion industry of Ghana.

### **1.7 Limitation of the Study**

The researcher encountered challenges during the distribution of the questionnaires. For example; the participants felt reluctant to give certain vital information concerning the

status quo of their fashion houses operations. Secondly, the researcher found it difficult retrieving the questionnaires back from the fashion designers. Thirdly, time constraints also affected the distribution of the questionnaires.

### **1.8 Delimitations**

The aim of this study is to investigate the emerging designing technology in clothing production in Ghana- the perception of Fashion designers within Adentan Municipality. Moreover, the concept of the study is delimited in scope to the research objectives including to investigate the emerging designing technologies used by the fashion designers clothing industry. Secondly, to assess the investigate the emerging designing technology being used by fashion designers in Adentan Municipality and thirdly, to organise a training workshop on the emerging designing technologies with the fashion houses in Adentan.

### **1.9 Organisation of the Study**

The study will be organised in five chapters of which the first is the introduction. The introduction covers the background to the study, statement of the problem, objectives, research questions, significance of the study, limitations, delimitations and organisation of the study.

The second chapter covers the review of related literature. The review covers literature in the areas relating to technology in today's fashion industry.

Chapter three covers the methodology to be used in collecting the necessary data on the study. The methods used include interviews, observation and the use of questionnaires.

The fourth chapter cover an assemblage of the findings. The findings will be assembled in sub topics in relation to the research topic.

The fifth chapter discussed the findings and the six chapter covers the summary of the study, conclusions drawn and recommendations made on the study and how it will impact positively on the Ghanaian fashion industry.



## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

The chapter reviewed comprehensive related literature to cover the role of the fashion designer, the fashion designer in a contemporary fashion industry, the fashion design process, producing collection, the impact of adopting emerging fashion technologies, the various production technologies used by major fashion houses, making fashion, designing, materials and production methods.

#### 2.2 History of fashion design

Refers specifically to the development of the purpose and intention behind garment, shoes and accessories and they are designs and construction. The modern industry based around firms or fashion houses run by individuals designers, started in the 19<sup>th</sup> century with Charles Fredrick who, beginning in 1858, was the first designer to have his label sown into garment he created (Rennold, Milbank, Caroline, 2010).

Fashion started when human begun wearing clothes. These clothes were typically made from plants, animal skins, and bones. Before the need 19<sup>th</sup> century the division between haute couture and ready – to – wear did not really exists but the most basic pieces of female clothing were made to measure by dressmakers and seamstresses dealing directly by the clients (Laver, James 2007).

#### 2.3 The Role of the Fashion Designer

The duty of the fashion designer who acts as the principal director in the design of garments, in a complex industry that is comprised of many sectors and different market levels. Within dress discourse and contemporary media, the fashion designer is often portrayed as an exaggerated caricature; a powerful creator who is responsible for the

continuing impact of fashion as a reflection of contemporary culture and a person who can directly influence the trends and movements within the fashion industry. At times described as “...precious and autocratic” the fashion designer is a figure who became a post-war phenomenon, the public ‘face of fashion’; a title ascribed by the fashion media reader and consumer (Breward, 2013, p.21). According to Kawamura (2015) the fashion designer needs to be seen as the luminary in the production of fashion since, “Designers personify fashion” (Kawamura 2015, p.57).

While the evolution of an early fashion system where dress was a personification of style, can be traced to the French court of King Louis XIV in the late 17th century (Breward, 2013), the modern fashion industry emerged in Paris in the mid-19th century with the establishment of the couture business of Charles Fredrick Worth. Wealthy courtesans and actresses began to replicate the styles of the court and would employ the skills of the Parisian embroiderers, tailors and dressmakers who benefited from royal patronage. During the 18th century French fashion was dictated by surface ornamentation rather than by garment form or silhouette. Whilst silhouettes were slow to change, the influence of the trimming’s supplier, or *marchande de modes*, was greater than that of the seamstress, or *couturiere en habit*, in the development of fashion styles (de Marly, 2010).

Rose Bertin (considered a *marchande de modes*) became a dressmaker to Marie Antoinette and has been widely credited as a precursor of the 19th century couturier (Wilson 2013; Breward, 2013 p.23). Bertin was successful in creating clothing that flattered her clients and suited their tastes, however she did not challenge the dress form of the day but merely worked with existing elements to produce fashionable garments. Throughout the late 18<sup>th</sup> century and beyond, working conditions for employees, whether tailor or dressmaker, were appalling and included long working hours; sleeping and eating on the premises; poor

pay; and seasonal employment (Wilson 2013). These were common issues symptomatic of a trade that disregarded the welfare of its employees.

At the turn of the 19th century political unrest ensured that the influence of fashion had moved beyond the French court. The Parisian dressmakers and tailors continued to enhance the city's reputation as a Centre for luxury and style, serving the new nobility and affluent international clients. According to Breward (2013) the fashion designer emerged as an outcome of the need for a conduit to act between the client, and the producers and merchants. The success of the newly evolved role of the fashion designer came from "...their ability to read the implications of cultural and stylistic change and incorporate it into a characteristic and very well-promoted personal vision" (Breward, 2013, p 23).

By the middle of the 19th century two systems of fashion production had emerged: the bespoke work of the tailor and couturier; and the expansion of a ready-to-wear clothing industry that was principally developing in the USA and the UK. Beginning with the production of uniforms and men's wear garments, the early development of a ready to wear industry emerged in response to a need for stock supplies of ready-made clothing (Wilson 2013, Leopold, 2012). Indeed, both Wilson and Leopold trace the beginnings of an unseen, 'invisible' ready-to-wear industry to the late 17th century with the production of large quantities of military and naval garments, which co-existed alongside the production of fashionable garments for an exclusive clientele from the artisan tailors, milliners and dressmakers (Wilson, 2013). Eventually, the manufacture of ready-to-wear clothing became factory-produced, but the method of manufacture did not impact on the women's wear market until the beginning of the 20th century. Perhaps in part it was due to the late entry of women in the urban workforce who needed ready-made clothing for work purposes (Leopold, 2012).

Leopold (2012, p 103), defined the type of manufacture as, "...the investment in and co-ordination of labour and machines in a designated workplace for the purpose of increasing the productivity – and profitability – of manufacturing." The patent of the sewing machine by Singer in 1851 ensured the growth in the availability of affordable ready-to-wear clothing that also capitalized on the continuance of the 'sweatshop' and the employment of poorly paid capsulized staff, predominately women (Wilson, 2013). The perception that couture is at the top of a hierarchical system largely stems from the characterizations of particular sectors defined during periods of fashion history.

Breward comments on the migrant entrepreneurs of London and New York in the mid to late 19<sup>th</sup> century who were inclined towards the profit-driven, low-investment, fast turnover area of manufacturing. This approach is still prevalent today, and can be seen as a precursor for mass-market clothing and an association with the "...rough and tumble of the rag trade with its language of deals and robust attitude to officialdom." (Breward, 2013 p.55). At the close of the 19<sup>th</sup> century the emergence of clothing factories created disputes within the growing mass-produced ready-to-wear clothing industry as the continual disregard for employee conditions created public unrest fueled calls for improved conditions from the trade union and activist movements (Wilson, 2013, p 55). But despite the controversy the mass production of clothing was now expanding, and the consumption of cheap fashionable goods continued to escalate as clothing became available in small boutiques and large city department stores across the USA and UK.

An understanding of fashion and dress history plays an integral part in an analysis of the role of the contemporary fashion designer since the conventional role of the designer emerged from the practices applied in the roots of the modern industry. Furthermore, the accepted role of the fashion designer as a player within a system, is clearly evident in these early beginnings. Breward (2013, p 49), notes that the rise of the named designer was in part

due to the role of the designer as the “...glamorous adjunct, employed to impart the sheen of fashionability to a trade that is sometimes anything but ‘fashionable’

However, it is critical to remember that the production of fashion clothing is a collective activity with the designer contributing as one actor in a much larger chain. Therefore, it is important to survey the rise of the fashion designer in the context of a historic and contemporary fashion system, which enables the investigation of the tasks and activities that are associated with the fashion design process in the manufacture of fashionable clothing.

#### **2.4 The Fashion Designer in a Contemporary Fashion Industry**

Understanding the role of the designer is fundamental to the arguments proposed within this thesis, since with the opportunity to analyse and reflect upon the designer’s tasks, responsibilities and collaborative relationships the possibility to suggest an alternate model of practice arises. In broad terms, the fashion designer initiates and generates design ideas that become new fashion garments; in industrialized nations it is usually a professionally trained person who is expected to have a high level of design ability (Cross, 2016).

The fashion designer must possess a range of skills, and these abilities fall into one of two areas, namely ‘creative’ ability and ‘technical’ ability. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea (Jackson, 2016).

In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production (Jackson, 2016). Importantly, the designer must also be able to communicate the new product to the manufacturer and the client (Cross, 2016). The new product is typically communicated through drawings, and in the case of fashion design this



may be achieved through the use of stylized fashion drawings. These drawings commonly provide a complete view of the garment and a technical or trade sketch that provides the garment specifications and details. They are then followed by the production of a prototype/mock-up or toile that enables the fashion designer to see the garment as a three-dimensional form.

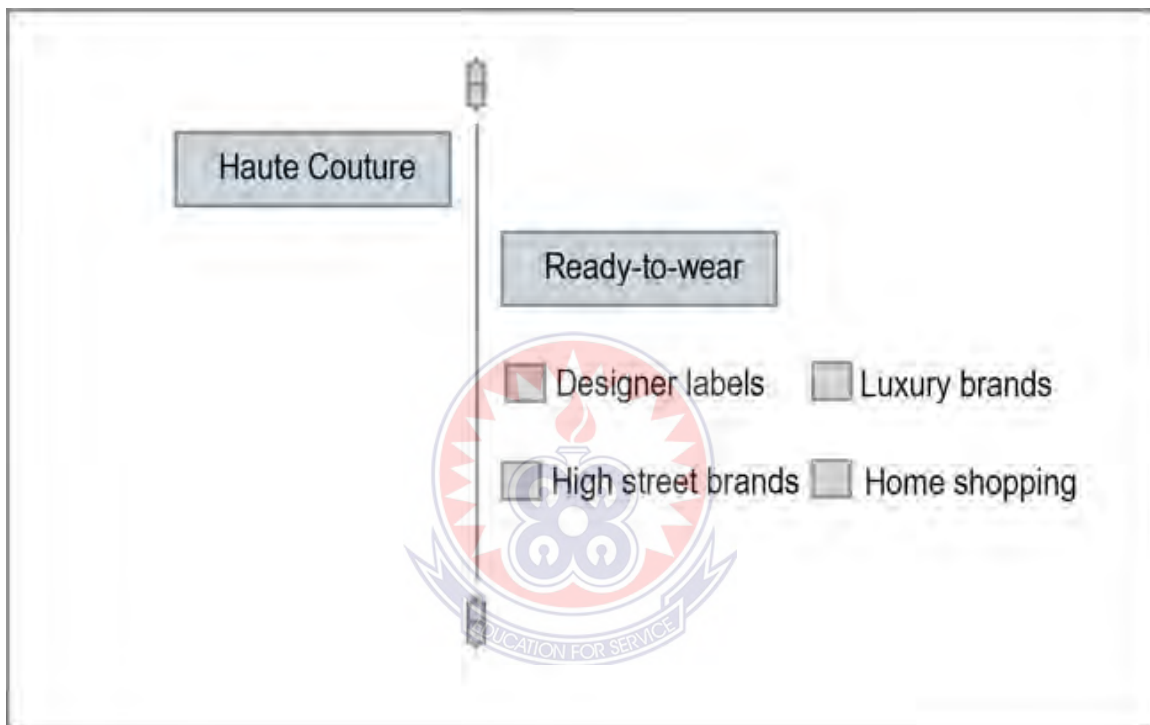
The prototype allows the designer to trial the garment on a body as a way of testing, and provides the opportunity to reflect upon the design and assess its appropriateness. At this stage modifications can be made, by evaluating its aesthetics, ergonomics, production capabilities and potential for success in the marketplace. It is also important to analyze and explore the industry in general, to appreciate the differences between the sectors and to plot the position of the fashion designer in relation to terms of tasks, duties and responsibilities within these sectors.

The global production of fashion involves numerous companies, manufacturers and retailers who develop products for specific sectors and market levels. Although the sectors of the fashion industry are broad (ranging from sportswear to lingerie) a company will typically operate within one sector with corresponding women's wear, men's wear or children's wear products (Stecker, 2016).

A company will often generate one or more product lines, which fit precisely within an identified market level. These lines are distinguishable by a defined set of criteria determined by factors such as price point, quality of material, manufacture, and production numbers. It is then the fashion designer's responsibility to create a new collection that fits within this criterion. In relation to the research, the question is how a designer can ensure that a product meets the defined market criteria and sustainability objectives at the same time.

Within the women's wear fashion sector, the market levels can be defined as: "haute couture and bespoke tailoring; prêt-a-porter or ready-to-wear; designer labels; luxury brands; high street or mass-market brands and home shopping." (Renfrew & Renfrew, 2009)

To provide further context for the thesis it is necessary to outline the key attributes of the different market levels that sit within the fashion system, and the placement of the fashion designer within the corresponding production method.



**Figure 2.1: Diagram showing the market levels of the fashion industry**

**Source:** (Renfrew & Renfrew 2009, p.80)

**Haute couture:** the production of haute couture fashion represents the height of symbolic and quality fashion clothing through its association with materiality, construction and performance. Equally haute couture places the named fashion designer within a high-profile position that is associated with prestige and exclusivity, for example labels such as Chanel, Christian Dior and Givenchy. The haute couture industry is considered to be the "...highest, most specialized level" of fashion, showing two seasonal collections a year, which are the


product of less than 12 couture houses who are each a member of the *Chambre Syndicale de la Haute Couture* (Renfrew & Renfrew, 2009, p 80).

There are strict membership guidelines, which ensure that the industry is retained in Paris, however membership by association has allowed designers such as Martin Margiela, and Giorgio Armani to exhibit alongside the couturiers in Paris in recent years (Renfrew & Renfrew, 2009). The fashion designer, or creative director, within the couture house is expected to direct the collections to meet the highest standards of quality, craftsmanship and creativity, and may lead the styling direction of all associated and licensed products. Therefore, the designer's position and contribution within the house is of utmost significance.

**Ready-to-wear or prêt-à-porter:** ready-to-wear (RTW) fashion emerged in response to a need for fashionable clothing to be produced in volume. While the RTW garments are produced in standardized sizes, rather than in singular made-to-measure production methods, the RTW collections may emerge from companies that range from small independent fashion labels to established international design houses. Renfrew and Renfrew (2009) chart the rise of the ready-to-wear line from the Paris couture houses in the 1930s, where customers could buy a diffused version of the couture garment off the shelf at an affordable price.

The contemporary designers who work within this market level are diverse and may be independent designers such as Belgian designer, Dries Van Noten, or employed by the luxury super brands such as Hermes or Burberry. However, the RTW garments embody the designer's individual design aesthetic and retain an air of exclusivity.

**Designer labels:** designer fashion labels include a broad range of businesses that encompass larger international labels to small independent fashion labels such as UK designer, Jonathan Saunders, or Australian designer Akira Isogawa. Designer labels will often influence future trends that in particular inspire the mass-market level brands. These labels commonly retail within boutiques or department stores and may have achieved acclaim in their country of origin, and perhaps internationally. Typically, the designer label will be a small run business that is led by the designer and perhaps employs a small team to produce the collection (Sorger & Udale, 2016). Moreover, the designer/owner of a small fashion label may be managing all aspects of the business including manufacturing, press and sales, and so on. This means that the available time for designing can often be compromised by these other activities.



**Luxury brands:** the luxury super brand is a relatively new phenomenon that includes large global companies who frequently employ high profile advertising campaigns to promote a range of products targeted towards different market levels that encapsulate a luxury lifestyle. The super brands may produce perfumes, accessories, and a range of luxury goods alongside RTW fashion collections. Super brands are often owned by large conglomerates; for example, the Gucci group, and Louis Vuitton Moët Hennessy (LMVH). Fashion labels under this type of ownership include Gucci, Louis Vuitton, Fendi, and Bottega Veneta (Sorger & Udale, 2016). Super brands are instantly recognizable through their extensive use of branding, with products distributed in most modern international cities. The fashion designer is typically high profile, and may additionally produce collections under their own name.

**High street brands:** the high street fashion companies or mass market brands are responsible for producing and buying collections in large volumes that retail directly in stores. The lead time from sketch to final product can take a matter of weeks rather than months as in RTW, and new collections will arrive in store frequently during the season, sometimes each fortnight as with companies such as H&M and Topshop (Renfrew & Renfrew, 2009). These stores do not typically take part in the conventional fashion show system, instead relying on press exposure and advertising to inform the customer of the newly available collection. The fashion designer employed within this market level is typically part of a large supply-chain, which may not be transparent or visible. A number of companies will have in-house design teams that may employ as many as 90 designers (Sinha, 2012). The designer will often be responsible for a particular fashion line, or a garment type, for instance ladies' jeans. The fashion designer in this market level usually remains anonymous, which may be due in part to the fact that the designer is creating garments to a specified design brief set by the company. This typically allows the designer little opportunity to design garments that reflect any individual design aesthetic.

**Home shopping:** this market level includes the retailing of products through the means of catalogues and / or online shopping (or e-tailing). Renfrew and Renfrew (2009) ascribe the origination of home shopping to the US-based Sears catalogue in the 1950s, where home shopping provided clothing to customers who could not easily access the collections in store.

Digital online shopping has revitalized the home shopping market and caters for a wide range of merchandise from luxury goods retailers to independent fashion labels and vintage sellers. For the fashion designer the accessibility of online shopping offers independent labels the opportunity to reach new markets, gain exposure and to build a faithful niche following.

In summary, there are a number of critical observations that can be drawn from an analysis of the fashion system. The first observation would be that there appears to be a hierarchical model of fashion design, which in turn creates a hierarchy model for fashion designers. Kawamura (2015, p 58), proposes that designers can be "...classified according to different types within the system of hierarchy, and each group of designers constitutes a class, that is the designers who belong to the fashion system and those who do not." The hierarchical model shows that the most expensive market levels depend upon the named designer, unlike mass manufacturing that relies upon the employment of 'invisible', unnamed designers in the production of large quantities of clothing. The tired fashion model outlined above suggests that the success of the designer is not measured by the amount or variety of clothing that is produced, but in the quality and exclusivity of the collection.

Kawamura (2015), argues that the hierarchy of fashion designers, which is reiterated through the institutional structure of the French organization La Chambre Syndicale de la Couture Parisienne, is based upon social organization rather than aesthetic qualities. Yet she admits that the work of the designer cannot be ignored since any comprehension of the fashion system depends upon an appreciation of the designer's role and the fashion garments they create.

However, the hierarchical model above does not suit all fashion labels and companies; there are inevitably fashion labels that do not sit comfortably within one market level or another. Stecker (2016) notes that many fashion designers will develop new business initiatives in response to their need for artistic recognition and to gain the flexibility to design garments, which reflect a personal design aesthetic. However, to be embraced by the fashion industry the designer needs to work within the fashion system, which is the second observation that can be drawn from analysis of the fashion system. This system is dictated by the fashion buyers, the press - the fashion show organizers who control the public

exposure of selected emerging designers - and the industry schedules of events, promotion, and buying. Indeed Kawamura (2015, p.62), argues that, "...it is the admission into the system that defines designers' creativity" and that the fashion system needs 'stars' to ensure its very existence. With this in mind it is important to explore what is meant by the phrase, 'fashion design process'; what it is, what is involved, and what the fashion designer does within the process that enables those selected to be celebrated within the popular media and to become the next fashion star.

## **2.5 The Fashion Design Process**

Before a product is generated a design, idea or proposal has to be initiated, Cross (2016, p.16), suggests that "...the generation of design proposals is therefore the fundamental activity of designers, and that for which they become famous or infamous". While particular design ideas may be perceived as innovative or new, Cross argues that in the majority of cases design ideas are reincarnations of preceding designs. It may be a contentious view, but in fashion design the point is best exemplified in the formal description of garment types, e.g. a full skirt; or a fitted blouse; or a tailored jacket. Traditionally, a designer will sketch early design ideas, Cross describes this process as "...thinking with a pencil..."

While sketching ideas the designer will be balancing a number of criteria that include: meeting the factors set out in the client or the fashion company's brief; technical or production constraints; and the designer's own aesthetic values. Through sketching, the designer engages in a non-verbal process to find a suitable design solution according to set criteria. Just as the tasks and responsibilities of the designer can vary across different sectors of the fashion and industry, the criteria within the design brief can also alter. When designing

for a high street retailer, for example, it is not uncommon to repeat silhouettes or styles that have achieved significant sales success in previous seasons.

The repeating of styles allows the consumer to expand upon an existing wardrobe of clothing; however, subtle design changes may be used to refresh these ideas i.e. a new fabric choice, or a new print colour way. These criteria around the need for consistency would be outlined within the design brief. However, this approach contrasts greatly to the brief of the fashion designer in the designer ready-to-wear, independent designer, or couture market levels, where the designer will be expected to set new trends in fashion for each coming season. Furthermore, within the luxury and couture market levels the fashion designer may also act as creative or artistic director.

John Galliano, at Christian Dior is a designer, for instance, who is recognized as the creative director of a couture brand. In these elevated roles the designer has a much greater freedom to set the criteria of the fashion brief. This brief may even expand to encompass the responsibility for the artistic direction of the brand image and other creative responsibilities (Jackson, 2016). However, while the creative freedom and role of the designer might fluctuate according to the market level and size of the organization, all designers need to engage in a complex system of production that relies on collaboration with a number of stakeholders.

### **2.5.1 Producing the collection**

Fashion garments are typically designed and produced as part of a seasonal collection or range. This range will establish the parameters for a set of inter-related design ideas displayed within a collection of products including jackets, pants, skirts, tops and coats. The designer will usually aim to produce a collection that has a set number of each garment type that will meet specified market criteria and capture the mood for the new



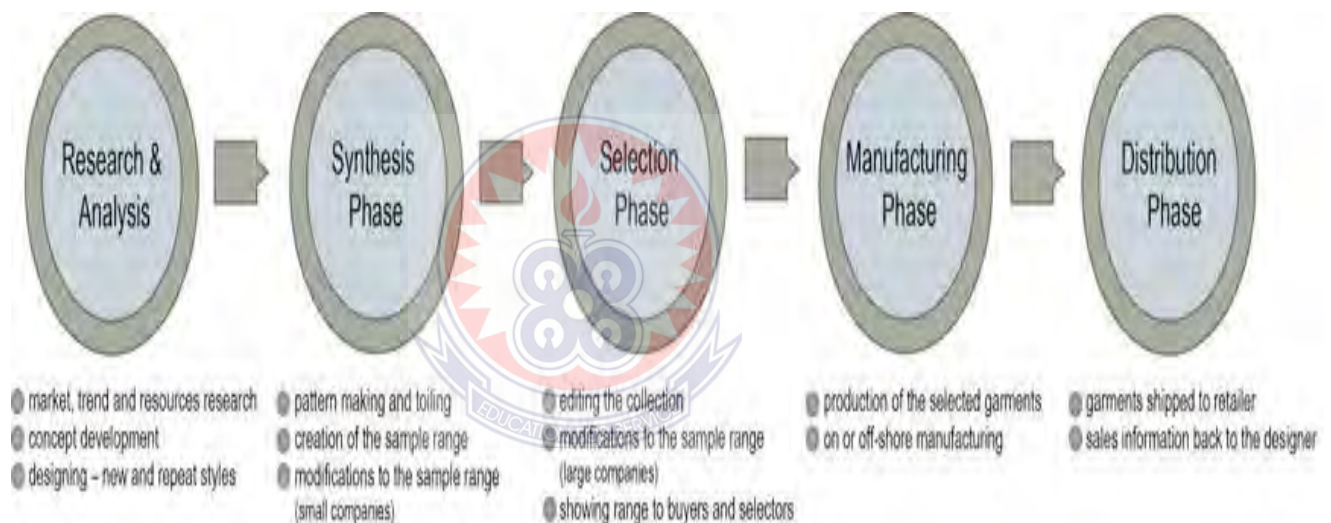
season. In designing a fashion garment, the designer has to primarily create a product, but also make sure that the product meets the wearer's requirements. Indeed, the creation of fashion garments "...is based on reciprocal interaction between the designer, object and viewer." (Loschek, 2009, p.7).

Philosophically fashion garments have the ability to construct and communicate identities, and it follows that there are a number of complex issues related to identity, gender and power involved in the cultural reading of the fashion garment. However, in the majority of cases the production of contemporary fashion clothing continues to be driven by the pragmatic need of meeting market expectations within budget and manufacturing constraints, factors which frequently form the basis of the designer's brief. However, while the majority of fashion garments continue to be designed, produced and measured by economically driven factors, it is becoming increasingly important to measure the manufacture of a fashion product against its impact on the environment and society.

Broadly speaking the fashion design and production process involves a generic sequence of activities, and phases that typically occur within all sectors of the fashion industry. This pattern of production is well documented in many contemporary texts including Renfrew & Renfrew 2009, Sorger & Udale 2006, Jackson & Shaw 2006, Jenkyn-Jones 2002, & Stecker 2016. In brief the process can be defined as five distinct phases: the research and analysis phase; the synthesis phase; the selection phase; the manufacturing phase; and the distribution phase (Sinha, 2012, p7). During the research and analysis phase Sinha notes that a fashion company might conduct market and trend research to support their design activity, and that a company would develop a framework which the designer would refer to for concept development (this is otherwise acknowledged as the 'brief').

A sample range would be produced during the synthesis phase, primarily made by the pattern cutters and sample machinists, with the designer in a managerial role. During the

selection phase garments would be presented to the buyers and selectors, and in most cases the designer would then respond to any modifications required before the garments proceed to manufacture. In the production of the selected samples, the time dedicated to the manufacturing phase for a smaller company is relatively short whilst for a larger company a factory sample range is typically required for quality purposes since manufacturing is often conducted off-shore. During the distribution phase the manufactured garments would be shipped to the retailers and feedback provided to the designer once sales had been noted and achieved (Sinha, 2012).



**Figure 2.2: The five phases of fashion design and production**

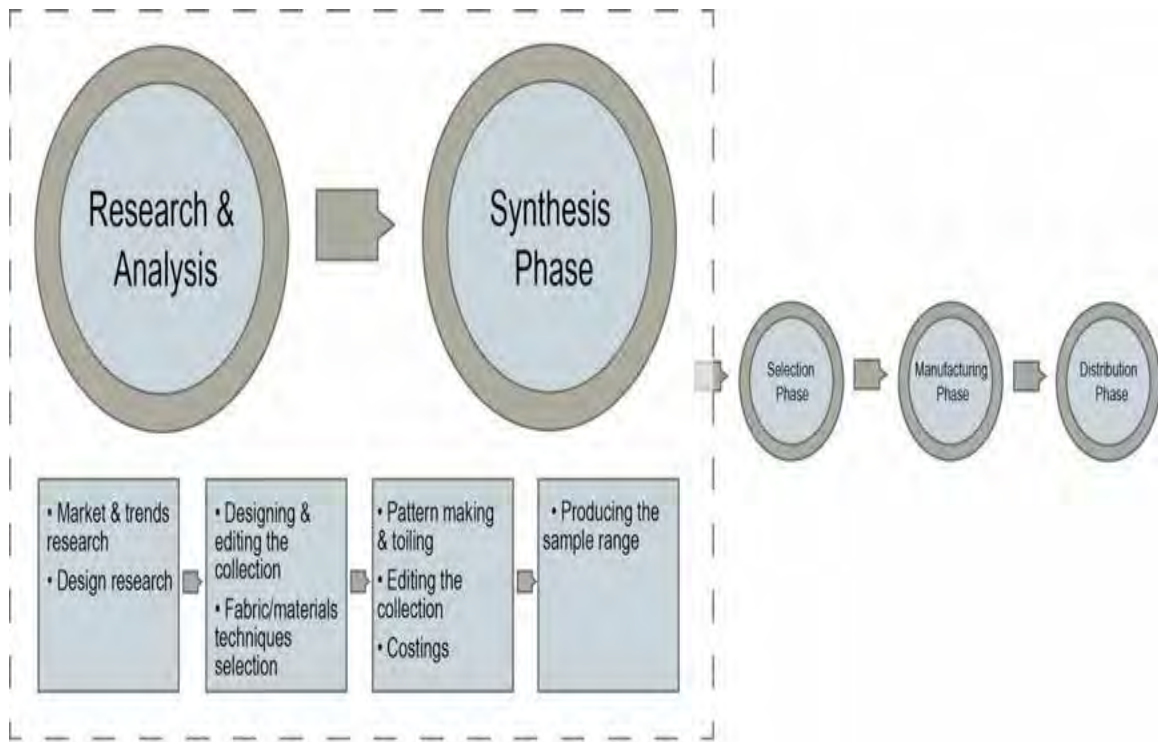
**Source: Sinha, 2012**

Within Sinha's model, Figure 2, the five phases can be further dissected into particular activities and tasks: duties that may be assigned to the fashion designer, or designated to another member of staff, department or other unit or facility within the supply chain. How these duties are designated depends upon the scale of the company. For example, as the size of the company increases the fashion designer's engagement within the process may diminish and their duties become confined to a set of well-defined tasks and activities (Sinha, 2012).

This division of labour can be observed in large scale manufacturing where the designer is typically involved in the research and concept phase only and unlikely to engage or influence any development within the synthesis phase and beyond (Sinha 2012). In contrast, within a micro, small or medium business the reach and influence of the designer is usually increased to extend across the entire design and production process.

However, as identified in Sinha's study there are common phases and activities that most fashion designers engage. Typically, these centre on the research and analysis phase and the synthesis phase, and a distinct series of activities which commonly occur, including: market and trends research; design research; designing and editing a collection; fabric selection; patternmaking and toiling; costings; and the production of the sample range (Renfrew & Renfrew 2009, Sorger & Udale 2006). These phases and activities (as described above) remain the areas where the designer has the most engagement or control from which to influence positive change, notwithstanding variations in the scale of the company.

In fact, these two phases, and their activities, could be alternatively labeled as the 'core' fashion design process (Figure 3), which mirror the practice as depicted within fashion educational texts (Renfrew & Renfrew, 2009, Sorger & Udale, 2006, Jackson & Shaw 2006, Jenkyn- Jones, 2002, Stecker, 2016). While the list of activities noted within the fashion design process are not exhaustive it can be assumed that in a micro, small or medium business the fashion designer will be engaged in these activities, and that their influence extends across all the phases of design and production to some extent.



**Figure 2.3: Comparing the fashion design process with Sinha's (2012) research and analysis phase, and the synthesis phase.**  
**Source: Sinha, 2012**

One of the first tasks for the fashion designer is to assimilate the set of criteria by which new designs can be measured as appropriate. The company, client, or designer may all play a part in nominating these criteria and it is this criterion that forms the basis of the designer's brief. In planning the fashion collection, the criteria will later assist the designer with the process of elimination and refinement of garment design ideas (Stecker, 2016; Seivewright, 2007).

The designer's brief will include developing design ideas which fulfil a number of prerequisites for instance the designs should: meet the consumer's needs; meet market trends; represent the brand or label's vision; work in relation to the body; are designed for a specific market, occasion, season or function; works in relation to fabric selection; that the required resources are accessible and affordable; that the garments can be produced within the budget and will achieve sales (Stecker, 2016). This is a typical set of macro requirements,

which help shape the design brief that a fashion designer will refer to when developing a collection.

In addition, there is a second set of factors that the designer also needs to consider and these relate to the development of individual garment design ideas within the collection. On a micro level the designer needs to consider the design elements within the collection and ensure that these remain appropriate to the requirements of the overall design brief.

Seivewright (2007) provides a list of design elements that include: form; proportion and line; purpose; garment details; colour; fabric; ornamentation and print; themed references; contemporary trends; target market and level, and genres in fashion (Seivewright, 2007). From a sustainability perspective if the already extensive range of criterion discussed here are the standard measure for the success of a design idea, then where, and when, do environmental or ethical criteria come in to play? Given the complexity of the existing design brief It is not surprising that most existing contemporary educational texts, which map the fashion design process and indeed the criteria for designing fashion garments, do not mention a requirement to consider sustainable design principles within the creation of fashion garments (Renfrew & Renfrew 2009, Sorger & Udale 2006, Jackson & Shaw 2006, Jenkyn-Jones, 2002, Stecker, 1996, Seivewright, 2007).

While Renfrew and Renfrew do comment on working with ethics (in a publisher note at the rear of the text) a comment has been provided by the publishers to raise awareness in the "...next generation of students, educators, and practitioners..." (Elvins and Goulder in Renfrew and Renfrew 2009, p.169). Clearly a contemporary viewpoint on design would expect the fashion design community to rigorously embrace sustainable design principles but this does not appear to be the case. Moreover, contemporary fashion educational texts are continuing to promote a traditional method of fashion design practice. To support this,

claim the following section steps through the conventional process of fashion design as applied within an SME, and typically portrayed within educational texts.

## **2.6 The impact of Adopting Emerging Fashion Technologies**

For a number of researchers, the sustainability discourse stems historically from an appraisal of the Industrial Revolution; an era universally identified as a period of rapid change. The Industrial Revolution provided the opportunity for "...industrialists, engineers and designers to solve problems and take immediate advantage of what they considered to be opportunities..." (McDonough & Braungart 2012, p.18). At a time when agriculture was the dominant occupation, the textile industry began as a cottage industry that relied on the skill of the crafts person to produce small quantities of cloth. However, with the invention of specialized and mechanized machinery; the railways; and ocean-going cargo ships; products, including large volumes of woolen cloth could be gathered, processed, manufactured and transported quickly to new and distant markets.

Inevitably people began to gravitate towards the growing cities for employment, as the industrious factories demanded larger workforces to help generate hundreds of products a day rather than over weeks. These early industrialists were optimistic, and driven by economic returns, which were built on producing large volumes of products as efficiently as possible (McDonough & Braungart 2012, p.25).

However, as the new industries flourished a number of major issues began to emerge, including: the wasting of resources; the increase in pollution; and the poor wages and working conditions of the employees. Although cities were often highly and quickly polluted by these industries, resources were abundant and at the time nature's ability to absorb waste and bi-products seemed limitless. Furthermore, it seemed that the industrialists rarely considered their activities in terms of an expansive system, other than in economic

terms. Many people believed that natural resources would remain plentiful and “At the same time, the Western view saw nature as a dangerous, brutish force to be civilized and subdued.” (McDonough & Braungart 2012, p.25).

Within the report, ‘Well Dressed? The present and future sustainability of clothing and textiles in the United Kingdom’, from the University of Cambridge, Institute for Manufacturing (2016), the authors identified that the significant and major problems facing the fashion industry were primarily the issues of environmental impact, and the social concerns associated with the materials, manufacture, supply, consumption, use and disposal of fashion products (Allwood et al., 2016). The major environmental impacts associated with the fashion industry included energy use in material and fibre production, and laundering clothes; the use of toxic chemicals, which are harmful to the environment and human health; the release of chemicals in water systems; and textile waste as a consequence of manufacturing processes and disposal of products.

While significant social concerns for the industry included the use of child labour; the use / abuse of a low or unskilled workforce; pay and employment conditions for employees and sexual harassment.

Furthermore, the dominant health concerns associated with the industry included hazardous chemicals, fibre dust; noise and monotonous repetitive processes during production (Allwood et al., 2016).

These same problems were identified in the 2007 Forum for the Future report, ‘Fashioning Sustainability: A Review of the Sustainability Impacts of the Clothing Industry’ (Draper, Murray & Weissbrod, 2017). The issues noted here are indicative of the problems that are typically associated with the design and production of fashion clothing, moreover the issues listed emphasize the multiplicity of problems that the industry is facing. As this project work specifically questions the designer’s role in integrating sustainable strategies

within the fashion design process it has to be acknowledged that some of the points listed may not come under the direct responsibility of the fashion designer, or that he/she may not be in a position to influence change. However, it can be surmised that the fashion designer is in a position to address some of the environmental and social issues that are associated with the fashion design and production process. Furthermore, it could be argued that it is the moral obligation of the fashion designer to question these accepted norms.

As mentioned, it is evident that the fashion industry as it functions today, where a product is designed and produced as quickly and as cheaply as possible, operates through the lens of an early industrialist perspective. According to McEwan (2014) with a growing population, unstable economic markets and the spread of globalization, if the fashion industry continues to play its part in a culture of 'business as usual' society's quality of life will dramatically deteriorate as natural systems fail. McDonough and Braungart use the phrase "Towards a new Industrial Revolution" as a means for describing a future when industry and the environment can exist together in harmony (2012, p.6).

As the activities of the industrious human population over the last century have often facilitated a decline in ecosystems, rather than see industry and the environment in opposition, McDonough and Braungart (2012, p.16), advocate the creation of "...products and systems that celebrate an abundance of human creativity, culture and productivity. That are so intelligent and safe, our species leaves an ecological footprint to delight in, not lament?" As other species in the natural world manage to operate industriously whilst nourishing the environment, McDonough and Braungart argue that it is humans who are the problem.

The industrial designer, educator and pioneering responsible design advocate, Papanek (2015, p17), posits the view that each person in society can inspire and lead change. While complex sustainability issues and problems are often left to professionals, scientists



and activists, Papanek and others suggest that the general population can create change at a local level by for example, simply separating and recycling household rubbish. It is through these various local acts that an individual can demonstrate that "...our most basic patterns of consumption, manufacture and recycling" can be reimagined (Papanek, 2015).

Moreover, these acts indicate that society is willing to accept changes to conventional and institutionalized patterns of behaviour. Papanek (2015), suggested that each person should reflect on his or her own role in society; and so, it follows that the fashion designer should examine the impact that is being created by the fashion industry, and question what it is that they can do to lessen the impact. If fashion garments are designed and produced using conventional methods that are damaging to the environment while contributing to ethical and social problems, then the question for the fashion designer is, how can a designer ensure that a product meets the defined market criteria and sustainability objectives at the same time?

Products that are frequently found in landfill waste are typically designed "...on a linear, one-way cradle-to-grave model. Resources are extracted, shaped into products, sold, and eventually disposed of in a "grave" of some kind, usually landfill or incinerator." (McDonough & Braungart, 2012, p27). These cradle-to-grave products include fashion garments. In the pursuit of economic rewards, the fashion industry, while not being purposefully immoral, continues to make products using "...outdated and unintelligent design". Chapman (2015) reinforces this point and argues that while it is generally agreed that the rapid growth in human population has led to an increase in resource consumption, a major contribution to this problem has been the mismanagement of resources in the way that products are designed, made and consumed.

Allwood et al., (2006); Fletcher (2008); Black (2008); & Hethorn & Ulasewicz (2008) all propose that all sectors of the fashion industry, from lingerie to high street brands

to luxury labels, need to develop sustainable products and services, which consider economic, environmental, social and ethical issues throughout the product life cycle. As a society the obsession for consuming fashion goods has seen an enormous growth in the 'fast fashion' sector. This sector is responsible for trend driven products that utilise 'just in time' technology in order for the product to reach the stores in the quickest possible time. High street retailers within this competitive sector focus on selling fashion garments that retail at a low price.

Characteristically the garments are manufactured from inferior fabrics and produced in countries where low salaries and poor working conditions for employees can be widespread (Clark, 2008). Moreover, the garments are recognized by the consumer as short lifespan products. For the consumer these lesser quality products are easily disposable garments; garments that provide a 'quick, cheap fashion fix' that will prove useful on a handful of occasions but will inevitably become landfill waste in a short period of time. Since it appears that the consumer has accepted that fashion garments are disposable items (in general terms), it is of no surprise to reveal that even expensive garments are often disposed of and replaced rather than repaired (Draper et al., 2007).

However, the fashion garment is almost inevitably recognized as an item designed for a particular 'moment in time'. This is evidenced in the fashion magazine seasonal catwalk report, or the launch of new fashion styles in the retail sector. The garment, like many products, is designed with a 'built-in obsolescence', which encourages the consumer to discard one product in pursuit of a replacement item (Chapman, 2015; McDonough & Braungart 2012). Predictions for the fashion industry offer a rather bleak outlook if the industry continues to disregard prompts for positive change. While it is suggested that the prices for fashion goods will continue to drop as competition increases within the industry, new production technologies continue to force a reduction in labour needs. In the meantime,

mounting pressure from the consumer, increasing legislation and international ethical campaigns all drive the demand for responsible production practices and seek improvements in the working conditions for employees in developing countries (Allwood et al., 2016).

Moreover, the desire for positive action increasingly being voiced by consumers, campaigners and governments seems to be at odds with the actions for the industry itself. While those external to the fashion industry look for change, the industry itself appears to be responding slowly, or not at all. These slow reactions suggest a ‘more of the same’ mentality; from an industry that is perceived to be dismissive of its environmental and social responsibilities based on an economic imperative. In recounting how, the fashion industry can approach sustainability, Clark (2008), argues that sustainable fashion garments can provide a sensorial experience and that this is particularly achievable through the notion of the hand-made product.

Clark states “...when a product is an investment, has functional longevity, and also remains in fashion, it retains its attraction for the particular consumer or user beyond the fashion season.” (Clark 2008, p.144) However, for this to occur a consumer needs to be more substantially, emotionally connected with the product (Chapman, 2005; Fletcher, 2008).

As discussed, the designer can play a critical role in developing sustainable products: a fashion garment is made desirable, stylish and functional through the actions of the designer (Draper et al., 2007). However, from a fashion designer’s perspective, a series of simple questions need to be asked, including; ‘what is a sustainable garment?’; and ‘how do you design and develop sustainable garments?’. From a designer’s perspective it can be particularly difficult to know where to begin in understanding how to improve a garment and knowing where to find help, assistance and guidance in redesigning the fashion product. Prior to the release of two seminal books on fashion and sustainability from Kate Fletcher,

and Sandy Black, in 2008, there was little specifically targeted fashion sustainability information available.

Clear, simple 'how to guides' that show fashion designers how and where to incorporate sustainable strategies and solutions within the design and production process of a fashion garment still do not exist, and it is here where this study attempts in part to contribute. While current and useful information is becoming available through online communities; blog sites; and web sites such as the UK not-for-profit organization Ethical Fashion Forum, in order to encourage and assist more fashion designers in how to integrate sustainable strategies within their design practice there is a need for further resources with which a designer can quickly and easily engage.

Sandy Black, in her book *Eco-Chic: A Fashion Paradox* (2008), listed a range of sustainable strategies that could be used within fashion and textile design practice. Black's list included:

**Re-thinking design for the entire fashion life cycle:** Design concern for use and end-of-life and possible reuse or disassembly.

**Reclaim and reuse waste materials:** Design with materials that would otherwise be discarded  
**Recycle:** Design using already reprocessed waste materials.

**Upcycle:** Design using reprocessed or waste materials to make a product of equal or higher value

**Repair and remodel:** Make good an existing item fit for new purpose

**Recreate:** Creatively re-think, customize or re-design an existing design concept

**Reduce:** Design for minimal use of energy, minimize or eliminate waste materials

**Use ecological materials:** Design choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact

**Use mono materials:** Use of only one material to facilitate recyclability

**Harness new technology:** Apply technology to achieve reductions in energy, materials or develop more efficient new process

**Longer lasting fashion:** Design with high quality materials and making, with aesthetic durability creating emotional bonds in addition to function

**Multifunctional clothing:** Design with more than one use or configuration

**Design for delight:** Creating new and sustained feel-good relationships with clothes to be valued (Black, 2008, pp46-47).

While the list was not intended as a complete set of strategies it does indicate the range of possibilities open to the fashion designer. However, the complex issue that is not addressed is the way in which the fashion designer can practically engage with these strategies. Questions still remain around: how do sustainable strategies work? Where and when can they be used? And does it mean that the fashion design process has to radically change? Black's text stops short of providing the answers to some of these questions, and this in turn raises another problem. Fashion designers are being bombarded with examples of best practice, however little guidance is available to show the fashion designer how to integrate the various types of strategies within the fashion design process.

In exploring the topic of fashion and sustainability inevitably most research tends to draw on existing models that are used within the product design discipline (Black, 2008; Fletcher, 2008). Although different types of tools, models and software programs exist to assess the environmental impact of a product, the Life Cycle Assessment (LCA) is the model most commonly referred to as a measure of environmental performance. Beginning with a set brief of defined parameters that are concerned with the environmental impact of a specific product, an LCA helps determine the negative impacts associated with the life cycle of the product, and reveals whether improvements at one phase of the life cycle might impact negatively on another phase (Fletcher 2008).

The analysis usually concentrates on the use of energy and materials, which also includes emissions of pollutants (starting at extraction of raw materials through to end-of-life / recycle phase). The results are then quantified into a unit of measure per material or resource. The process can be complex often involving extensive data collection, and costly; as specialists are often employed to undertake the study. Typically, a fashion garment is redesigned primarily for its aesthetic qualities, and this process might occur in a matter of weeks within the mass-manufacturing sector. In this situation using tools such as an LCA may be difficult. To conduct an LCA for each fashion garment in a collection would be a costly and time-consuming exercise, although this may be a suitable option for a generic garment e.g. a blouse, or a tailored skirt as demonstrated in the ‘Well Dressed?’ report (Allwood et al., 2016).

However, as comprehensive as the LCA report is likely to be, a blouse that is assessed once may be radically redesigned for the following season, incurring new and different design features that might well require changed amounts of materials; be constructed from different fabric; involve different trims and surface treatments; and so on. This redesign then might occur 3 or 4 times a year, which in essence would require further LCA studies. An alternative approach for the fashion designer would be to apply sustainable strategies as a framework for fashion design for sustainability. Rather than rely on responding to detailed LCA reports, there is an opportunity to encourage behavioural change that would enable the fashion designer to approach design practice from a new perspective. By integrating sustainable strategies throughout the fashion design process the fashion designer can engage with a framework that can help identify negative impacts and employ appropriate strategies, according to a garment’s intended life cycle. Therefore, it is imperative that the designer is informed of the possible sustainable strategies that are available for fashion design.

Re-examining the design process itself also provides an opportunity for a design evolution; the current fashion design process needs to be challenged and alternate methods for designing fashion garments need to be identified. Chapman (2005), Black (2008), Fletcher (2008) and Fuad-Luke (2009); all propose that the changes need to occur in the way that designers engage with design practice. One of the first duties of the fashion designer is to determine what the design brief is and to extract, from an analysis of the consumer, what the determined market level (and price point) are; what the intended function or purpose of the garment is; and the intended season. However, the conventional design brief of a fashion garment typically includes no consideration for the user's engagement with the garment; or garment end-of-life strategies; or any sense of responsibility for the textile waste generated through manufacture or use. It follows then that the fashion designer in industry needs to consider further criteria within the company's design brief and accept that the design brief should extend beyond the usual economically driven conventional criterion, to include criteria that will meet the needs of the environment and society.

## **2.7 The Various Production Technologies Used by Major Fashion Houses**

Cross (2016) suggests that designers employed within a fashion company often find that their role includes working to a design brief that follows a particular vernacular. For instance, a designer may have to develop a product range that reflects the label's recognized aesthetic so that it meets the expectations of an identified consumer. Furthermore, the designer may need to ensure that the product can be manufactured by means that are known to the company. This may require utilizing established patterns of design and production.

These customary patterns are identified in the numerous published case studies of the designers in the fashion industry. However, designers that continue to work within an

established system of design and production typically appear to resist the inclusion of sustainable strategies, as environmental and sustainable concerns are not routinely included within the designer's brief or form part of the fashion design process (Charter & Tischner 2011).

This raises the question: can the lack of environmental and ethical concerns within fashion design be attributed to an archaic fashion design process, or to the failings of the people working within this system? Furthermore, if the designer in industry is content with the current method of practice then is it possible to raise the level of motivation or enthusiasm to change what may be considered to be a good, workable model of practice. By exploring the relationship of the fashion design process alongside the fashion production process, it becomes apparent that different priorities within these structures can pose problems.

Ian Griffiths (2010) presents a case study of the fashion design process utilized in the designer ready-to-wear market level. As a designer for the Italian MaxMara label, Griffiths worked within a design team that produced a number of fashion lines under the MaxMara label. Griffiths' case study equally positions the importance of the design team as a contributor in the fashion design process, alongside a committee of selectors: the agents, the buyers and the merchandisers. Separated from the design team, the selectors decide upon the retail suitability of the designed garment when it is in its sample form. If accepted, the garment goes into production and then into the stores where the sales team report back to the design team on sales numbers and customer feedback. For the designer in this situation the fashion design process is driven by a shared belief in the product: between the designer and the customer, and the intermediaries in between.

Griffiths notes that the Weekend range produced by the MaxMara group developed garments that use "...classic inspiration...focuses on reinventing or modifying categories



of garment which have recognizable generic features, such as aran sweaters, duffel coats, or safari jackets.” (2010, p85) This observation reiterates the point made by Cross; that many fashion designers develop design ideas that are reincarnations of preceding designs.

A point to note here, which is shared by Sinha (2012), is that the process of design and production incorporated in large-scale manufacturing utilizes a vertical supply chain, where one phase may remain separated from the next. Each phase or stage of design and production will involve different people often working within separate sections of the company and/or supply chain, which are at times situated in different geographical locations. Within a vertical system the fashion designer works from within a design team that is geographically isolated, in many instances, from the production team (who handle the pattern making and sample making stage) and the buyers and merchandisers who manage the decisions regarding the selection of products that are to be placed within the stores.

This vertical system locates the fashion designer in one phase of the process, often excluding the opportunity to interact with other key contributors, or oversee the product (and its processes) from start to finish. In fact, according to Lawson, (2006 p.), in this system the division between the designers and makers has become “...a keystone of our technological society...” that in turn relies upon the designer to resolve complex issues that are often driven by the use of new technologies, processes and systems. The vertical design and production process are in complete contrast to that traditionally utilized by the couturier and the designer located within a micro, small or medium business.

Outside of the realm of large-scale manufacturing, within a typical SME environment the designer is a significant and central member of a team and is “...ultimately responsible for the initial design ideas, right through to overseeing first samples for selling.” (Renfrew & Renfrew, 2009, p27). Through a complex relational system, the designer works

with a diverse set of people that include the fabric merchant, textile specialists, the buyers and extending perhaps to others such as the PR agents. In this process the designer is placed within a central decision-making position, and will be apportioned the responsibility for any changes within the design process. This, according to Renfrew and Renfrew (2009), means that the ability to communicate, as well as being creative, is a vitally important asset in any designer.

### **2.7.1 Making Fashion**

This section of the chapter focuses on the existing approaches to sustainable design and manufacture of fashion garments from the perspective of the designer. As fashion designers become aware of environmentally friendly fibres and sustainable textile solutions, the real challenge for the designer and the production team is to find ways to engage with sustainable strategies within their design and production process whilst still attaining the typical range of design. The ideas and thoughts discussed within this section challenge the conventional notion of how fashion garments are currently created, and instead argue for alternative processes for designing and making clothes.

As the fashion supply chain is typically associated with business: from budgets and deadlines, to purchasing and selling, to shipping and supplying. It is complicated further by the interdependent relationships, between supplier and designer, designer and maker, maker and seller, seller and user, all of whom are connected to a product that is often determined by price, quality and speed.

Many people employed within the fashion industry make an important contribution in the process of creation; the fashion system employs designers, buyers, pattern makers, machinists, knitters, textile designers, finishers and dyers, production managers and so on, and each bring specialist skills and knowledge. According to Papanek (2015) everyone

should be reflecting on their role in society and while the complex sustainability issues and problems are often left to the professionals, the scientists and the activists, each individual should consider how they can create change at a local level. While this section specifically draws attention to how, where and what sustainable strategies the designer can integrate within the fashion design process there is an acknowledgement that the designer is a member of a larger production team that is also engaged in the making of fashion garments.

### **2.7.2 Designing**

A fashion designer is responsible for designing a range of garments in response to criteria within a set design brief. This may include details that define the market level, price point, quality of material, manufacture, production numbers and so on. The fashion designer typically works within one sector of the industry and it is useful to define and distinguish the divergent products available within the different sectors. In the Lifetimes project, the fashion theorists Kate Fletcher and Mathilda Tham (2013) begin their examination of the field with the characterization of the various types of products available to help determine the negative environmental impacts of a number of garments across the product life cycles. The project's objective was to reveal that “. a user-centered and appropriate approach to clothing will require us to re-evaluate our garments' durability and their lifetimes.” (Fletcher & Tham, 2013 p.2).

The research focused on comparing the design of the garment to the relevance of the product: to the market level, patterns of use, and garment longevity (Fletcher, 2008). Three archetypes of clothing were explored: 'classic'; 'basic'; and 'fashion', which were further defined by the use of the following subcategories:

- 'classic': expensive, high quality, durable, timeless design, frequently used over a
- long period of time.

- ‘basic’: inexpensive, functional, simple design, frequently used over a short period of time.
- ‘fashion’: affordable, fashionable, rich in status, identity, infrequently used over a short period of time (Fletcher & Tham, 2013).

Having defined the three archetypes of clothing Fletcher and Tham proposed a series of fast and slow design scenarios, from which emerged a range of sustainable solutions that were to inform and inspire a more user-engaged and less resource intensive approach to fashion (Fletcher, 2008, p15). Concepts were diverse and explored for example, the possibility that ‘fashion’ garments could be designed to support low impact care, and/or provide the opportunity for considerate disposal. Moreover, they proposed that ‘classic’ garments could be constructed using materials, dyes and finishes that could age gracefully.

These garments were to come with instructions for low impact care and wear and a full garment history to encourage a thoughtful bond between user and garment. Commenting on the environmental profile of production in the textile and clothing sectors, Fletcher and Tham (2003), contended that there had been little improvement in the global whole product or systems approach.

However, Fletcher and Tham advocate that fashion can have the ability to encourage social change and here Fletcher (2008, p.15) continues to promote the role that design has to play in the production of fashion garments and in the actions that assist social behavioural change. This can be achieved by forming a much closer relationship between the fashion designer and the practical and creative actions of the individual and the community to “...produce products, ways of working or visions compatible with sustainability” (Fletcher, 2008).

One strategy available to the fashion designer, for reconsidering design practice from a sustainability perspective, is to rethink the role of design in relation to the community of

use. Rather than seeing the act of designing from an external (professional) perspective, the fashion designer could approach designing from an internal (wearer) perspective. According to Janet Hethorn, the fashion designer has the opportunity to engage with design through the direct observation and engagement with the wearer. This might seem an obvious point to make but as Hethorn rightly points out, for the majority of the time ‘fashion designers’ are concerned with the aesthetics of a garment where conversely, ‘clothing designers’, for example those who create uniforms, are primarily focused on the functionality of a garment (Hethorn, 2008).

This subtle difference in terminology and perspective suggests that for the typical fashion designer there is a disjunct between aesthetics and functionality. It would seem logical to attempt to balance both aesthetic and functional values in “...designing for individual well-being” (ibid 2008, p58). Hethorn describes a number of activities that designers could engage in that would help the designer see fashion from other perspectives: the observation of wearers, watching how people move or how they arrange combinations of clothing; participant observations, where the designer directly experiences the same activity as the wearer to gauge the comfort and suitability of a piece of clothing; interviewing wearers, either as an individual or group to draw on a personal response and experience to clothing; managing data electronically, gathering together information through computer-based software and tools that allow a designer to visually analyze garments and examine data sets.

Hethorn (2008), also discusses the blog as a useful resource site for sharing this type of knowledge between design communities, which in itself could be seen as a radical departure from tradition. Drawing on the knowledge and experience of the wearer allows the designer to think beyond the production or retail phase, and consider how fashion garments are to be used, cared for or discarded. For example, new smart materials could

lead to the creation of fashion garments that can expand and retract with the body enabling the wearer to reduce the need for different garments over periods of fluctuating body changes (Hethorn, 2008). This type of user centred information could lead to new, inspired ways of developing fashion, which are not purely designed for aesthetic reasons but also incorporate functional reasons.

### **2.7.3 Materials**

Discussions relating to sustainability and fashion typically focus on the importance of appropriate fabric selection, since material is considered the principal resource used in the production of fashion clothing (Breds, Hjort & Krüger 2002; Draper et al., 2007; Diviney & White, 2009). The discussions frequently outline the negative environmental and social impacts associated with the manufacture and use of two dominant fabrics in the fashion industry: polyester and cotton. Polyester, a synthetic fibre, is derived from the production of petrochemicals and relies on high amounts of energy for material production, although it arguably uses less water and energy during laundering (Draper et al., 2007); meanwhile cotton involves high water and pesticide usage in the growing of cotton fibre although the increased availability of a range of organic fibres is providing the industry with an alternative.

A number of studies and LCA reports have been conducted on both of these fibre types (Fletcher, 2008), and yet it can be difficult for the fashion designer to establish which fibre is appropriate to use. However various guides and tools exist that outline the environmental impacts of a fabric so it is possible for the designer to make an informed choice. Moreover, industry magazines such as 'Ecotextile News' are a resource that can be utilized within fashion sourcing departments. The Ecotextile News publication, for example, covers advances in new fibre development, cleaner and more efficient dye and print

technology, transparent tracking and labelling systems and so on. However, the time devoted to the research of new processes, techniques, materials, and so on is recognized as greatly lacking within the industry (Sinha, 2001; 2002). It is important that the fashion industry should begin to engage in research and development that sits outside of trend gathering and market analysis if it is to capitalize on new areas of expertise and developments in sustainable technologies and ways of designing.

While it is essential that materials are assessed in terms of maximizing positive environmental impacts at the inception of a garment's life cycle, the fashion designer also has the opportunity to divert or delay materials away from landfill once a garment has come to the end of its 'first' useful life. Approaches that aim to avoid or delay materials from entering waste streams are typically considered as end-of-life strategies. An end-of-life strategy avoids, delays or minimizes the prospect of a garment (or its materials) reaching landfill before other alternatives have been exhausted. During the design phase it is beneficial from a sustainability perspective for the fashion designer to consider the selection of materials in relation to a desired end-of-life strategy.

For example, if a fashion designer works with one fibre type, thereby using a mono material (Black, 2008), then the opportunity for using a design for disassembly (DFD) strategy becomes possible. The DFD strategy was initially developed within industrial design and enabled the designer to develop a product that once it had come to the end of its 'first' useful life, could be disassembled with its materials reused in new product development (Papanek, 2015). This strategy can also work in the design and production of fashion garments. While clothing materials might be downgraded through reuse, such as in the production of cleaning cloths, ideally the materials would be upcycled, which essentially aims to retain or increase the value of the reused material (which is discussed in further detail below). As Papanek (2015), discusses, for the designer it requires a shift in thinking

because objects, such as fashion garments, have been traditionally designed with a built-in obsolescence.

This effectively means that the fashion garment is intentionally designed for disposal after a season or two. Changing this *modus operandi* would mean bringing about a major rethink in how the fashion industry works and in shifting the general public's expectation and engagement with fashion. Notwithstanding this paradigm shift, the fashion designer at the design phase still has the opportunity to consider an appropriate end-of-life strategy, which can divert the materials away from landfill.

While materials are routinely selected for aesthetic and functional reasons, as discussed above, the fashion designer can elect to work with recovered materials, which can contribute in the reduction of textile waste. Much of the reclaimed or recycled fabrics used will come from pre-consumer and post-consumer waste. Pre-consumer waste is the refuse material generated during the manufacture of textile products, while post-consumer waste is thought of as pre-worn, manufactured garments that are sourced through second-hand clothing merchants and charities (Hawley, 2008). By making use of these resources, a designer can remanufacture fragments or lengths of cloth to create original, one-off garments. This process challenges the notion of a standardized fashion garment or collection, as when working with reclaimed materials it becomes impossible to standardize one garment into a repeated set or series, since material supplies are irregular and quantities unpredictable.

Furthermore, there are technical considerations to bear in mind and resolve when working with recovered materials. For instance, a designer needs to be mindful of the condition of the raw materials; noting stains, holes or areas of fraying, while also working out a method for the careful deconstruction of an existing garment so that enough workable fabric can be extracted (Sanders & Seager, 2009). For some designers these issues may seem



too complex or difficult to take on board as a workable or worthwhile approach, however to others the perceived difficulties can act as a catalyst for new fashion ideas. However, a further issue for the fashion industry is the frequent downgrading of good quality fibres and materials. Jana Hawley (2008) succinctly maps the options available to a post-consumer garment before it reaches landfill or incineration. These various modalities include:

Re-use through either family/friends or resale, for instance through a charity shop; or passed to rag sorters who will either export (for re-use); or the shredding of fibres to produce other materials/products (such as wipers, cleaning cloths, or new non-woven materials, or yarns). While the development of new products, such as wipers and cleaning cloths, provide a beneficial reuse of discarded materials the original value of the fibre is downgraded, even if the garment itself was classified as unmarketable.

Moreover, fashion designers who use reclaimed materials for fashion garments typically see it as a reuse and recycling process. However, there are other strategies for inventively, and thoughtfully using such materials. McDonough and Braungart (2012) champion the approach of upcycling, which provides a designer with the opportunity to reassess the real worth and value of a waste material through the design and manufacture of new products.

Rather than recycling, which can result in the downgrading of a material, informed designers can engage with strategies such as upcycling to further prolong the life and value of a product and/or material. Strategies for the reuse and repurpose of existing materials allow a designer to divert textile matter away from incineration or landfill. However, inevitably some discarded clothing and materials are considered unsuitable for any of the options discussed above, and these materials are either incinerated or discarded in landfill.

#### 2.7.4 Variable Designing Technologies

**CAD Computer-aided design:** Any design activity that involves the effective use of computers for drawing and designing parts or products for analysis and testing of designed products.

**AIN Automated inspection:** Parts presentation and inspection are both performed automatically.

**AMHD Automated material handling devices:** Systems capable of automatically loading, unloading, or sorting unit loads; parts feeding and delivery devices.

**NC Numerical control machine tools:** A form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols.

**SPC Statistical process control:** Mathematical techniques used to control manufacturing processes within specified limits to ensure that the process conforms to the desired standards.

**PPIC Production planning/inventory management software:** A computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning.

**LAN Local area networks:** Communication system that permits various devices connected to the network to communicate with each other over distance of several feet to several miles.

**PPR Pick/place robots:** A simple robot with 1-38 of freedom, which transfers items from place to place.

**OR Other robots:** A reprogrammable, multifunctional manipulator designed for automation assembly line for apparel making, move materials, parts, tools, or specialized devices.

**HSSM High speed sewing machines:** Sewing machines run on high speed with fully/semi-automated operation, digital panel and control systems.

**MFPM Modern fusing and pressing machine:** Fusing machines used to fuse the materials which runs on controlled temperature and speed adjustments and the steam pressing machines with air suction systems.

**CUFF Computers used on factory floor:** Computers used solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions.

**IT Internet:** Usage of internet for web hosting, e-mail, on-line communication, and to search.

**CM Communication:** Usage of telephone, cell phone, pagers, and fax.

**Sources:** Adapted from Mechling et al., (2015) and Dunne, (2014)

### **2.7.5 Design and Production Methods for Fashion Garments**

The design and production methods for fashion garments can vary greatly, dependent upon the size and scale of the company; the sector, and the market for which the garments are being produced. A fashion business can be run as a small local owner/designer company producing high quality garments, or can be a large international brand that produces inexpensive garments offshore in various locations. What remains more or less consistent is the method of production. To recap, typically, a garment is sketched, a paper pattern is drafted, a toile is produced, the full sample range is made, and then selected garments are manufactured for retail. In the cut, make and trim (CMT) process of fashion manufacturing the designer and/or production team typically wastes between 10-15% of the fabric through uncreative approaches to pattern making (Rissanen 2015). Conventional pattern making methods produce paper pattern pieces that are often difficult to lay efficiently within the full width and length of the fabric.

Rissanen advocates that ideally the pattern making and design roles should be performed by one person or shared, between two people who have a close working

relationship. Fabric waste can then be minimized during the production phase and the careful design and laying out of pattern pieces, if the issue is treated as a design consideration. The ideal scenario is one where the paper pattern pieces form an interlocking jigsaw therefore no fabric waste is created; the process is commonly referred to as zero-waste design. However, in order to do this the designer/pattern maker needs to be able to confidently move between the 3D form and 2D pattern making, going back and forth until, through design choices, the fabric waste is minimized. Some fashion designers are beginning to integrate the strategy within the design and production process.

For example, Australian designer, Mark Liu combines this strategy with laser cut decorative edge finishes; while Issey Miyake developed the A Piece of Cloth (APOC) system of knitwear utilizing 3D technology to produce a knitted tube that efficiently embedded a range of garment pieces. The tube could be cut into separate garment pieces, by the wearer, which then required little or no finishing. Miyake has since progressed to producing his first range of zero waste fashion, 132 5. ISSEY MIYAKE (2011) that uses computer software to generate a 3D geometric form pattern, which utilizes all of the fabric in a single piece of cloth. Miyake has also made use of environmental materials such as lightweight PET fabric.

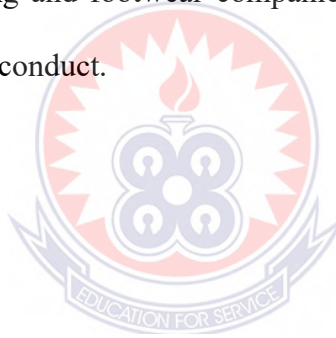
However, concepts like these, which challenge the notion of how garments are manufactured remain largely unexplored by much of the industry. Aside from investigations that explore strategies such as zero waste techniques, which aim to reduce fabric waste and thereby cut costs, or the use of new technologies that promises the customisation of clothing for individual wearers (Loker, 2008; Black, Eckert & Eskandarypur, 2009), there appears to be a gap of new knowledge in the area of new processes for production which foreground sustainable issues. Instead there has been an emphasis placed on the ethical considerations

associated with the manufacture of textile materials and fashion garments in often distanced or remote locations.

This is obviously an important consideration, which demands equal attention; by exposing the manufacturing phases of a garment, the producers and suppliers in the supply chain can help provide transparency for the many people employed within the fashion industry. In turn this transparency can help ensure that ethical standards are raised through a regulatory process. However as noted by Draper et al., (2007) the monitoring and enforcement of existing standards can be problematic as many suppliers struggle with compliance and the numerous assessments. Some large brands, such as Nike, however, have been able to use corporate reporting processes as a method for motivating changes within the supply chain of subcontractors. Through their 2004 Corporate Social Responsibility (CSR) report Nike worked to dispel the myth of an uncaring company, and instead chose to admit cases of social neglect following a spate of bad press that exposed the poor working conditions for employees within Nike suppliers' factories. This bold move allowed Nike to lead the field in forcing changes within the supply chain through incentive schemes and regular monitoring, and other big brands swiftly followed this tack.

In Australia the Ethical Clothing Australia organization provides a fashion label with assistance in conducting monitoring processes to meet mandatory NSW, and Victoria State government requirements for the fair and safe employment of outworkers and factory workers. The organization even goes one step further offering to guide a fashion label through its voluntary accreditation and labelling system that is designed to encourage and promote ethical production within Australia. Internationally, a wide variety of organizations, local government policies and industry schemes exist to encourage the ethical employment of people and fair-trading of locally produced goods.

Draper et al., (2007) identified three types of ethical fashion within the high street including: conventionally produced fashion; ethically produced fashion, which relies on meeting set standards such as those determined by the International Labour Organisation (ILO); and Fair-trade production, which draws of the production of fashion as a method for creating social development. This aims to support the livelihoods of people in often rural or developing communities by paying fair prices for goods and services, while reinvesting profit back into the local community (Draper et al., 2007). However, the task of creating a transparent supply chain is a complex undertaking within large-scale fashion manufacturing, while at the local small-scale level, it can be managed more effectively. And yet a review of the Ethical Clothing Australia directory demonstrates that only a handful of fashion labels (from a list of textile, clothing and footwear companies across Australia) are willing to engage in a voluntary code of conduct.



## CHAPTER THREE

### METHODOLOGY

#### 3.1 Introduction

This chapter presents the research methodology. As Howell (2013, p.18) put it “methodology is the general research strategy that outlines the way in which research is to be undertaken and, among other things, identifies the methods to be used in it. These methods, described in the methodology, define the means or modes of data collection or, sometimes, how a specific result is to be calculated.” The chapter is divided into research design, population and sampling, data collection instruments, data validity and reliability, data collection procedure, ethical consideration and data analysis.

#### 3.2 Research Design

Mixed method is a research approach whereby researchers collect and analyze both quantitative and qualitative data within the same study. Mixed methods research combines elements of quantitative research and qualitative research in order to answer a research question. Mixed methods can help in gaining a more complete picture than a standalone quantitative or qualitative study, as it integrates benefits of both methods (Haller, 2018).

The researcher used quantitative study technique for the study. The goal of quantitative studies is to broaden and rent mathematical models, theories and hypotheses bearing on phenomena. The process of measurement is central to quantitative research because it provides the fundamental nexus and synergy or connection between empirical observation and mathematical expression of quantitative relationships (Given-Lisa 2008).

Quantitative data is any data that is in numerical form such as statistics, percentages, etc. (Given-Lisa, 2008). The researcher analyses the data with the help of statistics and anticipate that the numbers will yield an unbiased result that can be generalized to some

larger population. Additionally, the direct observation and data collection occurred in the real-world context, hence adding credibility to the findings obtained (Yin, 2006).

### **3.3 Profile of the Study Area**

The Adentan Municipality was carved out of Tema Metropolitan Assembly in February 2008 by Legal Instrument (LI) 1888. Adentan serves as a dormitory town for most people who have migrated to seek employment in the service sector, industries and government institutions within the Tema-Accra metropolitan areas. The 2010 Population and Housing Census is the first census conducted by the Ghana Statistical Service with Adentan as a district.

The Adentan Municipal Assembly (with Adentan as its Central Business District) lies 10 kilometres to the North-east of Accra, which is specifically located on latitude 5' 43" north and longitude 0' 09" West. The Municipal has a land area of about 928.4 sq. km. It shares boundaries with Ashaiman Municipal Assembly and Kpong Akatamanso District Assembly in the east and north, La Nkwantanang Municipal Assembly in the West and south, in the north.

The population of Adentan Municipality, according to the 2010 Population and Housing Census, is 78,215. Males constitute 50.3 percent and females represent 49.7 percent. About 62.5 percent of the population resides in urban and 37.5 percent in rural areas. The Municipality has a sex ratio of 101.3. The population of the district depicts a broad base population pyramid which tapers off with a small number of elderly persons. The age dependency ratio for the Municipality is 51.1, the age dependency ratio for males is lower (49.5) than that of females (52.8).

The Total Fertility Rate for the Municipality is 2.7. The General Fertility Rate is 87.8 births per 1000 women aged 15-49 years and a Crude Birth Rate (CBR) is 26.3 per 1000



population. The crude death rate for the Municipality is 3.4 per 1000. Accident/violence/homicide/suicide accounted for 13.2 percent of all deaths while other causes constitute 86.8 percent of deaths in the Municipality 12 months prior to the census. Among migrants living in the Municipality, 24.1 percent was born elsewhere in the Greater Accra Region and 3.8 percent was born outside Ghana. For migrants born elsewhere in another region, 25.8 percent was born in the Volta region and 18 percent, in the Eastern Region.

The Municipality has a household population of 76,601 with a total number of 20,478 households. The average household size in the Municipality is 3.7 persons per household. Children constitute the largest proportion of the household members accounting for 35.1 percent. Spouses form about 12.4 percent. Nuclear households (head, spouse(s) and children) constitute 26.9 percent of the household structure in the Municipality.

Nearly four in ten (39.7%) of the population aged 12 years and older are married, 46.7 percent have never married, 6.8 percent are in consensual unions, 2.3 percent is widowed, 2.4 percent divorced and 6.6 percent separated. At age 25-29 years, about half of females (42.7%) are married compared to their male counterpart (21.7%). At age 65 and older, widowed females account for as high as 49.5 percent while widowed males account for only 9.0 percent. Among the married, 9.9 percent have no education while about 4.4 percent of those who are never married also have no education. About 8 in 10 of the married population (81.1%) are employed, 4.3 percent are unemployed and 14.6 percent are economically not active. A greater proportion of those who have never married (47.9%) are economically not active and 7.5 percent of them are also not employed.

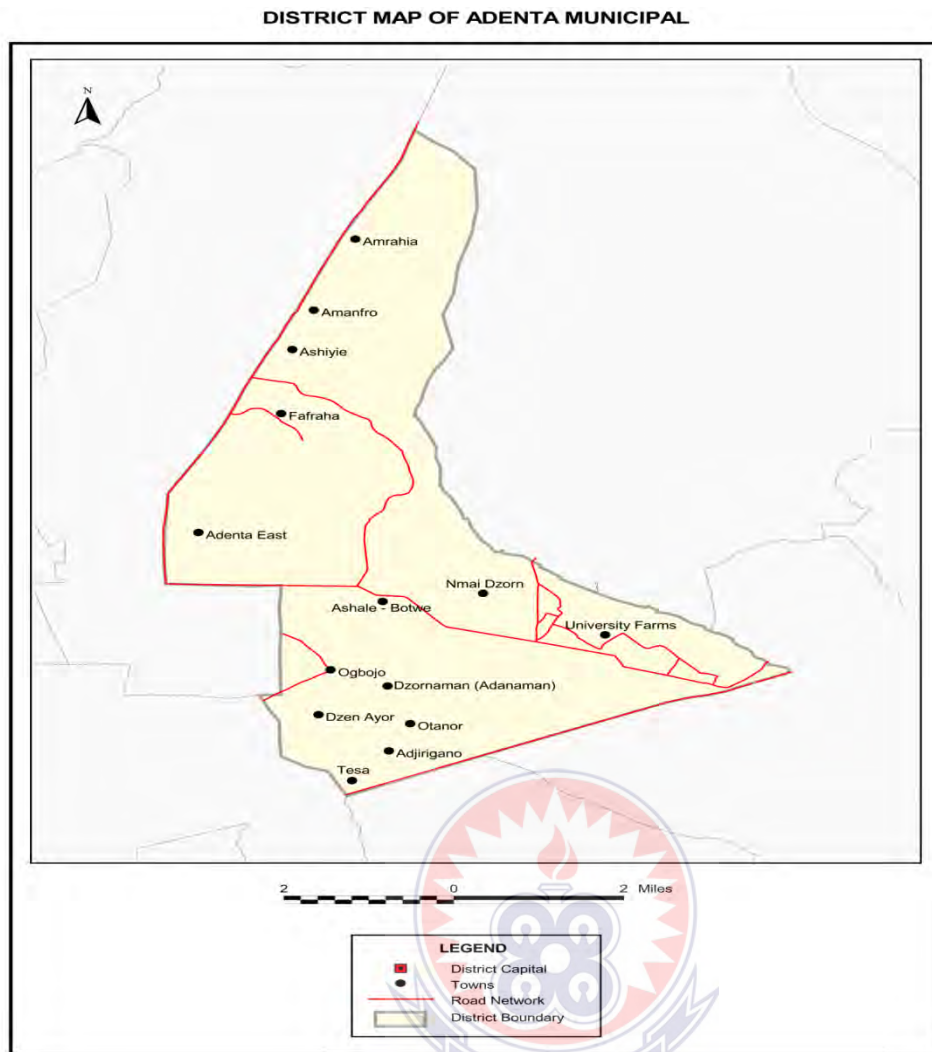
The population of the Municipality shows that Ghanaians by birth in the constitute 92.8 percent. Those who have naturalized constitute 0.9 percent and the non-Ghanaian population in the Municipality is 3.1 percent.

Of the population 11 years and older, 91.9 percent are literate and 8.1 percent is not literate. Slightly more than five out of ten people (54.8%) could read and write in both English and a Ghanaian language. Of the population aged 3 years and older 24,740 are currently attending school in the Municipality.

About 74.1 percent of the population aged 15 years and older are economically active while 25.9 per cent are economically not active. Of the economically active population, 91.2 percent is employed while 8.8 percent is unemployed. For those who are economically not active, a larger percentage of them are students (50.9%), 23.9 percent perform household duties and 2.4 percent are disabled or too sick to work. Nearly six out of ten (57.3%) of the unemployed persons are seeking work for the first time.

Of the employed population, 31.8 percent is in Service and sales work and 25.4 percent is in Craft and related trades. Females are more likely than males to be engaged in Service and sales work (51.5%) whereas males are more likely than females to be engaged as Craft and related trades workers (34.8%). Of the population 15 years and older, 40.5 percent of the workforce is self-employed without employees with females and males' proportions as 53.1 percent and 29.9 percent respectively.

Adentan has 13 public basic schools and 135 private basic schools. There are nine (9) Senior High Schools (SHS) which are private. There is one public SHS in the Municipality and therefore students who graduate from Junior High School (JHS) have to move to other districts to attend SHS. The Municipality has two private tertiary institutions.



**Figure 3.1: District Map of Adentan Municipality**

Source: Ghana Statistical Service (2014)

### 3.4 Population

Population in research refers to the aggregate or totality of objects or individuals regarding which inferences are to be made in sampling in a study (Seidu, et al., 2007). Population as used in this study refers to the people with common characteristics that the researcher decided to involve in the study. Hence, population studied was fashion designers in the Adentan Municipality. The study population was 120 fashion designers in Adentan Municipality. The population was given by the secretary of the fashion designers Association of the Adenta Municipality. 80 questionnaires were administered but 50 questionnaires were retrieved.

### **3.5 Sample size and Sampling Procedure**

Kumekpor (2002) explains sampling as the use of definite procedure in the selection of a part for the express purpose of obtaining from its description or estimates certain properties and characteristics of the whole. Sampling is the process of selecting a representative unit from population. Sample as used in this work is a small proportion of the population selected for the study. It is the subject of a whole, which is being used to represent the population (Seidu, 2007). Simple random sampling was used for this study.

Random sampling was used to obtain the sample size. Auka et al., (2013) posit that random sampling ensures that all the groups (categories) are adequately sampled and this facilitates comparison among the groups. According to the Krejcie and Morgan (1970), table for determining sample size, a population of 120 requires a sample size of 80. Therefore, random sampling techniques were used to select 80 participants for the study.

### **3.6 Research Instrument(s)**

A Research Instrument is a tool used to collect, measure, and analyze data related to a research interest (Siedu, 2007).

#### **3.6.1 Questionnaire**

Questionnaire is a form of enquiry document, which contains a systematically compiled and well-structured series of questions intended to solicit information or views which will provide insight into the nature of the problem under study (Seidu 2007:50). A well-structured questionnaire was used for the study. The questionnaires consisted of four sections. Section A consists of the demographic information of the respondents, including gender, age ranges, and highest educational qualification. Section B finds out what emerging designing technologies used by the fashion designers in the clothing industry. Section C

investigated the emerging designing technologies being used by fashion designers in Adentan Municipality and section D organised a training workshop on the emerging designing technologies with the fashion houses in Adentan.

Close ended types of questionnaires were employed. This was done with the view that the respondents were literates and could fill the questionnaire. The researcher used questionnaire because of its suitability to the study. In addition, it is relatively simple to administer, easy to analyse and above all capable of producing responses that are suitable for data analysis. To ensure validity and reliability in the test items, the questionnaires were given to my supervisor to read through and make necessary corrections. (Please refer Appendix A for a sample of the questionnaire).

### **3.7 Pilot Study**

The researcher conducted a pilot study at the selected fashion shops to assess the authenticity of the research instruments. The pilot questionnaires were given to 5 participants to answer in order to correct errors like repetition of questions and typographical mistakes. The pilot testing took place at some selected fashion shops at Adentan Municipality for the real study.

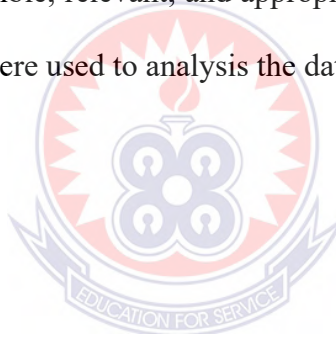
### **3.8 Data Collection Procedure**

Approval was obtained from the heads of the respective fashion shops, and the researcher was introduced as a post-graduate student from the Aketen Appiah-Menka University of Skills Training and Entrepreneurial Development (AAMUSTED), Kumasi campus. The procedures were followed in order to confirm to pre-fieldwork ethical issues. Saunder et al., (2007) advised that researchers should not assume that because they may be doing their research among people it would be smooth sailing. A meeting was therefore

organized to give the fashion designers briefings on the importance of the exercise and to seek their co-operation to ensure the success of the exercise. After this interaction, the researcher personally distributed the questionnaires to the designated respondents. Questionnaires were distributed, and explanation given as to how respondents were to answer the individual items. The respondents were given enough time to answer the items and received the questionnaires on the same day.

### **3.9 Data Analysis**

All items of the questionnaires were coded. Items in the form of Likert Scale were rated between 5-1 with 5 being the highest and 1 being the lowest. Questionnaires were edited to ensure that clear, legible, relevant, and appropriate responses had been provided. Tables as well as bar graphs were used to analysis the data



## **CHAPTER FOUR**

### **RESULTS AND DISCUSSIONS**

#### **4.1 Introduction**

The aim of this study was to investigate the emerging production technologies in clothing production in Ghana the perception of customers within Adentan Municipality. The main objectives of this research are to investigate the emerging designing technologies in clothing production in Ghana: the perception of customers within Adentan Municipality. Secondly, to assess the various designing technologies used by major fashion houses in Ghana and thirdly, to organize workshop on some designing technologies for the designers within Adentan municipality. The analysis of the study was based on the following specific objectives.

#### **4.2 Response Rate of the Questionnaires**

The research administered 80 questionnaires to the fashion designers to gather primary data, out of which 50 questionnaires were properly answered and returned or received, while 30 questionnaires were not returned. Therefore, the analyses of the questionnaires were based on 72.5% response rate.

#### **4.3 Fashion Illustration Workshop**

A workshop was organized for the fashion designers to introduce them to how to use Adobe photo shop (CAD) to illustrate apparel designs. The workshop was successful and turnout was great. At the end of the workshop some of the designers were able to design fabrics and used it to create design on a silhouette. Below are some pictures taken during the workshop.



**Figure 4.1: The researcher presenting to the participant (A)**

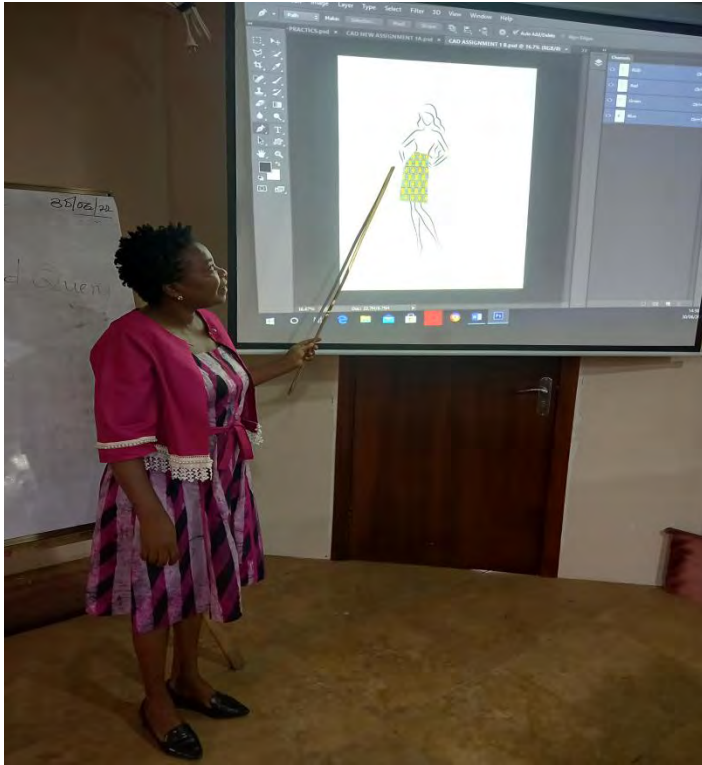
**Source: Resource Person**



**Figure 4.2: The researcher presenting to the participant (B)**

**Source: Resource Person**





**Figure 4.3: Fashion illustration presentation on Silhouette (C)**

**Source: Resource Person**



**Figure 4.4: Researcher and some Executives at the Workshop**

**Source: Resource Person**

**Table 4.1: Demographic Characteristics of the Respondents**

| Gender                            | Frequency | Percentage |
|-----------------------------------|-----------|------------|
| Male                              | 32        | 64         |
| Female                            | 18        | 36         |
| Total                             | 50        | 100        |
| Age category                      |           |            |
| Below 18 years                    | 6         | 12         |
| 18-25 years                       | 5         | 10         |
| 25-35 years                       | 8         | 16         |
| 35-45 years                       | 3         | 6          |
| 45-55 years                       | 20        | 40         |
| More than 55 years                | 8         | 16         |
| Total                             | 50        | 100        |
| Highest Educational Qualification |           |            |
| BECE/MSLC                         | 9         | 18         |
| SSSCE/WASSCE/NVTI                 | 12        | 24         |
| Diploma                           | 19        | 38         |
| Bachelor's degree                 | 5         | 10         |
| Master's degree                   | 5         | 10         |
| Total                             | 50        | 100        |

Source: Field survey, 2021, n= 50

Table 4.1 indicates that majority 32(64%) of the respondents were males while 18(36%) of the respondents were females. Moreover, 20(40%) of the respondents were between the age category 45-55 years, 8(16%) of the respondents were between the age ranges 25-35 years, and more than 55 years respectively, 6(12%) of the respondents were below 18 years, 5(10%) were between 18-25 years, while 3(6%) of the respondents were between 35-45 years.

Also, 19(38%) of the respondents were holding Diplomas, 12(24%) of the respondents were possessing SSSCE/WASSCE/NVTI, 9(18%) of the respondents were holding BECE/MSLC, while 5(10%) of the respondents were holding Bachelor's and Master's degrees as their highest academic qualification.

**Table 4.2: The Emerging Designing Technologies in Clothing Industry.**

| Technologies in apparel design                           | Yes        | No         | $\sum_{i=1}^n w_i / N$ | RII  | Ranking          |
|--|------------|------------|------------------------|------|------------------|
| Computer-aided design (CAD)                              | 47         | 3          | 4.78                   | 0.98 | 1 <sup>st</sup>  |
| Automated inspection (AIN)                               | 45         | 5          | 4.26                   | 0.96 | 2 <sup>nd</sup>  |
| Automated material handling devices (AMHD)               | 48         | 2          | 3.97                   | 0.92 | 3 <sup>rd</sup>  |
| Statistical process control (SPC)                        | 43         | 7          | 3.86                   | 0.87 | 4 <sup>th</sup>  |
| Production planning/inventory management software (PPIC) | 41         | 9          | 3.85                   | 0.85 | 5 <sup>th</sup>  |
| Local area networks (LAN)                                | 39         | 11         | 3.76                   | 0.83 | 6 <sup>th</sup>  |
| Pick/place robots (PPR)                                  | 37         | 13         | 3.54                   | 0.82 | 7 <sup>th</sup>  |
| High speed sewing machines (HSSM)                        | 35         | 15         | 2.87                   | 0.79 | 8 <sup>th</sup>  |
| Modern fusing and pressing machine (MFPM)                | 32         | 18         | 2.85                   | 0.77 | 9 <sup>th</sup>  |
| Computers used on factory floor (CUFF)                   | 33         | 17         | 2.75                   | 0.75 | 10 <sup>th</sup> |
| Internet (IT)  | 49         | 1          | 2.53                   | 0.73 | 11 <sup>th</sup> |
| Communication (CM)                                       | 46         | 4          | 2.46                   | 0.71 | 12 <sup>th</sup> |
| Numerical control machine tools (NC)                     | 29         | 21         | 2.44                   | 0.67 | 13 <sup>th</sup> |
| Other robots (OR)  | 28         | 22         | 2.39                   | 0.64 | 14 <sup>th</sup> |
| <b>Average Total</b>                                     | <b>552</b> | <b>148</b> |                        |      |                  |
| <b>Average percent (%)</b>                               | <b>79</b>  | <b>21</b>  |                        |      |                  |

RII - Relative Importance Index  
N = 50

As indicated in the table 4.2, the emerging designing technologies in clothing industry were ranked as Computer-aided design (CAD) representing first (1<sup>st</sup>) in the Likert ranking order with a mean of 4.78 and RII =0.98, Any design activity that involves the effective use of computers for drawing and designing parts or products for analysis and testing of designed products.

Automated inspection (AIN) ranked 2<sup>nd</sup> with a mean score of 4.26 and RII 0.96.

Automated material handling devices (AMHD) ranked 3<sup>rd</sup> with a mean score of 3.97 and RII 0.92.

Statistical process control (SPC) ranked 4<sup>th</sup> with a mean score of 3.86 and RII of 0.87.

Production planning/inventory management software (PPIC) ranked 5<sup>th</sup> with a mean score of 0.85 and RII 0.85.

Local area networks (LAN) ranked 6<sup>th</sup> with a mean score of 3.76 and RII of 0.83.

Pick/place robots (PPR) ranked 7<sup>th</sup> with a mean score of 3.54 and RII 0.82.

High speed sewing machines (HSSM) ranked 8<sup>th</sup> with a mean score of 2.87 and RII of 0.79.

Modern fusing and pressing machine (MFPM) ranked 9<sup>th</sup> with a mean score of 2.85 and RII of 0.77.

Computers used on factory floor (CUFF) ranked 10<sup>th</sup> with a mean score of 2.75 and RII of 0.75.

Internet (IT) ranked 11<sup>th</sup> and RII of 0.73.

Communication (CM) ranked 12<sup>th</sup> and RII of 0.71.

Numerical control machine tools (NC) ranked 13<sup>th</sup> and RII of 0.67.



**Table 4.3: The Usage of Various Designing Technology among the Fashion Designers in Adentan Municipality**

| Statement (s)   | 1<br>(%) | 2<br>(%) | 3<br>(%) | 4<br>(%) | 5<br>(%) |
|---|----------|----------|----------|----------|----------|
| Fashion designers design activities that involve the effective use of computers for drawing and designing products.   | 0        | (64.6)   | (17.5)   | (7.9)    | 0        |
| Fashion designers use automated inspection machines to perform product inspection.  | 0        | (70.2)   | (15.8)   | (14)     | 0        |
| Fashion designers use systems capable of automatically loading, unloading, and sorting out.   | (12.3)   | (45.6)   | (20.2)   | (21.9)   | 0        |
| Fashion designers use a form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols.               | (25.4)   | (45.6)   | (16.7)   | 0        | (12.3)   |
| Fashion designers use a computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning. | (44.7)   | (43)     | (7)      | (5.3)    | 0        |
| Fashion designers use communication system that permits various devices connected to the network to communicate with each other over a distance.                      | 0        | (43.9)   | (14.9)   |          | (41.2)   |
| Fashion designers use a simple or complex robot which transfers items from place to place.  | (12.3)   | (45.6)   | (20.2)   | (21.9)   | 0        |
| Fashion designers use a reprogrammable, multifunctional manipulator designed for automation assembly line for apparel making.   | (25.4)   | (45.6)   | (16.7)   | 0        | (12.3)   |
| Fashion designers use sewing machines that run on high speed.   | (44.7)   | (43)     | (7)      | (5.3)    | 0        |
| Fashion designers use fusing machines which runs on controlled temperature with speed adjustments.  | 0        | (74.6)   | (17.5)   | (7.9)    | 0        |
| Fashion designers use computers solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions.                | 0        | (70.2)   | (15.8)   | (14)     | 0        |
| Fashion designers used internet for web hosting, e-mail, online communication, and to search for design ideas.  | (44.7)   | (43)     | (7)      | (5.3)    | 0        |
| Fashion designers use telephone, cell phone, pagers, and fax.   | 0        | (70.2)   | (15.8)   | (14)     | 0        |

Table 4.3 shows that majority 74.6% of the respondents said that fashion designers design activities that involve the effective use of computers for drawing and designing products, 17.5% disagreed neutral, while 7.9% of the respondents strongly disagreed.

To add more, 70.2% of the respondents indicated that fashion designers use automated inspection machines to perform product inspection, 15.8% of the respondents disagreed, while 14% of the respondents strongly disagreed.

Also, 57.9% of the respondents agreed that that fashion designers use systems capable of automatically loading, unloading, and sorting out, while 42.1% of the respondents disagreed.

Moreover, 71% of the respondents agreed that Fashion designers use a form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols, while 16.7% of the respondents disagreed.

The study results held that 87.7% of the respondents agreed that Fashion designers use a computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning, 7% of the respondents were neutral, while 5.3% of the respondents disagreed.

Furthermore, 43.9% of the respondents agreed that Fashion designers use communication system that permits various devices connected to the network to communicate with each other over a distance, 41.2% of the respondents strongly disagreed, while 14.9% of the respondents were neutral.

To add more, 57.9% of the respondents agreed that Fashion designers use a simple or complex robot which transfers items from place to place, 21.9% of the respondents disagreed, while 20.2% of the respondents were neutral.

The table 4.3 indicates that 71% of the respondents agreed that Fashion designers use a reprogrammable, multifunctional manipulator designed for automation assembly line for apparel making, 12.3% of the respondents strongly disagreed, while 16.7% were neutral.

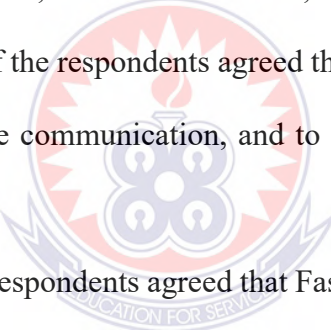
Also, 87.7% of the respondents agreed that Fashion designers use sewing machines that run on high speed, 7% of the respondents were neutral, while 5.3% disagreed.

To add more, 74.6% of the respondents agreed that Fashion designers use fusing machines which runs on controlled temperature with speed adjustments, 17.9% were neutral, while 7.9% disagreed.

Moreover, 70.2% of the respondents agreed that Fashion designers use computers solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions, 15.8% were neutral, while 14% disagreed.

Furthermore, 87.7% of the respondents agreed that Fashion designers used internet for web hosting, e-mail, online communication, and to search for design ideas, 7% were neutral, while 5.3% disagreed.

Finally, 70.2% of the respondents agreed that Fashion designers use telephone, cell phone, pagers, and fax, 15.8% were neutral, while 14% disagreed.



**Table 4.4: What kind of designing technology training workshop should be organised for fashion designers in Adentan Municipality?**

| Statement (s)   | 1      | 2      | 3      | 4      | 5     | Mean |
|---|--------|--------|--------|--------|-------|------|
|   | (%)    | (%)    | (%)    | (%)    | (%)   | X    |
| The fashion designer must possess a range of skills, and these abilities fall into one of two areas, namely 'creative' ability and 'technical' ability.   | 0      | (68.4) | (16.7) | (14.9) | 0     | 4.26 |
| In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea.                     | 0      | (57)   | (10.5) | (32.5) | 0     | 4.19 |
| In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production. | 0      | (52.6) | (15.8) | (17.6) | (14)  | 4.12 |
| Importantly, the designer must also be able to communicate the new product to the manufacturer and the client.  | (27.2) | (51.8) | (9.6)  | (11.4) | 0     | 3.81 |
| Design with materials that would otherwise be discarded Recycle: Design using already reprocessed waste materials   | (49.1) | (33.3) | (8.8)  | 0      | (8.8) | 2.73 |
| Design using reprocessed or waste materials to make a product of equal or higher value  | 0      | (44.8) | (15.8) | (39.5) | 0     | 2.56 |
| Make good an existing item fit for new purpose  | (39.5) | (47.4) | (4.4)  | (8.8)  | 0     | 2.49 |
| Creatively re-think, customize or re-design an existing design concept  | 0      | (52.6) | (15.8) | (17.6) | (14)  | 2.35 |
| Design for minimal use of energy, minimize or eliminate waste materials   | (27.2) | (51.8) | (9.6)  | (11.4) | 0     | 2.23 |
| Design choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact  | (27.2) | (51.8) | (9.6)  | (11.4) | 0     | 3.81 |
| Use of only one material to facilitate recyclability  | (49.1) | (33.3) | (8.8)  | 0      | (8.8) | 2.73 |
| Apply technology to achieve reductions in energy, materials or develop more efficient new process   | 0      | (44.8) | (15.8) | (39.5) | 0     | 2.56 |
| Design with high quality materials and making, with aesthetic durability creating emotional bonds in addition to function   | (39.5) | (47.4) | (4.4)  | (8.8)  | 0     | 2.49 |
| Creating new and sustained feel-good relationships with clothes to be valued  | 0      | (52.6) | (15.8) | (17.6) | (14)  | 2.35 |

**1 =Strongly agree, 2= Agree, 3 = Neutral, 4= Disagree, 5=Strongly Disagree)**

Source: Field survey, 2021, n= 50

The kind of designing technology training workshop should be organised for fashion designers in Adentan Municipality were the fashion designer must possess a range of skills, and these abilities fall into one of two areas, namely 'creative' ability and 'technical' ability



mean score of 4.26. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea mean score of 4.19.

In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production mean score of 4.12.

Importantly, the designer must also be able to communicate the new product to the manufacturer and the client mean score of 3.81. Design using reprocessed or waste materials to make a product of equal or higher value mean score of 2.56.

Make good an existing item fit for new purpose mean score of 2.49. Creatively re-think, customize or re-design an existing design concept mean score of 2.35. Design for minimal use of energy, minimize or eliminate waste materials mean score of 2.23.

Design choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact mean score of 3.81. The use of only one material to facilitate recyclability mean score of 2.73.

Apply technology to achieve reductions in energy, materials or develop more efficient new process mean score of 2.56. Design with high quality materials and making, with aesthetic durability creating emotional bonds in addition to function mean score of 2.49.

Creating new and sustained feel-good relationships with clothes to be valued mean score of 2.35.

## CHAPTER FIVE

### DISCUSSIONS

#### 5.1 Introduction

In this chapter, significant and novel findings shall be identified, interpreted and discussed. The discussion shall highlight the major findings of this research

#### 5.2 The Emerging Designing Technologies in Clothing Industry.

As indicated in the table 4.2, the emerging designing technologies in clothing industry were ranked as Computer-aided design (CAD) representing first (1<sup>st</sup>) in the Likert ranking order with a mean of 4.78 and RII =0.98, Any design activity that involves the effective use of computers for drawing and designing parts or products for analysis and testing of designed products.

This implies that the duty of the fashion designer who acts as the principal director in the design of garments, in a complex industry that is comprised of many sectors and different market levels. Within dress discourse and contemporary media, the fashion designer is often portrayed as an exaggerated caricature; a powerful creator who is responsible for the continuing impact of fashion as a reflection of contemporary culture and a person who can directly influence the trends and movements within the fashion industry (Breward 2013).

Automated Inspection (AIN) ranked 2<sup>nd</sup> with a mean score of 4.26 and RII 0.96. Parts presentation and inspection are both performed automatically. Fashion designers create a longer-lasting and better-functioning product, thereby reducing the need to replace it mean score of 3.97. These results are in agreement with Breward (2013) the fashion designer emerged as an outcome of the need for a conduit to act between the client, and the producers and merchants. The success of the newly evolved role of the fashion designer

came from “...their ability to read the implications of cultural and stylistic change and incorporate it into a characteristic and very well-promoted personal vision” (Breward 2013, p23)

Automated material handling devices (AMHD) ranked 3<sup>rd</sup> with a mean score of 3.97 and RII 0.92. Systems capable of automatically loading, unloading, or sorting unit loads; parts feeding and delivery devices. An understanding of fashion and dress history plays an integral part in an analysis of the role of the contemporary fashion designer since the conventional role of the designer emerged from the practices applied in the roots of the modern industry. Furthermore, the accepted role of the fashion designer as a player within a system, is clearly evident in these early beginnings. Breward (2013, p.49), notes that the rise of the named designer was in part due to the role of the designer as the “...glamorous adjunct, employed to impart the sheen of fashionability to a trade that is sometimes anything but ‘fashionable’

Statistical process control (SPC) ranked 4<sup>th</sup> with a mean score of 3.86 and RII of 0.87. Mathematical techniques used to control manufacturing processes within specified limits to ensure that the process conforms to the desired standards.

Production planning/inventory management software (PPIC) ranked 5<sup>th</sup> with a mean score of 0.85 and RII 0.85. A computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning. However, it is critical to remember that the production of fashion clothing is a collective activity with the designer contributing as one actor in a much larger chain. Therefore, it is important to survey the rise of the fashion designer in the context of a historic and contemporary fashion system, which enables the investigation of the tasks and activities that are associated with the fashion design process in the manufacture of fashionable clothing.

Local area networks (LAN) ranked 6<sup>th</sup> with a mean score of 3.76 and RII of 0.83. Communication system that permits various devices connected to the network to communicate with each other over distance of several feet to several miles.

Pick/place robots (PPR) ranked 7<sup>th</sup> with a mean score of 3.54 and RII 0.82. A simple robot with 1-38 of freedom, which transfers items from place to place.

High speed sewing machines (HSSM) ranked 8<sup>th</sup> with a mean score of 2.87 and RII of 0.79. Sewing machines run on high speed with fully/semi-automated operation, digital panel and control systems.

Modern fusing and pressing machine (MFPM) ranked 9<sup>th</sup> with a mean score of 2.85 and RII of 0.77. Fusing machines used to fuse the materials which runs on controlled temperature and speed adjustments and the steam pressing machines with air suction systems.

Computers used on factory floor (CUFF) ranked 10<sup>th</sup> with a mean score of 2.75 and RII of 0.75. Computers used solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions.

Internet (IT) ranked 11<sup>th</sup> and RII of 0.73. Usage of internet for web hosting, e-mail, on-line communication, and to search.

Communication (CM) ranked 12<sup>th</sup> and RII of 0.71. Usage of telephone, cell phone, pagers, and fax.

Numerical control machine tools (NC) ranked 13<sup>th</sup> and RII of 0.67. A form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols. These results agree with Cross (2016), he indicated that in broad terms, the fashion designer initiates and generates design ideas that become new fashion garments; in industrialized nations it is usually a professionally trained person who is expected to have a high level of design ability. The fashion designer must possess a range

of skills, and these abilities fall into one of two areas, namely ‘creative’ ability and ‘technical’ ability. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea (Jackson 2016). In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production (Jackson 2016). Importantly, the designer must also be able to communicate the new product to the manufacturer and the client (Cross 2016).

### **5.3 The Usage of Various Designing Technology among the Fashion Designers in Adentan Municipality**

Table 4.3 shows that majority 74.6% of the respondents said that fashion designers design activities that involve the effective use of computers for drawing and designing products, 17.5% disagreed neutral, while 7.9% of the respondents strongly disagreed. Draper et al., (2007) identified three types of ethical fashion within the high street including: conventionally produced fashion; ethically produced fashion, which relies on meeting set standards such as those determined by the International Labour Organisation (ILO); and Fair-trade production, which draws of the production of fashion as a method for creating social development. This aims to support the livelihoods of people in often rural or developing communities by paying fair prices for goods and services, while reinvesting profit back into the local community (Draper et al., 2007). However, the task of creating a transparent supply chain is a complex undertaking within large-scale fashion manufacturing, while at the local small-scale level, it can be managed more effectively. And yet a review of the Ethical Clothing Australia directory demonstrates that only a handful of fashion labels

(from a list of textile, clothing and footwear companies across Australia) are willing to engage in a voluntary code of conduct.

To add more, 70.2% of the respondents indicated that fashion designers use automated inspection machines to perform product inspection, 15.8% of the respondents disagreed, while 14% of the respondents strongly disagreed. The design and production methods for fashion garments can vary greatly, dependent upon the size and scale of the company; the sector, and the market for which the garments are being produced. A fashion business can be run as a small local owner/designer company producing high quality garments, or can be a large international brand that produces inexpensive garments offshore in various locations. What remains more or less consistent is the method of production. To recap, typically, a garment is sketched, a paper pattern is drafted, a toile is produced, the full sample range is made, and then selected garments are manufactured for retail. In the cut, make and trim (CMT) process of fashion manufacturing the designer and/or production team typically wastes between 10-15% of the fabric through uncreative approaches to pattern making (Rissanen 2015).

Also, 57.9% of the respondents agreed that that fashion designers use systems capable of automatically loading, unloading, and sorting out, while 42.1% of the respondents disagreed. Furthermore, there are technical considerations to bear in mind and resolve when working with recovered materials. For instance, a designer needs to be mindful of the condition of the raw materials; noting stains, holes or areas of fraying, while also working out a method for the careful deconstruction of an existing garment so that enough workable fabric can be extracted (Sanders & Seager, 2009). For some designers these issues may seem too complex or difficult to take on board as a workable or worthwhile approach, however to others the perceived difficulties can act as a catalyst for new fashion ideas.

However, a further issue for the fashion industry is the frequent downgrading of good quality fibres and materials.

Moreover, 71% of the respondents agreed that Fashion designers use a form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols, while 16.7% of the respondents disagreed. However, Fletcher and Tham advocate that fashion can have the ability to encourage social change and here Fletcher (2008) continues to promote the role that design has to play in the production of fashion garments and in the actions that assist social behavioural change. This can be achieved by forming a much closer relationship between the fashion designer and the practical and creative actions of the individual and the community to "...produce products, ways of working or visions compatible with sustainability" (Fletcher, 2008).

The study results held that 87.7% of the respondents agreed that Fashion designers use a computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning, 7% of the respondents were neutral, while 5.3% of the respondents disagreed. Many people employed within the fashion industry make an important contribution in the process of creation; the fashion system employs designers, buyers, pattern makers, machinists, knitters, textile designers, finishers and dyers, production managers and so on, and each bring specialist skills and knowledge. According to Papanek (2015) everyone should be reflecting on their role in society and while the complex sustainability issues and problems are often left to the professionals, the scientists and the activists, each individual should consider how they can create change at a local level. While this section specifically draws attention to how, where and what sustainable strategies the designer can integrate within the fashion design process there is an acknowledgement that the designer is a member of a larger production team that is also engaged in the making of fashion garments.

Furthermore, 43.9% of the respondents agreed that Fashion designers use communication system that permits various devices connected to the network to communicate with each other over a distance, 41.2% of the respondents strongly disagreed, while 14.9% of the respondents were neutral. However, the conventional design brief of a fashion garment typically includes no consideration for the user's engagement with the garment; or garment end-of-life strategies; or any sense of responsibility for the textile waste generated through manufacture or use. It follows then that the fashion designer in industry needs to consider further criteria within the company's design brief and accept that the design brief should extend beyond the usual economically driven conventional criterion, to include criteria that will meet the needs of the environment and society.

To add more, 57.9% of the respondents agreed that Fashion designers use a simple or complex robot which transfers items from place to place, 21.9% of the respondents disagreed, while 20.2% of the respondents were neutral. Allwood et al., (2006); Fletcher (2008); Black (2008); & Hethorn & Ulasewicz (2008) all propose that all sectors of the fashion industry, from lingerie to high street brands to luxury labels, need to develop sustainable products and services, which consider economic, environmental, social and ethical issues throughout the product life cycle. As a society the obsession for consuming fashion goods has seen an enormous growth in the 'fast fashion' sector. This sector is responsible for trend driven products that utilise 'just in time' technology in order for the product to reach the stores in the quickest possible time. High street retailers within this competitive sector focus on selling fashion garments that retail at a low price.

The table 4.3 indicates that 71% of the respondents agreed that Fashion designers use a reprogrammable, multifunctional manipulator designed for automation assembly line for apparel making, 12.3% of the respondents strongly disagreed, while 16.7% were neutral. In Australia the Ethical Clothing Australia organization provides a fashion label with



assistance in conducting monitoring processes to meet mandatory NSW, and Victoria State government requirements for the fair and safe employment of outworkers and factory workers. The organization even goes one step further offering to guide a fashion label through its voluntary accreditation and labelling system that is designed to encourage and promote ethical production within Australia. Internationally, a wide variety of organizations, local government policies and industry schemes exist to encourage the ethical employment of people and fair-trading of locally produced goods.

Also, 87.7% of the respondents agreed that Fashion designers use sewing machines that run on high speed, 7% of the respondents were neutral, while 5.3% disagreed. This is obviously an important consideration, which demands equal attention; by exposing the manufacturing phases of a garment, the producers and suppliers in the supply chain can help provide transparency for the many people employed within the fashion industry. In turn this transparency can help ensure that ethical standards are raised through a regulatory process. However as noted by Draper et al., (2007) the monitoring and enforcement of existing standards can be problematic as many suppliers struggle with compliance and the numerous assessments. Some large brands, such as Nike, however, have been able to use corporate reporting processes as a method for motivating changes within the supply chain of subcontractors.

To add more, 74.6% of the respondents agreed that Fashion designers use fusing machines which runs on controlled temperature with speed adjustments, 17.9% were neutral, while 7.9% disagreed. However, concepts like these, which challenge the notion of how garments are manufactured remain largely unexplored by much of the industry. Aside from investigations that explore strategies such as zero waste techniques, which aim to reduce fabric waste and thereby cut costs, or the use of new technologies that promises the customisation of clothing for individual wearers (Loker, 2008; Black, Eckert &

Eskandarypur, 2009), there appears to be a gap of new knowledge in the area of new processes for production which foreground sustainable issues. Instead, there has been an emphasis placed on the ethical considerations associated with the manufacture of textile materials and fashion garments in often distanced or remote locations.

Moreover, 70.2% of the respondents agreed that Fashion designers use computers solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions, 15.8% were neutral, while 14% disagreed. However, in order to do this the designer/pattern maker needs to be able to confidently move between the 3D form and 2D pattern making, going back and forth until, through design choices, the fabric waste is minimized. Some fashion designers are beginning to integrate the strategy within the design and production process.

Furthermore, 87.7% of the respondents agreed that Fashion designers used internet for web hosting, e-mail, online communication, and to search for design ideas, 7% were neutral, while 5.3% disagreed. For example, Australian designer, Mark Liu combines this strategy with laser cut decorative edge finishes; while Issey Miyake developed the A Piece of Cloth (APOC) system of knitwear utilizing 3D technology to produce a knitted tube that efficiently embedded a range of garment pieces. The tube could be cut into separate garment pieces, by the wearer, which then required little or no finishing. Miyake has since progressed to producing his first range of zero waste fashion, 132 5. ISSEY MIYAKE (2011) that uses computer software to generate a 3D geometric form pattern, which utilizes all of the fabric in a single piece of cloth. Miyake has also made use of environmental materials such as lightweight PET fabric.

Finally, 70.2% of the respondents agreed that Fashion designers use telephone, cell phone, pagers, and fax, 15.8% were neutral, while 14% disagreed.

#### **5.4 The kind of Designing Technology Training Workshop should be Organised for Fashion Designers in Adentan Municipality**

The kind of designing technology training workshop that has been organised for fashion designers in Adentan Municipality improved ‘creative’ ability and ‘technical’ ability mean score of 4.26. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea mean score of 4.19. These results imply that in broad terms, the fashion designer initiates and generates design ideas that become new fashion garments; in industrialized nations it is usually a professionally trained person who is expected to have a high level of design ability (Cross 2016).

The fashion designer must possess a range of skills, and these abilities fall into one of two areas, namely ‘creative’ ability and ‘technical’ ability. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea (Jackson 2016).

In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production (Jackson 2016). Importantly, the designer must also be able to communicate the new product to the manufacturer and the client (Cross 2016).

In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production mean score of 4.12. Philosophically fashion garments have the ability to construct and communicate identities, and it follows that there are a number of complex issues related to identity, gender and power involved in the cultural reading of the fashion garment. However, in the majority of cases the production of contemporary fashion clothing continues to be driven by the pragmatic need of meeting market expectations within

budget and manufacturing constraints, factors which frequently form the basis of the designer's brief. However, while the majority of fashion garments continue to be designed, produced and measured by economically driven factors, it is becoming increasingly important to measure the manufacture of a fashion product against its impact on the environment and society.

Importantly, the designer must also be able to communicate the new product to the manufacturer and the client mean score of 3.81. Design using reprocessed or waste materials to make a product of equal or higher value mean score of 2.56. Inevitably people began to gravitate towards the growing cities for employment, as the industrious factories demanded larger workforces to help generate hundreds of products a day rather than over weeks. These early industrialists were optimistic, and driven by economic returns, which were built on producing large volumes of products as efficiently as possible (McDonough and Braungart 2012).

Make good an existing item fit for new purpose mean score of 2.49. Creatively re-think, customize or re-design an existing design concept mean score of 2.35. Design for minimal use of energy, minimize or eliminate waste materials mean score of 2.23. However, as the new industries flourished a number of major issues began to emerge, including: the wasting of resources; the increase in pollution; and the poor wages and working conditions of the employees. Although cities were often highly and quickly polluted by these industries, resources were abundant and at the time nature's ability to absorb waste and bi-products seemed limitless. Furthermore, it seemed that the industrialists rarely considered their activities in terms of an expansive system, other than in economic terms. Many people believed that natural resources would remain plentiful and "At the same time, the Western

view saw nature as a dangerous, brutish force to be civilized and subdued.” (McDonough & Braungart 2012, p25).

Design choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact mean score of 3.81. The use of only one material to facilitate recyclability mean score of 2.73. As this project work specifically questions the designer’s role in integrating sustainable strategies within the fashion design process it has to be acknowledged that some of the points listed may not come under the direct responsibility of the fashion designer, or that he/she may not be in a position to influence change. However, it can be surmised that the fashion designer is in a position to address some of the environmental and social issues that are associated with the fashion design and production process. Furthermore, it could be argued that it is the moral obligation of the fashion designer to question these accepted norms.

Apply technology to achieve reductions in energy, materials or develop more efficient new process mean score of 2.56. Design with high quality materials and making, with aesthetic durability creating emotional bonds in addition to function mean score of 2.49. Characteristically the garments are manufactured from inferior fabrics and produced in countries where low salaries and poor working conditions for employees can be widespread (Clark 2008). Moreover, the garments are recognized by the consumer as short lifespan products. For the consumer these lesser quality products are easily disposable garments; garments that provide a ‘quick, cheap fashion fix’ that will prove useful on a handful of occasions but will inevitably become landfill waste in a short period of time. Since it appears that the consumer has accepted that fashion garments are disposable items (in general terms), it is of no surprise to reveal that even expensive garments are often disposed of and replaced rather than repaired (Draper et al., 2007).

Creating new and sustained feel-good relationships with clothes to be valued mean score of 2.35. While it is suggested that the prices for fashion goods will continue to drop as competition increases within the industry, new production technologies continue to force a reduction in labour needs. In the meantime, mounting pressure from the consumer, increasing legislation and international ethical campaigns all drive the demand for responsible production practices and seek improvements in the working conditions for employees in developing countries (Allwood et al., 2016).



## CHAPTER SIX

### SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

#### 6.1 INTRODUCTION

This chapter dealt with the summary of findings, conclusions, recommendations and suggestions for further studies.

#### 6.2 Summary

The aim of this study was to investigate the emerging production technologies in clothing production in Ghana- the perception of customers within Adentan Municipality. The research design adopted was mixed method. The researcher used quantitative research approach for the study. Population studied was fashion designers in the Adentan Municipality. The study population was 120 fashion designers. Random sampling was used to select 80 fashion designers for the study. Questionnaire was the main instrument used to gather primary data. Computer data analysis such as SPSS and other relevant software such as Microsoft excel were the main tools that were employed to analyze the data in order to help interpret results. The statistical package for social scientist (SPSS version 20) was used to analyze the pre-coded questions. Descriptive statistics was used to analyze data.

#### 6.3 Major Findings of the Study

##### 6.3.1 The Emerging Designing Technologies in Clothing Industry

As indicated in the table 4.2, the emerging designing technologies in clothing industry were ranked as Computer-aided design (CAD) representing first (1<sup>st</sup>) in the likert ranking order with a mean score of 4.78 and RII =0.98, Automated inspection (AIN) ranked 2<sup>nd</sup> with a mean score of 4.26 and RII 0.96. Automated material handling devices (AMHD) ranked 3<sup>rd</sup> with a mean score of 3.97 and RII 0.92.

Statistical process control (SPC) ranked 4<sup>th</sup> with a mean score of 3.86 and RII of 0.87.

Production planning/inventory management software (PPIC) ranked 5<sup>th</sup> with a mean score of 0.85 and RII 0.85. Local area networks (LAN) ranked 6<sup>th</sup> with a mean score of 3.76 and RII of 0.83. Pick/place robots (PPR) ranked 7<sup>th</sup> with a mean score of 3.54 and RII 0.82. High speed sewing machines (HSSM) ranked 8<sup>th</sup> with a mean score of 2.87 and RII of 0.79. Modern fusing and pressing machine (MFPM) ranked 9<sup>th</sup> with a mean score of 2.85 and RII of 0.77. Computers used on factory floor (CUFF) ranked 10<sup>th</sup> with a mean score of 2.75 and RII of 0.75. Internet (IT) ranked 11<sup>th</sup> and RII of 0.73. Communication (CM) ranked 12<sup>th</sup> and RII of 0.71. Numerical control machine tools (NC) ranked 13<sup>th</sup> and RII of 0.67.

### **6.3.2 The Usage of Various Designing Technology among the Fashion Designers in Adentan Municipality**

Table 4.3 shows that majority 74.6% of the respondents said that fashion designers design activities that involve the effective use of computers for drawing and designing products. To add more, 70.2% of the respondents indicated that fashion designers use automated inspection machines to perform product inspection. Also, 57.9% of the respondents agreed that that fashion designers use systems capable of automatically loading, unloading, and sorting out. Moreover, 71% of the respondents agreed that Fashion designers use a form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols.

The study results held that 87.7% of the respondents agreed that Fashion designers use a computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning.



Furthermore, 43.9% of the respondents agreed that Fashion designers use communication system that permits various devices connected to the network to communicate with each other over a distance.

To add more, 57.9% of the respondents agreed that Fashion designers use a simple or complex robot which transfers items from place to place.

The table 4.3 indicates that 71% of the respondents agreed that Fashion designers use a reprogrammable, multifunctional manipulator designed for automation assembly line for apparel making.

Also, 87.7% of the respondents agreed that Fashion designers use sewing machines that run on high speed.

To add more, 74.6% of the respondents agreed that Fashion designers use fusing machines which runs on controlled temperature with speed adjustments.

Moreover, 70.2% of the respondents agreed that Fashion designers use computers solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions.

Furthermore, 87.7% of the respondents agreed that Fashion designers used internet for web hosting, e-mail, online communication, and to search for design ideas.

Finally, 70.2% of the respondents agreed that Fashion designers use telephone, cell phone, pagers, and fax.

### **6.3.3 The kind of Designing Technology Training Workshop should be Organised for Fashion Designers in Adentan Municipality**

The kind of designing technology training workshop organised for fashion designers in Adentan Municipality enhanced their creative' and 'technical' mean score of 4.26.

In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel

design idea mean score of 4.19. In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production mean score of 4.12.

Importantly, the designer must also be able to communicate the new product to the manufacturer and the client mean score of 3.81. Design using reprocessed or waste materials to make a product of equal or higher value mean score of 2.56. Make good an existing item fit for new purpose mean score of 2.49.

Creatively re-think, customize or re-design an existing design concept mean score of 2.35. Design for minimal use of energy, minimize or eliminate waste materials mean score of 2.23. Design choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact mean score of 3.81.

The use of only one material to facilitate recyclability mean score of 2.73. Apply technology to achieve reductions in energy, materials or develop more efficient new process mean score of 2.56.

Design with high quality materials and making, with aesthetic durability creating emotional bonds in addition to function mean score of 2.49. Creating new and sustained feel-good relationships with clothes to be valued mean score of 2.35.

#### **6.4 Conclusions**

The study concluded that the fashion designers used intelligent fashion designs to reduce the social and environmental impact of a fashion product's life cycle and considered the environmental effects of the colours and prints they choose for their fashion collection. The challenges faced by fashion designers in their attempt to create a well-established sustainable brand were that the brand imitation of fashion design and piracy is a threat to the fashion design industry, inability to reduce the amount of solid and hazardous waste in

your packaging is a challenge. Moreover, lack of funds to expand the fashion design business is a threat to the fashion designers. Furthermore, lack of records keeping practices among fashion designers affected the fashion industry.

## **6.5 Recommendation**

1. The study recommended that the stakeholders in the fashion industry must check brand imitation of fashion design and piracy to improve profitability in the fashion design industry. Furthermore, fashion designers must be encouraged to reduce the amount of solid and hazardous waste in their packaging.
2. Also, the banks, Microfinance and financial institutions must provide flexible loans to fashions designers to expand their business. Furthermore, fashion designers must keep proper records of transactions to improve their businesses.
3. Furthermore, fashion designers should consider a local supply chain to decrease mileage in the fashion design production process and also, reduced the weight and volume of a product by using fewer or lighter materials to optimise transportation.
4. In order to demonstrate creative ability, the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea. In addition, the designer also needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production.
5. Importantly, the designer must also be able to communicate the new product to the manufacturer and the client. Design using reprocessed or waste materials to make a product of equal or higher value. Make good an existing item fit for new purpose.
6. Fashion designers should creatively re-think, customize or re-design an existing design concept. Design for minimal use of energy, minimize or eliminate waste materials. Design

choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact.



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## APPENDICES

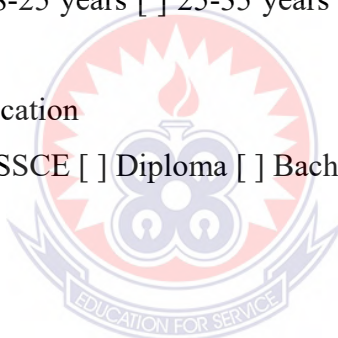
### APPENDIX A

#### QUESTIONNAIRES FOR THE RESPONDENTS

The researcher is a student of AKENTEN APPIAH-MINKA UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT conducting a piece of research to investigate the emerging designing technologies in the clothing industry in Ghana - the perception of Fashion designers within Adentan Municipality. I respectfully request that you form part of this research by completing the attached questionnaire. Anonymity and non-traceability are assured. It is my fervent hope that you participate in the study. Thank you for your valuable cooperation.

#### **Section A: Demographic Characteristics of the Respondents**

1. Gender: Male  Female
2. Age: Below 18 years  18-25 years  25-35 years  35-45 years  45-55 years   
More than 55 years
3. Highest Educational Qualification  
BECE/MSLC  SSSCE/WASSCE  Diploma  Bachelor's degree  Master's degree   
 other (please specify)



#### **Section B: The emerging designing technologies in clothing industry.**

Please, respond to the statements by ticking as sincerely as possible.

| 4. Do you know how to use the following technologies in apparel design? | Yes | No | I Do not know |
|---|-----|----|---------------|
| a. Computer-aided design (CAD)  |     |    |               |
| b. Automated inspection (AIN)   |     |    |               |
| c. Automated material handling devices (AMHD)                           |     |    |               |
| d. Numerical control machine tools (NC)                                 |     |    |               |
| e. Statistical process control (SPC)                                    |     |    |               |
| f. Production planning/inventory management software (PPIC)             |     |    |               |
| g. Local area networks (LAN)  |     |    |               |
| h. Pick/place robots (PPR)  |     |    |               |
| i. Other robots (OR)  |     |    |               |
| j. High speed sewing machines (HSSM)                                    |     |    |               |
| k. Modern fusing and pressing machine (MFPM)                            |     |    |               |
| m. Computers used on factory floor (CUFF)                               |     |    |               |
| n. Internet (IT)  |     |    |               |
| o. Communication (CM)   |     |    |               |

**Section C: The usage of various designing technology among the fashion designers in****Adentan Municipality**

Please, respond to the statements by ticking the number of the 5-point scale using the following keys: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (D), 1=Strongly Disagree (SD) as sincerely as possible.

| <b>Statement (s)</b>   | <b>1</b> | <b>2</b> | <b>3</b> | <b>4</b> | <b>5</b> |
|--|----------|----------|----------|----------|----------|
| 5. Fashion designers design activities that involve the effective use of computers for drawing and designing products.   |          |          |          |          |          |
| 6. Fashion designers use automated inspection machines to perform product inspection.  |          |          |          |          |          |
| 6. Fashion designers use systems capable of automatically loading, unloading, and sorting out.   |          |          |          |          |          |
| 7. Fashion designers use a form of programmable automation in which the processing equipment is controlled by means of numbers, letters, or other symbols.               |          |          |          |          |          |
| 8. Fashion designers use a computerized production planning system whose function is master production scheduling, material requirements planning and capacity planning. |          |          |          |          |          |
| 9. Fashion designers use communication system that permits various devices connected to the network to communicate with each other over a distance.                      |          |          |          |          |          |
| 10. Fashion designers use a simple or complex robot which transfers items from place to place.   |          |          |          |          |          |
| 11. Fashion designers use a reprogrammable, multifunctional manipulator designed for automation assembly line for apparel making.  |          |          |          |          |          |
| 12. Fashion designers use sewing machines that run on high speed.  |          |          |          |          |          |
| Fashion designers use fusing machines which runs on controlled temperature with speed adjustments.   |          |          |          |          |          |
| 13. Fashion designers use computers solely for data acquisition or monitoring daily data, but which are capable of being reprogrammed for other functions.               |          |          |          |          |          |
| 14. Fashion designers used internet for web hosting, e-mail, online communication, and to search for design ideas.   |          |          |          |          |          |
| 15. Fashion designers use telephone, cell phone, pagers, and fax.  |          |          |          |          |          |

**Section D: Organising a training workshop on the emerging designing technologies with the fashion houses in Adentan Municipality.**

Please, respond to the statements by ticking the number of the 5-point scale using the following keys: 5=Strongly Agree (SA), 4=Agree (A), 3=Neutral (N), 2=Disagree (D), 1=Strongly Disagree (SD) as sincerely as possible.

| Statement (s)   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 16. The fashion designer must possess a range of skills, and these abilities fall into one of two areas, namely 'creative' ability and 'technical' skills.  |   |   |   |   |   |
| 17. In order to demonstrate creative ability the designer should be able to generate an original design from a unique concept, or be able to interpret trend information into a novel design idea.        |   |   |   |   |   |
| 18. Fashion designer needs to possess the technical ability to recognize the capabilities of a fabric and have the capacity to follow a garment through the entire process of development and production? |   |   |   |   |   |
| 19. The designer must be able to communicate the new product to the textile manufacturer.   |   |   |   |   |   |
| 20. Design using reprocessed or waste materials to make a product of equal or higher value.   |   |   |   |   |   |
| 21. Fashion designers Creatively re-think, customize or re-design an existing design concept.   |   |   |   |   |   |
| 22. Fashion designers design for minimal use of energy, minimize or eliminate waste materials.  |   |   |   |   |   |
| 23. Fashion designers design choices for environmentally benign fibres, fabrics and other materials seeking to minimize impact on environmental hazards.  |   |   |   |   |   |
| 24. Use of only one fibre type to facilitate recyclability.   |   |   |   |   |   |

**Thanks for your cooperation!**