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Design Development Gaps in Apprenticeship - Trained Garment Producers in Ghana

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Abstract

Product development process in the garment industry begins with Design, which is a critical component in fashion product development. The designers interpret findings after series of research and translate concepts into styles. These key skills are highly desired in attempt to boost a country's economy through standardised product development. Notwithstanding, apprenticeship-trained garment manufacturers in Ghana who occupy a considerable percentage of fashion designers in the country seemingly disregard the requisite processes involved in garment manufacturing in their practices. This study seeks to investigate the skill level of the apprenticeship-trained small-scale garment producers in design development processes. The Qualitative research approach was adopted for the study. With fashion designers in Kumasi Metropolis as a target population, thirty-two (32) respondents were sampled using the purposive and random sampling techniques. Non-participant observation, one-on-one interview as well as document analysis were used significantly as research tools to collect data from the respondents. The study revealed that apprenticeship-trained garment producers rely on designs copied from catalogues and posters without innovations due to their lack of design interpretation and CAD application. It is recommended that small-scale garment manufacturers consider the design process as highlighted in this study to be the appropriate means of developing standardised products.

Keywords: Garment producers, Apprenticeship-trained designers, Skill gab, Design development.

1.0 Introduction

Traditional apprenticeship in the informal sector consists of private contractual arrangements between a parent or apprentice and a master craftsperson who agree to provide practical training in the workplace, lasting for a duration of several months to about three or four years. Some amount of fee is paid to the master craftsperson as commitment and to certify the training for the apprentice while learning. Ghana's apprenticeships training regime is increasing for youth between 15 to 30 years of age (World Bank, 2009). Traditional apprenticeships are by far the

most frequent form of skills training in Africa, particularly west and Central Africa (World Bank, 2009).

Filipiak (2007) and Haan (2006) estimate that up to 70 per cent of urban informal sector workers in Africa have had their training through the traditional apprenticeship system. For instance, the Ghana Statistical Service in 2012 discovered that whereas in the same year, little over 50,000 teenagers were recruited by both public and commercial providers, there were 207,000 youths registered as apprentices in 2002 (World Bank, 2009). Traditional apprenticeships have both strengths and weaknesses. Strengths include self-financing, self-regulation, practical, hands-on instruction, and high employment prospects following training. However, this system of skill acquisition suffers from weak education among the entrants, where literacy is an issue (Biney-Aidoo, Antiaye, & Oppong, 2013). The method of teaching in apprenticeship training varies and few market standards are available to judge the quality of the training provided (Johanson & Adams, 2004). Palmer (2007) espouses that few participants' educational background pass beyond a junior secondary education, and many do not even complete a primary education. In this system of training, the master craftsmen do not provide theoretical knowledge alongside practical experience and in most cases teach outdated technologies that lack skills in design processes (Biney-Aidoo, et al., 2013).

Competition among fashion companies is based on aesthetics, the symbolic meaning of the style ingrained in the visual qualities of the various components of a collection (including apparel and accessories), and how these components are put together. The choices made in terms of textiles and materials, weavings, colours, volume, shape, and silhouette determine fashion style (Davis, 1992). Fashion designers use their expressive freedom to continuously develop new designs that are saleable at the market.

Research is the first step in the design process, during which designers gather data about consumer preferences and forecasts for the future of fashion (Bureau of Labor Statistics, 2022). Firstly, designers examine their own feeling of the market based on trade shows, museums, designs that is currently selling, and their own contacts and experiences in society. Secondly, they examine trend reports that describe styles, colours, and fabrics popular for the coming seasons. Thirdly, designers visit textile manufacturers to procure samples of fabrics and make an initial selection of fabrics and patterns and match them to the expected products (Statistics

2008; Bureau of Labor Statistics, 2022). After the selection of fabrics, colours, patterns, and shapes; the design phase starts where the designers sketch preliminary designs by using pencil and ink for their sketches and then translating them into digital blueprints with Computer-Aided Design systems. The use of computer systems by designers allows for quicker iterations and modifications throughout the final stages of prototype and sampling since they can view their designs on virtual models and in many colours and shapes (Parsons & Campbell, 2004).

The technical facets of the designs are dealt with in the paper pattern drawing stage. The basic silhouette of a garment is drawn on paper in the form of a paper pattern, which details all of its components and features (for example, in a shirt construction, the neckline or collar, sleeves, the pockets, the cuts, the lengths, the draperies). The fabric used to make toiles is then covered by the paper design after it has been cut (Statistics, 2008). Prototypes are constructed utilizing multiple materials or with minor pattern modifications throughout the testing process in order to test numerous options. Then, these prototypes are tested on human models to see how they perform and determine whether any alterations are required. This procedure results in the decision of the ultimate designs that will be sold (Statistics, 2008). The sampling process comes next. Following the last-minute changes and decisions, samples of the product manufactured from the real materials are created and sold to apparel merchants at fashion and trade exhibitions. The creation of the various sizes of the same object marks the conclusion of this step. This technique for developing clothing is iterative and offers a lot of room for experimentation and learning. Choice of fabrics and colours, however needs to be guided by the data gathered in the design process.

A multidisciplinary term, creativity in business depends on the study of economics, psychology, management, innovation, sociology, and cultural studies (Gardiner, 2004). One of the foremost experts in the field of creativity research, Mark Runco, co-wrote a correction in the Creativity Research Journal and offered a "standard definition" of creativity (Runco & Jaeger, 2012). They went back to the writings of psychologist Maurice Stein, who defined creative labour as an original effort that is at some point in time acknowledged by a group as tenable, helpful, or rewarding. This indicates that the creative product did not previously exist in its current form. Although the product is created by the integration of previously used materials or expertise, it eventually contains new components (Stein, 1953; Henriksson, 2021). It is instructive to note that the nearly 60-year-old definition still holds true today because it

encompasses a wide range of creative endeavours. To start the process, the creator needs a body of information or pre-existing material, and an audience is needed to evaluate the finished output. Although novelty seems to imply uniqueness, the product need not be 100 percent original. According to Barron and Harrington (1981), creative people tend to have the following core traits: aesthetic sensitivity, a broad range of interests, an attraction to complexity, high energy, independence of judgment, autonomy, intuition, self-confidence, tolerance of ambiguity, persistence, intellectual honesty (Amabile, Barsade, Mueller & Staw, 2005), and having an internal locus of control (Woodman & Schoenfeldt, 1990).

The garment industry involves significant creativity and innovation in order to satisfy the criteria of both aesthetic design and utility to consumers (WIPO, 2011). Fashion designer not only improves the outside beauty and aesthetics of the object but most importantly improves the use and functioning of the object. WIPO (2011) notes that a product is well designed when aesthetics and functionality along with saleability are all in a perfect balance. Viktoriya, Malyavko and Lyubov (2018) opine that one of the primary problems in the garment industry is that of training highly skilled personnel, the combination of the fashion industry and the digital economy and the introduction of an innovative approach to all stages of the garment manufacture. According to Arlidge (2016), these lessons may be drawn from fashion companies that have given fashion designers strategic and high-profile roles, like Roberto Menichetti, the design director at Burberry, who oversaw a 110 percent increase in profits after the company's image and design were revamped. In addition to forecasting trends and moods, the fashion designer also functions as a conduit for the expression of the moment's feelings. Creativity is an emotional issue in garment production of which the designers themselves cannot agree what it is. Designs that are inappropriate are blamed as major causes of product rejection (Wood, 2002). According to Fringes (2007) the fashion designer is someone who creates fashion ideas and supervises patternmaking and sample making. Stecker (1996) notes that the role of the fashion designer is to participate in original and creative collections. According to Cooper & Press (1995), a designer must comprehend market statistics as well as the social, cultural, economic, and political environments; qualities that the majority of Ghana's small garment producers lack (Stecker, 1996). Finally, Marinova (2004) postulates that market knowledge diffusion propels creativity and innovation, whereas satisfaction with past performance hinders efforts in creativity. The purpose of this study was to investigate the

competence of the apprenticeship trained garment producers in areas of designing innovations and computer applications.

2.0 Methodology

Qualitative research method based on the Survey type of descriptive research design was employed for the study. Descriptive study was useful as this paper was aimed at giving accurate portrayal of the characteristics of persons and situations (Creswell, 2012). Non-participant observation, one-on-one interview as well as document analysis (Bowen, 2009) were the tools used for data collection for delving into the issues about gaps in design development processes amongst tailors and dressmakers in Ghana. Accessible population for the study comprised garment merchandisers, tailors and dressmakers in Kumasi, lecturers and students at Kumasi Technical University (KsTU) and Kwame Nkrumah University of Science and Technology (KNUST). A total of thirty-two (32) respondents were engaged in one-on-one interview. This is quite an adequate figure for the study as Creswell (1998) avows that for quality research 30 respondents give a fair representation for an acceptable accuracy of results. Purposive and random sampling methods were used in selecting respondents for the study. Grounded theory analysis was employed in the data analysis under the following criteria: Design development processes, Designers' competence in the use of computer and Innovations in the Ghanaian small-scale garment industry.

Data were presented and analysed descriptively, conclusions were drawn, and recommendations were made on ways of improving fashion designer's competence in designing. To ensure anonymity and confidentiality, names of respondents were not included in their responses. As regard, respondents from apprenticeship trained garment manufacturing firms were identified with ASG 1, 2, 3, … 15 in that order respectively and respondents from formally trained garment firms were identified with FSG 1, 2, 3,…9 in that order. Respondents from educational institutions were identified with EI 1, 2, ---- 6 while respondents from merchandising business were identified with FM 1 and 2.

Table 1 provides the category of respondents engaged for data collection. The selected respondents have an affiliation with the garment industry and are therefore able to give responses which are true reflection of the situation on grounds. Thirty-two (32) respondents were selected for the study because they fairly represent the population (Creswell, 1998).

Table 1: Distribution of the Respondents

Respondent	Gender		Type of Training		Total Respondents
	Male	Female	Informal	Tertiary Institution	
1. Small-scale garment firms	12	12	15	9	24
3. Students	2	2	-	4	4
4. Lecturers	1	1	-	2	2
5. Fashion merchandisers	1	1	1	1	2
Total	16	16	16	16	32

3.0 Results and Discussions

3.1 Design Development Processes

One pertinent issue investigated in the study was the respondents' views on the processes followed by garment industry in creating designs. Different opinions and experiences were shared by the respondents. Citing the responses gathered from respondents on the issue about design processes, ASG 8 stated that he sometimes got his designs from dreams. The respondent therefore concludes that it was a gift of God. "In fact, I don't follow any order in creating design" (ASG 8). Moreover, ASG 13 expressed the sentiment that he gets his designs from God. *"My design skills are about the gift of God, the moment I lay the fabric on table, the design just comes up"* (ASG 13). On the same question a respondent from formally trained small firm, FSG 2 expressed the following revelation: *"As a designer I sketch the designs down on paper by studying catalogues and other designs somewhere"* (FSG 2).

Responses from respondents suggested that most informally trained small fashion designers had little or no knowledge about sources of inspirations such as mood-board for designs development. For example, a question was posed about whether Ghanaian fashion designers gather information on mood-board to serve as foundation for creation of design. The general response gathered from the respondents, most of whom had their training through apprenticeship were:

> *I don't know anything about mood board and what it is used for because we don't use it here. When I want to create new designs, I look at the fabric at hand and then make something out of it" (FSG 3 & ASG 15).*

The pieces of information obtained from the respondents about garment design processes indicate that small garment designers especially the informally trained ones have little knowledge about ways of creating designs for new collections. The researchers observed that the formally trained designers exhibited design skills which were manifested in possession of sketch books. FSG 1 stated: "*sometimes we design on the dummy and invite clients for input and approval, sometimes too we use the old patterns to generate something new from them*". This suggests that designers who are formally trained go through research processes and make unique garment styles which is not the case with those who obtained training through apprenticeship. Carr and Latham (2008) suggest that the effect of designs that are not backed by research often result in creation of designs that would not sell since the customers are not involved in the creation of the designs.

ASG 5 explained that design is about evolution, what existed in the past later comes back into fashion. She indicated that designers need to keep collection of catalogues which would serve as reference point or source of inspiration for future collections. In agreement with WIPO (2011) the garment industry involves significant creativity and innovations in order to satisfy the criteria of both aesthetic design and utility to consumers. FSG 8 also states that she often finds colleague tailors and dressmakers copying others. "*Those people who copy designs are lazy thinkers and cannot face competitions*" (FSG 8).

Responses presented above suggest that the small-scale garment industry, particularly those who acquired skill through apprenticeship training do not have the knowledge and skill to study trends to create designs. This trend means that the small-scale garment manufacturers do not have skills in garment designing processes or do not see the need for it and therefore cannot forecast future trending designs. However, to create a niche at the global competitive market, Nyarko, Essuman and Peligah (2015) posit that worldwide, a variety of standards are used for designing and manufacturing clothing, but the fundamental ones focus on trend analysis, design concepts, drawings, pattern creation, and production management.

The data further revealed that unlike large-scale garment industry which have design department, the informally trained small-scale garment firms have little or no ideas about designing processes as indicated in their responses. It is therefore concluded that the apprenticeship trained garment producers have serious gap in garment designing skills as result would find it almost impossible to withstand market competitions. The behaviour at the small-scale garment sub-sector is in contrast with Nyarko, Essuman, and Peligah (2015) who espouse

that design is about building theme boards which reflect the general theme for the collection, reflecting on trends which give the designers ideas for their colour schemes and styles. Table 2 shows the means of designing at the small and large garment industries as observed and found by the researchers.

Table 2: Means of designing in the small and large garment industries

Garment Industry (informally trained)
No research made into design trends.
Nothing used as source of inspiration.
Mostly rely on copying of designs directly from posters.
Designs are not kept for the future review

3.2 Designers' Competence in Computer Applications

The researchers sought to understand the real situation at the small-scale garment industry (apprenticeship-trained designer's industry) regarding competence level in the use of computer. The responses obtained from the respondents indicated that designers in the small garment industry whether formally trained or informally trained were handicapped in the use of computer for designing. Also, findings from the study showed that the formally trained producers are comfortable with the use of the hand in sketching designs. The researchers observed that the respondents at the informally trained garment firms had nothing to show as samples of the sketches they had made which confirmed that they were less motivated to sketch designs with the hand. It was also observed that workshop layout and available documents do not include computer or computer aided works.

When a question sought to find out the respondent's competence in computer, respondents made these remarks, "*I still go by the manual way because the ideas come as I sit then I draw*" (FSG 6). "*I have not tried using computer before and it's not something I can do now*" (ASG 12). Similarly, other respondents from the small-scale industry provided the same response, which suggests that the small-scale industry is gravely deficient in Computer Aided Designs (CAD). A respondent at Kumasi Technical University also expressed the sentiment that *"At Kumasi Technical University where I am doing Fashion design, we are taught illustrations and garment designing using the hand, however computer-based training is not adequate" (EI 3 & 2).*

It could be deduced from the data that computer applications for designing have not been studied by the small-scale garment entrepreneurs. Designers who had some CAD experience at the tertiary education level have not had in-depth skill to enable them apply in their career. The researchers observed that the small-scale industry has relegated the use of computer in designing to the background. A major gap on the small-scale that hinders efficient production is the complete loss of interest in CAD.

The atmosphere at the large-scale garment firms appeared opposite of what happens at the small-scale firms. Responses from respondents showed firm reliance on CAD for production at the large-scale firms. Data shows that small-scale fashion enterprises struggle with manual means of designing, neither can they rely on CAD for the designing. The researchrs agree with Keiser and Garner (2015) that with the use of CAD all details of garment are done on the computer and corrections are easily affected before plotting out. This means that the customer could have a look at the final design on the computer and make his or her input before the garment is sewn. Such standards are not followed in the small-scale firms. But currently, circumstances in the global garment industry indicate that it is past time small-scale firms had training in CAD and manual designing skills.

3.3 Skill in Innovations at Small-Scale Garment Industry

Another research question looked into the issue of design innovations. Data obtained from respondents showed that most small-scale garment producers relied on copying popular designs from catalogues without modifications. When respondents were asked to express their opinions of the innovative capabilities of the small-scale garment the responses gathered from ASG 4, FSG 6, indicate that foreign designers are ahead of Ghanaian small-scale garment manufacturers in creativity and innovations because elsewhere they train garment designers to create designs that sell well to customer likes. These respondents were the small garment makers who conceded that the foreign designers were ahead of them in the area of design developments. The responses are indication that the local small-scale garment designers have conceded that something needs to be fixed in terms of creativity and design development.

These respondents were realisation that Ghanaian local designers are behind creativity as far as global fashion design competition is concerned. Similarly, when the same question was posed to a respondent from a formally trained firm the response was.

I recently established a new association called Ghana Association of Fashion Designers and Exporters to train members in creativity and innovations in garment manufacture. There was massive participation, but I could not continue due to lack of funding" (FSG 2).

His comments suggest that informally trained small garment makers are looking up for an opportunity to participate in training in innovations. Opoku, Baiden, & Kemevor (2015), note that some of the local fashion designers were trained through apprenticeship with some being school drop-outs. This infers that such people would need training to equip them with innovative skills rather than copying. FSG 2 suggested that designers who cannot create their own designs and rather rely on direct copying of designs cannot face current market competitions. He said that such designers fear competition in the market. Figure 1 was observations made by the ressearchers which suggest that some local designers rely on catalogues in designing.

Figure 1: Display of catalogue at small firms (*Source: Field research, 2018)*

The observations made by the researchers revealed that indeed the local designers could create elaborate designs. However, those designs do not sell at the international market. Some of the reasons being inconsistencies in sizing, designs, stitches, and seams as observed by the

researchers in the data gathering process. FSG 2 indicated that the small-scale garment manufacturers are unable to produce exactly, two or more garments of the same features and specifications. Such characteristics in the local garment industry conflicts with Liu, Wang and Gu, (2009) who opine that innovative creation refers to some new design, which has structural, functional, or formal novelty. Furthermore, Liu et al (2009) indicate that a design is the development upon the skeleton of an existing product which innovates and satisfies the demand of consumers and generates better sale. The small industry therefore needs a little push in terms of training to be able to meet global competition.

Buttressing the small industry's need for training, it was found from a market survey that some foreign garments for example, T-Shirts and jeans are simple in terms of design and construction details, however, they sell better than popular local apparels like *fugu, kaba and kente*. The concern now is that there are considerable gaps in the operations of the small-scale local garment manufacturing that must be rectified to enable small-scale garment manufacturers meet the demands of the consumer.

4.0 Conclusion and Recommendations

The apprenticeship trained small-scale garment producers do not have the knowledge and skill in analysing trends as inspiration for creative product development resulting in the sub-sector struggling to meet global market competition. Computer application in designing is completely unnoticed in the small-scale garment producers. Furthermore, the study revealed that apprenticeship trained garment producers rely on design copying popular from catalogues and posters without innovations. It is recommended that small-scale garment manufacturers consider the design process as highlighted in this study to be the appropriate means of developing standardised products. Periodic trainings therefore need to be organised by heads of the small scale industries, bringing on board experts in arrears such as CAD in order to improve on their competence, especially, in the area of design and creativity.

5.0 References

Amabile, T. M., Barsade, S. G., Mueller, J. S., & & Staw, B. M. (2005). Affect and Creativity at Work . *Administrative Science Quarterly*, 50(3) 367–403.

Arlidge, J. (2016). Future of Britain's Luxury Brands is in the Past. *Retrieved from http://www.just-style.com*.

Barron, F., & Harrington, D. M. (1981). *Creativity, Intelligence and Personality , 32, 439–476.* . Retrieved from Annual Review of Psychology: http://www.corwin.com/upmdata/33595_Anderson.pdf - Retrieved 19th Frbruary, 2017

Biney-Aidoo, V., Antiaye, E., & Oppong, J. A. (2013). An Assessment of the Apprenticeship System as a Means of Acquiring Sewing Skills in Ghana. *Developing Country Studies*, Vol.3, No.11.

Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method . *Qualitative Research Journal*, 9(2), 27-40.

Bureau of Labor Statistics. (2022, September 8). *Occupational Outlook Handbook, Fashion Designers*. Retrieved from U.S. Department of Labor: https://www.bls.gov/ooh/arts-and-design/fashion-designers.htm

Carr, H., & Latham, B. (2008). *Technology of Clothing Manufacture.* Oxford OX4 2DQ: Blackwell Publishing Ltd.

Cooper, R., & Press, M. (1995). *The Design Agenda; A Guide to Successful Design Management.* London: Wiley and Sons.

Creswell, W. J. (1998). *Qualitative inquiry and Research Design: Choosing among Five Traditions.* Thousand Oaks: Sage.

Creswell, W. J. (2012). *Educational Research Planning, Conducting and Quantitative and Qualitative Research (Fourth Ed.)* . New York: Pearson Education, Inc.

Davis, F. (1992). *Fashion, Culture and Identity.* Chicago: University of Chicago Press.

Filipiak, E. (2007). *Vocational training in the informal sector: The outcomes of a field survey in seven African countries. Agence Francaise de Development.* Paris: A Powerpoint presentation prepared by the Research Department.

Fringes, S. G. (2007). *Fashion: From Concept to Consumer.* London: Pearson.

Gardiner, B., Martin, R., & Tyler, P. (2004). *Competitiveness, Productivity and Economic Growth across the European Regions.* . Working paper.

Haan, H. C. (2006). *Training for work in the informal micro-enterprise Sector: Fresh Evidence from Sub-Sahara Africa.* Springer, The Netherlands: Unesco-Unevoc .

Henriksson, F. (2021). On Material Selection and its Consequences in Product Development. Linköping : Linköping University.

Johanson, R. K., & Adams, A. V. (2004). *Skills development in Sub-Saharan Africa.World Bank Regional and Sector Studies.* Washington, DC: World Bank.

Keiser, S. J., & Garner, M. B. (2015). *Beyond Design: The Synergy of Apparel Product Development.* New York: Bloomsbury publishing inc.

Liu G, X; Wang, J; Gu, W. (2009). *Process Decision-Making Response - Costume Design Methodology.* Beijing: China Textile Press.

Marinova, D. (2004). Actualizing Innovation Effort: The Impact of Market Knowledge Diffusion in a Dynamic System of Competition. *Journal of Marketing*, 68: 1-20.

Nyarko, M. N., Essuman, M. A., & Peligah, Y. S. (2015). Garment Designing Process – Kumasi Polytechnic Experience . *Journal of Innovative Research and Devolopment*, Vol 4, Issue 4, 316-323.

Opoku, M., Baiden, S., & Kemevor, K. A. (2015). Quality Systems of Finishing Clothing in the Small-Scale Industries in Ghana. *Projournal of Humanities and Social Science*, VOL. 2(4), pp. 01-11.

Palmer, R. (2007). *Skills development, the enabling environment and informal microenterprise in Ghana* . University of Edinburg: Unpublished Doctoral thesis (mimeo), Edinburgh.

Parsons, J. L., & Campbell, J. R. (2004). Digital Apparel Design Process: Placing a New Technology Into a Framework for the Creative Design Process. *Clothing and Textiles Research Journal*, 22 (1/2), 88-98.

Runco, M. A., & Jaeger, G. J. (2012). The Standard Definition of Creativity. *Creativity Research Journal*, , 24(1), 92–96.

Statistics. (2008). *Fashion Designers. In Occupational Outlook* . New York: U.S. Bureau of Labor Handbook, 2008-2009 .

Stecker, P. (1996). *The Fashion Design Manual* . Sydner, Australia: Macmillan Education.

Stein, M. I. (1953). Creativity and Culture . *The Journal of Psychology*, 36(2) 311–322.

Viktoriya, A. M., Malyavko, N. L., & Lyubov, V. K. (2018). Innovative Approach to Garment Construction and Manufacturing Technologies of Light industry Products. *International Journal of Engineering & Technology*, 7 (3.5), 68-70.

WIPO. (2011). *The African Fashion Design.* Adis Ababa.

Wood, N. (2002). Creative Genius or Commercial Suicide? *Drapers Record*, February 16, pp. 29-30, EMAP Fashion Ltd.

Woodman, R. W., & Schoenfeldt, L. F. (1990). An interactionist Model of Creative Behavior . *The Journal of Creative Behavior*, 24(4) 279–290.

World Bank. (2009). *Ghana: Job creation and skills development draft report. Vol.I: Main Report. Report No. 40328-GH. Washington, DC: World Bank.* Retrieved from Retrieved: http://ddp-ext.worldbank.org/EdStats/GHAstu09a.pdf.