Chapter 1

AN OVERVIEW OF THE STUDY

1.1 INTRODUCTION

Female body shapes and proportions vary and change over time and between populations, as a result of nutritional changes, lifestyles, ethnicity, age, grooming and concepts of ideal beauty such as breast enlargement within different cultures. These differences have an impact on the fit of the constructed apparel, be it ready-made or custom-made (Hillestad, 1980:121; Winks, 1997; Ashdown, 1998; Simmons & Istook, 2003). Given that ready-made apparel depends on an accurate estimate of the distribution of body shapes and sizes within a target population, it becomes necessary for every country, and even regions within countries, to establish their own sizing systems based on the target population (Ashdown, 2000; Simmons, Istook & Devarajan, 2004a; Devarajan & Istook, 2004; Honey & Olds, 2007). The problem of fit with ready-made apparel has gained a lot of attention recently as consumers' demands for well-fitted apparel are increasing. Dissatisfaction with fit is one of the most frequently stated problems with garment purchases. Women have been reported to be the most dissatisfied consumers (DeLong, Ashdown, Butterfield & Turnbladh, 1993; Otieno, Harrow & Lea-Greenwood, 2005; Alexander, Connell & Presley, 2005a). This has been witnessed by the emergence of mass-customisation establishments, which have been facilitated by the use of body scanners in the developed countries. Through body scan technology, body dimensions and shapes can easily and rapidly be extracted from a population and converted immediately into body form categories, size charts and patterns for garment production (Ashdown, 1998; Simmons & Istook, 2003; Ulrich, Anderson-Connell & Wu, 2003; Ashdown, Loker & Adelson, 2004; Fiore, Lee & Kunz, 2004). Due to costs and technical requirements, body scan technology would not be feasible in a less developed country.

African developing countries such as Kenya also face similar apparel fit problems, but sizing issues are often overlooked or regarded as unimportant issues, finally giving rise to non-standardised size ranges that do not conform to the recommendations given by standard bodies (Chun-Yoon & Jasper, 1995; Faust, Carrier & Baptiste, 2006). A lack of basic design technologies such as computer-aided design and pattern design systems, in most apparel industries, are an indication of the ignorance about the importance of size and fit and a

reluctance to respond to consumer demands (Mason, 1998). The increase in the number of working women in Kenya, as in most parts of the world, can contribute to a surge in fashion interest. Regrettably, the ready-made apparel items available in Kenya are not satisfactory in terms of fit.

1.2 THEORETICAL BACKGROUND

1.2.1 Overview of the ready-made apparel in Kenya

Kenya's ready-made apparel manufacturers fall into two major categories, namely, those that manufacture on a large scale, usually referred to as the industry manufacturers (formal sector), and those that manufacture in mass, but in smaller quantities, comprising tailors, dressmakers, and home sewers (informal sector) (Ongile & McCormick, 1996:40; Mason, 1998:98). The few remaining large-scale manufacturers can further be split into those producing for the local market, and those that produce purely for export (Ongile & McCormick, 1996:40). Ready-made apparel is defined as apparel items produced in advance using standardised measurements (recorded size charts) as well as established body shapes for a specific market (Stone, 1999:179; Bye, LaBat & DeLong, 2006:66). The size charts are compiled from measurements taken from a large population using various techniques that would influence the quality of the size charts and consequently the fit of ready-made apparel (Winks, 1997).

In Kenya, however, the sources of the size database are, unknown and/or outdated, as the available anthropometric data was collected in 1975 (Kenya Bureau of Standards, KEBS, 2001- Appendix 4A). This information is ambiguous since the original source of the anthropometric data mentioned is unknown. The size standards, do not give any breakdown of body shapes or population representations of different sizes. Body dimension charts need to be revised frequently to keep abreast with continuous biological changes that occur in individuals and generations (Brunn, 1983; Winks, 1997; Le Pechoux & Ghosh, 2002:13; Olds, 2003; Bye, LaBat & DeLong, 2006:66). It is assumed that the size charts used in Kenya's apparel industries, are borrowed or copied from foreign established charts. It has been observed that existing size charts used by most manufacturers were copied or adapted in the hope that they would also work for their target market (Winks, 1997; Zwane & Magagula, 2006). However, since people's shapes and sizes vary, adapted sizing systems would result in ill-fitting apparel items.

Apparel production, trade, and consumption are currently undergoing dramatic upheavals in Kenya. Domestic production of ready-made apparel for local consumption has declined tremendously as the industry operates in an environment characterised by competition from imports of new and second-hand apparel as well as counterfeit textile products (Mason 1998:96; Regional Agricultural Trade Expansion Support (RATES) Program, 2003:4). Significant changes in the global regulatory environment affecting Kenya, including preferential trade agreements with the European Union (the Cotonou Convention of 2000) and the United States (the African Growth and Opportunity Act, passed by the United States Congress in 2000), have resulted in tremendous growth in emerging export apparel production just prior to the upcoming end of the Multi-fibre Agreement in 2005 (Omolo, 2006). The increasing importation of second-hand apparel, banned in Kenya until the 1990s, has likewise profoundly affected production of, trade in, and consumption of apparel (McCormick, Kimuya & Kinyanjui, 2001; KEPZA, 2005). Nevertheless, the textile industry ranks first among Kenya's manufacturing sectors in terms of both size and employment (GOK, 2000; RATES, 2003:11). Existing apparel manufacturers produce various types of apparel items, both for the local market and for export. Local apparel manufacturers supply only 45% of the Kenyan textile market requirements, while imported new and second-hand apparel accounts for about 37% of the market. The demand for textile products in the country is estimated to be growing at 3.8% annually (Ministry of Trade and Industry in KEPZA, 2005:7).

The lack of competitiveness has been highlighted as a major obstacle for the growth in the local apparel manufacturing industry (McCormick *et al*., 2001). Local ready-made apparel is poor in terms of fit, design, materials and workmanship. These problems have been seen as resulting from a lack of skilled personnel, outdated, under-utilised and insufficient machinery to tackle specialised work and furthermore, unreliable body dimensions, and lack of information about the uniquely Kenyan body shape, particularly for females. The latter aspect forms the most important component determining the quality of apparel (Ongile & McCormick, 1996:40-41; Mason, 1998:98). With the worldwide continuous increase in international trade in apparel, Kenya – like many other countries – has also witnessed enormous growth in ready-to-wear women's apparel retailing. Many apparel retail stores operating throughout the major cities and towns of the country, bear witness to this. Although locally produced ready-made apparel in Kenya accounts for 45% of all ready-made apparel supplied to the local market, this figure is likely to decline as consumers become more exposed and critical to the way an apparel item fits. The sound traditional custom-made apparel as well as the imported new and second-hand ready-made apparel are an indication that consumers' consumption pattern would soon lean more towards apparel items that are likely to satisfy their needs (Ongile & McCormick, 1996:40; Mason, 1998).

The tailors/dressmakers and/or home sewers custom-tailor each apparel item to the personal dimensions of the wearer. Within the custom-made sewing process, various measurements of the body are directly taken and transposed to the relevant parts of the pattern, to be used in cutting out apparel items (Tamburrino, 1992b). Within the custom-made tailoring, the mastery of the unique relation of the body's characteristics to the apparel produces apparel items that would fit the three-dimensional body as plausibly as possible. However, some "trying-on" and provisional adjustments are necessary with custom-made apparel, particularly with elaborate styles, high quality and complex garments, which require a much closer fit (Tamburrino, 1992b). According to Bye, LaBat and DeLong (2006), the tailor's interaction with the consumers as they are measured, facilitates a deeper understanding of the body shapes' components that need to be critically transformed into well-fitting apparel. Although custom-made apparel is supposed to provide the best fit as opposed to all other types of apparel items available in the market, regrettably, Mason (1998:137-138) reported that most tailors/dressmakers in Nairobi-Kenya, have very low skills and work with inadequate tools and machinery that may actually contribute to the poor fit. Linking the body's proportions to the fabrics and transposing them to three-dimensional apparel items could be a great challenge to tailors with only the most basic or very scant skills.

Although some of the second-hand clothes have been used in their home country, the apparel items may still be in a good condition and in most cases bear designer labels/names such as Armani, DK, Calvin Klein and/or famous brands such as Levi, Lee, Brooks Brothers, Marks and Spencer, Dorothy Perkins and many others. They are more often unique, made of high quality fabrics and workmanship, and are usually sold at affordable prices (Ongile & McCormick in McCormick & Pedersen, 1996:40; Hurreeram & Little, 2005; Mhango & Niehm, 2005). Some of the second-hand apparel bear self-descriptive labels, which act as a guide during selection and hence contribute to the consumer's satisfaction with the fit. All these characteristics collectively render the second-hand clothes quite popular in Kenya's market. Regrettably however, the fit problems of the ready-made apparel are also experienced with the popular custom-made as well as the second-hand clothing.

Ready-made apparel has over time almost replaced the custom-made apparel in most developed countries, as it offers flexibility in terms of style variety, price competitiveness and efficiency. Adams (1988) and Stone (1999:39) affirm that working class women's apparel consumption patterns differ from those of the non-employed, as the former group place greater value on time-saving, convenience-shopping centres, place greater accent on fashion, and take considerable interest in the flattering qualities of apparel and its suitability for work or other occasions. However, there is an outcry worldwide about the bad fit of ready-made apparel, particularly for women (Knight, 1994:15; Chun-Yoon & Jasper, 1996;

Ashdown, 1998). Finding ready-made apparel items of the correct size that fit well is often a frustrating dilemma for many female consumers worldwide (DeLong, Ashdown, Butterfield & Turnbladh, 1993; Otieno *et al.*, 2005; Klepp & Storm-Mathisen, 2005:329).

The problem of fit with ready-made apparel has gained a lot of attention recently as the consumers' demands for better fitting apparel increases (Knight, 1994:15; Ashdown, 1998; Shin & Istook, 2007). In an attempt to solve the sizing and fit problems associated with the manufacture of apparel, the apparel industries in developed countries have introduced body scanners and automated manufacturing systems. These have facilitated easy and faster mass-customised apparel, with fewer sizing and fit problems. Although the quality of the custom-made apparel surpasses that of the ready-made category, the traditional custom-made tailoring tends to be expensive, time consuming and rigid in terms of quick response to a busy consumer (Ashdown, 1998; Fralix, 2000; Ashdown, Loker & Adelson, 2004).

1.2.2 Female consumers and marketing issues

Due to women's varied body shapes, their fashions not only offer a larger variety of styles than men's, but also change more rapidly. Unfortunately, women find it difficult to satisfy their apparel needs and are more concerned with the social significance of apparel than men (Hogge, Baer & Kang-Park, 1988; Goldsberry, Shim & Reich, 1996b; Delk & Casill, 1999; Keiser & Garner, 2003:28-30). It has also been documented that size labels on women's apparel are not related to body dimensions, which has further contributed to frustration when female consumers select their apparel items (Goldsberry *et al.*, 1996b; Chun-Yoon & Jasper, 1996; Holzman, 1996; Winks, 1997; Faust *et al.*, 2006).

The female labour force in Kenya has increased greatly with more education and affirmative action taken by the government and non-governmental organisations to promote gender equality in all sectors (GOK, 2000:24). Working woman are continuously exposed to fashion and have the incentive, the opportunity and the means to respond to fashion's appeal. Often the better educated a woman becomes, the more willing she is to learn new things and to try out new fashions (fashion leaders), which serves to accelerate fashion change (Stone, 1999:38; Keiser & Garner, 2003:28-30). Educated females are experienced with global culture, more observant, more demanding and more confident in their taste and feel for fashion (Stone, 1999:39; Marshal, Jackson, Stanley, Kefgen & Touchie-Specht, 2004:10).

Female executives in the corporate world wearing a size 14 and above mostly have good fashion sense and want to look trendy, luxurious and unique in their selected apparel (Solomon & Rabolt, 2004:159; Marshal *et al.*, 2004:10; Klepp & Storm-Mathisen, 2005:333).

They are independent and cannot accept uncomfortable and constricting apparel just to follow the dictates of some fashion authority (Klepp & Storm-Mathisen, 2005:333). Today's busy and active females have carefully defined preferences for fashions that suit their own individual needs and comfort (Adams, 1988; Stone, 1999:41). However, a working woman places greater value on fashionable, time-saving, convenient shopping outlets and takes considerable interest in apparel's fit, its flattering qualities, durability and suitability for work (Knight, 1994:15; Klepp & Storm-Mathisen, 2005:333). It is reasoned that career women in Kenya as in many developing countries would spend their discretionary income on fashionable apparel. Kenya's local ready-made apparel is of poor quality in terms of materials used, workmanship and fit (Mason, 1998:98). The imported apparel on the other hand, could be appealing to the consumer in terms of visual appearance, quality, design, variety and fabrics used, but the problem of fit still persists (Mason, 1998:99; De Klerk & Tselepis, 2007). Inevitably, the female consumer is forced to have expensive alterations done or simply wear apparel with unsatisfactory fit. The effects of a stunning design, striking fabric and fine workmanship are destroyed if the finished apparel items do not fit the intended wearer (Winks, 1997; Kwong, 2004).

A review of the literature indicates that problems related to apparel fit stem from a variety of factors, such as an outdated anthropometric database from which sizing systems are developed, a lack of classified body shapes, non-standardised communication of sizing and fit and non-standardised fit quality management amongst the apparel industries (Salusso-Deonier, 1989; Chun-Yoon & Jasper, 1996; Holzman, 1996; Winks, 1997; Desmarteau, 2000; Ashdown, 2000). Ashdown (2000) sees sizing systems as the focus point around which all the other factors concerning sizing and fit revolve. She has identified the main factors affecting sizing systems and consequently the fit of ready-made apparel to be the population measurements (body dimensions), the design features (construction of the apparel), the fit issues (fit quality management), and the communication of sizing and fit (size labelling). These factors have been identified as issues that happen within the manufacturing process and occur throughout the production of apparel, from the conception stage to the dispatch stage. It has also been reasoned that fit problems could be attributed to factors outside the apparel manufacture such as the consumers' knowledge about size and fit and their fit preferences (Mason, De Klerk, Sommervile & Ashdown, 2008).

A starting point for the assessment of apparel's fit is studying the influencing fundamentals underlying fit, and studying the influence that the body shapes have on the fit of apparel (Salusso-Deonier, 1989; Gersak, 2002; Ashdown, Loker & Adelson, 2004; Kwong in Fan *et al.,* 2004). Body shape, being in a sense the apparel's framework (Sallusso-Deonier, 2005), will in one way or another affect all four factors highlighted in Ashdown's (2000) model. For

example, firstly, body dimensions require measuring the body in a specific way that will facilitate body shape classifications and accurate reflection of the three-dimensional body's characteristics when the apparel item is made. Secondly, the design features require that the body's framework (three-dimensional characteristics) be correctly interpreted to patterns for the construction of well-/better-fitting apparel. In most developing countries and particularly in Kenya, there is no known research on female body shapes or any related subject to support the quality of apparel styles. Thirdly, the fit issues (fit quality management) require that fit testing techniques, which are applied in the apparel industry, such as the use of fit models and dress forms, should conform with the body shapes of the target market. In Kenya, most of the personnel in the apparel industry are inadequately skilled to tackle fit issues and seldom employ modern technologies or dress forms to test the fit of the prototype apparel before even engaging fit models (McCormick, Kimuyu & Kinyanjui, 2002). In addition, communication of sizing and fit requires that the measurements and body shapes indicated on the size labels reflect the true picture of the target market (population). In Kenya, the source of size systems are unknown while most size labels presented on apparel are uninformative. Therefore this study is undertaken to evaluate apparel sizing and fit problems in Kenya in respect of career women's distinctive body shapes, and to assess career women's perceived fit problems, their knowledge about the communication of size and fit, as well as their fit preferences.

1.3 STATEMENT OF THE PROBLEM

According to KEBS (2001: Preface), anthropometric data in Kenya was taken in 1975 and the measurements were obtained from girls and women of Kenya's learning institutions and organisations. However, the size ranges are not grouped into body shape categories. The source of the original data from which the sizing systems were developed is unknown and obscure, so the quality of the techniques and instruments used for the data collection cannot be authenticated. The 1975 data would also be considered outdated and obsolete to cater for dynamic body changes.

Not all body shapes are alike or perfect. Careful evaluation of different figures reveals that most proportions, frameworks, contours and postures may symmetrically or asymmetrically deviate from the so-called ideal figure. Age also affects the body's proportions and hence the need to understand the body proportions and the fit needs of different age groups of females. Apparel has the potential to create a new and better perception of the body, even if it is not considered ideal. The use of apparel therefore is to alter the perceived proportions of the body, and to provide a sense of satisfaction to the individuals who do not fit the cultural

ideals of size and weight (Feather, Herr & Ford, 1996; Fiore & Kimle, 1997:331; Rasband & Liechty, 2006:3, 5 & 19). A question may arise, namely: how would career women's distinctive body shapes contribute to the fit problems of the ready-made apparel in Kenya? This constitutes the problem of this study. A pilot study in this regard was undertaken in Kenya, with the aim to sort out the most distinctive body shape of career women in Kenya, rather than simply categorising body shapes. It should be noted that it is possible to classify/categorise shapes from a large and representative population such as the 12,000 (United States of America) or 11,000 (United Kingdom) body-scanned subjects (Devarajan & Istook, 2004) in other studies. However, it would only be feasible to identify distinctive body shapes from data collected from a small population. This study employed manual anthropometric techniques of attaining body dimensions and was only carried out within two urban regions of Kenya. Investigation was therefore undertaken to sort out only distinctive body shapes emerging from the sample data. Accompanying body characteristics that occurred repeatedly, and are critical to apparel's fit, were described to establish how they may contribute to the fit problems of ready-made apparel in Kenya.

Considering that the majority of female consumers are dissatisfied with the fit of female ready-made apparel (Otieno *et al*., 2005; Klepp & Storm-Mathisen, 2005:329), most studies carried out were done in developed countries (Kurt Salmon Associates, 1996; Otieno *et al*., 2005; Zwane & Magagula, 2006; Shin & Istook, 2007) . However, little has been done in a developing country such as Kenya. The question to ask would therefore be: what are the perceptions of the career women in Kenya concerning the fit problems of ready-made apparel in Kenya? As part of the problem statement, this study therefore assessed Kenya's career women's perceptions of general fit problems that they encounter with ready-made apparel.

Communication of sizing and fit involves informing the consumers how the apparel items should fit in terms of size (key dimensions) and fit (body shape). Ready-made apparel items contain a variety of labels/tags that express information to the consumers for estimating the quality of apparel items in terms of size, fit and care. Although supplying size label/tags takes place voluntarily, clearly and accurately written labels provide a means for the consumer to learn about the apparel items (Mason *et al.,* 2008). Labels aid the consumer in making informed decisions about selecting and even caring for the apparel items. However, it has been documented that size label/tags on women's ready-made apparel are not correlated to body dimensions – unlike in men's apparel – thus contributing to the confusion and frustration as female consumers select their apparel items in retail stores (Chun-Yoon & Jasper, 1996; Holzman, 1996; Desmarteau, 2000). Most female sizes are not expressed as body dimensions, but rather expressed as arbitrarily chosen numbers or letters that correlate

with sets of hidden body dimensions (Brown & Rice, 2001:147-148; Faust *et al.,* 2006). When body dimensions are not revealed to an ignorant consumer, the size designations are meaningless, thus leaving the consumers to guess and assume what would fit appropriately. Literature on this phenomenon is scarce, while no study has evaluated the consumer's knowledge about the communication of sizing and fit in Kenya. This therefore raises the question: How does consumers' knowledge about the communication of size and fit contribute to the fit problems of ready-made apparel? As this comprises the problem statement of this study, this study was also undertaken to determine career women's knowledge about the communication of size (key body dimensions) and fit (body shapes), and how this may contribute to fit problems.

In a consumer market-driven society, the challenge to the apparel industries is not about giving customers extra choices, but rather to contain consumers' individual preferences. Career women, in particular, expect to get what they want with minimal time and energy committed to the apparel search (Kaiser & Garner, 2003:28-29). An individual's fit preference could be defined as the way that an individual consumer expects or would want the apparel to fit the body correctly. Consumers become loyal to certain brands and stores that repeatedly deliver satisfactory apparel items in terms of size, style and comfort within the fashion trend of the time (Workman, 1991; Glock & Kunz, 1995:135). Consumers with different orientations have different preferences and needs within specific social contexts. In most developing countries such as Kenya, little research has been done, while no study has assessed career women's fit preferences. Hence, another research question emerging is: how do career women's fit preference for differently fitted apparel, contribute to the fit problems of ready-made apparel in Kenya?

To focus properly on the problem under investigation, the following questions therefore directed the investigation:

- What are the career women's distinctive body shapes in Kenya and how do they differ from Western distinctive body shapes?
- What fit implications are associated with Kenyan career women's distinctive body shapes?
- What are the distinctive body proportion differences among different age groups of Kenya's career women?
- What are the general fit problems that career women encounter with the ready-made apparel in Kenya?

- Do career women lack knowledge about the communication of size and fit, and how does this contribute to the fit problems they experience with ready-made apparel in Kenya?
- What are the career women's fit preferences for differently fitted apparel items and how do these preferences contribute to the fit problems with ready-made apparel in Kenya?

1.4 PRIMARY OBJECTIVES AND SUB-OBJECTIVES

Primary objective 1: **To identify and describe distinctive female body shapes of career women in Kenya from body dimensions and photographs**

Sub-objective 1.1: To identify and describe distinctive female body shapes of career women in Kenya from the body dimensions

Sub-objective 1.2: To identify and describe distinctive female body shapes of career women in Kenya from the photographs

Sub-objective 1.3: To establish and describe associations between distinctive shapes emerging from body dimensions and those emerging from the photographs of the career women

Primary objective 2: **To distinguish and describe differences between the emerging distinctive body shapes (from measurements and photographs) and the Western distinctive body shape**

Primary objective 3: **To scrutinise and describe the fit implications associated with the emerging distinctive body shape of the career women**

Primary objective 4: **To assess and describe career women's self-perceived fit issues with the ready-made apparel in Kenya**

Sub-objective 4.1: To investigate career women's perception of fit with different apparel categories that are sold in various retail stores in Kenya

Sub-objective 4.2: To describe fit problems that career women in Kenya encounter regarding the specific critical fit points of different parts of their bodies

Sub-objective 4.3: To describe career women's degree of satisfaction with the

process of finding appropriate ready-made apparel items in Kenya

Sub-objective 4.4: To explore career women's self-perceived sources of fit problems with apparel in Kenya

Primary objective 5: **To determine and describe Kenyan career women's knowledge about the communication of size (key body dimensions) and fit (body shapes)**

Sub-objective 5.1: To explore Kenyan career women's knowledge about the communication of size

Sub-objective 5.2: To explore Kenyan career women's knowledge about the communication of fit

Primary objective 6: **To determine and describe how career women's preferences for differently fitted skirts and jackets may contribute to fit problems with apparel**

1.5 EXPECTED SIGNIFICANCE OF THE STUDY

1.5.1 Emerging distinctive female body shapes

In today's competitive business environment, companies must ensure that they focus on building the loyalty of and retaining their consumers by offering products and services that fulfil their needs. It is important that the apparel manufacturers, retailers, researchers/educators and government/public agencies in Kenya are aware of the emerging distinctive female body shapes and the apparel's fit implications associated therewith, so as to develop strategies that would help to solve the problem and to promote the production of well-fitting apparel items for the career women in Kenya. Understanding how the prevalent body shape differs from the Western fit model enhances greater knowledge on style selection, pattern development and fabric required for those specific body shapes.

1.5.2 Career women's perception regarding general fit problems with the ready-made apparel in Kenya

Examining consumers' perception of fit problems regarding ready-made apparel would facilitate a deeper understanding of consumers' satisfaction with the process of finding apparel items in their appropriate sizes and styles, consumers' fit problems encountered at

critical fit points of their bodies, as well as consumers' perceived sources of those fit problems. Being a new study in Kenya, this will highlight critical areas such as sizing systems that need to be developed or modified to counteract the fit problems.

1.5.3 Consumers' knowledge about the communication of size and fit

In the context of the United Nation's consumer rights (1985), consumer education is valued worldwide. The discipline of consumer science education in actual sense concerns itself with responsible, informed consumer decision-making. Careers in the field of apparel and textiles attempt to educate consumers and assist them with relevant product information to enable them to make appropriate purchasing decisions. Consumers' ignorance on the communication of sizing and fit (terms used on size labels/tags and the meaning of symbols on the labels) should be regarded as a matter of concern. An improved understanding of consumers' knowledge/ignorance about the communication of sizing and fit would be valuable in terms of consumer education and facilitation, and would enlighten the apparel industries for the supply of satisfactory apparel items affixed with durable, legible and efficiently informative size labels/tags.

1.5.4 Consumers' fit preferences

Understanding the fit preferences of female consumers and relating these preferences to the body characteristics that determine the fit of an apparel item, would help apparel companies to produce suitable and better-fitting apparel within consumers' desired fit parameters. If apparel manufacturers produce apparel without taking into account the link between the fit preferences of the consumers and the body's most common critical fit points in a target population, the available products would be purchased based on availability rather than desire – and hence, fit problems.

1.5.5 Contribution to existing theory

Considering that this research would be new in Kenya, and with the emergence of a distinct female shape that differs from the Western prevalent one, it is hoped that all the information gathered would be used as input units, for the development of a knowledge base that would lead to better designing and better predicting the degree of fit, and ultimately to the production of well-fitting apparel in Kenya and other African developing nations.

1.6 STUDY OUTLINE

This thesis is divided into seven chapters. This introductory **Chapter 1** deals with background information, statement of the problem, the expected significance of the study as well as the study outline.

Chapter 2 entails a literature review on the theoretical framework. It uses Ashdown's (2000) model as a launching point. Four main areas (population measurements, design features, fit issues and the communication of size and fit) highlighted in the Ashdown (2000) model, are addressed to facilitate a deeper understanding of issues revolving around the sizing systems, which are key in the fit of ready-made apparel.

Chapter 3 examines specific supporting sources that are directly related to the phenomenon of the study, which encompass female body shapes, consumers' knowledge about size and fit, and consumers' fit preferences. Body shape characteristics, which are critical to the fit of apparel, are addressed. The consumer's knowledge about the communication of size and fit, key dimensions, and the terms used on size labels/tags are also examined, as well as the importance of consumers' fit preferences. The chapter ends with a schematic conceptual framework for the study. This was formulated to bring the various concepts of the phenomenon concerned, to facilitate straightforward definitions and to direct the entire study. It highlights each component that is vital in women's varied body shapes in relation to the fit of ready-made apparel, consumers' knowledge about size and fit in relation to the selection of better fitting ready-made apparel, and consumers' fit preferences and how they relate to the body shape's critical fit points.

Chapter 4 explains the methodology used for the study as it gives an exposition of research instruments employed for the study, such as the chosen research framework and the research strategies employed, limitations encountered, and the measures that were taken to ensure reliability and validity of the study while collecting data. It describes the choice and application of data-collection methods used, which encompassed obtaining body dimensions and photographs from career women dressed in minimal apparel items (leotards) and administering questionnaires. Empirical body dimensions and photos were taken first (Phase one), while the questionnaires were administered immediately, afterwards (Phase two). The assignment of phases was for practical purposes and ease of presentation of the data. This chapter also discusses the statistical analyses used, the quality of the study and how research ethics were observed.

Chapter 5 presents the results and discussions of the phase one data that was collected

empirically through measuring and photographing women dressed in minimal apparel (leotards). This was to address primary objectives 1, 2 and 3 of this study. It involved identification of a distinctive female body shape and sorting out common body characteristics critical to apparel's fit from body dimensions and visually evaluated photographs of the career women in Kenya. It was also concerned with assessing and describing apparel fit implications associated with the Kenyan career women's distinctive body shape.

Chapter 6 presents the results and discussions of the phase two data that was collected using the questionnaires, mainly addressing primary objectives 4, 5 and 6 of this study. These were to assess and describe career women's perceived general fit problems, knowledge about size and fit, as well as their fit preferences for differently fitted apparel items.

Chapter 7 contains a summary of pertinent findings according to the primary objectives, an evaluation and the limitations of the study, and how this research contributes further to existing theory. Recommendations for future research are also discussed in this chapter.

Chapter 2

THEORETICAL FRAMEWORK FOR THE STUDY

2.1 INTRODUCTION

A review of the literature indicates that problems related to apparel fit stem from a variety of factors, such as an outdated anthropometric database from which sizing systems could be developed, lack of classified body shapes, non-standardised communication of sizing and fit, non-standardised fit quality management and lack of agreement amongst the apparel industries (Chun-Yoon & Jasper, 1996; Holzman, 1996; Winks, 1997; Desmarteau, 2000; Loker *et al*., 2005). In an attempt to solve fitting problems, Ashdown developed a model of the factors determining and influencing apparel's fit. Ashdown (2000) sees sizing systems as the focus around which all the factors concerning sizing and fit evolve. She has identified the main factors affecting sizing systems and consequently the fit of ready-made apparel to be: the population measurements (body dimensions), the design features (construction of the apparel), the fit issues (fit quality management), and the communication of sizing and fit (size labelling). These factors are presented in **Figure 2.1** (as a Theoretical Framework).

2.2 SIZING SYSTEMS

A sizing system is the assignment of body dimensions and a group of body shapes representing a market segment. The body dimensions and body shapes are presented in a chart for the purposes of creating a set of ready-made apparel for a variety of people in the target market (Winks, 1991:3; Ashdown, 2000; Keiser & Garner, 2003:30; Salusso-deonier, 2005; Petrova, 2007:57). Ready-made apparel is clothing developed in advance using size tables and offered through retailers for potential customers to make selections (Loker *et al*., 2005). A sizing system that sets out to satisfy its target market must be up to date, precise in measurements and body shape classification (proportions), and must represent the population that it was designed for (Salusso-Deonier, 1989; Schofield, Ashdown, Hethorn, LaBat & Salusso, 2006). Sizing systems are designed to fit a segment of a population, defined by demographic data (Ashdown, 2000; Petrova, 2007:57). Most regular sizing systems in the apparel industry use the foundation size (sloper) derived from a fit model whose shape and measurements do not represent a wide population of consumers within the

targeted market (Schofield & LaBat, 2005a; Schofield *et al*., 2006; Schofield, 2007:152). Even though the sloper may have been created in a cut and fit that have proven successful in the past, it could be argued that dynamic fashion changes would call for a different fit philosophy in every foundation pattern at different times.

Fit is affected by grading since grading plays a key role in developing a range of apparel sizes. However, existing grading practices have little basis in measurement information from size charts, as they are not based on anthropometric research (Schofield & LaBat, 2005b). Thus a base size sloper that is finally proportionally graded into many sizes leads to poor fitting apparel, because the actual shapes and contours of individuals do not follow a similar outline (Salusso-Deonier, 1989; Workman, 1991; Glock & Kunz, 1995:108; Keiser & Garner, 2003:251; Schofield *et al*., 2006). Notably fit and styling ease should be varied for different body shapes, proportions and sizes – characteristics that are overlooked during grade rule application to a base size.

According to Kenya's sizing standards, anthropometric data was last collected in 1975. Considering that these sizing systems are based on an outdated anthropometric database, it is possible that sizing systems currently in use could be an alteration of the 1975 data, or different industries might have individually made them. They could also have been borrowed or copied from other countries. It has however been observed that sizing systems that are currently being used in most developing countries are adaptations of the Western types (Zwane & Magagula, 2006). When such adopted, modified or outdated sizing systems are used, apparel's fit problems will persist because the sizing systems used would not reflect the actual measurements and body shapes of the present Kenyan woman. Used as a point of departure and as foundation for this chapter, is Ashdown's (2000) model of sizing systems in the apparel industry presented in **Figure 2.1** below.

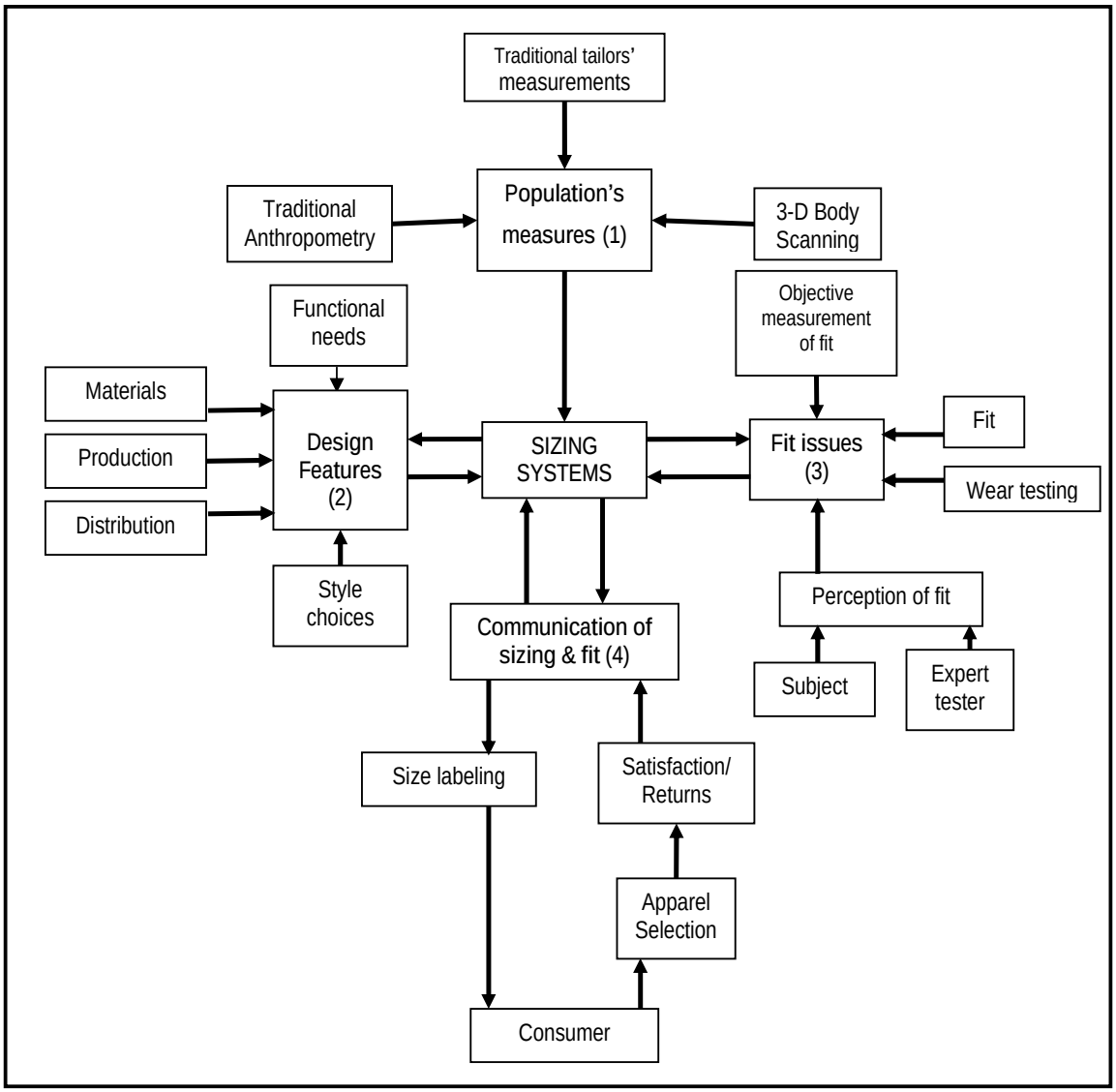


FIGURE 2.1: THEORETICAL FRAMEWORK

(Sources: Ashdown, 2000; Ashdown in Ashdown, 2007:xix)

The framework (**Figure 2.1**) highlights four main factors (population measurements, design features, fit issues and communication of sizing and fit) that are useful for addressing sizing and fit problems. The model is complex and this study focuses mainly on female body shapes, as they act as the apparel's frame and could affect all the major issues highlighted in Ashdown's model regarding fit. This study also focuses on the communication of size and fit from the viewpoint of the consumers' knowledge and how consumers would prefer their apparel items to fit their bodies.

The body shape, being a framework for apparel (Salluso-Deonier, 2005), will affect all four of the major factors in Ashdown's (2000) model, either directly or indirectly. Population

measurements demand that the body dimensions should be obtained from the three-dimensional body in an explicit way that will facilitate body shape classifications. Accurate reflection of the three-dimensional body's characteristics would be achieved when the apparel has been made based on the elements of fit (grain, set, line, balance and ease) and dressed on the body (Erwin, Kinchen & Peters, 1979). Design features necessitate that the body's framework (three-dimensional characteristics) are correctly interpreted to patterns for the construction of well-fitting apparel. The fit issues which involve fit quality management strategies call for certain fit testing techniques such as the use of fit models and dress forms. The fit models and/or the dress forms used must correspond with the body shapes and sizes of the target market. Communication of sizing and fit requires that the measurements and body shapes indicated on the size labels reflect the true picture of the target market (population).

2.3 POPULATION MEASUREMENTS (SOURCES OF SIZING SYSTEMS)

The dimensions of the human body underpin an effective sizing system and consequently better-fitting apparel items. Sizing systems originate from people's measurements and body shapes (Bye, LaBat & DeLong, 2006:66; Petrova, 2007:56). Since the body shape is three-dimensional, the measurements obtained from it must be accurately taken and must be representative of the characteristics of body shape that are critical to the fit of apparel. This would facilitate the production of apparel items that harmonise with the body shape. The measurements and the varied body shapes can only be accurate, consistent and representative if they are taken accurately by employing correct methods, instruments and techniques (Ashdown, 2000; Simmons & Istook, 2003; Ashdown & Dunne, 2006). Ashdown's framework illustrates how the population measurements contribute to the effectiveness of any sizing system. The measurements used should be current, accurate, consistent and representative of the population for which the system is being developed (Kunik, 1984:12; Winks, 1997; Ashdown, Loker & Adelson, 2004; Honey & Olds, 2007).

It has been observed that body shapes and proportions vary significantly from one country to another, and to some extent also within one country (Bougourd, 2007:111). Updated and current population measurements are therefore vital in most countries, in order to minimise fitting problems related to ready-made apparel (Kunik, 1984:12; Winks, 1997; Ashdown *et al*., 2004; Devarajan & Istook, 2004; Shin & Istook, 2007). In the event where anthropometric data shows little relationship with the target markets' existing measurements and proportions, the existing systems should be modified to incorporate the differences in the critical fit points

as well as varied body proportions (Ashdown & Dunne, 2006; Zwane & Magagula, 2006; Shin & Istook, 2007).

Body dimensions can be obtained accurately through recommended methods, namely, the traditional (ordinary) tailor or dressmaker's method, traditional anthropometry and the three-dimensional body scanner. Once the measurements are obtained, they are transposed into patterns, which are to be used for cutting out the apparel. If the measurements taken are incorrect, the resulting apparel will contain fitting problems, no matter how accurate the other processes of production may be (Ashdown, Lyman-Clarke, Smith & Loker, 2007:349). Winks (1997) agrees that when apparel does not fit properly, the consumer is dissatisfied – irrespective of the quality of the fabric, the workmanship or even the item's fashionability. The accuracy and the representativeness of a population's body dimensions can be greatly influenced by measuring methods or skills employed (Bye, LaBat & DeLong, 2006: 66). Considering that the source of Kenya's anthropometric database is unknown, the quality of the measuring methods, techniques and instruments used cannot be guaranteed. This means therefore that the skills used to create the data underlying sizing systems currently used in Kenya remain unknown and questionable. However, discussed below are some of the measuring techniques that are commonly applied.

2.3.1 Traditional tailor or dressmaker's measurements

These measurements refer to body dimensions taken manually using a tape measure (measuring tape). Measurements that are directly related to the item to be made often determine the dimensions required (Cornell University, 2004). Although reliable measurements may be obtained with experience, precision cannot be achieved. The tailor or dressmaker (with reference to Kenya) takes body dimensions when the subject is dressed in normal apparel and shoes. Most measurements are taken along the contours of the body and not in straight lines between points, while landmarking is not done before the actual taking of body dimensions. Often there is not much attentiveness by the tailor while taking measurements, particularly to the body's areas that would be critical to the apparel's fit. The subject's movements while being measured would also affect measurements as a result of shifts during the measuring process. Accuracy varies significantly with different professionals in the tailoring and dressmaking fields. It depends entirely on the persons' skills and the experience they have, particularly in their ability to capture characteristics of varied body shapes that are critical to apparel's fit (Kunik, 1984:4; Ashdown, 2003; Yu, 2004:183-184; Aldrich, 2007:3, 5, 22). In Kenya, it could be argued that each segment of the apparel industry, both the formal and informal, uses its own style of obtaining body dimensions for each specific apparel item. Non-standardised and/or inaccurate measuring techniques,

combined with the lack of skills and inappropriate tools, could result in unsatisfactory apparel (Ongile & McCormick, 1992; Mason, 1998; McCormick *et al*., 2002)

2.3.2 Anthropometry

Anthropometry is defined as the study of human body dimensions (Pheasant, 1986; Carrol, 2002). The term *anthropometry* is derived from *anthropos,* meaning "human", and *metrikos*, meaning "measuring" (Roebuck, 1995:1). Quelet first used the term in 1870 with the aim of obtaining the measurements of average man (Anthropometry, 2000:1). Anthropometry like any other scientific path depends upon the adherence to particular rules of measurement as determined by national and international bodies controlling standards. Standardised rules of obtaining body measurements facilitate a comprehensive measuring of all the body parts necessary for the fit of apparel items, which eventually must fit a three-dimensional body shape from which the measurements were taken. Formal anthropometry studies specifically for apparel design use apparatuses that have been designed to produce reliable and valid measurements. Anthropometric apparatuses include the Anthropometer (Measuring stand) consisting essentially of a rule, graduated in millimetres, vertically mounted and with a moveable arm. It is used for measuring straight, linear distances. Other instruments are callipers and calibrated measuring tapes, which measure linear depths and widths (Beazley, 1997:58; Bye, LaBat & DeLong, 2006:66).

Measurement errors could be reduced if the techniques of landmarking were well understood and taken seriously. Landmarks are identifiable skeleton points that generally lie close to the surface of the body, and are the points that identify the exact location of the measurement sites (ISAK, 2001:21). Subjects should be landmarked prior to taking measurements. This is to ensure conformity and consistency while taking body dimensions. Standardisation would be achieved once the universal (landmark) points on the body were identified. When correctly identified, landmarks reduce the viewer error, which is common with traditional anthropometric studies (ISAK, 2001:21; Simmons & Istook, 2003). Errors common with landmarks could be reduced and improved if the measurements are obtained by a well-trained/professional anthropometrist, who understands the anatomy of a human body and can link the anatomical terms with apparel design requirements. Understanding the cultural beliefs of the target consumers could help to pinpoint sensitive issues that should be avoided during a measurement exercise (Apeagyei, Otieno & Tyler, 2007; Mastamet-Mason, De Klerk & Ashdown, 2008). Participants could be requested to wear minimal apparel – as minimal as possible – to allow the natural contours of the body without constricting (e.g. body suits). The instruments and tools must be arranged well in advance and in the sequence that the measurements will be taken, in order to minimise the contact time with the participants

(Norton & Olds, 1996:29-30I; Winks, 1997; Beazley, 1997:64; ISAK, 2001:21; Simmons & Istook, 2003:308; Ashdown & Dunne, 2006).

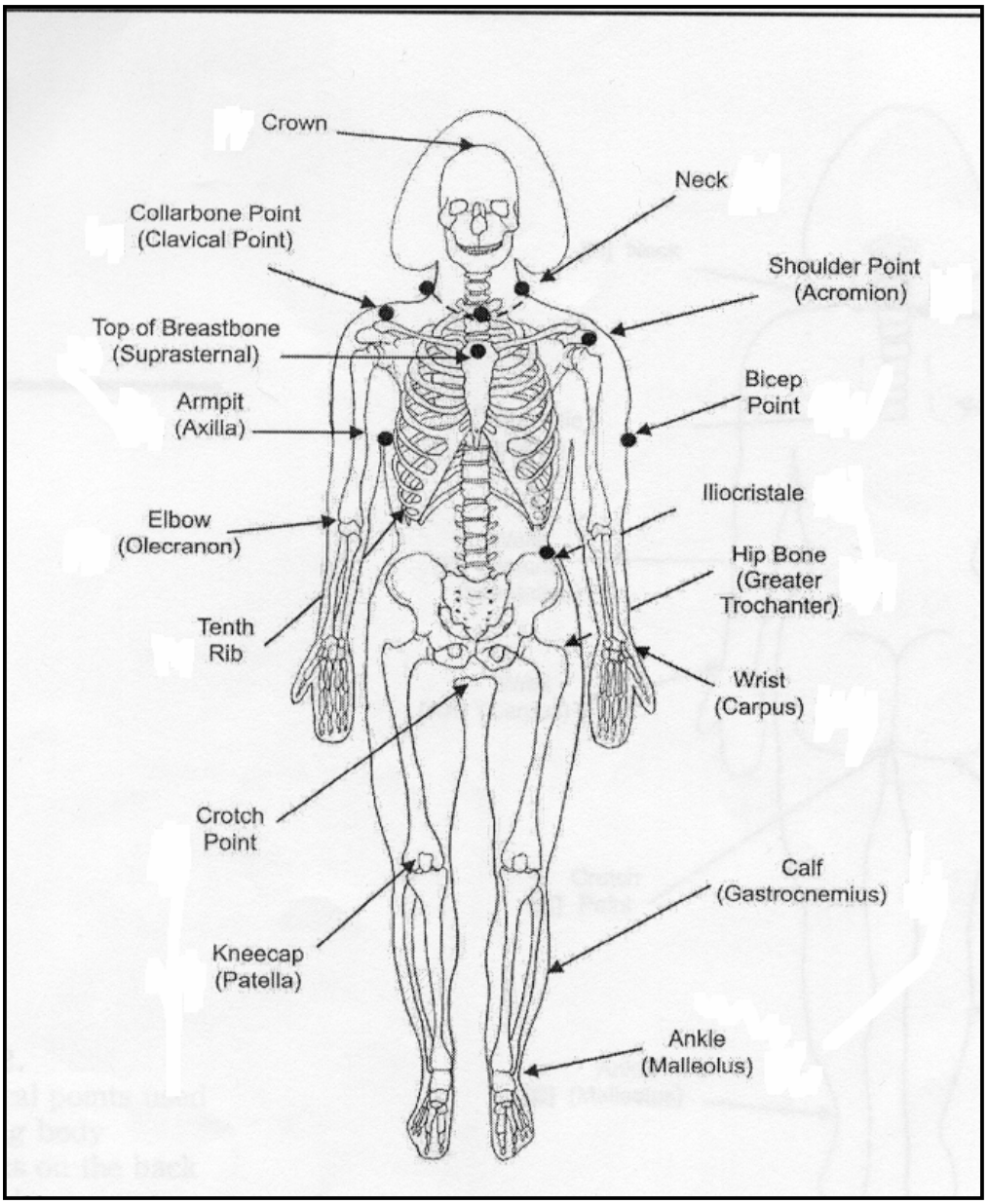


FIGURE 2.2: ANATOMICAL POINTS USED IN LOCATING BODY LANDMARKS ON ANTERIOR POSITION

(Source: Simmons & Istook, 2003: 311)

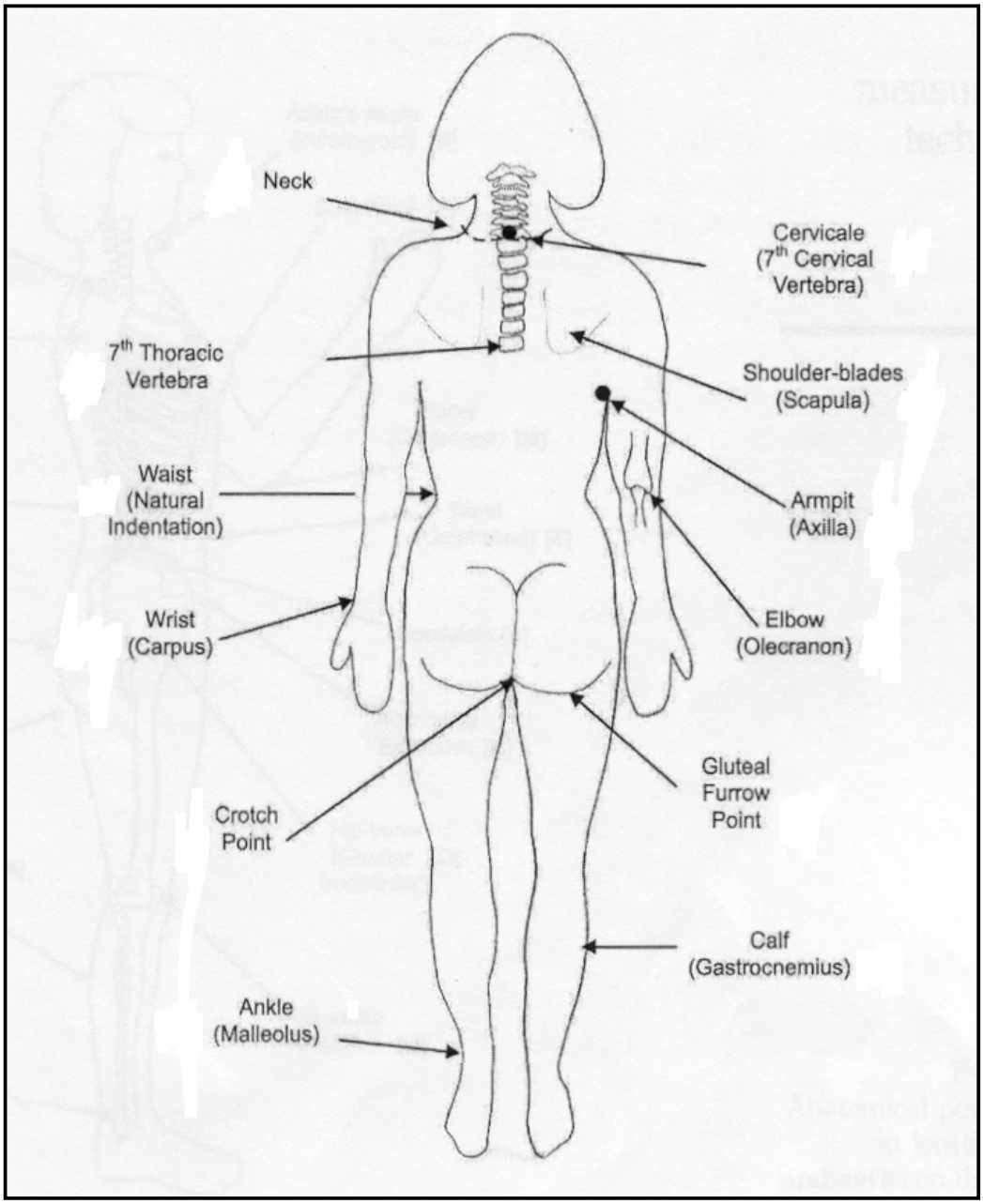


FIGURE 2.3: ANATOMICAL POINTS USED IN LOCATING BODY LANDMARKS ON POSTERIOR POSITION

(Source: Simmons & Istook, 2003: 312)

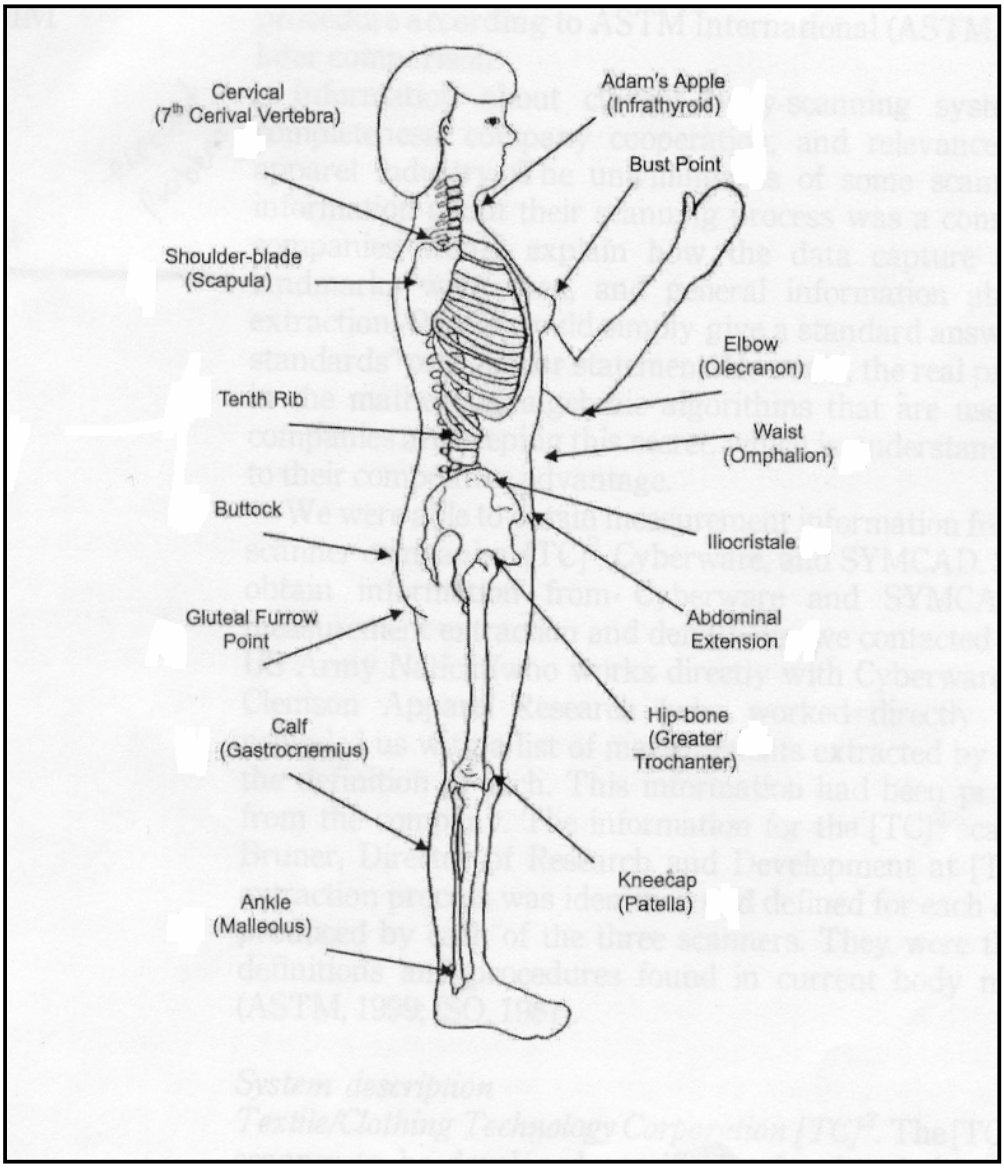


FIGURE 2.4: ANATOMICAL POINTS USED IN LOCATING BODY LANDMARKS (Source: Simmons & Istook, 2003: 313)

Disadvantages with traditional anthropometry are linked to the measuring exercise being tiring as well as the time taken to complete the exercise. Measuring methods require palpitation or touching of the human body or bending of parts while trying to find appropriate landmarks for the required measurements, thus violating the privacy of an individual (Winks, 1997; Simmons & Istook, 2003; Istook, Little, Hong & Plumlee, 2003). Although there are limitations with traditional anthropometric measurements, they have however been used for many studies and have produced reliable results before the emergence of body scan technologies. To ensure the validity and reliability of traditional anthropometry, a thorough preparation, particularly on landmarking (**Figures 2.2**, **2.3** and **2.4**), is required before the

commencement of the measuring exercise. In Kenya, it can be argued that, since the sources of the anthropometrical database are obscured, the information on this method of attaining body dimensions is also flawed, thus creating a wide research gap on anthropometric body dimensions. The fact that data collection was last done in 1975 (KEBS, 2001: Preface) could also suggest that instruments and techniques used then could by now be outdated/obsolete and questionable in terms of validity and reliability. This study is therefore designed to fill this gap by providing updated anthropometric data for the purposes of identifying the prevalent body shapes of career females as a market segment in Kenya.

2.3.2.1 Developing sizing systems from anthropometric database

A sizing system is a set of pre-determined body sizes and body shapes represented in size charts, which should be accurate and up to date. Although the development of sizing systems is beyond the scope of this study, it is recommended that sizing systems should be revised at least every ten years to keep abreast with continuous biological changes that occur from one generation to the next (Brunn, 1983; Olds, 2003). This could facilitate the production of better-fitting apparel that would continuously satisfy the consumers. Chun-Yoon and Jasper (1996) identified problems with fit as stemming from the use of obsolete anthropometric data, faulty selection of key dimensions for the body shape classifications and the subsequent developing of sizing systems.

According to Winks (1997), all body dimensions surveys conducted in countries such as the UK, USA, and Germany, agree on the basic rule that a sizing system must be three-dimensional in structure. The bust girth, hip girth and stature as the main control measurements, as these are critical dimensions for the manufacture of body-fitting apparel. The key dimensions should be convenient to measure, be an integral part of the apparel and should have a high degree of correlation with other dimensions that are as important in design and sizing (Robinette, 1986; Winks, 1997). According to Petrova (2007:66), construction of any sizing system involves the assortment of control dimensions and secondary dimensions with respect to garment type and corresponding body shapes in a market, the choice of interval value between sizes, creating the minimum possible number of sizes that could accommodate a large percentage of the population's sizes and shapes, and calculations of secondary dimensions. However, it is almost impossible to address the consumer's problems of fit, unless a set of accurate body dimensions as well as body shapes are recognised and understood (Istook & Hwang, 2001; Loker *et al.,* 2005).

The size standards available for Kenya's females contain vague information, as the source of the anthropometric database from which they were developed is obscure. The following statement is quoted from the Kenya size standards:

"The body dimensions tabulated in this standard were obtained from girls and women in Kenyan learning institutions and organizations" (KEBS, 2001: Preface).

The size standard however does not give any breakdown of body shapes or population representations of different sizes. This may have contributed to the poor fit of Kenya's locally made apparel and hence the closing down of many apparel firms (McCormick *et al*., 2002; RATES, 2003:58)

2.3.3 Three-dimensional body scanning

The development of the three-dimensional body scanning technology came as a result of the desire in the apparel industry to provide apparel with a better fit to the customer at the shortest time possible. It was also due to the fact that traditional anthropometric methods are slow, time consuming and often not accurate. For the spatial analysis of clothing appearance and fit, a three dimensional digitisation of the body shape and clothing surface is essential. Variation in body size and shape can be accessed quantitatively and expressed by contour maps or polygons (Yu, 2004:135). Body scanners facilitate the extraction of body dimensions and body shapes within seconds and allow consistent body measurements and shapes analysis that would encourage the production of mass-produced apparel that is customised for fit (Istook, 2000; Simmons & Istook, 2003; Ashdown, 2003; Loker, 2007:246). There are four main clothing applications of body scanning, which include: non-contact body measurements for size survey, pattern generation for customisation, tailor made mannequin for a target market and clothing fit evaluation of appearance such as drape, wrinkling and bagging. Other than clothing it can also be used in the medical, fitness and dietetic fields. However, main applicable result of three-dimensional body scanning technologies is the point data cloud to be used for the generation for virtual or physical dress model, critical landmarks and anthropometric data to guide the design and sizing of garments (Yu, 2004:135).

According to Yu (2004:135), non-contact body measurements and garment analysis systems are available in four categories: one, two-dimensional systems, which include a "silhouetter" developed to capture a two-dimensional photograph of a body contour with a background of calibrated standard grid, the LASS system which requires that a person must stand as still as possible when the strips of light are projected onto the body and measured by television

cameras, and the SYMCAD system, which requires that a person stands in the middle of the boot dressed only in underwear while a digital camera captures the front and the profile images of the silhouette (Gazzuolo, DeLong, Lohr, LaBat & Bye, 1992; Yu, 2004). The second non-contact body measurements and garment analysis system is the structure light, such as moiré topography and phase shift. Moiré topography is a contour mapping technique, which involves positioning a grating close to an object and observing its shadow on the object through the grating. Shadow and projection moiré techniques are applied to obtain object's measurements and form. In the shadow moiré technique, a linear grating is placed close to the surface of the object to be evaluated. When a light source is illuminated against the grating, grating's shadow is emitted onto the object and a distorted shadowed silhouette is formed as a result of the three-dimensional shape of the object (Yu, 2004:148). Although its main purpose was for screening of spinal deformities of school children, Shadow moiré topography has been used for research on the three-Dimensional analysis of relationship between human body and apparel patterns. Some of the examples of the moiré topography are: CubiCam, Nuoro Ailun and RSI – DigiScan. Phase shift involves shifting the grating preset distances in the direction of varying phase, and capturing images at each position. It uses a white light source to project a contour pattern on the surface of the object. As irregularities in the shape of the target object distort the projected grating, the resulting fringe patterns describe the surface contour. Examples of phase shift technologies are: Textile and Technology Corporation (TC^2) and Telmat – OptiFit (Hwang, 2001; Xu, *et al*., 2002; Yu, 2004:150-153).

The third non-contact body measurements and garment analysis system is a laser scanner, which project a line of laser light around the body. The laser line is reflected into cameras located in each of the scan heads. Data is obtained using triangulation method in which a strip of light is discharged from the laser diodes onto the surface of the scanned object and then reviewed simultaneously from two locations, using an arrangement of mirrors. Viewed from the angle, the laser stripe appears deformed on the object's shape; sensors record the deformations and create a digitised image of the subject. Examples of laser scan technologies include: Cyberware, TecMath, Humano – Voxelan, Cubic and Polhemus – FastScan (Paquette, 1996; Yu, 2004:154-157). The fourth technology being Infrared scanner with infrared (IR) imaging sensor operates in the IR region of electromagnetic spectrum. A lens attached to a detector converts the IR energy to an electrical signal. With an infrared LED and a semiconductor position-sensing detector (PSD), triangulation is used for the rapid, non-conduct measurements of three-dimensional shapes of target objects. It extracts the three-dimensional shapes of human body by positioning multiple distance sensors around the person being measured. Examples of infrared technologies include: Hamamatsu and Hokuruku-Conusette (Crawford, 1998; Conusette, 1999; Yu, 2004:159).

As people change in shape due to diets and lifestyle, it becomes apparent that frequent data collection is needed to keep abreast with these changes. The body scanner would be an ideal instrument to use because it provides speed and consistent and accurate data to redefine sizing systems so as to reflect the dynamic changes in body shapes and dimensions (Ashdown, 2003). The disadvantages of body scan technology, compared to traditional anthropometric measuring, are the costs involved and the technical skills required, which are thought to be too advanced for a developing nation such as Kenya. Introducing such technology needs a feasibility study regarding its acceptance and extensive training of manpower to operate the machine. According to Ashdown and Dunne (2006), body scan technology is expensive and requires high maintenance – costs that most retail operations may not be ready to absorb.

Although the advantages of body scanners outweigh all other methods of obtaining body dimensions, regrettably, a developing country such as Kenya may be reluctant to adopt the new technology due to the high costs involved in terms of acquisition and maintenance, and the technical and management skills required to operate it. It may also require a feasibility study on consumers' acceptance due to cultural differences. In this respect, therefore, this study aims to come up with alternative functional, reliable and acceptable techniques such as the traditional anthropometry and others, as recommended by Ashdown and Dunne (2006:122).

2.4 DESIGN FEATURES

Design may be defined as the organisation of different elements (line, colour, texture, pattern and silhouette), using principles of design (proportion, balance, emphasis, rhythm and harmony) to create apparel items that are in harmony with body shapes and sizes, and are aesthetically pleasing to the users. Design plays an important role in the aesthetics of apparel. It describes how a textile product (an apparel item) satisfies the needs of the customer in terms of appearance, fashion preferences, fit and styling.

Design features are those components that make up the product, and include: the number of pieces used to make up the apparel, the apparel details used and the finishing applied, resulting in a completed apparel item ready for use. This will require both design and functional ease to create a specific style and to allow for body movements. The design features chosen at this stage must correspond with the different body shapes and sizes available in the market (Parker, Winters & Axelrod, 1988:9; Keiser & Garner, 2003:316).

Design involves the processing of an apparel item from the conception stage, which basically takes into account the varied body shapes available and sizes. The designer begins from the development stage consisting of design ideas presented in the form of designs on sketched body shapes (production drawings/working drawings), which act as guiding tools for the pattern maker and later, the apparel assembly (Burns & Bryant, 1997:169; Rosenau & Wilson, 2001:136; Keiser & Garner, 2003: 238). In the process of producing well-fitting apparel, the design features of the actual apparel play an important role, all the way from the pattern maker to the finished product (Hudson, 1980:110; Desmarteau, 2000; Ashdown *et al.*, 2007:348).

The relationship between the design and the fit of apparel is complex, because each apparel style has its own ease allowance and ideal relationship to the size and body shape. Each apparel style allows a different range of variation in the bodies that it will fit in an acceptable manner (Solinger, 1988:63; Beazley, 1998pt3: 67). It is generally reasoned that the more style ease an apparel item has, the greater the range of body variations and sizes that the apparel will fit. The look/appearance will vary according to the different body shapes beneath the apparel item (Glock & Kunz, 1995:110). It has been observed that two people could possess the same basic body dimensions, but would look totally different when dressed in the same apparel item due to shape variations (Schofield & LaBat, 2005a; Schofield *et al*., 2006).

Ease can be defined as the difference between the actual measured size of the body and the measured size of the apparel as intended by the designer (Beazley, 1997, Part 3:67; Keiser & Garner, 2003:316). The amount of ease required for comfort, movement and attractive appearance depends on the manufacturer's standards of fit, the apparel style, the fabric, the size/body shape and the needs of the perceived consumer. These characteristics must simultaneously be synchronised into overall suitable and accepted styles (Huck, Maganga & Kim, 1996; DeLong *et al*., 1993). Wearing or comfort ease is an allowance given to provide for flexing, reaching and movement of the body (Beazley, 1997:68; Keiser & Garner, 2003:316). Every apparel item must contain enough ease to enable the body to move comfortably. This type of ease is provided, for example, at the chest to allow for moving and breathing, the sleeves to allow for bending over and raising of arms, the hips to allow for sitting and walking. Each apparel item thus has specific critical fit points based on the fit points of the body. The generally accepted amount of wearing ease can be affected by fashion trends, fabric characteristics and consumers' fit preferences. However, apparel should be designed to fit the intended consumer, irrespective of fashion and fabric behaviour, but within the fit preference context of the consumers (DeLong *et al.*, 1993; Brown & Rice, 2001:47).

Design ease, also referred to as styling ease, is the degree of closeness, looseness or fullness of fit necessary for the style or silhouette (Glock & Kunz, 1995:154). It is the amount added to the pattern during its creation to provide the look that the designer desires. In other words, it is the details added to a basic pattern block to come up with a certain style. Some styles are designed to fit the body very closely and others are intended to be slightly fitted or loosely fitted (DeLong *et al*., 1993). Design features may limit or widen the range of dimensions that can be fitted to a style. Structural seams and darts incorporated into the design of apparel influence how the apparel will fit on the consumers' varied body shapes (Glock & Kunz, 1995:110; Ashdown, 2000). Fullness beyond wearing ease is created by adding the flares, gathers, shirring, smocking, tucks or pleats. Use of these fullnesses together with adjustable openings, can result in apparel that will fit a wider range of sizes, although the appearances will vary according to the body shapes wearing it.

On the other hand, styles with narrower structured features such as the princess-lined apparel, the midriff designs and tailored apparel will fit a limited number of people (Glock & Kunz, 1995:111). For the success of an anthropometric survey used for mass-produced apparel, Ashdown (2000) suggests that it would be practicable and economical to have a reduced number of sizes for a population through the use of creative design or style features that are suitable to varied body shapes, and also acceptable to the consumers. The level of fit offered in those styles must be maintained following the fashion that the customers prefer. The initial size charts used for the creation of patterns must at all times be representative of the target consumers' sizes and body shapes. This facilitates correct ease allowances to be integrated into the patterns at the very early stage of development, for the production of well-fitting apparel for the intended consumer. With the lack of classified body shapes and with the unskilled manpower in Kenya's apparel industry, it is possible that the concept of fit in relation to design may not be well understood and interpreted appropriately; hence the production of poorly fitting ready-made apparel.

2.4.1 Functional features

Functional features refer to the way the apparel will serve the customer or perform according to his/her expectations. The fabric's performance determines the standard it meets and how it benefits the customer (Solinger, 1988:61). Functional performance refers to the apparel's utility in terms of correct fit and the comfort it provides to different body shapes as well as sizes. It also refers to the apparel's durability and its service for its intended purpose (Kadolph, 1998:30). Providing good fit for the full range of the population with varied body shapes is usually more vital for a functional apparel item, especially for protective apparel. Lack of good fit could jeopardise the protection and comfort presented by the apparel and

thus the safety of the wearer (Huck *et al.,* 1997). Work-related movement analysis is an effective way of determining the design needs for specific functional apparels. The designers must therefore evaluate the fit, performance, comfort and level of protection of a prototype apparel item to various body shapes and sizes. The choices made in the design process of a functional apparel item will significantly affect the fit, comfort and performance of the apparel on the wearer (Ashdown, 2000; Kadolph, 1998:30).

Expectations for durability may differ, depending on whether the item is a high fashion garment or just a basic product. Kadolph (1998:29) suggests that the durability and comfort used in a product play a major role when designing functional apparel items. The functionality of an apparel item is expected to serve the customer satisfactorily, even after repeated washings and handling (Solomon & Rabolt, 2004:196; Ashdown *et al*, 2007:349). Thus it is important that the manufacturer should estimate the degree of the apparel's serviceability for at least several washings after purchase (Solinger, 1988:66). The designer and the manufacturer should take into account the consumers' body shapes' characteristics that are critical to the apparel's fit, the consumer's expectations and the performance of a particular apparel item. For example, special apparel items such as a raincoat meant to be worn over several other apparel items, are expected to have a wider allowance than an ordinary dress, although both garments will bear the same size code (Glock & Kunz, 2000:154). The lack of classified body shapes to act as design guides together with the low levels of skills in Kenya's apparel industry may be contributing factors to the poor fit of female ready-made apparel in Kenya. The lack of quality raw materials among other elements, coupled with poor production methods, could also contribute to fitting problems with apparel in respect of its functional features (McCormick *et al*., 2001; RATES, 2003:58).

2.4.2 Materials

For the purposes of this study, materials will be defined as *piece goods* and *findings*. Piece goods are fabrics that are cut and assembled into apparel (Glock & Kunz, 1995:87). Findings are all materials other than piece goods that are required to make an apparel item. Examples of findings include: interlinings, trim, zippers, buttons, and thread (Glock & Kunz, 1995:87, Keiser & Garner, 2003:274). Different body shapes and sizes would call for different characteristics of specific materials that would be suitable and appropriate for them.

Material/fabric is one of the critical factors that affect apparel's fit, and therefore understanding fabric's properties has a significant place in the addressing of size and fit issues (Branson & Nam, 2007:264). Fabric's properties such as its texture, hand-drape ability, pattern and colour often influence and dictate style choices and the amount of ease

needed in the design process for different body shapes and sizes (Solinger, 1988:66; Branson & Nam in Ashdown, 2007:266). The hand-drape ability of a fabric is an important contributor to the satisfaction with the aesthetics and performance of the fabric (Solinger, 1988:66; Kadolph, 1998:29; Brown & Rice, 2001:187-189). Material properties affect the way that an apparel item fits a person, and also impact on how many different people of diverse shapes and sizes could be fitted with one size. Appropriate and consistent selections of quality findings (trims) required to support and complete the apparel items are important for the apparel's quality and performance.

The amount of ease and the type of fabric used both interact to affect how appropriately a garment will fit an individual (Keiser & Garner, 2003:274-276). Rigid fabrics require more comfort ease than stretch fabrics; highly elastic fabrics may require negative comfort allowances and therefore can be used to fit a wider population with varied sizes and shapes (DeLong *et al.*, 1993). The lack of knowledge about fabric characteristics on the part of the pattern makers could contribute to fitting problems. The lack of a system of classified body shapes as a design guide, combined with the poor skills and the poor quality of raw materials available in Kenya, could also contribute to the production of apparel items with poor fit (McCormick *et al.,* 2002).

2.4.3 Production

Apparel firms are organised in different ways, depending on the type of operation or product line. However, there are certain basic steps involved in the production of any apparel item. Collection of apparel items (product line) may be made from the original designs of a staff designer, based on different body shapes and sizes of the target market. This is the case for a company that produces highly priced, high-fashion apparel or designs that are adapted or copied from original creations. In either case, the actual production does not begin until the line is decided upon (Zangrillo, 1990:45; Glock & Kunz, 1995:156). Basic steps involved in the manufacturing are listed and discussed in respect of their effect on the fit of apparel. Some of these steps may overlap or may be performed simultaneously. The different production stages presented here are:

- design creation stage (fashion illustration)
- pattern creation
- cutting room
- apparel assembly
- pressing/finishing stage

2.4.3.1 Design creation stage (fashion illustration)

The design creation stage is a stage where the designer and design team generate ideas and develop sketches for the new lines (styles), based fit model's body type rather than on varied body shapes and sizes prevailing in a target market. Decisions are based on fabrics, recent sales activity of previous designs and knowledge about the consumer market to be served in terms of body shapes, sizes, styles, colours and prices (Glock & Kunz, 1995:165). The sketches must therefore contain clear and detailed information, particularly on the styles, to be understood and interpreted by the pattern maker, and later also by the sample maker, who must come up with an accurate, well-fitting sample (Brown, 1992:25: Keiser & Garner, 2003:173-177; Ashdown *et al*., 2007:350). Use of computer-aided design (CAD) increases accuracy and efficiency. Fabrics are used as a source of design inspiration and as a guide in the selection of suitable sizes, styles and colours (Zangrillo, 1990:45; Burns & Bryant, 1997:177).

2.4.3.2 Pattern creation

Critical to the development of an apparel pattern is the way in which the human body is measured (as discussed in **paragraph 2.3** above) and how those measurements are interpreted. As was pointed out, the human body is three-dimensional while the measurements obtained from it are one-dimensional. The flat pattern creation is two-dimensional and must result in a three-dimensional garment to fit the three-dimensional body shape (Davis, 1980:69). The successful translation of original designs into finished apparel items is realised through the techniques of draping and/or flat pattern making by a skilled pattern maker. Draping is the molding of fabric to the rounded dress-form figure, representing the human figure, to produce a three-dimensional fabric pattern shape (Zangrillo, 1990:68; Keiser & Garner, 2003:250). Although the art of draping would result in better-fitting apparel, the dress form used for the production of the prototype does not represent the varied body proportions of the different body shapes.

Flat pattern making is the drawing of a pattern on a flat surface to individual or standard measurements in a given size, by applying the principles of drafting (MacDonald & Weibel, 1988:2; Keiser & Garner, 2003:250). Sample pattern makers convert designs into sample patterns that, when the pieces are cut and sewn together, create a sample garment which must fit a three-dimensional human figure. The pattern maker develops a pattern piece for each part of the garment, making necessary changes in the company's basic pattern (i.e. the sloper or the basic block) which was created through drafting from body dimensions and body shapes of the typical target customer (Brown, 1992:26; Brown & Rice, 2001:82). The

pattern maker must understand the characteristics of the body shapes, the fabrics to be used, particularly their drape and stress characteristics, as these will determine the effectiveness of the pattern. Knowledge about the exact amount of stretch of the fabric, in all directions, is required so as to adjust the sloper for different body shapes and sizes accordingly. Different sized bodies and different body shapes will exert pressure in different areas, depending on how the bodies are shaped – and this must be understood well by the pattern maker. Shrinkage characteristics should also be well understood and patterns should be created to cater for it (Hudson, 1980:110; Solinger, 1988:55; Ashdown, 2000). The pattern maker must also accurately assess, from the sketch, the overall silhouette desired, the amount of ease and the designer's desired proportions for the design detail, as well as the shape of the intended customer (Burns & Bryant, 1997:178).

A sample maker following the specifications set by the company or the customer makes prototype garments that reflect what is suitable to varied body shapes as well as the consumers' demand (Glock & Kunz, 1995:168; Rosenau & Wilson, 2001:184-187). The fit of the company's product is a way to achieve product differentiation. A fit model is used to assess the fit, styling and overall look of the new prototype, but the problem lies in the fact that the body shapes of the consumers differ from that of the fit model (Salusso-Deonier, 1989; Burns & Bryant, 1997:185; Schofield & LaBat, 2005c; Ashdown *et al*., 2007:353).

Grading as a major process of developing apparel in a range of sizes plays a significant role in the way that an apparel item would fit the intended consumers' sizes and body proportions. Grading is defined as increasing and decreasing a base sized pattern into subsequent larger or smaller sizes with similar outlines as the base pattern (Schofield & LaBat, 2005b; Schofield, 2007:157). Production pattern pieces, which have been made in the sample size and perfected on either fit model or dress stand, are then graded to create a set of pattern pieces for each of the sizes listed on the apparel specifications sheet (Schofield, 2007:157). The pattern maker develops patterns for optimum fabric utilisation and ease of assembly, and determines how each apparel item can be economically mass-manufactured, while retaining the look that the designer intended. Existing grading practices have little basis in measurement information from size charts, as the majority of grade rules applied are not based on anthropometric research (Shofield & LaBat, 2005c). This suggests therefore that the resulting apparel's sizes and styles would contain fit problems as individuals' proportions differ. It has been observed that grade rules used by the industries are not standardised, while body shapes do not change in the same way (linear pattern), and therefore consistent incrementing or decreasing of sizes when grading, does not cater for the diverse body shapes available in a market (Salusso-Deonier, 1989; Schofield & LaBat, 2005).

The lack of formal training in pattern making could also lead to fit problems as there would be no coordination between body forms' characteristics and the two-dimensional flat pattern required to produce a well-fitting three-dimensional garment. If a base pattern has a fit problem, whether in grain line, its balance or proportions, these problems are transferred to new styles developed or graded from the same base pattern, and this leads to the production of ill-fitting apparel (Hudson, 1980:111-113; Desmarteau, 2000). Grade rules used are obtained from anthropometric data for that specific market (DeLong *et al.*, 1993).

It may be argued that the lack of skilled personnel in Kenya's apparel industry is a major contributing factor to the fit problems experienced with ready-made apparel (Mason, 1998; McCormick *et al*., 2002).

2.4.3.3 Cutting room

Marker making: A marker is a diagram of a precise arrangement of pattern pieces for the sizes of a specific style that are to be cut for a single spread (Glock & Kunz, 1995:375). Although body shapes and sizes do not directly influence marker making, pattern making, as mentioned above, requires a thorough understanding of the characteristics of various body shapes as well as sizes. Accurately prepared patterns would therefore influence the arrangement of a marker. The marker indicates how all the pattern pieces of the apparel items are to be arranged on the fabric to achieve the most economical and efficient layout. In the process of producing the most efficient layout, the grain line and seam strength may be affected, resulting in apparel items with poor fit (Hudson, 1980; Brown, 1992:28; Brown & Rice, 2001:95; Ashdown *et al*., 2007:356). The use of computer-aided design to create markers helps in achieving accuracy as well as speed and cost savings (Istook, 2000). In Kenya however, the industry has not advanced to computer-aided design, and manual operations could affect the fit of the final apparel item (Sasia, 1991; Ongile & McCormick, 1996:40; McCormick *et al*., 2001).

Spreading: Fabric spreading is the process of superimposing lengths of fabric on a spreading table, cutting table or specially designed surface. Spreading may be done manually or by computer-controlled machines (Glock & Kunz, 1995:381; Ashdown *et al*., in Ashdown, 2007:358). Although varied body shapes do not directly influence this technique, the way that the fabrics are spread would affect the fit of the final apparel worn by varied body shapes and sizes. A spread should be as tension free as possible. Tension or tightness of a spread is usually a major factor that affects apparel fit and quality because of the reaction of the fabric (Hudson, 1980:120; Solinger, 1988:121; Brown & Rice, 2001:98). If under too much tension during spreading, the fabric may stretch or elongate and later

contract in length, even before the apparel parts are assembled – leading to smaller sizes than intended (Hudson, 1980; Solinger, 1988:121; Ashdown *et al*., 2007:360).
According to Hudson (1980:119), the spreading machine operator could affect fit by failing to smooth out wrinkled cloth or to check cloth width or edge accurately. The use of modern spreading equipment improves the overall quality of the product because it has a reliable automatic edger, tension control and electronic width monitors. However, manual spreaders without automatic devices are still largely used in the apparel industry (Brown, 1992:29). In Kenya, most industries operate manually (Sasia, 1991; Ongile & McCormick, 1996:40), and therefore accuracy may not be achieved – resulting in apparel items with poor fit.

***Cutting*:** According to Glock and Kunz (1995:390), cutting is the reproduction process of separating a spread into apparel parts that are the precise sizes and shapes of the pattern pieces on a marker. Accurate, clean-cut, ravel-free pieces facilitate sewing and improve the quality of garments. Accurately cut pieces are easy to align and position during sewing operations. Inaccurate cutting will cause the operators to compensate by stretching or easing to make the apparel parts the same length or size, resulting in puckered seams and hence, apparel with poor fit (Solinger, 1988:128; Brown, 1992:29; Ashdown *et al.*, 2007:360). Although varied body shapes do not directly influence this part of the process, the way that the patterns pieces are cut out, would affect the fit of the final apparel worn by the varied body shapes and sizes.

Since all patterns are cut out simultaneously, if apparel pieces were cut inaccurately, they would plague the entire assembly process. Mistakes made once would affect the entire line's sizes and styles. The type of cutting equipment and any lack of precision while cutting, may also affect the size of the apparel items (Hudson, 1980:120; Ashdown *et al.*, 2007:360). After the apparel items are cut, the cut pieces are marked to enable operators to align seams, details, and other pieces properly, to facilitate ease of constructing the pieces accurately. If any information is missing, then some apparel items would not meet the size specifications required and again, a problem with the fit would ensue. Computerised cutting systems provide accuracy and efficiency. However, most apparel industries have not introduced modern automatic cutters in their firms (Glock & Kunz, 1995:390).

In Kenya, most industries have the basic operator-controlled cutting blades that are controlled manually. It is assumed that factors that may cause cutting inaccuracies include: wide or vague lines on the marker, imprecise following of lines on the marker, variation in the cutting pitch, allowing the fabric to bunch up or push ahead of the knife, using improper equipment and incorrect cutting sequence, while apparel parts are being cut (Hudson, 1980:199-120; Glock & Kunz, 1995:391).

2.4.3.4 Assembly

Most factories produce apparel items on assembly lines (Brown, 1992:30). The cut pieces are tied together into bundles with identification tickets attached. Each cut piece passes through many hands in the assembly line, one step at a time. Due to varied skill levels and moods of the operators, the resulting product could end up with substandard quality. Subsequently, different specialised machines, if not controlled properly during the sewing process, will also affect the size of the apparel. An over-locking machine, for example, if not controlled, will trim the apparel excessively – thus affecting its size in the end. Hudson (1980:120) argues that sewing operators could cause fit problems by overloading folders, taking excessive trim and not matching guide points. Apparel sizes could also be affected during the sewing process, due to the unique characteristics of the fabric, which may give, stretch or undergo other changes. Puckering of seams also affects the fit of a garment, and this may happen when the machine operators pull fabrics unevenly while sewing. It is also difficult to inspect every apparel item against specifications at every stage of production. This limitation allows fit problems to accumulate, having skipped previous inspections (Hudson, 1980:122). Although body shapes do not directly influence these techniques, the way that an apparel item is assembled could affect the fit of the final product.

A wide variety of technologically advanced sewing machines, some of which are computerised, help the operators to speedily and accurately perform the various steps in assembling apparel. However, smaller industries may not be able to purchase such automatic machines (Brown, 1992:30; Brown & Rice, 2001:101). The outdated machinery, together with the unskilled personnel in Kenya's apparel industries, could also be a cause of poor fit (Sasia, 1991; Mason, 1998).

2.4.3.5 Pressing and finishing

At the pressing stage, shrinkage could occur due to numerous factors, some of which are in-built in the structure, finishing or handling of the fabric. The problem may not be obvious until the fabric is cut or apparel items are assembled. Shrinkage of any type is seldom consistent, which makes it difficult to compensate for the changes into adapted pattern measurements (Hudson, 1980; Brown & Rice, 2001:102). Snap-back type of shrinkage is one that occurs in cutting and is common with knitted fabrics. This is due to fabric being subjected to too much tension when being placed on the roll or the spread for cutting; in the end, undersized garments are produced. When incompatible interlinings are used, different degrees of shrinkages occur where apparel parts of different materials shrink at unequal amounts during the wet ironing or pressing process, resulting in apparel items with varied dimensions. These

garments would be labelled with sizes that do not correspond to their physical dimensions. Shrinkage control is critical to the satisfactory performance of apparel (Glock & Kunz, 1995:409). Although the varied body shapes and sizes of consumers do not directly influence this part of the process, the way that the apparel reacts to pressing would affect the fit and size of the final apparel worn by those varied body shapes and sizes.

It is assumed that quality control is done at almost all levels in Kenya's apparel industry. With inadequate equipment and low-level skilled personnel in Kenya's apparel industries, it is also possible that most of the inspections are done manually and some processes such as wet processing may be skipped, due to ignorance and/or costs involved.

2.4.4 Distribution

Distribution implies logistics, which encompasses the proper distribution and replacement of raw materials and apparel, in servicing customers from the time that orders are received to the delivery of the product to the retailer. Based on available body shapes and sizes in a target market, it is possible to accurately distribute appropriate sizes and suitable styles. Distribution basically involves the selection of the appropriate styles and the numbers of each size to be sold at each store location, based on the consumers' body shapes, sizes and the size of the entire population (Glock & Kunz, 2000:108; Ashdown *et al*., 2007:368).

The classification of commodities and of the target markets' body shapes and sizes would determine the size range for a line, though determining the number of sizes to offer usually entails complex work. If a firm targets women, for instance, it would probably offer apparel in misses, juniors, women's and half-sizes (Glock & Kunz, 1995:108). The apparel industry has also developed a model stock plan which identifies the number of sizes, styles, and colours that will be included in each product line, and establishes a percentage allocation for each. This is designed to reflect the consumer order for each size, colour and style, and to present a basis for a balanced stock in developing a line. With the use of quick response (QR) deliveries and Electronic Data Interchange (EDI), the retailers and the apparel manufacturers can offer their consumers a better selection of styles and sizes, as the inventories are efficiently restocked with desired sizes and styles (Ashdown, 2000). The overall aim is to offer correct and adequate – but not an unnecessary excess – in variety of sizes, styles and colours to the intended consumers (Glock & Kunz, 1995:77; Keizer & Garner, 2003:412; Ashdown *et al*., 2007:368).

The advantage of the optimised sizes is that the number of individuals who fit in each size are more uniformly distributed across a range of sizes, and if each retailer has a precise

anthropometric database of their customers, it would be possible to work out the number of different sizes essential to accommodate the population in that area. As the sizes are directly based on data from an anthropometric database, such a forecast should be plausible (Robinette, 1986; Ashdown, 1998; Ashdown *et al*., 2007:368). In cases where the categories of body shapes are unknown, the apparel distributed would be based on estimates and these would ultimately end up with fit problems. In Kenya, it may be argued that the lack of an anthropometric database, and of classified body shapes, may be major contributing factors to wrong distribution methods.

2.4.5 Style choices

The apparel silhouette is the outer shape of a garment; the shape and size of a silhouette is the first thing seen when the garment is worn (Keiser & Garner, 2003:180). Lewis, 2007:319) states that the body shape and the apparel silhouette worn become attached and united so that the body shape beneath the apparel enhances the aesthetic appeal of that particular apparel, while the apparel silhouette enhances the aesthetic appeal of the entire person. Style details incorporated into design such as structural lines, control of fullness and the creation of different silhouettes or shapes influence how the apparel will fit on the wearer. The style features and the general structure of the apparel also influence the consumer's perceptions about the fit of that apparel (Ashdown, 2000). The structure of apparel (silhouette) is an indicator of how closely an apparel item would conform to the body. Generally, the closer the apparel silhouette conforms to body shape, the more limited the apparel is in accommodating the proportions of varying body shapes (Glock & Kunz, 1995:110; Rasband & Liechty, 2006:3-5). Apparel components with limited fit points include rigid apparel parts that do not readily expand or contract to accommodate different body shapes and dimensions. These limited fit points would include: collar length, shoulder width, waist length and hip circumference, depending on the style or design of the apparel. However, these components can be modified to allow more variance in fit. Waistbands of skirts, for example, could be in-built with sections of elastic and side tabs (Glock & Kunz, 1995:112).

Careful evaluation of different body shapes reveals that most proportions, frameworks, contours and postures may symmetrically or asymmetrically deviate from the so-called ideal figure (a comprehensive discussion on body shapes is given in **Chapter 3** (**paragraph 3.2**). Apparel styles have the potential to create a new and better perception of the body – even if it is not considered to be ideal, to alter the perceived proportions of the body, and to provide a sense of satisfaction to the individuals who do not fit the cultural ideals of size and weight (Fiore & Kimle, 1997:331; Rasband & Liechty, 2006:3, 5 & 19). Ready-to-wear apparel

depends on an accurate estimate of the distribution of body shapes and sizes within a target population. Therefore, it becomes necessary for every country, and even regions within countries, to establish their own sizing systems, which can only be complete, if body shape classifications are representative of the population that they were designed for (Simmons & Istook, 2003; Shin & Istook, 2007; Honey & Olds, 2007). The styles to be produced would then be based on an understanding of the different shapes available in a market place, rather than being produced at random (Ashdown & Dunne, 2006; Shin & Istook, 2007).

Fashion being so dynamic, the type of fit that is fashionable could change from body-hugging silhouette to loose, flowing styles within a short period of time. However, different groups in a population will want different levels of fashion, style and fit. The challenge to the manufacturer is to offer apparel that is suitable to the varied body shapes and sizes, and yet in harmony with the customers' desires (Hudson, 1980:109-110; Ashdown & Dunne, 2006). Due to the lack of established body shapes as well as the lack of skilled manpower in Kenya's apparel industry, it is possible that the concept of fit in relation to style features may not be well understood – and hence the production of poor-fitting ready-made apparel.

2.5 FIT ISSUES

Fit is defined as the relationship between the apparel's dimensions and the three-dimensional human size and form/shape (Kadolph, 1998:550; Keiser & Garner, 2003:315; Solomon & Rabolt, 2004:196). In other words, it is the apparel item's silhouette and size being right for the human's body shape and dimensions. Fit issues would therefore be seen as those measures carried out by the apparel industry to achieve well-fitting apparel for the target market's body shapes and sizes.

Solinger (1988:562) affirms that fit has two parameters, namely aesthetics and utility. The fit measurements must consider the utility specifications for the styles (aesthetic), and both must be suitable for different body shapes and sizes, and also acceptable to the consumers. Although comfort is subjective to individual consumers' expectations for each apparel item, fit affects comfort as well as the durability of apparel in the sense that if an apparel item was smaller than it should be either in parts or in the entire garment, the wearer's movement is restricted in the area of the problem (Rasband & Liechty, 2006:3-5). This therefore necessitates that the crucial characteristics of different body shapes, such as the bust, derriere, thighs, hips, shoulders and biceps, be well understood by the apparel producers. Once the person is restricted, there is a feeling of discomfort resulting from the restrictions. A tight-fitting apparel item would also tend to wrinkle and finally tear as a result of tension and

strain around the affected area. The debate on how well an apparel item fits would depend on one's judgement, perception of fit/comfort and the fashion at that point in time, and these would vary according to the consumer, the designer and the pattern maker (Ashdown & DeLong, 1995; Alexander *et al*., 2005a; Loker *et al*., 2005). It can be argued that, since each industry uses self-made sizing systems and delivers differently fitting apparels, judgements on the concept of fit would also differ. Brown and Rice (2001:154) argue that fit is evaluated subjectively in terms of current fashions, cultural influences, body shapes, age, sex and lifestyle (personal taste). Better-fitting apparel could be a close fit to one person and a loose fit to another or on different occasions and depending on what is fashionable at that point in time.

The concept of a good fit is subjective and dynamic, hence the need to address it at different times and from different viewpoints, to come up with at least an acceptable and plausible fit at that particular given time (Loker *et al*., 2006). It could be suggested that continuous pursuit of quality management for each line production be carried out to ensure the production of better fitting apparel that is suitable for varied body shapes and sizes within the fit preferences of the consumers.

The fact that quality assurance is integrated within all the departments in most apparel industries is an indication of commitment to quality. Random inspection on apparel defects and sizes according to specifications does not, however, simply eliminate fit problems but would detect a problem during the production process or at the final stage rather than prevent it. Accurate sizing systems with categorised sizes and body shapes, and based on correctly taken anthropometric data, are likely to prevent problems with the fit of apparel.

In Kenya, it is assumed that the concept of fit may be a new phenomenon, or it is taken as something frivolous. With the lack of a classification of body shapes, together with the inadequate equipment and low-level skilled personnel, specific strategies such as fit and wear tests may be only rarely or minimally administered – resulting in poorly fitting ready-made apparel. Although set standards of quality assurances may be observed in apparel industries, the lack of sizing systems would still lead to the production of ill-fitting apparel – even if all the quality measures were observed.

2.5.1 Perception of fit

Living in a consumer-driven era (Capraro, Broniarcczyk & Srivastava, 2003:164), companies should aim at managing consumer satisfaction/dissatisfaction by producing products that are tailored to the consumers' fit preferences. According to Yu (2004:31), the definition of fit

depends on factors such as fashion culture, industrial norm and individual perceptions of fit. These subjective definitions have however been reflected in the non-standardised philosophy governing good fit. Although there is lack of agreement amongst the stakeholders on fit (industry, retailers and consumers), consumers' perceptions of fit should be taken as an important element in addressing matters pertaining to fit for the purposes of supplying better-fitting apparel to a population with varied body shapes and sizes (Keiser & Garner, 2003:29). Istook (2002) argues that the personal preferences of each customer would govern their perception of fit. The consumers' previous encounter with the apparel shapes her perception of fit (Ashdown, 2000). This could, of course, change with the fashion trend at that point in time. Therefore, frequent checks on fit preferences could be tapped and translated into desired and suitable apparel items to keep abreast with the dynamics of fashion. The satisfaction offered by the apparel in terms of expected performance, may also contribute to a consumer's perception of fit.

In Kenya, no known research has been carried out on consumers' perception of fit. The conclusion drawn is that perception of fit may differ from person to person. It could also be assumed that fit issues could be seen by the apparel industry as conformance to the specifications that are used as quality assurance measures. The set standards are static specifications that are applied repeatedly and therefore cannot address the consumers' fit preferences with the changing dynamics of fashion trends.

2.5.2 Objective measure of fit

To judge the quality of the fit provided by a sizing system, one should rely for the assessment of the fit of the apparel on the individuals for whom the system was designed. Unfortunately, there is no reliability or validity in the responses given by the wearer, the designer or the pattern maker, due to their varied judgements (Ashdown, 2003). The designer's, pattern maker's and consumer's concept of fit could vary a great deal, and therefore there could be confusion concerning everyone's perception of fit, which makes it difficult to be analysed (Loker *et al.,* 2006). The designer's interest is to create a specific artistic look in relation to the body of an ideal figure – a body shape and size that differ from those of the entire population. The pattern maker/grader tries to maintain that look over a range of bodies, while the consumers on the other hand, have their own judgements or preferences regarding fit (Ashdown, 2000). Keiser and Garner (2003:29) are of the opinion that product developers must find ways to gather information regarding consumers' preferences in order to produce apparel items that are satisfactory to consumers.

It is impossible to approach the consumer's perception of good fit without a set of accurate and comprehensive measurements and classified body shapes (Istook & Hwang, 2001:120; Ashdown & Dunne, 2006). Consistent fit within a brand, based on accurate measurements and body shapes, builds customers' loyalty as they can rely on finding a good fit where they have found it before (Glock & Kunz, 1995:107; Yu, 2004:31). Major obstacles in addressing fit issues have been reported to be inadequate agreement among apparel professionals on the parameters defining good fit, varied perceptions of good fit and lack of information about which concepts of fit are important to the consumers (Ashdown, 1998; Ashdown, Loker & Adelson, 2004; Yu, 2004:31).

Ashdown, Loker and Adelson (2004) report that objective measurements used for defining fit have been developed. This includes comparing apparel measurements to the body dimensions, particularly at standard, critical fit locations for different apparel items. Pressure gauges could also be used to measure the actual amount of pressure generated on the body by the apparel item (Ashdown, 1998). The critical fit points for different body shapes differ and this calls for attention so as to assess the objective measuring of fit in different consumers with varied body shapes and sizes. Interactions that occur in the complex system of the dressed body could only be solved by the use of a body scanner (Ashdown, Loker & Adelson, 2004). Unfortunately, not all the apparel industries, particularly in developing countries such as Kenya, could employ such expensive technology, which makes fit issues complex to deal with; hence, the continuous production of poor-fitting apparel items.

2.5.3 Fit testing

Manufacturers should aim to consistently satisfy their consumers by producing apparel items that are suitable to varied body shapes and sizes (Brown & Rice, 2001:154). As discussed earlier, consistent quality of fit is pursued at every step of the apparel production process. Prototypes are checked on models with measurements and body shapes that are conforming to the desired body dimensions and form, but are not necessarily a representation of the shape/dimensions of the entire population. The fit of the sample apparel is also checked on the three-dimensional form (dress form), which is a replica of the so-called ideal body shape (Glock & Kunz, 1995:165-166). Fit testing is crucial because it prevents unwanted returns by the consumer, while it much improves apparel's quality as it becomes the company's norm. Testing the apparel's fit reveals key problems underlying the fit or the functionality of a garment, which serves as an improvement tool for the consistent and continuous production of better-fitting apparel. There are methods established to subjectively measure fit through analysis by experts in the apparel profession who visually analyse the apparel's fit on the wearer. Using trained, professional panel members would avoid bias and perception error

during such a study, as the training helps them to develop a high degree of sensitivity to the complexities of good fit. Data gathered from expert assessments are used to qualitatively analyse the fit of the apparel and evaluate the accuracy of sizing systems and pattern prototypes (Ashdown, 2000, Keiser & Garner, 2003:318-319).

Disadvantages observed in the use of live models are that they may gain or lose weight, change proportions or become unavailable, making it difficult for a company to maintain consistent fit – even when the company pro-actively maintains a current group of fit models (Brown & Rice, 2001:155). In Kenya, it may be argued that apparel industries might be ignorant of fitting tests. The lack of appropriate basic tools, such as dress forms for pattern draping, could be an indication of ignorance or negligence. However, the apparel industries countercheck apparel's fit with the specifications written for a certain product, which is not sufficient to capture the unique relationship between the body and apparel.

2.5.4 Wear testing

Wear testing is also necessary in order to address issues of durability and consistent fit of the apparel item, even long after purchase. Although Solomon and Rabolt (2004:148) argue that apparel must imperceptibly reconcile body changes that occur over time and encourage comfort without looking age-specific, the performance and fit of apparel still change over time. This poses a challenge for manufacturers to provide apparel that continues to fit after wear and care. Brown and Rice (2001:52-54) state that consumers cannot accurately evaluate apparel's functional performance at the point of sale, but may estimate some features of functional performance, such as comfort or freedom of movement, by trying on the apparel. Care labels represent an implied warranty by the manufacturer that the apparel will retain its shape and appearance if laundering care instructions were carried out appropriately. Based on design, material, workmanship and information given on the labels, consumers should be able to predict the functional performance of apparel, especially if they had prior experience with similar apparel items (Brown & Rice, 2001:147-148; Keiser & Garner, 2003:333).

It could be argued that customers' satisfaction extends beyond the fit observed in a retail environment, to also include the performance of the apparel long after purchase and even after repeated washings. Wearing and caring for the apparel under normal circumstances without change, helps determine how the interaction between the body shape and the apparel (design, material and construction) affects its performance overall (Brown, 1992:18). Wear tests also occur uncontrollably under different circumstances, and although the reports could be subjective, the wearer's results regarding the behaviour of a garment under actual

wearing conditions could be useful for addressing fit problems resulting from wearing and handling of the apparel long after purchase. Unfortunately, reports from the subjects are hardly ever received (Ashdown, 2000). Ashdown (2000) is of the opinion that wear tests should be done on subjects that are identified by the company, to wear an apparel item over a period of time, while it is subjected to recommended cleaning methods, normal handling, and wearing. The processes can be monitored and studied, and any changes that might occur over time would be used to address the problem and could eventually lead to the production of enduringly better fitting apparel (Ashdown, 2000; Cornell University, 2003).

Some manufacturers and few retailers perform extensive lab tests or a day's tests on apparel that they produce to ensure that quality is maintained. Lab testing or a day's testing could be simple or complicated, with equipment ranging from home washing machines and dryers to more sophisticated computer-integrated instrumentation. However, many manufacturers do not carry out any tests on the apparel they sell, and if they ever perform the tests, they seldom inform the consumers about the results (Brown, 1992:18). In Kenya, no known wearing tests are carried out. It is assumed that the industry is ignorant or generally negligent in this regard.

2.6 COMMUNICATION OF SIZING AND FIT

Istook (2002:65) explains the importance of communicating how each apparel item was designed to fit, by the manufacturer to their consumers. This communication is an indispensable step to meet the fit expectations of consumers. Ready-to-wear apparel contains a variety of labels and tags that express information to the consumers for estimating the quality of an apparel item in terms of size, fit and care. According to Brown (1992:45), apparel labels must be permanent and must remain legible throughout the useful life of the garment, as this would act as a future reference for a similar size and fit. It would also continuously guide the consumers in caring processes that would facilitate consistent fit even after long use. According to Chun-Yoon and Jasper (1996:89), a size label is a tool for communicating sizes and body types to the consumers and to assist them in choosing apparel that fits their body shapes and sizes appropriately. Glock and Kunz (1995:108) state that size labels are supposed to indicate dimensions and to describe the body shapes that the apparel was designed to fit. They should indicate whether the person is tall with large/small bust and large/small hips, short with large/small bust and large/small hips, or regular (medium height) with large/small bust and large/small hips. These indicators of fit would provide a foundation for judging the suitability of apparel in selecting for a particular body type and size. Unfortunately, female consumers often get frustrated and confused as

they flip through several assortments of styles and sizes trying to get an apparel item that fits correctly (Chun-Yoon & Jasper, 1996; Ashdown, 1998).

Reasons for the variations that exist between apparel that has been sized with the same codes within one company or between different companies could be traced to the use of obsolete and/or wrong measurements. Most databases were taken many years ago and do not reflect the dimensions of the present female body shapes (Brunn, 1983; Olds, 2003). The methods of obtaining body dimensions are inappropriate and most apparel industries do not adhere to the suggested (voluntary) standard sizes (Faust *et al*., 2006). Most sizing systems available do not include classification of body shapes, which is the core component of a successful sizing system (Chun-Yoon & Jasper, 1996; Istook & Hwang, 2001). The pattern development, grading, fabric spreading, cutting and assembling procedures employed by different manufactures are inconsistent (Hudson, 1980:112; Solinger, 1988:128; Brown, 1992:29; Glock & Kunz, 1995:390). Failure of quality control measures right from the size charts/tables through various apparel production processes could easily permit errors to slip through from one section of apparel processing to the other.

The factors determining apparel's fit are also not clearly defined, thereby enabling manufacturers and retailers to use size labels as competitive advantage and as a marketing gimmick (Ashdown & DeLong, 1995; Glock & Kunz, 1995:111). For example, apparel of different brands and styles, as well as apparel items of the same brands, may be labelled with the same size but could fit differently (LaBat & DeLong, 1990; Workman & Lentz, 2000; Brown & Rice, 2001). Size labels keep from larger to smaller sizes as a result of "vanity sizing". These psychological sizing systems are best described as lying labels as they portray a smaller size on the face of the label and yet the measurements of the garment, fit a large sized person. Thus, a woman whose measurements are normally within a size 14 range, could wear an apparel item sized 12 or even size 10 (Tamburrino, 1992a & 1992b; Ashdown & DeLong, 1995; Glock & Kunz, 1995:111; Keiser & Garner, 2003:304; Faust *et al*., 2006).

2.6.1 Size labels' quality and consumers' apparel selection

Size labels for women's apparel lack the correlation that men's size labels have to their actual body dimensions, leaving manufacturers to develop their own sizing systems, which are confusing and frustrating to the women consumers as they look for apparel that fits (Workman, 1991; Holzman, 1996). Although size labels are not obligatory (Keiser & Garner, 2003:336; Faust *et al*., 2006), the way they are presented to the consumers plays a major role in their apparel selection exercise. Ironically, an apparel item bearing a mandatory care

label also bears a size label with flawed information. Care labels represent an implied guarantee by the manufacturer that the apparel will perform exactly as stated, and yet the information on the non-instructive size labels is vague and obscure.

Informative (self-explanatory) size-labelling that relates directly to body dimensions contributes to consumer satisfaction (Chun-Yoon & Jasper, 1995; Holzman, 1996). Most women sizes are not expressed as body dimensions, but rather expressed as arbitrarily chosen numbers or letters that correlate with sets of unrevealed body dimensions (Brown & Rice, 2001:147-148; Faust *et al*., 2006). Unfortunately, when body dimensions are not revealed to uninformed consumers, the size designations are almost meaningless, thus leaving the consumers to guess and assume what would fit appropriately. These uninformative labels would contribute consumer frustration in their humiliating experience of apparel selection.

2.6.1.1 Uninformative size labels

The uninformative size labels have been described as tacit, implicit or inferred (Mason *et al.,* 2008), because only individual manufactures and retailers know the meaning. The meaning of the numbers indicated and exactly how large, medium or small a person should be, is kept a secret by individual manufacturers/retailers. As in the case of numerical labels (**Table 2.1**), different manufacturers whose aim is to maximise profits, would actually keep the key measurements concealed. To an uninformed consumer, these would actually be seen as meaningless labels, as they cannot link the letters or the numbers indicated on a size label to the body shapes and dimensions used for the construction of that particular apparel item (Brown, 1992:55; Mason *et al*., 2008).

Numbered size labels, for example, size 16 or size 34, is the most common method of sizing for the majority of mass-produced apparel, particularly on moderately priced and even on expensive apparel (Workman & Lentz, 2000). However, consumers often find it difficult to link the number to their own measurements, as they do not understand what constitutes those numbers (Chun- Yoon & Jasper, 1995; Workman & Lentz, 2000). The information on the size labels is not adequate enough and not sized according to body dimensions to assist the consumer in finding the correct size and style (Chun-Yoon & Jasper, 1995; Faust *et al*., 2006). Uninformed consumers may not be able to interpret odd numbers such as sizes 9 and 11 or even numbers such as sizes 10 and 12, or even the larger numbers such as 38 and 40. The efforts of retailers and apparel manufacturers to reduce stock units have been reflected in the move to double sizing or collapsing sizes. For example, combining sizes in juniors and misses, such as sizes 9 and 10, could be confusing and frustrating during apparel selection.

Research shows that differences in body contours exist between people of the same measurements and more so between different categories of people (Zwane & Magagula, 2006; Shin & Istook, 2007). Therefore, if sizes are combined it could end up confusing the customers even more, because neither misses nor junior female consumers would then be fitted well (Kunik, 1984:16; Winks, 1997; Ashdown, 1998).

TABLE 2.1: NUMERICAL SIZE LABELS

Sizes indicated as numbers and presented on the apparel's label sometimes singly or accompanied by key dimensions			
Numbered sizes -examples	Numbered sizes - examples	Numbered sizes (odd numbers)	Half sizes
8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28 ----------	36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56 ----------	13, 15, 17, 19, 21, 23, 25, 27 ----------	8½, 10½ , 12½ , 14½, 16½, 18½, 20½ ----------

Lettered size labels are particularly uninformative systems and are also known as average sizing. Examples are: S = Small, M = Medium, L = Large and XL = Extra Large, and sometimes XXL = XX-Large and XXXL = XXX-Large for yet larger sizes and XS = Extra Small. These size indications reduce the possibilities for excellent fit, because they result in collapsing size categories to a small number of size divisions. In the lettered sizing, as in other sizing systems, there is little standardisation from brand to brand and no consistent correlation to the body dimensions – making it more confusing and exasperating to the consumer (Hudson, 1980:116). Although lettered sizing is popular in loose-fitted apparel, some retailers use them on woven apparel with a closer fit. Nonetheless, consumers cannot find an accurate fit within S, M, L and XL as easily as they can within the numbered sizes developed from anthropometric data of the targeted population. People's sizes vary between regions, different ethnicities and even within a region or ethnic group. A small size in one region would be a larger size in another region – thus the need to have accurate data of each region or ethnic group (Shin & Istook, 2007). In a case like Kenya, where information on sizing systems is inconsistent and confusing and no known anthropometric database exists, the question arises of which labels are to be used. As was mentioned earlier, the size standards records (KEBS, 2001:7) indicate that the anthropometric data available was collected in 1975. The sources of the original data are not available to verify the reliability of the records.

The one-size-fits-all label type of sizing is also an attempt by manufacturers and retailers to further collapse sizing by providing apparel that has the ability to stretch and to fit many body shapes and sizes (Abend, 1993; Brown & Rice, 2001:148). It can be argued that one-size-fits-all apparel cannot accurately fit body shapes of extreme sizes. The stretch characteristic

of a fabric has a certain percentage of elasticity (stretchability), which may either be too little for the largest size or too much for the smallest size. Design ease provided for this kind of sizing has its limitations within each body build/size and cannot be suitable for the entire range of varied body builds and sizes.

2.6.1.2 Informative size labels (Figure 2.5)

A size label that shows or tells the consumer how the apparel should fit is referred to as an informative/self-descriptive/instructive label. Informative (self-descriptive) size labelling that relates directly to body dimensions contributes to consumer satisfaction, while apparel manufacturers enjoy profits (Chun-Yoon & Jasper, 1995; Holzman, 1996). Since sizing and size labelling are often used by the manufacturers/retailers as a marketing tool, it is important to have accurate information. Brown and Rice (2001:147) argue that instructive or self-explanatory size labelling (**Figure 2.5**) that directly indicates the body type and relates to the body measurement, is beneficial not only to the consumer, but also to the companies aiming at satisfying and retaining their customers. Chun-Yoon and Jasper (1995) confirm that consumers prefer the wordless pictogram label, which is self-explanatory as it indicates measurements essential to the fit of a particular apparel item on a little sketch or diagram of the human body. Pictograms are particularly useful for international trade because they overcome language barriers and are easy to understand at a glance by the consumers (Brown & Rice, 2001:147/148). The efficient apparel selection that an informative size label allows will not only ensure customers' emotional well-being as well as manageable wardrobes, but also growth in manufacturers' and retailers' business.

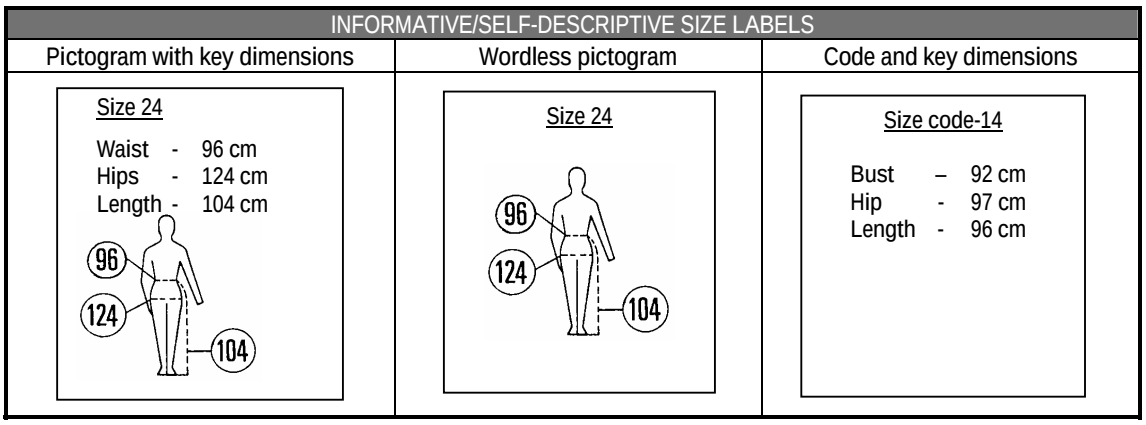


FIGURE 2.5: INFORMATIVE SIZE LABELS

Wordless pictogram (without supportive written key dimensions): With an increase in international trade in apparel, difficulty of communicating sizes of imported/exported apparel becomes an issue (Brown & Rice, 2001:147-148). Methods of sizing differ between different

manufacturers within countries and between different parts of the world. This means that different countries could have different sizing techniques and codes to communicate sizes. Pictograms therefore have proven to overcome the language barriers (Chun-Yoon & Jasper, 1995). The body dimension critical to the fit of a particular apparel item is indicated on an illustration of a human figure. The illustrated human figure enables a consumer at a glance to estimate the fit of the apparel, thus providing meaningful information about sizes and easing apparel selection (Mason *et al.,* 2008). Unfortunately, the imported and the local ready-made apparel in the Kenyan market, continues to use tacit size labels with very little, insufficient and hidden meaning; thus their entire purpose of size communication fails.

Pictogram supported with written key **dimensions**: This size label is considered to be effective and its strength is enhanced by the use of a wordless pictogram, indicating specific parts/regions of the body that are accompanied by body dimensions. It may be argued that this system would be strongly effective within a country where there is an updated anthropometric database. In countries where the data is obsolete, it would be more valuable to provide all the necessary information on the apparel labels to facilitate some close estimation of key body dimensions by the consumers, in order to ease the apparel selection exercise (Mason *et al*., 2008).

Size code and the key body dimensions: This system could be very effective in a country where there is an updated anthropometric database. The size code given is accompanied by measurements of the key dimensions, making it easier for the consumers to predict how the apparel would fit, and thus easing the process of apparel selection. This therefore demands that all the necessary information be given on the apparel label, with the presence or absence of updated anthropometric data.

Although providing size labels is voluntary, Istook (2002:65) explains the importance of communicating how each apparel item was designed to fit, by the manufacturer to their consumers. This communication is an indispensable step to meet the fit expectations of the consumers. In Kenya, size labels presented on either imported or local apparel are flawed and in most cases the uninformative types. Uninformed consumers may not comprehend what the codes mean and therefore may not find it useful enough during apparel selection.

2.7 CONCLUSION AND IMPLICATIONS FOR THE STUDY

After going through each concept presented in Ashdown's model and other supportive literature, the following conclusions based on the main concepts highlighted throughout this chapter, are hereby given.

2.7.1 Population measures

The foundation of any successful sizing system should reflect accurate dimensions and body shapes of a studied population. The body dimensions of a population must be accurately taken, using recommended techniques and instruments. This means that outdated, borrowed/copied size data cannot be used or improved without an accurate, up-to-date and representative anthropometric database for a target market. Kenya's sizing standards are outdated, while the anthropometric database from which they were developed is obscure. There is no classification of body shapes to act as design guide for the purposes of producing better-fitting apparel.

2.7.2 Design features

The lack of classified body shapes could mean a lack of design guides for the production of better-fitting apparel. The low-level skills of personnel in the apparel industry are likely to lead to the production of poor-fitting ready-made apparel. Personnel with low-level skills are also likely to face many challenges in translating the different body shapes into suitable styles and sizes. Kenya's lack of classified body shapes together with the lack of skills in the apparel industry's personnel could be viewed as contributing factors to the poor fit of ready-made apparel in Kenya.

2.7.3 Fit issues

The lack of standardised agreement on the concept of fit amongst different stakeholders (designer, pattern maker and the consumer) could contribute to fitting problems because fit quality standards based on representative body shapes would vary from one manufacturer to another. In Kenya, research on the perception of fit by the apparel industry and by the consumers, is not readily available. The industry, however, lacks adequate and modern technology necessary for improving the fit of apparel.

2.7.4 Communication of sizing and fit

The lack of adequate information on the size labels leads to consumers' confusion and frustration as they select ready-made apparel items. Informative size labels based on accurately taken anthropometric data should inform the consumer about the dimensions used, and which body shape the apparel will fit best. The sizes and body shapes indicated on a size label must reflect the dimensions and body shapes of the target market. Obsolete sizing systems and the lack of a body shape classification systems in Kenya could be major contributing factors to the poor fit of the ready-made apparel. The uninformative size labels presented on women's ready-made apparel are most probably not well understood by the consumers, and hence they select inappropriate apparel items.

Based on the above conclusions and for the purposes of this study, sizing systems are therefore defined as the classified dimensions and body shapes, based on a target population (market) for the construction of ready-made apparel for that specific market. It is further reasoned that a sizing system would not be complete and successful, if the dimensions and body shapes represented are not communicated effectively and appropriately to the consumers. The consumers as the receivers should also be acquainted with size and fit issues, to understand their own body shapes as well as their key dimensions necessary for a specific apparel item. This enables a link between the information given on the labels to the consumers' body shapes, dimensions and proportions. All these aspects could collectively result in easy and successful apparel selection as well as satisfactory apparel items for the consumers, while the retailers/manufacturers enjoy profits.

The situation in Kenya regarding sizing and fit seems to be worse than in most developed countries where studies have been carried out. According to Kenya Bureau of Standards' records (KEBS, 2001: Preface), anthropometric data was collected in 1975; the original database from which the size charts were established is unknown and obscure. This suggests, therefore, that the data available is flawed and obsolete as there is no known evidence to guarantee the quality of the sizing systems currently in use. The size charts available do not include body shapes, which should form the core component of a successful sizing system. The consumers do not understand the tacit size labels used on Kenya's ready-made apparel and this has an influence on their choice of appropriate apparel styles and sizes. Ignorant consumers could make wrong apparel choices and at the same time get frustrated as they flip through several apparel assortments, guessing and estimating what would fit their bodies and sizes appropriately. The lack of research carried out on sizing and fit issues or on any related subject in Kenya, highlights the deficiency that needs to be addressed. Considering the novelty of the concept of sizing based on consumers' varied

body shapes, consumers' knowledge about size and fit, their perceptions regarding general fit problems and their fit preferences, this study may provide reference data on apparel sizing and fit issues in Kenya. As the focus of this study, these issues are addressed in Chapter 3.

Chapter 3

SPECIFIC SUPPORTING LITERATURE REVIEW AND CONCEPTUALISATION

Considering that this study is new in Kenya, this chapter provides a review of specific literature addressing the female's body shape identification and body characteristics that are critical to the fit of apparel, and how they (shape and body characteristics) may contribute to fit problems. It also focuses on the female consumers' knowledge/ignorance about the communication of sizing and fit, as this would determine the success or failure of her selection of appropriate apparel in a retail environment. Although every consumer's fit preference is a subjective matter and varies from one person to the next, understanding consumers' fit preferences could allow the tapping and translation of the consumers' required degree of fit, into apparel styles and sizes that should be suitable for the different body shapes and sizes within specific markets (Keiser & Garner, 2003:29; Ashdown & Dunne, 2006).

3.1 INTRODUCTION

3.1.1 The concept of fit

Beautiful and well-fitted apparel is not only attractive, but also enhances the appearance of the wearer, because apparel is an extension of the self. Apparel that is too large gets in one's way, creating a comical appearance, whereas too small apparel restricts movement, and appears immodest and odious (Rasband, 1994:8; Rasband & Liechty, 2006:5-6). In either case, poorly-fitted apparel distracts attention, emphasises body shape problems and undermines the confidence of the wearer (Zangrillo, 1990:4; Fiore & Kimle, 1997:176). A well-fitting garment hides a body shape problem and directs the attention away from the problem area – thereby contributing to the psychological and social well-being of the wearer (Farmer & Gotwals, 1982:3). Pleasing apparel leads to the customer's loyalty to the store that continues to satisfy her needs, and hence profit to the manufacturer/retailer (Hudson, 1980:112; Rasband, 1994:19; Bougourd, 2007:108). In Kenya, with regards to sizing and fit, it is likely that, if the customer identifies a retailer that stocks satisfactory apparel in terms of fashion and better fit, it is possible that she will develop a loyalty to the store and perhaps tell others about it.

Fit refers to how well the apparel conforms to the three-dimensional body in a comfortable and flattering manner. It is determined by proportional relationships between the dimensions and the body shape used in a firm's sizing system (Ashdown & DeLong, 1995; Glock & Kunz, 1995:110; Fiore & Kimle, 1997:175; Brown & Rice, 2001:153). Fit is an important part of both the aesthetic and the performance features of apparel (Yu in Fan *et al*., 2004:31; Bougourd, 2007:108). It is crucial to consumer satisfaction, as it influences the attractiveness as well as the comfort of an apparel item; thus it is one of the attributes that an individual evaluates when trying on apparel items (Kadolph, 1998:27-28). However, Brown and Rice (2001:153) argue that it is often easier for consumers to find colours, prices and styles they like, than to get better-fitting apparel. This implies that attaining the correct fit is a very exigent task in the apparel industry. This also confirms that apparel sizing and fit are difficult concepts to research and analyse as the relationship between the body and apparel is complex and often ambiguous (Loker, Ashdown & Schoenfelder, 2005). Examining the body shape and its components requires knowledge of the elements of fit and how they interact with the body's physical features to produce aesthetically pleasing and better-fitting apparel.

Apparel is the product of a design process and the fabric's properties, and its quality is measured by its drape-ability, appearance and comfort on the body shape. The body shape functions as a framework for the apparel (Salluso-Deonier, 2005), and the fabric's properties and the apparel's style must be in harmony to produce aesthetically pleasing, comfortable and well-fitting apparel. However, the effects of a stunning design, gorgeous fabric and exquisite workmanship are destroyed if the finished apparel does not fit the intended wearer (Winks, 1997; Brown & Rice 2001:153). The elements of fit, which encompass grain, set, line, balance and ease (Erwin *et al.,* 1979), contribute to both the appearance and the comfort of the apparel. They are used as appraisal gauges for the quality of the apparel's fit.

The correct grain of the fabric contributes to the correct hang of the garment in harmony with the size and body shape, while the set is the apparel's smoothness without undesirable wrinkles or folds. It results from correct body dimensions and body shape proportions that are translated into the three-dimensional apparel style. The style must harmonise with the size and the body shape that the apparel is designed for. Correct body dimensions and the alignment of the apparel's structural lines in accordance with the natural lines of the body shape, characterise the line as an element of design. The balance is achieved through correct body dimensions and correctly translated body proportions used to create the apparel silhouette's equilibrium on the right and left halves of back, front and profile characteristics of the body shape. The ease involves the use of correct body dimensions and the amount of ease allowed into a pattern for the purposes of wearing and styling/design. The functional ease allowed must be in a harmonious relation to the body shape, size and proportions to

provide comfortable apparel items without wrinkles or creases. The design ease allowed should result in suitable styles that must also be suitable for the various body shapes and sizes (Erwin *et al*., 1979; Brown & Rice, 2001:153). The comfort of an apparel item is attributed to its wearing/functional ease and styling/design ease. The wearing ease allows for flexing and movement without restriction or straining in any way. It is judged on both tactile and visual responses (Kadolph, 1998:30; Ashdown & DeLong, 1995; Glock & Kunz, 1995:111). The comfort provided by the amount of ease allowed, differs with differently fitted apparel (such as the three basic types of fit: close fit, relaxed or semi-fitted, and looser to very loose fit), the body shape and the end-use of the apparel.

All the aforementioned elements of fit work simultaneously to produce aesthetically appealing apparel that is comfortable and well-fitted to various body shapes. The lack of any of these attributes contributes to apparel fitting problems, which could be seen as too tight, or too loose a fit. It could also contribute to a lack of symmetry in the apparel item, sagginess in parts such as pockets, bulginess in linings, seams that pucker, wrinkles and/or any other undesirable fabric behaviour in the finished apparel (Hudson, 1980:110; Brown & Rice, 2001:157; Rasband & Liechty, 2006:29, 194, 324). With low-level skilled personnel in Kenya's apparel industry, it is possible that the factors contributing to apparel's fit quality (the elements of fit) are not well understood, and hence the production of poor-fitting ready-made apparel. Since body shape plays a major role in apparel's fit quality, an overview of body shape is hereby given to provide a deeper understanding of the body's physical properties, such as proportions, postures, shapes and sizes, and how they could influence the fit of apparel.

3.2 BODY SHAPE

For the purposes of this study, the body is described as a three-dimensional human structure, which Salusso-Deonier (2005) describes as a framework for proportioning apparel. It is usually discussed in terms of shape, contours and postures (Davis, 1980:73; Liechty *et al*., 1992:33-35; Rasband, 1994:15; Marshal *et al*., 2004:137). People's shapes and proportions change over time as a result of changes in nutrition, lifestyle, ethnicity, age, grooming and concepts of ideal beauty (Winks, 1997; Ashdown, 1998; Shin & Istook, 2007; Bougourd, 2007:108). It has been observed that body shapes vary not only from country to country but also from region to region within countries (Winks, 1997; Yu in Fan *et al.*, 2004:185; Zwane & Magagula, 2006). Chun-Yoon and Jasper (1996) identify one of the fitting problems as a lack of appropriate sizes to accommodate the full range of variation in body shape that exists in the current population. Ready-to-wear apparel depends on an

accurate estimate of the distribution of body shape and sizes within a target population (Salusso-Deonier, Delong, Martin & Krohn, 1985; Yu in Fan *et al.*, 2004:185). The adequacy of a standard sizing system depends on both database and body shape classification methods (Ashdown, Loker & Adelson, 2004). An anthropometric database must be classified such that the majority of the sample is accommodated by a minimum number of size categories, yet it should integrate the variation in body shapes within the population that the sizing system is expected to serve (Workman, 1991; Ashdown, 1998; Loker *et al*., 2005).

Differences in body shape arise from variations in body type, posture and body size (Salusso-Deonier, 2005). According to DeLong (1987:38, 42), the weight distribution on the body frame constitutes the shape of the body. The body can be considered to be a vertical graduation of size, with the upper section containing more details than the lower section. As a visual structure, the body is made up of visual units that can only be clearly distinguished when viewed from the front, back (silhouette) and side (profile) (DeLong, 1987:38-42; Salusso-Deonier, 1989). Apparel sizing relies therefore upon an understanding of body shape variation in terms of dimensions and shape that should be translated into three-dimensional apparel, which should fit a shape appropriately. However, many apparel designers tend to build their products around conventional (fit model/ideal shape) consumers with well-proportioned body features. In doing so, they neglect many important body shapes that exist in the market place (Bougourd, 2007:108).

3.2.1 Ideal body shape

Although the ideal shape varies, and is bound to change due to the whims of fashion and within different cultures (Rasband & Liechty, 2006:23-30), most studies define the ideal figure (**Figure 3.1**) as a perfect human structure, and a well-balanced shape, which is usually used as a standard figure and/or a fit model (Armstrong, 1995:33). The perfect body is assumed to provide a silhouette that will fulfil everyone's desired image of perfection, but in reality it denies the consumers the opportunity to see themselves sensibly (Lewis, 2007:319). To facilitate an in-depth understanding of aesthetically appealing apparel, insight into and knowledge about the ideal figure's proportional relationships of body components become important. This will provide some form of standard in examining the proportions of any other body shape that may differ from it, and hence in the making of apparel that is suitable and pleasing to different body shapes – even if they are not ideal. Proportion, or the relationship of one segment of the body to another, is used to describe the ideal body shape (LaBat & DeLong, 1990; Rasband & Liechty, 2006:23-30).

The bust, waist and hip positions are in relation to the total height of the figure. The height of an average (ideal) shape is divided into four equal parts (Lyle & Brinkley, 1983:63; Armstrong, 1995:33). Hips serve as the mid-point of the total body height, where the waistline is the mid-point between the hipline and the underarm. Knees serve as the mid-point between the hips and the floor line. If any of the figure's four length points are not equally distributed as in the ideal figure, then the body shape could be described as high-waisted, high-hip, short-waisted or low-hip, depending on where these points fall within the height of the figure (**Figure 3.2**) (Lyle & Brinkley, 1983: 63). The height proportions could also influence the design values applied to an apparel pattern at specific height fit points such as the hips, waist and the bust. The height proportions can be obtained more accurately through body dimensions and to some extent, through visual analysis.

Typically, the ideal figure shows the following characteristics:

- It has just enough weight covering the bone and hollows of the body softly and smoothly.
- Its body mass is distributed evenly from the centre core of the body or the spine, as the body is viewed from back, front and side.
- The bust balances the buttocks as the body is viewed in profile.
- It is similar in width in the shoulders and hips, with medium bust, small waist, flat to slightly curved abdomen, moderately curved buttocks and slim thighs.
- It is a well-balanced figure with no exaggeration on any part of the body (bust/shoulders and hips/buttocks measures the same or are closely similar, with a waist of about 26 centimetres (cm) or 10 inches smaller than the hips.

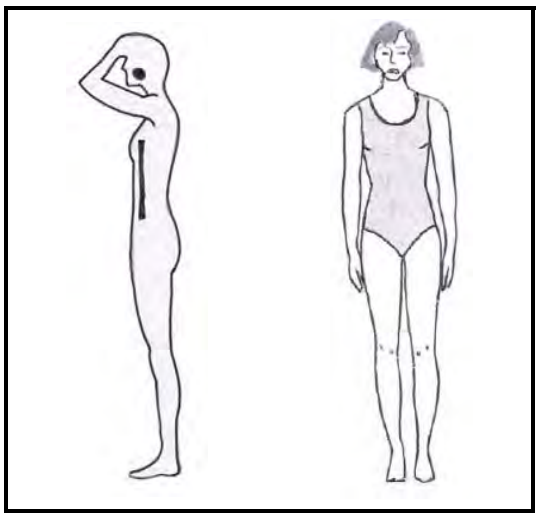


FIGURE 3.1: IDEAL BODY SHAPE

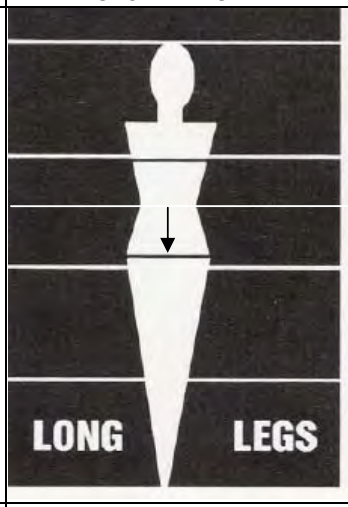
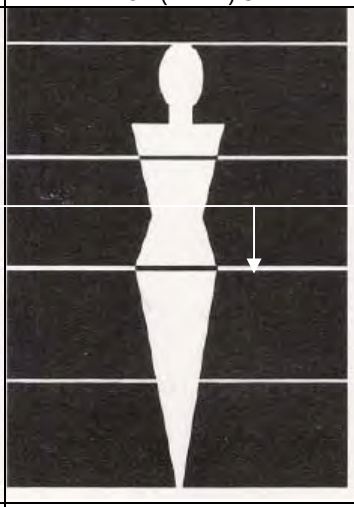
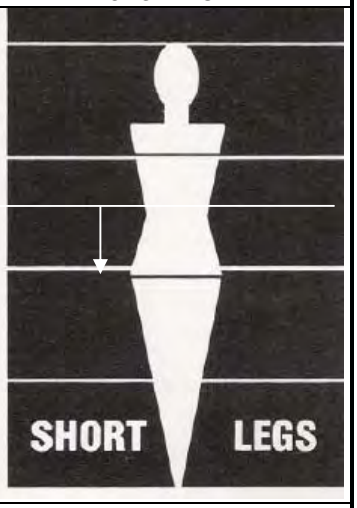
	SHORT-WAISTED	AVERAGE (IDEAL) SHAPE	LONG-WAISTED
			
BUST	Bustline is above the bustline of the ideal figure.	Bustline is midway between shoulders and waistline.	Bustline is below the bustline of the ideal figure.
WAIST	Waistline is above the waistline of the ideal figure.	Waistline is midway between the bustline and the hipline.	Waistline is below the waistline of the ideal figure.
HIPS	Hipline is above the hipline of the ideal figure or above the mid-point of the figure's height.	Hipline is the mid-point of the total figure's height.	Hipline is below the hipline of the ideal figure or below the mid-point of the figure's height.

FIGURE 3.2: HEIGHT PROPORTIONS

(Adapted from: Lyle & Brinkley, 1983:63)

With non-standardised height proportions among body shapes, ready-made apparel is bound to contain fit problems around the waistline. The fit problems arising as a result of non-proportional height distributions could be high or low waist, and problems of too tight fit. Currently, media and apparel companies worldwide use a well proportioned but relatively slim body shape for their fashion shows and catwalks. This is viewed in Western society as ideal (Yu, 2004:33; Zwane & Magagula, 2006). Most apparel industries and apparel designers use the slim figure described as perfect, for wear-testing sample apparel items (Brown & Rice, 2001:154; Yu, 2004:33; Loker *et al.*, 2005). The heavier or the plus-figures are left out without representation (Glock & Kunz, 1995:166; Bougourd, 2007:108). It may be argued that the criteria used for selecting the ideal figure by the industry are unknown and biased. It should be noted that live models are trained professionals whose bodies, in most cases, have been moulded, groomed and guided by accepted concepts of ideal beauty – characteristics which most consumers lack, but crave to possess. This implies that the fit of the apparel available in the marketplace are only suitable for the fit model and not for the entire target market. Salusso-Deonier (1989) states that accuracy, and consequently quality, of apparel can only be attained through dress forms, fit models and sizing systems that represent the target population's sizes and body shapes.

In contrast to the Western viewpoint, the ideal body shape in Africa (black race) varies with different cultures. Roach & Eicher (1973:101-102) describes the Ghanaian female ideal body shape as consisting of egg-shaped ovals right from the head through to the legs. The head-top to the chin forms an egg shape, while the neck consists of wrinkles. The torso must also contain two oval shapes above and below the waist. The thighs to the knees form another oval, while the knees to the ankle form another. A figure with a prominent hipline, narrow waistline with medium breasts (pear shape) is considered beautiful and desirable in Kenya, as expressed in most love songs. However, due to culture transfers, online marketing/website cat walks, movie stars and imports of different styles and designs to the country, mostly through second-hand apparel (Mason, 1998:100; McCormick *et al*., 2001 & 2002), the Western slim hourglass ideal figure is becoming part of what the acceptable body shape should look like. This is even further enhanced by sporting, the wellness and fitness industry in which most working-class women participate (Rudd & Lennon, 2000). Most women, on realising that certain styles are not available in their sizes, tend to indulge in dieting and weight loss activities in the hope of attaining their perceived ideal body (LaBat & DeLong, 1990:43). Not all the women in weight loss exercises attain the ideal bodies they crave. DeLong (1987:38, 42) states that body shape is determined by the body framework, and not by exercises or dieting. The apparel industry must therefore produce apparel items that have a better fit for all kinds of body shapes and sizes within their target market.

The ideal body shape is a base from which most apparel patterns and ready-made apparel are designed (Bougourd in Ashdown, 2007:108). This ensures that ready-made apparel items fit only body shapes and sizes that are similar to those of the ideal figure. However, because there are many body shapes whose proportions and dimensions deviate from those of the ideal, ready-made apparel will not fit many bodies as properly as the ideal body shape (Schofield & LaBat, 2005b). With the lack of classified body shapes in Kenya, it is impractical to discuss the ideal body shape. However, since most sizing systems used in developing countries are adaptations of the Western systems (Zwane & Magagula, 2006), it is also possible that the ready-made apparel items are designed on the basis of the Western ideal body shape's characteristics.

According to Bougourd (2007:131-132), a fashion model form is built according to the style dimensions that women should possess, rather than to their true dimensions and shapes. In most cases, the dimensions used are based on fit models that possess rare body proportions. Using these dress forms therefore cannot produce better-fitting apparel to a population of varied body shapes. The lack of classified body shapes in Kenya's apparel industry could be viewed as a factor affecting the production of well-fitted apparel (Mason, 1998; McCormick *et al*., 2002). Apparel samples produced need to be tested, not only on

dress forms made from a current, accurate and representative sizing system, but also on live fit models whose dimensions and body proportions represent the range of sizes and proportions of the population (market). This would guarantee that the fit is correct on both stationary and moving body shapes before mass production and dispatch of the apparel items. The use of inadequate and outdated equipment/machinery in Kenya is still a major challenge to the apparel industry (Sasia, 1991; Mason, 1998; McCormick *et al.,* 2002).

3.2.2 Established body types in some selected countries

Body shapes differ from one country to the next and even from region to region within countries (Winks 1997; Shin & Istook, 2007). Differences in body shape arise from variation in body type, proportions, posture and body size (Fiore & Kimle, 1997:331; Bourgourd, 2007:120). To facilitate an in-depth understanding of the characteristics of established body types, an ideal body shape becomes a basis from which to address the other shapes. The symmetrical deviations from those of the ideal body shape, which occur identically on both sides of the body, are noticeable from the front or back and side views of the body. Examples include broad or narrow shoulders, broad or narrow upper back, small or wide waist, large or small hips, full or small bust, high hips or low hips, large or flat buttocks and protruding or flat abdomen (Rasband & Liechty, 2006:29-30). Finding that symmetrical and uniform deviations occur repeatedly on different body shapes, facilitates the development of preliminary subgroups/patterns of weight distribution (categories) referred to as body shape, which are useful in the construction of well-fitting apparel (design guidelines), as well as in the selection of appropriate and suitable sizes and styles by informed consumers.

Rudd and Lennon (1994:163) refer to body shape as the size, shape or weight distribution of the various body parts. A well-proportioned body has a “pleasing” relationship between its various parts as well as in the entire body conformation (Armstrong 1995:33; Yu, 2004:33). However, few individuals have perfect body proportions in terms of the Western ideal body shape. A person’s body size and shape could be proportional, if the individual parts were balanced with the application of elements and principles of apparel design (Zangrillo, 1990:5; Rasband, 1994:12). The emphasis in categorising/classifying body shape is to produce apparel items that can alter the perceived proportions of the body, and to provide a sense of aesthetic appeal as well as satisfaction to the individuals who do not necessarily fit the cultural ideals of size, weight and shape (Fiore & Kimle, 1997:331). The success of ready-to-wear apparel depends on an accurate estimate of the distribution of body shapes and sizes within the target population (Ashdown, 1998). Body classification based on a target market ensures that consumers within that market would be able to purchase apparel with a better fit (Chun-Yoon & Jasper, 1993; Loker *et al.,* 2005). Most developed countries have classified

women's shapes to ease the apparel selection crisis experienced within retail environments and to provide better-fitting apparel. Unfortunately, developing countries such as Kenya have no classification of body shapes. It is assumed that the apparel designs in Kenya are based on Western established body shapes, and hence all the fit problems with the ready-made apparel available.

3.2.2.1 Classification of body types in the United States of America

In the USA, for example, apparel is made for various body types. The following examples have been compiled from: *Readers' Digest* (1988:46-47), Winks (1991:63), Glock and Kunz (1995:108), Burns and Bryant (1997:110), Kaiser and Garner (2006:304-307).

Women's sizes: These are made for the adult shape of average to above-average height (5'5" – five foot five inches – to above 5'6"), with fuller and more mature in girth and weight distribution than the misses' category. Women's sizes are denoted with size codes such as 14W (W = Women) as the beginning size up to 24W or above, depending on retailers'/manufacturers' target market.

Women's petites: This category is designed to reflect a shorter figure of larger girth, with a fuller torso, shorter sleeves and larger waist in proportion to the bust than in the women's category. They are denoted with size codes such as 14WP up to 20WP or more, as the starting and end sizes for this category. They are also denoted with size codes such as 38 up to size 50 or above, depending on the target consumers.

Misses: This category is made for the mature youthful figure of average build. Size codes such as 2 are used as a starting size, while size 20 is used as the last size code in this category and only even numbers are used.

Misses-petites: This category is made for the mature youthful figure of average build, but of shorter height under 5'4". Size codes such as 2P (P = Petites) to 20P are used to reflect dimensions similar to those of the misses, except that they are shorter, which is denoted by the letter P.

Juniors: This category is made for women with average height of about 5'6". This type of figure has a shorter torso and less mature development than the misses' categories. It is usually labelled with odd-numbered size codes starting from size 3 or 5 up to 17. The numbering of the sizes varies from one manufacturer/retailer to another, depending on the target market.

Half- sizes: These are made for the full-bodied shape of shorter height (less than 5'4") but with a larger waist and shorter back-waist length than for the misses' sizes.

3.2.2.2 Classification of body types in the United Kingdom

In England, the apparel council measured 4,349 women between the ages of 18 and 70. The council defined three body shapes by height and bust development. ***Short:*** Body shape with height less than 155cm, ***Average:*** Body shape with a height of between 155 cm and 162.5 cm, and ***Tall:*** Body shape with a height of 165 cm and over.

The bust types were divided into six categories, namely (Kemsley, 1957:14):

Extra large bust: Body shape with bust measuring 4" more than the hips
Large bust: Body shape with bust measuring 2" more than the hips
Full bust: Body shape with bust measuring the same as the hips
Medium bust: Body shape with bust measuring 2" less than hips
Small bust: Body shape with bust measuring 4" less than hips
Very small bust: Body shape with bust measuring 6" less than hips

3.2.2.3 Classification of body types in the Republic of Germany

Germany conducted surveys in 1983 and 1994 respectively. Body size tables for women's outerwear provided nine body size groups in three (3) height groups and narrow (slim), normal, and heavy/strong (broad) hips for each of the height groups (160, 168 and 176 cm). The values of the primary control dimension, bust girth, were set down using "standard" preferred numbers with fixed inter-size intervals, and the hip values were obtained incrementally reducing drop values (Winks, 1991:51; DOB-Verband, 1994:6-7).

Sheldon (1940) in Salusso-Deonier *et al*. (1991) is accredited with originating somatotyping. Somatotyping is defined as a system of classifying human physical types and body shapes by their natural, genetically predetermined body build, appearance and temperament. Sheldon and colleagues classified over 10,000 nude male students into 76 commonly occurring body types. However, Salusso-Deonier (1989) argue that most studies have focused only on the stereotypical versions of the three body types characterised by extreme development of either long, slender bones (commonly known as ectomorphs), muscle/bone bulk (commonly known as mesomorphs), or fat accumulation (usually referred to as endomorphs).
Although the established body shapes from the selected countries do not exhaustively

describe the various characteristics of the body that are critical to the fit of ready-made apparel, they do provide some guidelines that are useful for designing and distributing apparel to the marketplace. If informative size labels were presented in a country with established body shapes, the informed consumers (in size and fit issues) would be able to select appropriate apparel items that are suitable for their body shapes as well as their sizes. Kenya lacks representative size tables as well as classified body shapes to guarantee the production and distribution of appropriate apparel styles. Body shapes classifications based on a target market, ensure that consumers within that market would purchase apparel with a better fit (Chun-Yoon & Jasper, 1993; Loker *et al.,* 2005).

3.2.3 Commonly used established body types

It has been observed that there are more than five typical patterns of weight distributions. However, presented in **Figures 3.3**, **3.7**, **3.12**, **3.14** and **3.16** are the five prevalent categorised body shapes common within the regular-sized and the plus-sized body shapes. The descriptions provided are based on different authors' views as well as the researcher's observations of photographs taken in the field, particularly on the characteristics of profile views. They have been summarised and were compiled from: Harper and Lewis (1983:29, 31); Salusso-Deonier (1989:373); Zangrillo (1990); Rasband (1994:12-13); Armstrong (1995:33); Spillane (1995:33); Fiore and Kimle (1997); Kuma (1999:65-68); Connell *et al*. (2003); Simmons, Istook and Devarajan (2004a); Devarajan and Istook (2004), Rasband and Liechty (2006:23-29); Zwane and Magagula (2006); Connell *et al*. (2006) and the researcher's observations in the field.

3.2.3.1 Triangle body shape

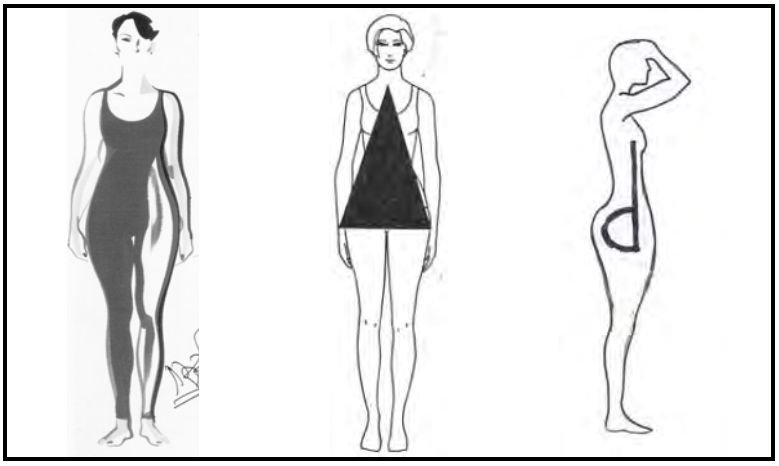


FIGURE 3.3: TRIANGLE BODY SHAPE

The triangular body shape (**Figure 3.3**) is also known as the pear shape, the A-line, the bell shape, the Christmas tree or bottom-heavy, and is sometimes represented by the following symbols

Typically, it shows the following characteristics:

- The bottom section is heavier than the upper section. From the front and back views, this appears like a triangle due to the wider parts falling around the thigh and hip area, giving an illusion of a narrower waist.
- The lower part of the body could be described as large, by the combined heavy buttocks (full pelvic tilt) and thigh prominence or by the prominence of either buttocks (full pelvic tilt) or thighs separately.
- The shoulders and/or bust are relatively small as compared to the large hip/buttock area.
- When viewed from the side, the buttocks may appear as the letter “d” when the person is facing the right side.

The weight in the lower part of the triangular body shape could be attributed to buttock/derriere protrusions and heavy hips and/or bulging thighs which may contribute to problems of tight fit. Shown in **Figure 3.4** are apparel items such as skirts and pants with fit problems due to more weight concentrated around the lower part of the body. Since the upper part of the body is much smaller, it may experience problems of loose fit, particularly around the bust and shoulder regions (**Figure 3.4**).

Over-sized buttocks curve outward more than the average, and this causes creases (wrinkles) or strain on apparel across the buttocks (**Figures 3.4** and **3.5**). The side seam appears bowing backward as the strained fabric cups under the abdomen and/or buttocks (Rasband, 1994:134-135).

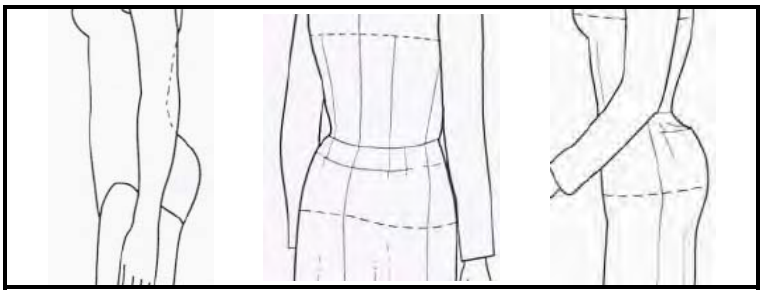


FIGURE 3.4: STRAINED FABRIC CUPS ABOVE BROADEST BUTTOCK REGION
(Sources: Rasband, 1994:134; Rasband & Liechty, 2006:324)

Heavy/bulging thighs may be positioned and/or shaped differently, thus affecting the fit of the apparel, either vertically or horizontally. They affect the way that pants and skirts fit. If thighs are fuller or heavier than for the average body shape, pants or skirts with a close fit are likely to form wrinkles at the affected region (**Figure 3.5**).

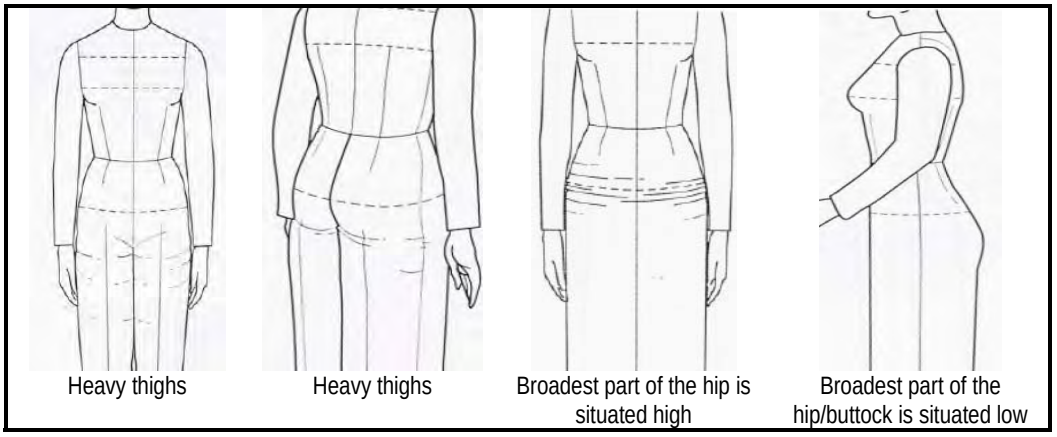


FIGURE 3.5: WRINKLES AROUND THE FULLEST PART OF THE THIGH/HIP
(Sources: Rasband, 1994:130,138; Rasband & Liechty, 2006:324)

The position of the fullest part of the thigh is critical in designing patterns and particularly when curving skirt or pants patterns around the hip/bulge area. The shaping of fitted skirts/trousers, will call for more attention to each critical fit point of the hipline and the fullest part of the hip separately. In cases where the latter has been ignored, the resulting apparel forms wrinkles around that part, or uncalled-for “pockets” may form above the hipline (Rasband, 1994:138-140; Rasband & Liechty, 2006:340).

Fit problems may result from the narrow upper part of the body, that is from narrow/small shoulders and/or bust. The apparel item worn by such a body shape would indicate folds

forming on the garment as a result of excess fabric in the area where the body is narrow/small (**Figure 3.6**).

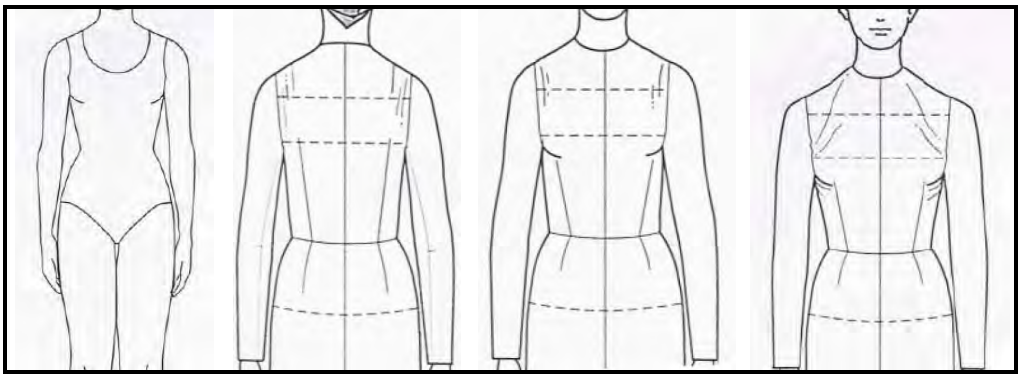


FIGURE 3.6: NARROW SHOULDERS AND/ OR BUST
(Source: Rasband, 1994:66, 68)

3.2.3.2 Inverted triangle body shape

The inverted triangular figure (**Figure 3.7**) is also referred to as the barrel, wedge, V-shape or top-heavy, and is represented by the following symbol:

Typically, it shows the following characteristics:

- Heavy upper torso translating into a short, wide waist and wide-shouldered form, with relatively narrow hips.
- When viewed from the side, the shape may appear as the letter “P” at the bustline if the width prominence is attributed to the size of the breasts.
- Width prominence may be attributed largely to prominence of bust and shoulders combined or to the prominence of either bust or shoulders separately. In either case, the width prominence concentrates on the upper part of the body.

It may be assumed that this kind of shape, when viewed from the side, may also bear a moderate to full pelvic tilt, a characteristic of protruding buttocks – and therefore may appear like the letter “**P**” (bust) at the upper part and the letter “**d**” (buttocks) on the lower part.

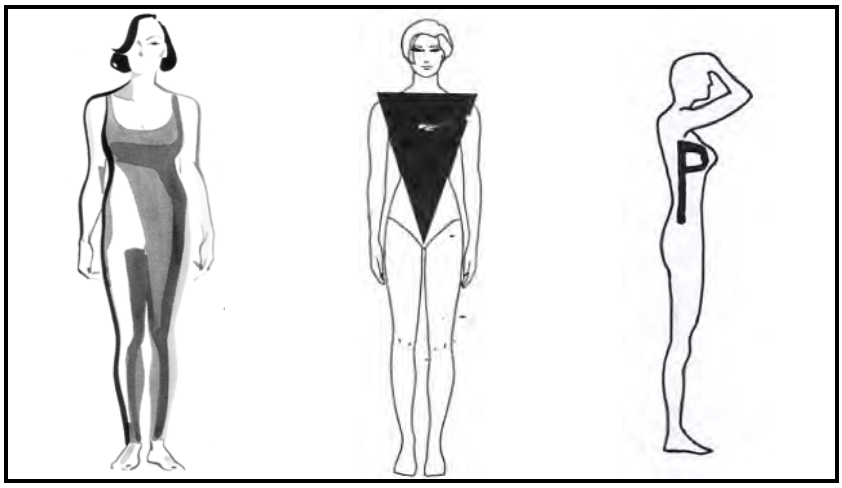


FIGURE 3.7: INVERTED TRIANGLE BODY SHAPE

The weight in the upper part of the inverted triangular body shape could be due to bust protrusion, broad shoulders and/or shoulder blades region, which may contribute to problems of tight fit. Shown in **Figure 3.9** are apparel items such as blouses and jackets with fit problems resulting from more weight concentrated on the upper part of the body and particularly in the bust region. The lower part of the body may experience loose fit problems, particularly around the hips and thigh regions (**Figure 3.11**).

A	Small bust (almost flat)	
B	Average bust, with little protrusion	
C	Full bust, but slightly out of proportion	
D	Full bust, extremely out of proportion	

FIGURE 3.8: BUST CUP (Adapted from: Solinger (1988:77); Spillane (1995:84))

Figure 3.8 shows that busts vary anatomically with respect to the horizontal protrusion which they are comprised of, and the vertical droop, nipple position and bust shape denoted by AA, A, B, C, D, DD cup sizes (Solinger, 1988:76; Spillane, 1995:84)**.** Bust cup size is determined by the difference between over-bust girth (chest girth) and the under-bust girth (Beazley, 1997:282). The under-bust is not necessarily parallel to the horizontal because it depends on the torso's back and side curvatures (Solinger, 1988:77; Spillane, 1995:84). The different

protrusions/droops (**Figure 3.8**) can only be noticed in a profile view and could be clarified with the use of dimensions. The trick lies in the fact that bust dimensions obtained from two people may be similar, and yet their shapes and proportions may be totally different, resulting in dissimilar looks in the same apparel item (Schofield & LaBat, 2005a; Schoefield, *et al*., 2006).

A person's back width (over the shoulder blades) and/or under-arm area, for example, could be broader with small breasts, while another person's body shape may be characterised by large breasts and a narrower back width (over the shoulder blades) and/or under-arm area. In such circumstances, the two people would have the same circumferential dimensions, yet different shapes. Bust has been identified as the key dimension representing the upper part of the body; its size and shape plays an important role in determining the correct bra size, and subsequently, well-fitted apparel without wrinkles (**Figure 3.9**) or folds resulting from too large or too small bust size and shape.

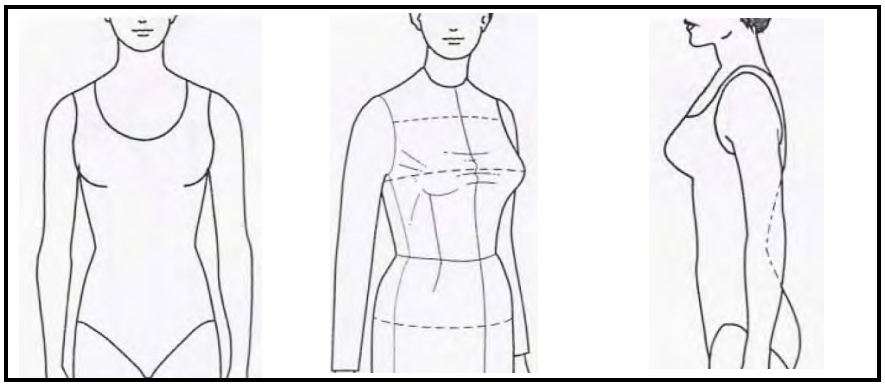


FIGURE 3.9: WRINKLES AT BUST REGION DUE TO LARGE BUST
(Source: Rasband, 1994:86; Rasband & Liechty, 2006:194)

Shoulders act as the hanger for the apparel, and as a pivot point which facilitates an aesthetic appearance, as the apparel drapes gracefully on the body. The size of the shoulders in relation to other parts of the body and how they are shaped will affect the fit of the apparel. If the size and the shape of the shoulders on apparel items are wrong for the size of the body's shoulders, as in the case of barrel- or pear-shaped bodies, then the apparel item would fold, sag (collapse) or wrinkle as a result of narrow, sloping or squared and broad shoulders respectively, as shown in **Figure 3.10** (Bray, 1978:28-30; Rasband, 1994:68-72).

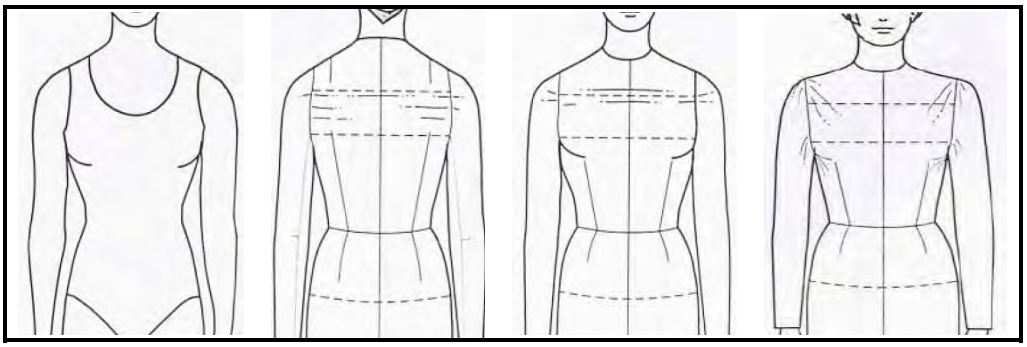


FIGURE 3.10: APPAREL FORMS WRINKLES AT SHOULDER REGION

(Source: Rasband, 1994:66, 68)

Fit problems resulting from the narrow lower part of the inverted triangular body shape may be due to narrow hips or flat buttock and/or thighs. The apparel item worn by such a body shape would indicate folds forming on the garment as a result of excess fabric around the area where the body is narrow (**Figure 3.11**).

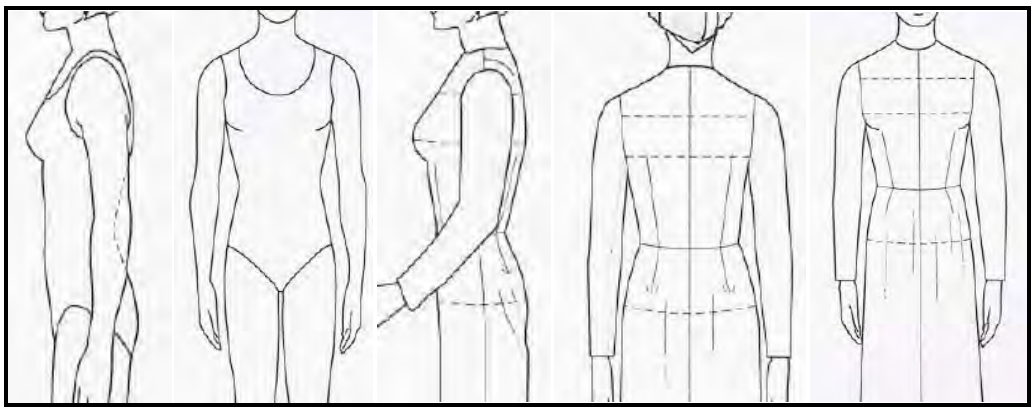
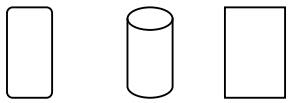


FIGURE 3.11: APPAREL FORMS FOLDS AT HIP/THIGH REGION

(Source: Rasband, 1994:66 & 68)

3.2.3.3 Rectangle body shape

The rectangular shape (**Figure 3.12**) is sometimes also called the box shape, square, straight, block, tubular, oblong, angular, figure 11, figure H and figure 1. It is sometimes represented by the following symbols:



Typically, it shows the following characteristics:

- Full and firm, evenly packed figure.
- Broad all round and straight up and down.
- The shoulder-/bust line width equals that of the hips/buttocks, with no visible waistline.

This kind of figure may have a flat bust or buttocks, or a full bust appearing like the letter "**P**", or protruding buttocks and/or abdomen, depending on the pelvic tilt of the individual; this is only observable through the profile view which might show a shape with the stomach appearing like the letter "**b**" or the letter "**D**" at the front, and the buttocks appearing like the letter "**d**" at the lower back.

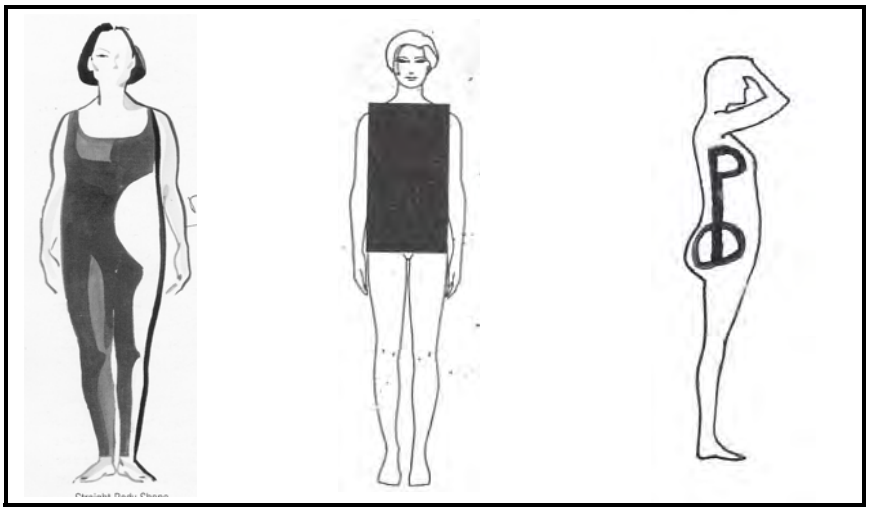


FIGURE 3.12: RECTANGLE BODY SHAPE

The weight in the upper and lower parts of the rectangular body shape is distributed evenly without a waist indentation. This could be attributed to a large stomach/waist (**Figure 3.13**). Apparel items such as skirts, pants, blouses, jackets and dresses would have a tight fit around the stomach region.

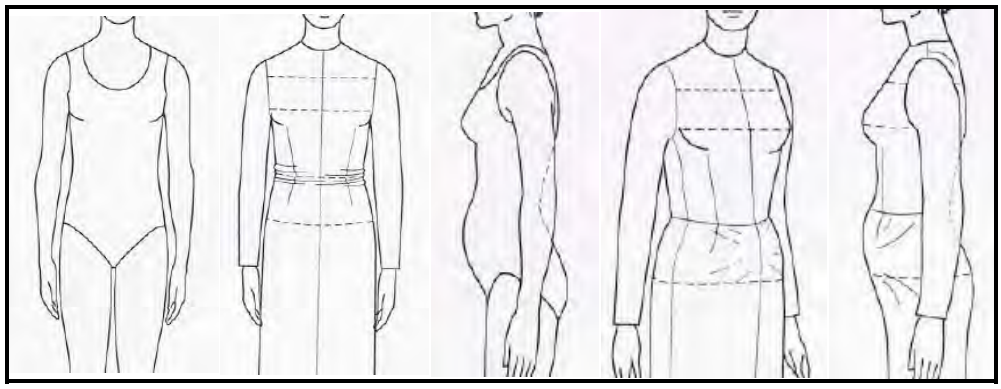


FIGURE 3.13: APPAREL FORMS WRINKLES AT WAIST/MIDRIFF REGION

(Source: Rasband, 1994:66, 68)

3.2.3.4 Hourglass body shape

This shape (**Figure 3.14**) is also called the rectangular “8”, figure X or “curvy” and is presented by the following symbol:

Typically, this shape shows the following characteristics:

- The shoulders and the hips are aligned, with a visibly indented waistline.
- Most evenly proportioned within the plus sizes.
- Has more weight and flesh covering the bone and hollows than the ideal body shape.

Viewed from the side, this shape may appear with bust prominence like the letter “**p**” at the top and large buttocks appearing like the letter “**d**” at the bottom or just moderate buttocks but with heavy thighs.

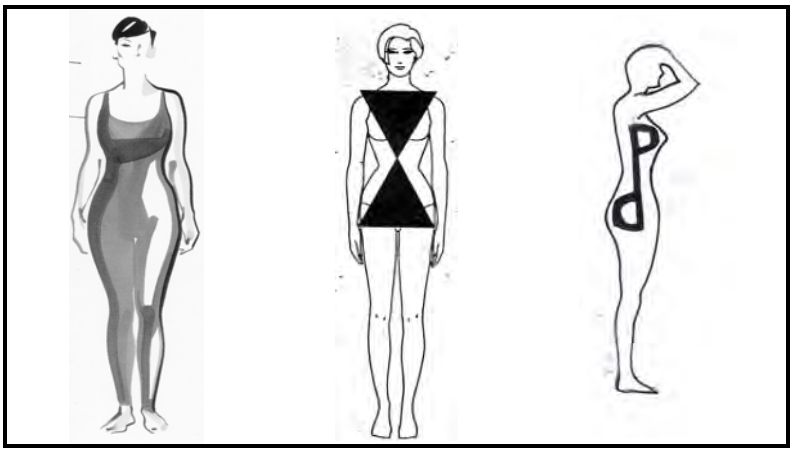


FIGURE 3.14: HOURGLASS BODY SHAPE

The weights in the upper and lower parts of the rectangular body shape are distributed evenly with a noticeable waist indentation. The lower part of the body's weight could be attributed to large hips/derriere and/or thighs. Large bust and shoulders could characterise the upper part of the body's weight. Fit problems encountered by such a body shape could be attributed mostly to the narrow waistline. However, the heavy parts on the upper and lower body sections may also contribute to the tight fit of apparel items around the heavy parts as already seen in **Figures 3.5**, **3.9** and **3.10**. Apparel items such as skirts, pants, blouses, jackets and dresses would have a loose fit around the stomach region (**Figure 3.15**).

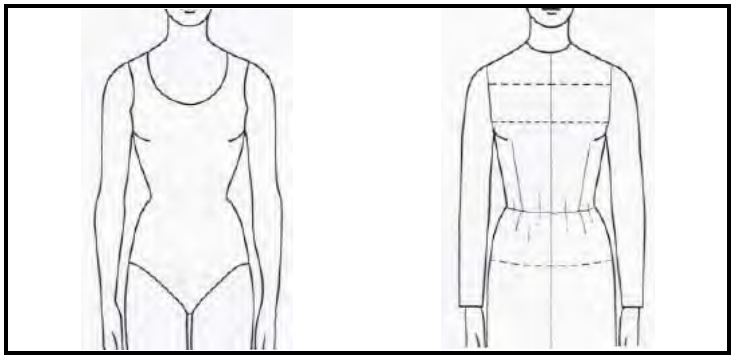
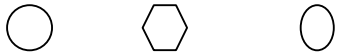


FIGURE 3.15: APPAREL FORMS FOLDS AT WAIST/MIDRIFF REGION

(Source: Rasband, 1994:66, 68)

3.2.3.5 Apple body shape

This figure (**Figure 3.16**) is sometimes referred to as circular, oval, egg, ball or round, and is represented by the following symbols:



Typically, this shape shows the following characteristics:

- Has curves, and carries weight from shoulders to hips.
- The front, back and side views of this type of figure present a rounded torso with round shoulders, waistline, bust and buttocks.
- No waist indentation as the upper torso connects to the lower torso with an almost continuous same circumference.
- The waist may be bigger than the bust and the hips. When this is the case, this sort of shape is referred to as a diamond shape because of the bulging waistline.

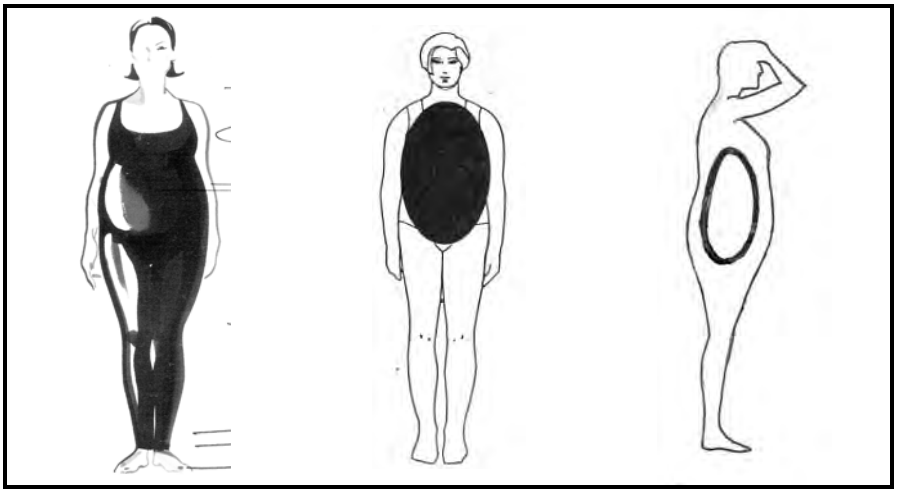


FIGURE 3.16: APPLE BODY SHAPE

The weights on the upper and lower parts of the rectangular body shape are distributed evenly, with large stomach protrusion. The whole framework of the body is filled up with muscle and fat and thus may cause problems of tight fit throughout the body. However, most weight concentration is usually around the stomach region, causing the fit problem (**Figure 3.17**). This kind of body shape may also experience tight fit problems throughout the entire body due to roundness of the entire body shape. The size of the body could be more critical for this body shape than its contours.

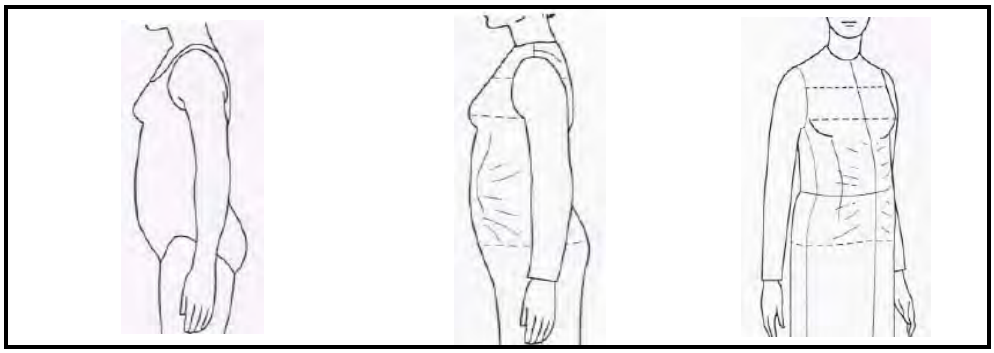


FIGURE 3.17: WRINKLES AT WAIST/MIDRIFF REGION DUE TO FULL STOMACH

(Source: Rasband, 1994:66, 68)

3.2.4 General factors critical to apparel's fit (applicable to all body shapes)

3.2.4.1 Posture

Although fit implications of each body shape have been discussed under each body shape, there are some fit problems caused by the body's posture in general and by the upper arm of the body, which cannot be confined to any specific body shape. Posture refers to the alignment of body parts and the manner in which the frame is carried (Liechty *et al.*, 1992:37). A correct posture assumes a balanced alignment of all the body parts over each other and could influence the physical attractiveness of apparel items (Rasband, 1994:13). Rasband and Liechty (2006:29) state that excessively incorrect posture could be termed as a figure variation as it would cause fit problems with any apparel (**Figure 3.18**). It has also been reported that posture has a direct bearing on physical health and on how one visualises oneself. An overly erect posture, for example, may indirectly feel over-confident and arrogant, while a slumped posture tends to express fatigue and unpleasantness (Rasband, 1994:13; Rasband & Liechty, 2006:29).

					
Correct posture, with balanced pelvis	Overly erect back, with balanced pelvis	Rounded upper back and shoulders with a forward head and a balanced pelvis	Swayed back with forward pelvic tilt	Slumped posture, with forward pelvic tilt and a pronounced stomach	Rounded shoulders, forward head and backward pelvic tilt

FIGURE 3.18: POSTURES

(Sources: *Reader's Digest*, 1988:82-83; Liechty, Pottberg & Rasband, 1992:37-38; Rasband, 1994:78, 79, 122, 124, 134)

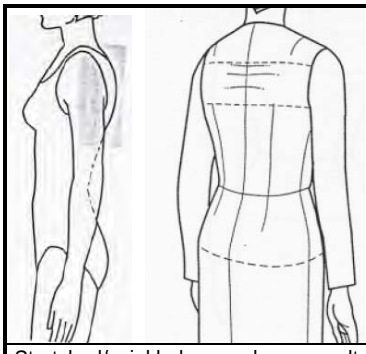
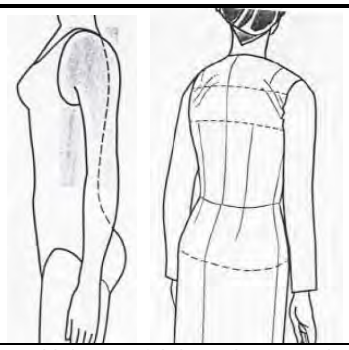
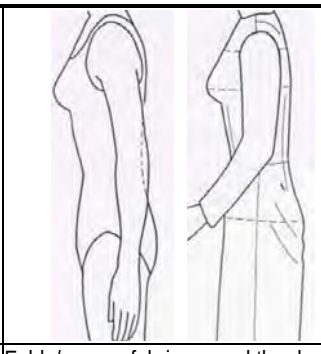
		
Stretched/wrinkled apparel as a result of rounded upper back	Folds/excess fabric on the apparel as a result of erect upper posture/shallow back	Folds/excess fabric around the derriere as a result of a swayed front and a backward pelvic tilt

FIGURE 3.19: FIT PROBLEMS RELATED TO POSTURE

(Source: Rasband, 1994:78-79)

3.2.4.2 Upper arm

Arm contours or the upper arm shape is important to all the apparel items with sleeves. The size of the arms (**Figure 3.20**) varies from thin (bony with little flesh), average (softly curved without excess flesh or muscle development), to full (heavy/fatty or masculine curves). An apparel item showing wrinkles or folds around the upper arm region is an indication that the contours of the wearer are either full/fatty/heavy masculine, or excessively thin (Rasband, 1994:106-108).

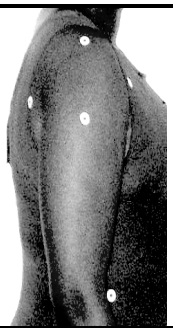
			
Slender biceps	Medium biceps	Large biceps	Wrinkles forming on the sleeve around the top arm as a result of large biceps

FIGURE 3.20: UPPER ARM SIZES AND FIT PROBLEMS

In Kenya, no research is available on body shapes. According to the KEBS (2001), the size tables meant for female apparel are presented with size codes and accompanying dimensions, but without any indication of body shapes. Since body shape acts as a design guideline for apparel manufacture, established body shapes would therefore facilitate ease of manufacturing as well as distributing suitable styles to a marketplace from which the body shape categories were developed.

It may also be argued that the lack of classified body shapes in Kenya is an indication of consumers' ignorance on size and fit issues with apparel, such as important parts of the body that are critical to the fit of the apparel. Since a classified body shape structure is the foundation from which fit-related problems are addressed, the lack of classified body shapes would therefore contribute to fit problems with apparel. Low-level skilled labour together with obsolete and inaccurate sizing systems (particularly on body shapes) – or a complete lack thereof – in Kenya, would be viewed as major contributing factors to the fit problems with apparel in Kenya.

3.3 TECHNIQUES USED FOR THE CLASSIFICATION OF BODY SHAPES

It is important for any country and/or apparel industry aspiring to satisfy their consumers with better-fitting apparel, to consider different techniques of classifying body shapes. Being a guideline for the designing and production of suitable and well-fitting apparel styles, body shape identification becomes critical in a country where there is such a lack of classified body shapes as in Kenya. Examining different techniques used for the development of classified body shapes could facilitate a deeper knowledge of the critical issues required to identify and isolate only the significant body characteristics that are critical to the fit of apparel.

3.3.1 Key dimensions necessary for the development of body shape

Body measuring techniques have been in use for many studies and have proved to produce reliable results when the recommended instruments and standards are applied. Different body measurements techniques were described in **Chapter 2 (paragraph 2.3)**. Successful body shape classification depends on the correct selection of the key dimensions (Chun-Yoon & Jasper, 1996). Key dimensions, also referred to as control dimensions, are the combination of those dimensions most closely related to other body dimensions (DOB, 1994:6; Robinette, 1986:573; Winks, 1997:24). O'Brien and Shelton (in Winks, 1997:14) stated that the success of body shape classification relies on special selection of the key body dimensions. In classifying variations in body builds, O'Brien and Shelton selected a pair of key dimensions, which they found to have low correlation between vertical and horizontal body dimensions. Stature was selected as the index of vertical dimensions because it was closely related to most vertical dimensions measured. Weight was selected as the index for horizontal, because it was highly correlated with most trunk circumference dimensions (O'Brien & Shelton, 1941 in Salusso-Deonier *et al*., 1985).

Kemsley (1957:56) also stated that a key dimension must be a good predictor of other related body dimensions, which are a collection of all the dimensions of all the body units covered by an apparel item. Kemsley (1957:70) selected the key dimensions by a correlation analysis within an anthropometric data set. He discovered that height and weight had the highest multiple correlation coefficients. However, bust and hip were selected because these two dimensions offered flexibility for varying relationships between upper and lower parts of the body. Key dimensions must be convenient to measure, must have a high degree of correlation with other dimensions important in design and sizing, but they should not be highly correlated with each other, and they should form an integral part of the apparel (McConville, Tebbetts & Churchill, 1979 cited by Chun-Yoon & Jasper, 1996:90).

Ashdown (1998) developed an optimised sizing system, which uses as many body dimensions as needed to account for the variability in the population. These sizing systems, according to Ashdown (1998:324), would potentially fit the population better than sizing systems that are currently based on one or two dimensions only. However, this complex method is not possible in countries without advanced technologies to facilitate easy grading. Ashdown (1998:336) confirmed this by saying, "If it were still the case that most grading was done by hand, this complexity of grading would be extremely labour intensive and therefore not worth any gains in the fit of sizes generated."

Devarajan and Istook (2004:7) in their study, selected bust, waist, hips, high hip, abdomen

and stomach based on the literature review and their professional expertise of more than thirty years in the field of apparel. This was used for the purposes of developing the software Female Identification Technique (FFIT©) for classifications of body shapes from body scanned and body dimensions data.

Most sizing systems developed in most countries vary in the body dimensions chosen to divide the population, but the basic structure of most sizing systems remains the same. Most have classified body shapes by height and drop value (the difference between the hip circumference and the bust circumference), so as to ease the problem of fit (Chun-Yoon & Jasper, 1993; Winks, 1997; Yu, 2004:185; Petrova, 2007:64).

Describing body shape with the use of body dimensions alone, cannot give a true representation of the proportions of the body. Body characteristics such as buttock prominence and breast protrusion cannot be exhaustively explained in terms of the dimensions taken around the most prominent protrusion of the breast or around the fullest part of the hip (McConville *et al*. in Simmons & Istook, 2003:309). The circumference dimensions obtained are one-dimensional and do not isolate contours and protrusions along the circumferential measurement. The depth/size of the protruding body characteristics such as the buttocks, the breasts and stomach, can only be understood through visual analysis of silhouette and profile images/photographs. Thus the body dimensions necessary for the development of body shape could be enhanced by critically evaluating body shape images.

3.3.2 Key physical characteristics of the body necessary for the development of body shape

Although body scan technology has demonstrated a high reliability in capturing three-dimensional body shape, its use in developing countries, as mentioned earlier, may not be practical in terms of the cost and technical skills involved. Detailed information on body scanning has been given in **Chapter 2** (**paragraph 2.3.3**). Salusso-Deonier (1989:373) stresses the importance of different body shape views from all angles as opposed to the usual front-view line drawings. She noted that this format precludes viewing the three-dimensional form, which allows artistic interpretation of variation in real humans' body shapes. For the purposes of this study, this demanded that images of female shapes be captured using the recommended techniques and modern technology. Since body scanning is impossible in a developing country such as Kenya, photography would be an alternative method as suggested by Ashdown and Dunne (2006). Though photography has been scantily used for the purpose of classifying body types, it has however produced reliable results (Douty, 1968 in Simmons, Istook & Devarajan, 2004a; Salusso-Deonier, Markee &

Pedersen, 1991; Kuma, 1999:39; Anderson *et al*., 2001:7).

Photography is the art of capturing images using either an ordinary camera filled with a film, or a digital camera. Other than describing body shape with the use of dimensions alone, in-depth descriptions can be enriched by the use of visual sensory evaluation of stimulus materials. This implies that human figures are photographed (stimulus material) for this purpose. Sensory evaluation as a method allows for the systematic, subjective evaluation of a product. It uses perception psychology to measure, understand and define the visual relationships of varied human body shape characteristics/variables that impact on a person's shape, such as the body's size, contours and proportions (Gazzuolo, DeLong, Lohr, LaBat & Bye, 1992; Bye & DeLong, 1994:1-3; DeLong, 1998:26-27; Istook *et a*l., 2003). This calls for consistency and reliability when photographing. An explanation of measures that were taken to ensure reliability and validity of photography are explained in **Chapter 4** (**paragraph 4.6.1.1**).

Although the body shapes already discussed in **paragraph 3.2.3** above are prevalent, it may be argued that the African female's body shape may differ from those already mentioned above, due to differences/changes in nutrition, lifestyle, ethnicity, age, grooming and concepts of ideal beauty within different cultural contexts. Most of the established figures appear to have been classified on the basis of front/back silhouette characteristics only, omitting the profile characteristics, which are critically essential to the fit of apparel. From the descriptions given under each shape, it appears that judgements have been based on dimensions and/or two-dimensional points of view**,** which are also clearly demonstrated by the two-dimensional symbols attached to each body shape. Another example is the assumption of evenly distributed weight on the back and front parts of the body, derived from circumferential dimensions rather than the visual, physical configurations of the various body components as they appear. However, it may be reasoned that the weight/size distribution of body components are not balanced or standardised, even amongst shapes of women assumed or thought to fall within the same category (Kwong, 2004; Zwane & Magagula, 2006). Most established body shape classifications have not incorporated striking side view characteristics (**Figures 3.21** and **3.22**).

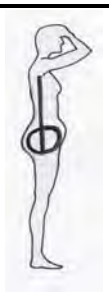
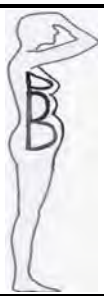
					
Proportional	Full large buttocks “d”	Protruding stomach “b” below waistline	Full bust “P”	All rounded “0”	Full bust extending to full stomach “D” and protruding buttocks “d”
					
Full buttocks “d” with heavy thighs	Full bust “P” with full buttocks “d” and heavy thighs	Full buttocks “d” with protruding stomach below waist “b”	Full bust “P”, protruding stomach below waist “b” and full buttocks “d”	Full bust “P”, full stomach above and below waist “B”	Full stomach above and below waist “B” and flat buttocks

FIGURE 3.21: SIDE VIEW BODY SHAPE’S STRIKING CHARACTERISTICS

Salusso-Deonier (1989) is of the opinion that it is important to view the body from all angles as opposed to the usual front-view line drawings. She noted that this format precludes viewing the three-dimensional form, which allows artistic interpretation of real human variations. She identified a key component of posture as pelvic tilt, which is only observable through profile analysis. The pelvis serves as a balancing point for posture and it results from the angle of the juncture between the spine and the pelvis. It is both inherited and influenced by posture and muscle development. **Figure 3.22** presents three different pelvic tilts identified and analysed by Salusso-Deonier (1989). However, the direction of the pelvis was not indicated, whether forward or backward; this could have facilitated a deeper understanding of the relationship between the pelvic position, the buttocks size/prominence, the back curvature and the posture generally (**Figure 3.18**). Backward pelvis is likely to result in a forward-headed body shape and flat buttocks, while a forward pelvic tilt results in a slumped posture, large buttocks and hollow back (Rasband, 1994:78-79).

		
1. Slight pelvic tilt Yields little curvature in lower back as well as flat buttocks	2. Moderate pelvic tilt Yields medium lower back curvature and slightly rounded buttocks	3. Full pelvic tilt Yields deep curvature and very rounded buttocks

FIGURE 3.22: DEGREE OF PELVIC TILT

(Source: Salusso-Deonier, 1989:373)

From the discussions of the different body shapes, it is clear that a critical evaluation of the body's characteristics that influence the fit of apparel items should be understood and categorised from all the views so as to facilitate the production of well-fitting or better-fitting apparel. However, consumers' ignorance about issues that relate to the fit of ready-made apparel items could also lead to inappropriate selection of ready-made apparel, even if the available merchandise were well made for different body shapes in a market. Consumers need to know their own body shapes as well as their key dimensions to be able to identify well-fitting or better-fitting apparel. They need to understand how their body shapes deviate from those of the ideal, so that they may appreciate their own body shapes and dress appropriately. As discussed in **Chapter 2**, Ashdown (2000) has given a breakdown of all the possible factors that may contribute to the fit of ready-made apparel. All these factors are related to the manufacture of the apparel and they happen throughout the production processes, from the design stage through to dispatch (Hudson, 1980; Salusso-Deonier, 1989).

3.4 FACTORS EXTERNAL TO APPAREL MANUFACTURE THAT MAY CONTRIBUTE TO POOR FIT OF READY-MADE APPAREL (FIGURE 3.23)

The magnitude of the problem of consumers' dissatisfaction with fit is an extreme challenge to both the retailers and the manufacturers of women's ready-made apparel. From the consumer's point of view, finding an apparel item that fits correctly can be time consuming and frustrating (Chun-Yoon & Jasper, 1996; Ashdown, 1998). Factors that are not linked to apparel production processes, but may contribute directly or indirectly to the fit of ready-

made apparel, are treated as factors external to apparel manufacture. They are the consumers' behaviours as they interact with the apparel in and outside a retail environment. Consumers' perceived satisfaction with the fit of a garment depends on physical comfort, psychological comfort as well as appearance (aesthetics).

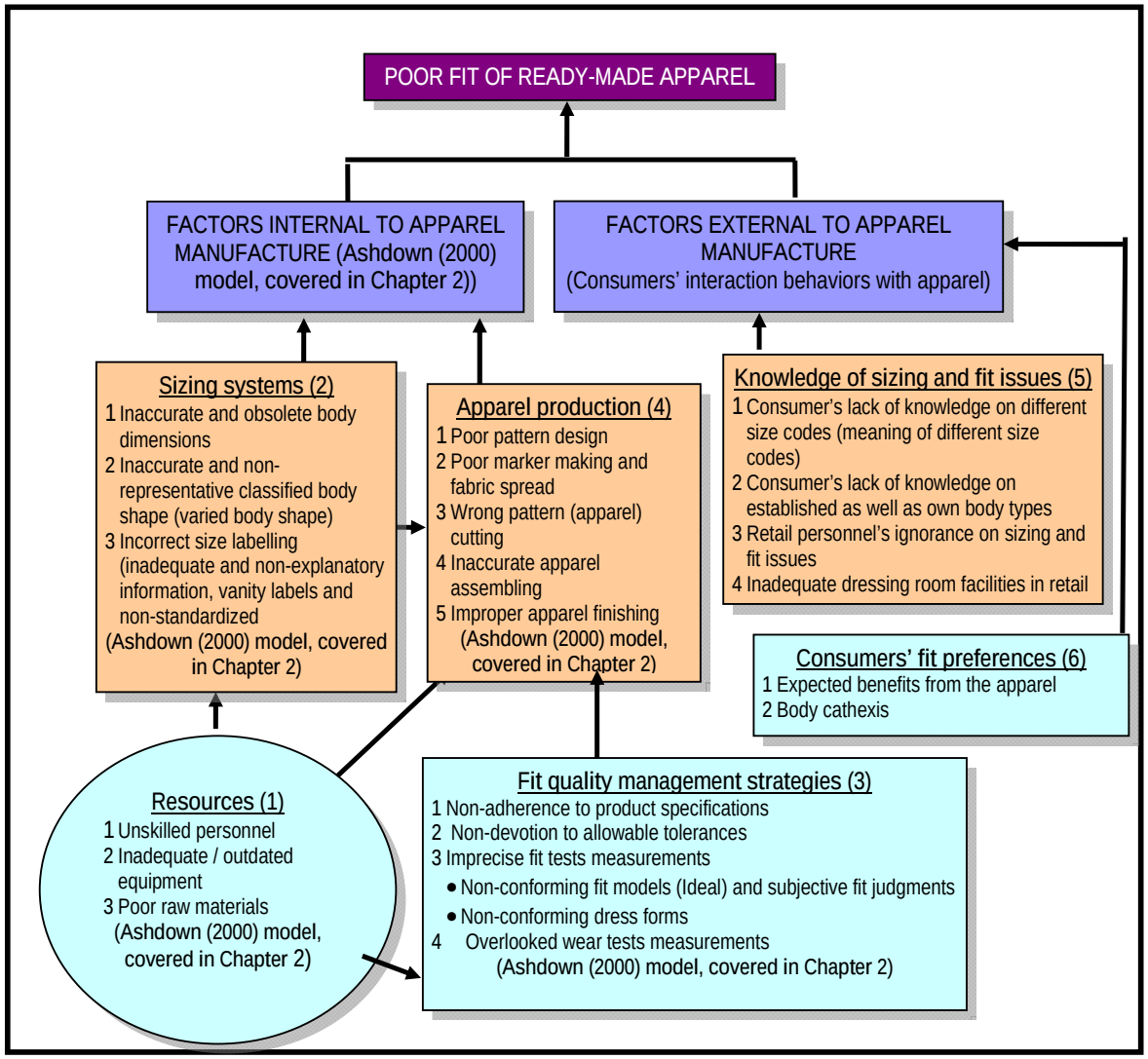


FIGURE 3.23: APPAREL MANUFACTURE'S INTERNAL AND EXTERNAL FACTORS THAT MAY CONTRIBUTE TO FIT PROBLEMS WITH APPAREL

(Based on: Hudson, 1980: 111-114; Solinger, 1988:37, 66, Salusso-Deonier, 1989; Glock & Kunz, 1995:98-111; Chun-Yoon & Jasper, 1996; Winks, 1997; Ashdown, 2000; Anderson *et al.*, 2001; Brown & Rice, 2001:154-156; Alexander, 2005a).

In a country such as Kenya, where little is known concerning apparel sizing and fit, the ignorance of both retailers and consumers about sizing and fit issues may also be a major

contributing factor for consumers' inappropriate selection of apparel items, and hence the fit problems they experience. **Figure 3.23** depicts possible internal and external factors in the manufacture of apparel that may contribute to fit problems. Since the factors internal to apparel manufacture were already discussed in **Chapter 2**, only factors external to apparel manufacture will be examined.

3.4.1 Consumers' fit preferences

For the purposes of this study, fit preference will be defined as the consumers' desired apparel fit. In a consumer market-driven society, the challenge to the apparel industries is not about giving consumers extra choices, but rather to contain consumers' preferences (Chun, 2007:221). Professional women, in particular, expect to get what they want with minimal time and energy spent on the apparel search (Kaiser & Garner, 2003:28-29). Consumers become loyal to certain brands and stores that repeatedly deliver satisfactory apparel in terms of size and style within the fashion trend of the time (Workman, 1991; Glock & Kunz, 1995:135). Consumers with different orientations have different preferences and needs within a specific social context. Apparel manufacturers must therefore gather information regarding the fit preferences of specific groups of people so as to be able to cater for their needs (Ashdown & Dunne, 2006). There are various reasons for a preference for certain fitted apparel. Closely fitted or body-hugging apparel may be preferred to emphasise certain body shape characteristics such as broad hips, large breasts or narrow waistline, while loosely fitted apparel may be worn to camouflage certain unpleasing body features. There are apparel benefits that consumers may achieve from differently fitted apparel.

Apparel benefits (expectations), according to Anderson *et al.* (2001), are the outcomes that a certain product may provide for the consumers. Differences exist within cultures as well as between cultures. Socio-cultural differences affecting aesthetic preference include geographic locations, ethnicity, religion, and sexual orientation (Fiore & Kimle, 1997:86). These differences often lead to divergence in aesthetic preference and consumer behaviour (Morris, 1993; Feather *et al.*, 1996; Marshal *et al.*, 2004:94).

Apparel manufacturers should tap into consumers' thoughts, beliefs and feelings pertaining to their fit preferences, so as to translate these into preferred apparel, which are also suitable for the different body shapes available within a market at a particular point in time (Keiser & Garner, 2003:29; Ashdown & Dunne, 2006; Lewis, 2007:310-311). Fiore and Kimle (1997:80) state that consumers' selection of a product strengthens, or gives credibility to, the situation, as selection shows acceptance or approval of the ideas that must be in harmony with different body shapes and sizes of the consumers. If consumers' fit preferences were

incorporated into different styles suitable for the established body shapes, there would be satisfying, better-fitting apparel within the fit preference context. According to Shim and Bickle (1994), the most common apparel benefits sought by females are said to be the following:

- Self-improvement: Human beings have the desire to beautify their bodies, either by enhancing existing attractive characteristics or camouflaging unsatisfactory ones. Beauty enrichment could be attained from make-up and apparel's qualities of the structural composition, such as the colour, texture, pattern, fabric and the silhouette (shape) or style (Spillane, 1995:91; Romano, 2000:11-14, 23-24).
- Sex appeal: Physical attractiveness affects a person's well-being, as people are judged based on their appearance. Apparel designed to almost expose some sensual parts of a woman's body, for example, could be seen as or may be used for sex appeal (Stone, 1999:51; Romano, 2000:59). In cases where the characteristics of the natural physical body are not attractive enough, they are transformed to achieve standards of ideal beauty through the invented grooming techniques such as make-up, fitness and varied apparel styles, even if they could not meet the standards before.
- Social status/prestige: This may be achieved by wearing apparel for self-expression and to create individual effect. Combining various fashion components, dressing expensively and/or imitating the famous people in a way, could be seen as prestigious. Branded apparel may also be seen as a form of status (Stone, 1999:51, 60-61). However, a consumer whose body shape's characteristics does not meet those of the standard ideal body shape, would only attain prestigious status if the apparel styles selected are suitable and flattering for their kind of body shape (Fiore & Kimle, 1997:331).
- Body shape flaw compensation: Consumers with unattractive physical features (body cathexis), may also have special aesthetic preferences and functional needs for apparel products. Although the body shape may not be perceived as ideal, consumers with this kind of body are usually interested in an aesthetic appeal that would camouflage and enhance their appearance (Zangrillo, 1990:4; Rasband, 1994:12; Spillane, 1995:22-44; Romano, 2000:24-56).
- Fashion leader: This would entail taking the lead in purchasing new fashion on the market. According to Stone (1999:60), a fashion leader is a person constantly seeking individuality, an individual constantly daring to be different. Since appearance is culturally constructed, an individual's expectations of what is beautiful are most likely to be influenced by her culture's ideal figure (Roach & Eicher, 1973:95).

In Kenya, however, there is no available research on consumers' fit preferences or expectations. It is assumed that people's body shape characteristics, culture and the fashion

trend are likely to influence the consumers' fit preferences. Considering that there are no classified body shapes in Kenya, it may be assumed that consumers' choices are made on the basis of the Western ideal body shape characteristics. Although body cathexis is not the focus of this study, it is imperative to bring forth the underlying factors for a satisfactory image, which could then be translated into appropriate apparel that can provide all the benefits expected by the consumers.

3.4.2 Consumers' preference for an ideal body shape

Consumers may have troublesome physical features, which may affect their aesthetic preferences and functional needs for apparel products (Schofield *et al*., 2006). A consumer whose body shape does not conform to the ideal figure's size and proportions would choose apparel close to her size from the available apparel, even if it is not suitable to her body proportions. Sizing systems used in the apparel industry are based on an ideal body shape, which ready-made apparel manufacturers usually interpret as the characteristics of that ideal figure (Morris, Cooper & Cooper, 1989; Salusso-Deonier, 1989; Zwane & Magagula, 2006). Consumers judge the reinforcement effect of apparel on their own bodies and make assumptions about the effect, based upon the images in promotional media. When the apparel does not fit as it did on the model, the consumer may perceive the cause as being related to her body rather than to the apparel. She forgets that the interaction of the apparel on her shape differs from that on the model or the ideal figure. All this, results in negative feelings (body cathexis) towards her own body shape rather than to the apparel (LaBat & DeLong 1990; Fiore & Kimle, 1997:30; Yu. 2004:33).

Body cathexis is an evaluative dimension of body image. It is defined as positive and/or negative feelings towards one's body (LaBat & DeLong, 1990:43). Body image is a mental perception of one's body and may influence one's general desire for apparel and even one's self-confidence (Fiore & Kimle, 1997:92). How people experience their bodies affects their pursuit of beauty and, consequently, their desire for products and services to enhance their bodies (Domzal & Kerman, 1993). Rudd and Lennon (1994:167) observe that it might be impossible for many women, particularly those with large bones, to attain the ideal body shape. In this case, the apparel industry should ensure that apparel is available that is suitable for these people.

The negative feeling towards the self could be aggravated even further, if each time a woman goes shopping, she does not get suitable and better-fitting apparel. It becomes worse if the apparel industry does not respond to her needs, by providing fashionable or attractive apparel to fit her body. In a study correlating body cathexis and satisfaction with the fit of

ready-made apparel, Shim and Kotsiopulos (1990) observed that petite women were less satisfied with their bodies, and most dissatisfied with the fit of apparel, compared to average-/medium-sized women. Large-sized women have also been reported to be less satisfied with the sizing and fit of apparel (Salusso-Deonier *et al*., 1985). Understanding how cultural standards impart body image and body esteem would also influence apparel-sizing and fit decisions for a specific market (Salusso-Deonier, 2005). Research on consumers' satisfaction with their self-images is not readily available in Kenya. Body cathexis is an important factor, but it is beyond the scope of this study.

3.4.3 Knowledge about the communication of apparel sizing and fit

According to Shani, Sena and Olin (2003), knowledge is viewed as a socially constructed phenomenon within the context of collective learning cycles in any environment. It may be seen as the cognitive comprehension capacities of people, the accumulation of facts and the ability to see functional relationships between them. Knowledge requires assumptions, interpretations and rules. True knowledge is being able to take the interpreted information and understand the relationships in a social context (Shani *et al*., 2003). Since there is no literature on consumers' knowledge pertaining to apparel sizing and fit, literature that would provide supportive theory for this specific topic, would be on consumer socialisation and product-related consumer socialisation.

Consumer socialisation and product-related consumer socialisation are important for the professional women consumers to enable them to make informed and responsible purchasing decisions regarding the selection of well-fitting apparel. Their selections will depend on their previous experiences with the apparel items, the support they get from the retail environment, their education level and personal fit preferences and expectations. These factors will influence the apparel evaluation in terms of size, style, functional, performance, and care attributes. All these facts are supposed to be communicated effectively through an apparel label/tag (Mason *et al.,* 2008). It would enhance consumer satisfaction if they could receive quality products repeatedly that meet their needs (Reid & Brown, 1996). Consumer socialisation is defined as the process by which people acquire skills and knowledge relevant to their functioning as consumers in a market place (Hawkins *et al*., 2001:212). Consumer socialisation is both directly and indirectly related to consumption. The first is concerned with the acquisition of skills and knowledge relevant to budgeting, pricing and brand attitudes. The latter is concerned with underlying motivations that stimulate an individual to seek further detailed information and to purchase the products, even though he/she has not been exposed to them before (Sciffman & Kanuk, 2000:346-351). The latter is significant for this study, because when the consumer encounters

physically attractive apparel, purchases could only be made once the apparel's label/tag has been consulted, and the apparel item tried on to check the size, style and perhaps fibre content and care instructions. When the consumers can establish and understand their sizes and body shapes, their decision-making behaviour will be simplified because they would already understand how apparel that is labelled in a specific way would fit. A lack of knowledge will therefore lead to inappropriate apparel selection, and hence fit problems.

Aspects of size presented on a size label are those factors pertaining to the body dimensions that are necessary for the production of a specific apparel item. Those key dimensions that are critical to the fit of a specific apparel item, and were used for its construction, should be presented on a size label/tag. The waistline, the hipline and the length of a skirt, for example, are the key dimensions required on skirts' size labels, while the bust measurement is an important key dimension for an apparel item covering the top part of the body. Critical aspects of fit are mainly the characteristics of the body, the apparel silhouette and how they relate to each other harmoniously, resulting in what DeLong (1998:27) refers to as apparel-body-construct. The styles produced in an apparel industry should be based on the common body shapes found in a target market. The label/tag attached to an apparel item should therefore indicate the body shape, which it should fit.

The body as a pre-existing physical structure may be used as a basis for the visual presentation of apparel. The interrelationship between body and an apparel item creates the integrated body-apparel silhouette, which either accentuates or de-emphasises characteristics of the body, as may be desired (Davis, 1980:73; Salusso-Deonier, 1989; Keiser & Garner, 2003:315). A consumer who is well informed on issues pertaining to the apparel's sizing and fit and the body shape's characteristics would be able to successfully select a pleasing apparel item. Retailers who are devoted to satisfying their consumers should provide information on how each size is classified (in other words, the key dimensions). They should also provide instructions on how to take specific body dimensions for specific apparel items, and how to evaluate and identify different body shapes. Ashdown and Dunne (2006) observed that consumers' self-dimensions were more accurate when instructions and illustrations showing how to take those dimensions, were given.

Literature on size and fit issues tailored specifically for the consumers' use, are available in the form of textbooks, magazines, brochures and as electronic versions online. Most of these books and magazines have been written in the developed countries and are tailored for the Western body shapes and sizes as well as for a light skin. The consumers in the developing countries could hardly access them. It may be argued that even if those books were available in the marketplaces of developing nations, the principles laid down would not be fully

applicable for dark-skinned persons who have very different body shapes, sizes and builds. In such cases, therefore, the retailers and perhaps the researchers/scientists are responsible for the lack of the necessary information reaching to the consumers. On the basis of the United Nations' consumer rights (1985), consumer education is valued worldwide, and not confined to developed nations only. The discipline of consumer science actually concerns itself with responsible, informed consumer decision-making; thus professionals in the field of apparel and textiles attempt to educate consumers and assist them with relevant product information to enable them to make appropriate purchasing decisions. Consumer education on size and fit issues in Kenya is not happening.

Consumers' ignorance about the communication of sizing and fit, and the terms used on size labels, means that some education in this regard is necessary. Consumers' knowledge on how to link size label information to their own shapes and dimensions could be regarded as a matter of concern. It would be pointless to sell apparel that the consumers cannot relate to their own body dimensions and proportions. Women's apparel lacks the kind of correlation that men's sizes have; most women sizes are not expressed as body dimensions, but rather as arbitrarily chosen numbers or letters that correlate with sets of unrevealed body dimensions (Holzman, 1996; Workman & Lentz, 2000; Brown & Rice, 2001:147-148; Faust *et al*., 2006). There is flawed communication amongst the stakeholders, on problems related to the communication of size and fit of apparel, right from the dressing rooms of the retail environment through to the manufacturers (Ashdown, 2000). Although size labels are not obligatory (Keiser, 2003:336; Faust *et al*., 2006), the way they are presented to the consumers plays a major role in the apparel selection exercise. As mentioned earlier, informative (self-descriptive) size labelling that relates directly to body dimensions would contribute to consumer satisfaction (Chun-Yoon & Jasper, 1995; Holzman, 1996).

Professional women in particular expect to get what they want with minimal time and energy spent in the apparel search (Kaiser & Garner, 2003:28-29). Uninformative labels would make their frustration and humiliating experience during apparel selection worse. On the other hand, presenting informative size labels to the informed consumers would make their apparel search easier and provide satisfactory, better-fitting apparel. According to KEBS (2001:7-9), the size designation of each apparel item should be indicated clearly, in plain and legible form on a label or a swing ticket. In contrast to this, the sizes presented on the ready-made apparel in Kenya are uninformative. It seems that retailers/manufacturers generally do not disseminate the correct information pertaining to body shapes and/or sizes to their clients (Faust *et al*., 2006). An improved understanding of the consumer's knowledge/ignorance on the communication of sizing and fit would be valuable in terms of consumer education and facilitation, and will enlighten the apparel industries to supply satisfactory apparel items

affixed with durable, legible and informative size labels/tags. Size communication systems have been discussed in detail in **Chapter 2** (**paragraph 2.6**).

Any sales transaction is a dyadic interaction between a consumer and a salesperson and is an important determinant of the consumer's overall satisfaction with a service (Solomon, Surprenant, Czepiel & Gutman, 1985). Sales people in a retail store often influence sales (Reynolds & Arnolds, 2000; Regan & Llamas, 2002). Knowledge has been cited as one of the key dimensions of service quality (Kim & Lennon, 2005). It is assumed that the retail personnel, particularly in developing countries, lack knowledge on sizing and fit issues. They might not know the correct key body dimensions necessary for specific apparel items, nor the varied body shapes available in the market. Unskilled personnel would not sufficiently guide the consumers to search for better-fitting and more flattering apparel items. In actual sense, sales persons should have knowledge on which styles, and from which company, an apparel item would accommodate variations in size and shape.

Consumers' satisfaction with apparel depends on its aesthetic appeal, which is attributed to the interaction between the body and the apparel. Consumers judge the apparel's appeal, as it interacts with their bodies. It is therefore important to have fitting room facilities that are well equipped with full-length mirrors, adequate ventilation and lighting, to facilitate a thorough evaluation of the apparel before the consumers make a purchase. A lack of fitting room facilities in a retail store could also be viewed as a contributing factor to problems with apparel fit. A customer who does not properly evaluate an apparel item before purchasing it, could discover fit problems later at home. The solution to this problem could be to educate the consumers and the retail personnel on sizing and fit issues, thus enabling them to recognise varied shapes and to identify the key dimensions necessary for every apparel item and size. They should also be able to practically and accurately take those key body measurements for different apparel items, and be competent in the use of the principles and elements of design, so as to guide consumers while selecting styles and sizes for the varied body shapes. The importance of fitting room facilities and after-sales service could also be emphasised, along with accurate sizing systems (Zangrillo, 1990:21; Rasband, 1994:58).

In Kenya, one can assume that most consumers and apparel sales assistants are uninformed on apparel sizing issues, particularly on the key dimensions necessary for identifying a size, taking body measurements and correlating them to the sizes of apparel. One may also assume that they are uninformed about the various body shapes, principles and elements of design that are used to flatter the different body shapes. Most retailers have very small and congested dressing rooms, not conducive for trying on and evaluating an apparel item's fit before making any purchasing decisions. It is important that consumers'

knowledge about sizing and fit issues should be addressed alongside body shapes classification to facilitate a base from where to address the fit problems.

Size chart (measurement table) can only be effective if it is applicable to the people for whom it is designed (Winks, 1991; Shin & Istook, 2007). Fitted apparel, irrespective of fabric and style, usually ends up in the closet unworn, being altered or even given away. This causes loss and disappointment to the consumers. The success of well-made apparel could only be achieved, if the consumers are able to efficiently and effectively select apparel items without undergoing the exasperating exercise of trial and error in the retail environment. This implies that those dimensions and body shapes used during the construction of apparel must be true representations of the dimensions and the body shapes of the target consumers. Those dimensions and body shapes must also be communicated effectively to the consumers who in turn should be able to interpret and link them to their own sizes and body proportions.

In Kenya, however, there are no classified body shapes to act as design guidelines. The sources of the size standards are also flawed and thus cannot guarantee the quality of ready-made apparel. Communication of sizing and fit through size labels is also flawed and is uninformative, making it difficult for the consumers to use effectively. Ignorant consumers in the market place would not find them useful, as they would continue to guess and estimate how an apparel item would fit their sizes and body proportions. Size labelling is a tool for communicating sizes and body types to the consumers and to assist them in choosing apparel that would fit their body shape and size appropriately. Such labels are supposed to indicate dimensions and to describe the body shape that the apparel was designed to fit (Glock & Kunz, 1995:108; Chun-Yoon & Jasper, 1996:89). Furthermore, labels should indicate whether the person is tall with large/small bust and large/small hips, short with large/small bust and large/small hips, or regular (medium height) with large/small bust and large/small hips. These fit indicators provide a foundation of judging the suitability of an apparel selection for a particular body type and size. Non-instructive size labels become almost meaningless to uninformed consumers on size and fit issues.

3.5 CONCLUSIONS

From the literature review, it is clear that consumers in various parts of the world, particularly women, encounter problems with the fit of ready-made apparel. The implications these problems have on the clothing industry are also costly and burdensome. Based on the literature review covered in **Chapters 2** and **3**, the following conclusions in relation to the focus of this study are hereby given:

3.5.1 Female body shape classifications

Based on the literature about the female body shape, it is evident that:

- The lack of varied body shape representation in a sizing system is one of the contributing factors to the fit problems experienced with apparel.
- Female body shape identification forms the basis of developing a successful sizing system. The success of any body shape categorisation depends on the correct classification techniques being applied, the selection of the key dimensions, which must be taken accurately, and/or evaluating photographs/images.
- An understanding of different body shape characteristics or components that are critical for the production of apparel patterns, could lead to an understanding of the theoretical issues concerning female body shapes, and hence to the manufacturing of better-fitting apparel for the various body shapes.

3.5.2 Consumers' knowledge about size and fit communication systems

Regarding consumers' knowledge about size and fit communication systems, it is evident that:

- Consumers' lack of knowledge about the codes and contents of different size labels, can lead to inappropriate apparel selection and hence fit problems.
- Uninformative size codes are not instructive enough to guide the consumers while selecting appropriate sizes and styles.
- Informative size labels can only be effective if the consumers are able to link their own key dimensions and shapes accurately to the information provided on the size labels.
- Recognising consumers' lack of knowledge on sizing and fit issues from the consumers' point of view, will allow researchers and apparel manufacturers to understand fit problems in the light of a lack of knowledge. Based on this understanding, measures can be devised to educate the consumers. Consumers potentially have much to gain from well-orchestrated consumer education efforts that are jointly endorsed by concerned parties at both the micro- (apparel manufacturers/retailers) and the macro-levels (governmental agencies and private consumer-oriented organisations).

3.5.3 Fit preferences

Concerning consumers' fit preferences, it is clear that:

- Consumers' fit preferences that do not harmonise with their critical fit points can contribute to fit problems, hence the need to educate the consumers on the elements

and principles of design to provide them with knowledge regarding the selection of suitable apparel for specific body shapes and sizes.

- Understanding the fit preferences of female consumers can help apparel companies to realistically produce suitable and better-fitting apparel within the consumers' desired fit.
- If apparel manufacturers produce apparel without taking into account the fit preferences of the consumers, the available products could be purchased based on availability rather than on what the consumers desire.

All the information gathered based on the above conclusions, can in the end be used as input units for the development of a knowledge base that can lead to practical designing, predicting the degree of fit, and ultimately the production of better-fitting apparel in Kenya. This will enhance customer satisfaction and increase financial gains for the apparel industry (LaBat 1989; Gersak, 2002).

Based on these conclusions, schematic framework (**Figure 3.24**) was developed.

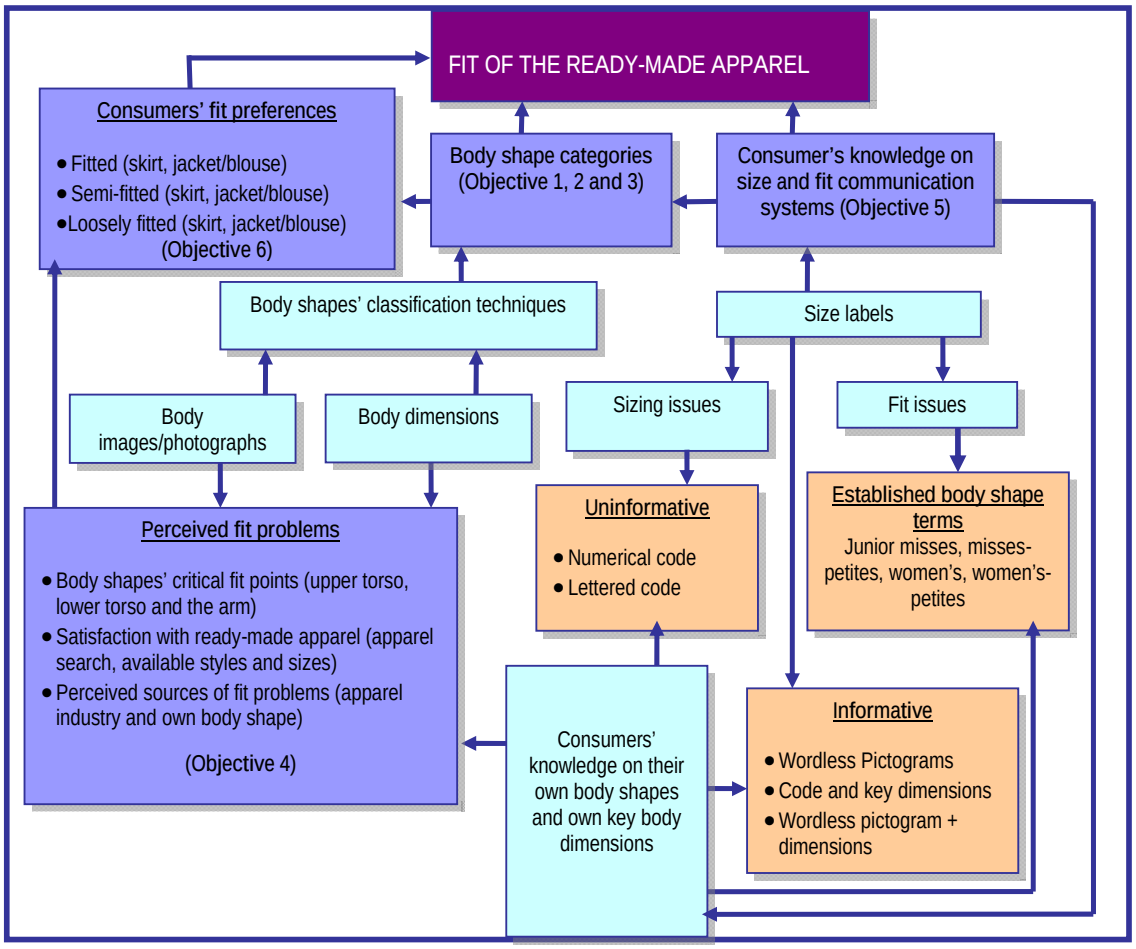


FIGURE 3.24: SCHEMATIC FRAMEWORK

The framework (**Figure 3.24**) includes the objectives of this study and have been conceptualised from the theoretical definitions within the literature covered in **Chapters 2** and **3** of this study. The dimensions and concepts presented play important roles in the fit of ready-made apparel.

Strategies to address the above-mentioned problems of this study are discussed in **Chapter 4**.

Chapter 4

RESEARCH METHODOLOGY

4.1 INTRODUCTION

The purpose of any research undertaking is to explore and describe phenomena leading to the generation of applicable results (Neumann, 2000:21). The research question in this study addresses an everyday problem in World 1 (W1), where people's knowledge has been acquired through experience and learned through tradition. World 2 (W2), being the world of science, tries to use the phenomena of W1 as objects of research and attempts to investigate these in a systematic and methodological way. Research methodology refers to the methods, techniques and procedures used to implement the research design. This process enables the scientist to examine the phenomena in the most accurate manner and make truthful (epistemological) judgements about them (Babbie & Mouton, 2001:10-11). World 3 (W3) is the world of meta-science where the development of academic disciplines stems from. This discipline takes W2 (the world of science) as the object of investigation and reflects thereupon (Mouton, 1996:8-9). Thus empirical, scientific inquiry begins with a movement from W1 to W2 (Mouton, 1996:64).

For the purposes of reliability and validity of the study, the methods, techniques and procedures must be carefully chosen. However, the choice of the research instruments and techniques would depend on the nature of the research problem statement, the research objective, the expectations of the researcher, and to a certain extent the resources available (Morse in Schurink, 1998:253; Babbie & Mouton, 2001:XXV). From the review of the literature, the conclusions given in **Chapter 3** and the schematic framework (**Figure 3.24**) of the main concepts of this study, it is clear that all the aspects mentioned have implications for the choice of the research strategy, data collection methods and statistical analyses used in this study. In order to obtain results that are reliable and valid, this chapter gives an exposition of the aspects employed for this study. They are:

- The chosen research framework and the research questions, which are stated as the primary objectives and sub-objectives for this study.
- The research strategies that are employed under two phases in the study, are
  - the samples chosen for the study,
  - the choice, description and application of data-collection methods for phases one

and two of the study,

- analysis of data for phases one and two of the study,
- the quality of the study, and
- how the research ethics were observed.

Figure 4.1 on the next page, outlines the research framework, phases and objectives of this study.

<table>
<tr><td rowspan="2">PHASE ONE</td><td colspan="3">QUANTITATIVE DATA (BODY SHAPE CLASSIFICATION) THROUGH BODY DIMENSIONS AND PHOTOGRAPHS
(Objectives 1, 2 and 3)</td><td rowspan="4">THE FIT OF FEMALE'S READY-MADE APPAREL</td></tr>
<tr><td colspan="2">Career women's body dimensions</td><td>Career women's body images/Photographs</td></tr>
<tr><td></td><td colspan="2">1. Top part of the body (the shoulder slope, the bust, the waist, the sleeve length and upper arm (biceps), bust extension and the arc measurements of both front and back body at bust, and both front and back waist arc measurements).
2. Lower part of the body (the hip, the broadest hip region, the thigh, the arc measurements at the waist, hip, and the buttock extension)</td><td>1. Front view's areas for scrutiny: whole body, shoulder, bust, top arm, waist, hip sizes and the thighs
2. Side view's areas for scrutiny: bust prominence, back curvature, stomach prominence, pelvic tilts/buttocks and thigh bulge and height proportions
3. Back view's areas for scrutiny: whole body, shoulder, waist, hip sizes, top arm and thighs</td></tr>
<tr><td rowspan="2">PHASE TWO</td><td colspan="3">QUANTITATIVE DATA, THROUGH QUESTIONNAIRE
(Objectives 4, 5 and 6)</td></tr>
<tr><td>Career women's general fit problems with ready-made apparel (Objective 4)</td><td>Career women's knowledge about size and fit issues (Objective 5)</td><td>Career women's fit preferences (Objective 6)</td></tr>
<tr><td></td><td>1. Fit perception of different apparel categories
2. Fit problems at specific critical fit points (neck, bust, shoulders/shoulder blades, nape to waist, waist, armcye, upper arms, abdomen, hips/buttocks, thighs and crotch line)
3. Satisfaction with the fit of ready-made apparel
4. Perceived source of fit problems</td><td>1. Communication of fit issues (Junior Females, Females petites, Misses, Misses-petites and linking to their own body shape)
2. Communication of sizing issues (meaning of size codes and linking to their own dimensions)</td><td>Fit preference for differently fitted apparel items
1. Fitted jackets and skirts
2. Semi-fitted jackets and skirts
3. Loosely fitted jackets and skirts</td></tr>
</table>

FIGURE 4.1: RESEARCH FRAMEWORK AND PHASES FOR THE STUDY

From the research framework and research phases (**Figure 4.1**, previous page), the following research questions directed the investigation:

- What are the distinctive body shapes of career women in Kenya and how do they differ from the Western distinctive body shapes?
- What implications for the fit of apparel are associated with Kenyan career women's distinctive body shapes?
- What are the distinctive differences in body proportions among the different age groups of Kenya's career women?
- What are the general fit problems that career women encounter with the ready-made apparel in Kenya?
- Do career women lack knowledge about the communication of size and fit, and how does this contribute to their fit problems with ready-made apparel in Kenya?
- What are the career women's fit preferences for differently fitted apparel items and how do these contribute to the fit problems of ready-made apparel in Kenya?

4.2 PRIMARY OBJECTIVES AND SUB-OBJECTIVES OF THE STUDY

Primary objective 1: **To identify and describe distinctive female body shapes of career women in Kenya from body dimensions and photographs**

Sub-objective 1.1: To identify and describe distinctive female body shapes of career women in Kenya from the body dimensions

Sub-objective 1.2: To identify and describe distinctive female body shapes of career women in Kenya from the photographs

Sub-objective 1.3: To establish and describe associations between distinctive shapes emerging from body dimensions and those emerging from the photographs of the career women

Primary objective 2: **To distinguish and describe differences between the emerging distinctive body shapes (from measurements and photographs) and the Western distinctive body shape**

Primary objective 3: **To scrutinise and describe the fit implications associated with the emerging distinctive body shape of the career women**

Primary objective 4: **To assess and describe career women's self-perceived fit**

issues with the ready-made apparel in Kenya

Sub-objective 4.1: To investigate career women's perception of fit with different apparel categories that are sold in various retail stores in Kenya

Sub-objective 4.2: To describe fit problems that career women in Kenya encounter regarding the specific critical fit points of different parts of their bodies

Sub-objective 4.3: To describe career women's degree of satisfaction with the process of finding appropriate ready-made apparel items in Kenya

Sub-objective 4.4: To explore career women's self-perceived sources of fit problems with apparel in Kenya

Primary objective 5: **To determine and describe Kenyan career women's knowledge about the communication of size (key body dimensions) and fit (body shapes)**

Sub-objective 5.1: To explore Kenyan career women's knowledge about the communication of size

Sub-objective 5.2: To explore Kenyan career women's knowledge about the communication of fit

Primary objective 6: **To determine and describe how career women's preferences for differently fitted skirts and jackets may contribute to fit problems with apparel**

4.3 RESEARCH STRATEGY CHOSEN FOR THIS STUDY

This study is exploratory and descriptive in nature. Fit problems with ready-made apparel associated with career women' distinctive body shapes, career women's knowledge about the communication of size and fit as well as career women's fit preferences have not been addressed in Kenya. Considering that these issues are new in Kenya, an exploratory study was carried out in order to obtain an insight into a relatively new area of study (Babbie & Mouton 2001:80). According to Miles and Huberman (1994:23), no research study can claim inductive purity, because all research begins to a certain extent with existing knowledge and builds on previous research. This study initially followed a deductive route, starting with an abstract idea, obtained from a thorough review of the literature covered in **Chapters 1, 2** and **3**. From this, some guiding principles could be extracted for the quantitative research

approach used (Neumann, 2000:132).

Although data collection occurred simultaneously from the participants, this research is divided into two phases for practical purposes and ease of presentation (**Figure 4.1**). In the first phase of the study, the career women were measured and photographed for the purposes of sorting out and identifying their distinct body shapes. The second phase was to determine by means of a structured questionnaire, general problems that career women experienced with the fit of ready-made apparel, their knowledge about size and fit, and their fit preferences.

Based on the research problem statement, and the primary objectives and sub-objectives formulated for this study, a quantitative research style was selected as the most suitable paradigm. In quantitative research, the process of measurement begins after the research question has been formulated, the variables identified and the units of analysis determined. This is done to develop clear definitions and create measures that will yield precise and accurate findings (Neumann 2000:132). In order to gain a broad understanding of the stated phenomenological issues of this study, an extensive literature search was done, as clearly indicated in **Chapters 2** and **3**. This study primarily followed a deductive route by starting with an abstract idea as stated in **Chapter 1**, followed by measurement procedures with concrete indicators, and ending with empirical data (precise numerical information) that represents the abstract ideas, as presented in **Chapters 5** and **6** of this study. The measurement techniques that were used, were precise, linking the relevant concepts with the data and predicting what the data would be (Neumann, 2000:158). This study was cross-sectional, implying that it was undertaken at a specific point in time and not over a long period.

4.4 CHOICE OF THE RESEARCH SAMPLE FOR THE STUDY

4.4.1 Units of analysis for the study

The units of analysis for this study (in both phases) were female urban high-school teachers between the ages of 25 and 55 from three major cities (Nairobi, Kisumu and Eldoret) situated in the central and western regions of Kenya (**Figure 4.2**). They were used to represent urban career women in Kenya. The decision to use urban high-school teachers was taken because the teaching profession in Kenya has the highest percentage of female employees (KNUT, 2001:1). Considering the time constraints, these groups of women had the advantage of time and financial savings, as they would be exposed simultaneously to the same stimulus

material and measured at the same time, at their respective schools (Delport in De Vos, 2002:175).

For the purposes of this study, a career female is described as a woman whose growth in height is completed (International Standards Organization (ISO)/TR 10652, 1990:32), and who is pursuing a certain profession as a means of earning an income (Callahan, 1988:31). Career women are exposed to fashion, and have got the means and the incentive to respond to fashionable apparel, but are also critical regarding the way that apparel items fit (Stone, 1999:39; Klepp & Storm-Mathisen, 2005:329). Women in the teaching profession also fall within a wider age bracket suitable for the study. It is assumed that females attain their profession by the age of 25, while retirement age in Kenya is 55. There are enough urban high schools in the two regions, to obtain the sample from. Given that this study was undertaken in two regions of Kenya (**Figure 4.2**), the findings of this study shall not be generalised to the entire population of career women in Kenya, but rather to the career women of the two regions only. The following criteria (**Table 4.1**) were used to select the respondents for participation in this study.

TABLE 4.1: CRITERIA USED FOR SELECTING THE CAREER WOMEN

CRITERION	JUSTIFICATION
Respondents had to be females.	Females' ready-made apparel offers a variety of styles and changes fast (Hogge *et al*., 1988), whilst their body shapes are also varied and dynamic.
They had to be between the ages of 25 and 55.	It is assumed that females attain their profession by the age of 25. In Kenya, retirement age is 55.
They had to be employed in a full-time or part-time profession of teaching.	Involvement in activities that save time (wasted in shopping and apparel selection and trials) is greater for a woman in a profession than unemployed females (Stone, 1999:38). Female professionals would have the income to spend on apparel.
They had to have a post-school education with a diploma or a degree certificate.	The more educated a woman, the more she is exposed to and willing to try out new fashion, and the more critical she would be about the fit of her apparel (Stone 1999:36-37).

4.4.2 Sample selection for the study

Kenya as a country covers a large geographical area. It was not possible to study the whole area within the time constraints at the time of research. The study was therefore limited to two geographical regions situated at the western region (comprising Kisumu and Eldoret), and the central region (comprising Nairobi city) of Kenya (**Figure 4.2**). The sample size was predetermined before the fieldwork commenced; however, while in the field, unanticipated problems arose which demanded that the initial plan be revised.

FIGURE 4.2: GEOGRAPHICAL AREAS COVERED FOR THE RESEARCH

4.4.3 Initial plan of sample selection for both phases of the study

Two samples were to be drawn from the two regions of study (one sample from each region). There are 41 urban high schools in the western region (Kisumu has 20 and Eldoret has 21

schools), with a total population of 1083 female teachers. There are 35 urban schools in the central region (Nairobi), both private and government schools, with a population of 1052 female teachers. Both regions together yielded 2132 (1083+1052) female teachers. The entire population sample was selected using the probability sampling technique (**Appendix 2A**) for the purposes of addressing all the objectives of the study, involving empirical body measuring (phase one), photographing (phase one), and the use of questionnaires (phase two). This method was chosen because in the probability sampling technique, all the elements in the population would have an equal (or unequal and subsequently weighted) chance of selection, as it avoids any conscious or unconscious bias on the part of the researcher in the selection of elements. There is also an excellent chance that the sample selected will closely represent the population of all elements. Although they may not be perfectly representative in all respects, controlled methods permit the researcher to estimate the degree of expected error (Kerlinger, 1986:110-111; Bailey, 1994:90; Babbie & Mouton, 2001:201-202; Strydom & Venter in De Vos, 2002:205). Prior to the fieldwork, a list of schools had been obtained from municipal education offices in both regions of study. Systematic sampling methods were applied for each region.

In the Kisumu region with 20 schools, the ninth number was randomly picked as a starting number. Thereafter, every third school was picked from the list, making a total of 6 schools to be studied. The list of names of the teachers from the selected schools was to be obtained from the respective schools, to facilitate further selection of participants, using the same procedure of every third person on the list, after the first number had been determined by flipping a coin (heads – odd number, and tails – even number). A total of 76 female teachers were thus randomly selected from this region to participate in the study.

In the Eldoret region with 21 schools, the fifth number was randomly picked as a starting number. Thereafter, every third school was picked from the list, making a total of 6 schools to be studied. The list of names of the teachers from the selected schools was to be obtained from the respective schools, to facilitate further selection of participants using the same procedure of every third person on the list. The first number was determined by flipping a coin (heads – odd number, and tails – even number). A total of 74 female teachers were thus randomly selected from this region to participate in the study.

In the Nairobi region with 35 schools, the 15th number was randomly picked as a starting number (point). Thereafter, every third school was picked from the list, making a total of 12 schools to be studied. The list of names of the teachers from the selected schools was to be obtained from the respective schools, to facilitate the further selection of participants, using the same procedure of every third person on the list after the first number had been

determined by flipping a coin (heads – odd number, and tails – even number). A total of 151 female teachers from this region were thus randomly selected from this region to participate in the study. The two cities of Kisumu and Eldoret had a total population of 150 teachers to be studied; this figure added to 151 from the Nairobi region brought the total to 301 female teachers for the whole study.

4.4.4 Limitations of the predetermined sample while at grass-roots level

When planning to carry out the study in both government and private schools, certain problems were overlooked. In the field, some of the head teachers (gatekeepers) of the private schools refused us access to their schools and demanded a research permit from the Ministry of Education (**Appendix 1C**, **1D** and **1E**). Strydom (in De Vos, 2002:283), cautions that in some cases, gatekeepers and other sensitive obstacles might prevent one from gaining access to the field. Neumann (2000:352) also warns that bargains and promises of entry may not remain stable over time and may require that the researcher return later for re-negotiations. It was decided to eliminate all the private schools in both the regions, because time and limited finances could not facilitate any further trial and error. The number of private schools is lower than the number of public schools, but the wages of the female staff members in both private and public schools are the same, thereby ensuring that the results of the study would not be significantly affected. This decision demanded that a research permit and new lists of only government schools be sought from the Ministry of Education's Headquarters, as well as offices within the two regions that had been identified for the study. The research permits (**Appendix 1C**, **1D** and **1E**) were granted and the new lists of female teachers were obtained for re-sampling purposes. Babbie and Mouton (2001:299, 310) state that most field research offers no fixed rule in methodology or ethics to follow, because sometimes, sampling criteria emerge from the fieldwork. Although the new lists represented fewer schools, the original predetermined sample sizes of 151 and 150 participants from different regions respectively, were maintained. Systematic sampling techniques as planned earlier remained in force, and the procedure followed was sustained (**Appendix 2C**).

4.4.5 Emergence of qualitative (snowball) technique within quantitative (systematic sampling) technique

Socio-cultural differences that often lead to divergence in perceptions, beliefs and behaviour, include geographic location, ethnicity, religion, and sexual orientation (Fiore & Kimle, 1997:86; Marshal *et al.*, 2004:94). Considering the nature of the study – taking body dimensions and photographing female career women while dressed in minimal apparel – is a delicate matter, as also observed by Apeagyei, Otieno and Tyler (2007). It required caution,

patience and a deep understanding of the participants' cultural and religious beliefs, even before negotiating with them.

The researcher, after seeking permission from the head teachers (gatekeepers), comprehensively explained the objectives and the importance of the study to the staff members (the potential participants of the study). The researcher then requested them to volunteer at their own discretion. As soon as agreements were made, those who were willing to participate in both phases of the study, were requested to decide on a suitable date and time for the measurements, photographs and completing the questionnaires. Initially, all the sampled participants were positive and agreed unanimously to participate in both phases of the study. Later on, the majority agreed to complete the questionnaire, but declined to be measured and photographed.

According to Hammersley and Atkinson (1995:55), it is imprudent to allow one's strategy to be led entirely by one's own prepositions concerning what is, and is not accessible. Although participants had refused to participate in both phases of the study (measurements and photographing exercises, and completing the questionnaire), a re-negotiation process was still achievable, as recommended by Neumann (2000:352). A new approach was devised and reached with caution and patience. Having interacted with the teachers, the researcher identified skilled and influential (vocal) members with apparel and textiles skills, to be used as pioneers, negotiators/recruiters and persuaders of other participants. The vocal members convinced a few other members, who then in turn identified others for the exercise. This recruiting exercise went on until there were no further participants willing to participate from each school. This ended up with an emergence of snowball sampling techniques within the initial (already) systematically sampled groups in different schools. Out of the 301 participants identified for the original study sample as initially pre-determined by the researcher and the statistician, only 123 participants' body dimensions and only 89 participants' photographs were taken (**Appendix 2C**) from the snowball-sampled group (phase one). This agrees with what Babbie and Mouton (2001:310) reported that in an interpretive research design, two types of sampling are commonly found: one where the researcher sets up sampling before commencing with the fieldwork, and the other where sampling criteria emerge from the fieldwork.

Neumann (2000:349) asserts that the steps of the field project are not completely programmed but rather serve as an estimated guide or road map. As a re-entry strategy, the researcher and the research assistant were forced to develop stronger trust and rapport with the participants by providing their own photographs that were taken while dressed in body suits and without any masks on their faces. The purpose and importance of the study were

once again comprehensively explained to all the willing participants (snowballed sampled group). Some apparel items with fit problems were used to demonstrate how the body shape influences the fit of apparel, to drive the point home. Neumann (2000:352) reports that the researcher has to continuously negotiate and explain the research objectives of the study time and again in the field.

4.5 CHOICE, DESCRIPTION AND APPLICATION OF THE DATA COLLECTION TECHNIQUES

As reported earlier, data collection occurred simultaneously from all the participants. The presentations of two phases are given here for practical purposes and ease of data reporting and management. Data collection was done from two groups sampled through the systematic technique and the emerged snowball technique. Not all of the snowball-sampled participants were measured and photographed. There were some participants who were only measured, and others were measured and photographed (**Appendix 2C**). The measuring and photographing exercises were however performed before the structured questionnaires were administered.

4.5.1 Body dimensions and photographs for body shape classification (First phase of the study – Objective 1)

To address objective 1 of this study, which is to identify and describe distinctive female body shapes of career women in Kenya, it involved taking the body dimensions as well as photographs of career women from the snowball-sampled groups only. Out of the 301 participants identified for the original study sample as initially pre-determined by the researcher and the statistician, only 123 participants' body dimensions and only 89 participants' photographs were taken from the snowball-sampled group. It was observed that the majority of the women who appeared older were adamant to be measured and photographed, although their shape differences were not conspicuous.

Body shape identification is the backbone behind the development of apparel sizing and ultimately, well-fitting apparel. As discussed earlier, most female sizing systems currently in use are based on the ideal Western figure that has well-proportioned body components, and in any case on an outdated database (Simmons & Istook, 2003; Newcomb & Istook, 2004; Devarajan & Istook, 2004). Although shapes have been classified in most developed countries to solve the problem of fit, African shapes with reference to Kenya, however, have not been considered. The dimensions of body components can only be extracted from the

human shape through measurements and images, which are only obtainable through body-scan technologies and/or photographs with the use of recommended instruments and techniques.

For the purposes of identifying the distinct body shapes of the career women in Kenya, traditional anthropometrical techniques of obtaining body dimensions were employed in this study. Anthropometry has been applied in many studies, while photography (somatography) has been used scantily, but has produced reliable results (Gazzuolo *et al*., 1992; Douty, 1968; Salusso-Deonier, Markee & Pedersen, 1991; Kuma, 1999:39; Anderson *et al.*, 2001:7). It may be argued that in describing body shapes, measurements alone would not be exhaustive enough to give true representations of the proportions of the body. Profile characteristics such as pelvic tilt (buttock prominence), stomach protrusion, back curvature and breast protrusion can only be understood through visual analysis of the body's silhouette and profile. Based on this understanding, and on a thorough study of the literature on traditional anthropometry, somatography and body shape classifications, a comprehensive body measurement form, a body shape assessment training manual and a body shape assessment scale were compiled.

Important key body dimensions necessary for the identifying of body shape, and that are critical to apparel's fit, were included in the body measurement form (**Appendix 3A**), while the characteristics of body shape that are critical to fit were included in the body shape assessment training manual as well as the body shape assessment scale (**Appendix 3D**). To obtain the body dimensions as well as the images, the empirical/practical study was carried out as follows.

4.5.1.1 Preparations for measuring and photographing exercises

Prior to taking the measurements and the photographs, the subjects were informed about the apparel items to be used, the measurements to be taken and the different views required for the images. To be efficient and effective in the exercise, the subjects were provided with and requested to wear body suits (leotards) with minimal thickness and that follow the natural contours of the body without constriction – as recommended by ISAK (2001:5). This was to ensure uniformity amongst all the participants. The researcher provided all the body suits that were the same in colour and thickness. Due to a shortage in ready-made leotards in the recommended colour and style, and within the available finances and time constraints, the researcher made only 20 body suits for all the participants. They were dry-cleaned after each use or before the next participant's use. The size description system used for assigning sizes to the body suits was the lettered type of Small (S), Medium (M), Large (L) and Extra Large

(XL). The measurements used for the production of the body suits were based on the Kenyan size standards (**Appendix 4A**). The Small (S) size category comprised size 8 and 10 measurements; the Medium (M) size category comprised size 12 and 14 body dimensions; the Large (L) category comprised size 16 and 18 body dimensions; while the Extra Large (XL) category comprised sizes 20 and 22 measurements.

Taking body dimensions: Dimensions from the human body form the foundation for well-fitting apparel. The body dimensions taken accurately, by employing the correct methods, instruments and techniques, can yield accurate and representative results (Ashdown, 2000; Simmons & Istook, 2003; Bye, LaBat & DeLong, 2006:66). It is not practical to use body scanners in developing countries due to its costs and the technical skills required, even though it promises better results (see **Chapter 2, paragraph 2.3.3**). The use of traditional anthropometry in conjunction with specific successful tailoring techniques of taking body dimensions (stipulated in most sizing standards) was deemed appropriate for this study as they offered alternative methods. Since these techniques are standardised and have been used in many studies, reliability and validity were ensured (Winks, 1997; Beazley, 1998; Simmons & Istook, 2003; Bye, LaBat & DeLong, 2006:66).

Body shape scrutiny is the foundation from which the development of apparel sizing stems. Distinctive characteristics of the body, which are critical to the fit of apparel, are considered in body shape identification. In this regard, more dimensions were required than just the basic key body dimensions (i.e. height, bust, waist and hips), which alone cannot exhaustively describe body shapes in terms of specific characteristics (such as pelvic tilt/buttock protrusion, back curvature, shoulder slope, and the protrusion of stomach and breasts).

After having reviewed the literature on apparel anthropometry and having considered all the characteristics of the body's front, back and side views, the body measurement form was developed (**Appendix 3A**) to guide and ease the measuring exercise. The body measurement form contained the dimensions of the upper and lower parts of the body that were carefully selected to improve the quality of the sorting and identification of the different body shapes. The body measurement form was designed in such a way that it would promote quick measuring. Height and vertical measurements were grouped and arranged in the order of their occurrence, from the top to the lower part of the body. All the horizontal (girth) measurements and all the width and length measurements were also grouped and arranged in the order of their occurrence, from the right to the left part of the body.

The landmarks and measurements for both the upper and the lower parts of the body (**Figure 4.3**) were obtained through standardised techniques, as stipulated in ISO-8559-89;

Beazley (1996); ASTM-D 5219-99; ISAK (2001); and Simmons and Istook (2003) (**Appendix 3B**). The landmarks identified were:

- **The neck/nape (7th cervical vertebra):** The subject assumed a relaxed position with hands hanging by the sides and the head in the Frankfort plane position. The landmark was obtained by bending the neck forward (lowering the chin) to locate it, as it pops out when the head is lowered. This position was marked with the circular hole on the sticker, being placed on the centre (RMSS, 1994; Beazley, 1996). This landmark guided the calculation of the shoulder slope, which was obtained by subtracting the shoulder to ground measurement from the nape to ground measurement.
- **The shoulder point (Acromion):** The subject assumed a relaxed position with hands hanging by the sides and the head in the Frankfort plane position. Acromio-clavicular joint positions on both right and left sides were determined by palpating along the spine of the scapula to the corner of the acromion. Marking was applied with the stickers' central holes placed at the mid-points of the acromions (ISAK, 2001:29; McConville, in Simmons & Istook, 2003). The shoulder landmark guided the calculation of the shoulder slope. It was also one of the points used to obtain the side seam line (profile trunk line).
- **The armpit (axilla) level:** The subject's hands were raised and the head in the Frankfort plane position. Landmarks were placed with the stickers' central holes at the mid-points of the hollow armpit regions. This landmark guided the bust extension measurement and the bust measurement. It was also one of the points used to obtain the side seam line (profile trunk line).
- **The upper arm/bicep point:** The subject assumed a relaxed position with arms hanging by the sides. The site is located at the mid-point of the straight line joining the Acromiale and Radiale, perpendicular to the long axis of the arm, also appearing as the fullest part of the bicep region. This landmark guided the upper arm circumferential measurements.
- **The breast tips/bust level:** The subject assumed a relaxed position with hands hanging by the sides and the head in the Frankfort plane position. Marking was then applied with the stickers' central holes placed at the breast tips. This landmark guided the bust extension measurement and the bust circumference measurement.
- **The waist (natural indentation):** The subject assumed a relaxed standing position with the arms folded across the thorax and the head in the Frankfort plane position. The landmarks were placed with the stickers' central holes at the mid-points of the natural waist indentation at the sides. Subjects with waistlines difficult to identify in a relaxed standing position, were requested to bend sideways in order to facilitate the locating of the waistline. This landmark served as a guide for measuring waist

circumferences, waist height and was one of the points used to obtain the side seam line (profile trunk line) (ISAK, 2006:87).

- **The hip (trochanterion):** The subject assumed a relaxed standing position, with the arms folded across the thorax and the head in the Frankfort plane position. The site was identified by palpating the lateral aspect of the gluteal muscle, with the heal of the hand up, until the superior surface of the hip bone (trochanter) could be felt when strong downward pressure was applied. For subjects with thick adipose tissue over the hipbone it was difficult to locate it. However, it helped to request, while supporting the left side of the subject's pelvis that the subject lift up her right leg as the palpation continued. This landmark served as a guide for measuring hip/buttock circumferences at the level of their greatest posterior protuberance, and was one of the points used to obtain the side seam line (profile trunk line) (ISAK, 2006:87).
- **The thigh bulge point (almost at gluteal furrow point):** With the subject assuming a relaxed standing position, the arms folded across the thorax and the head in the Frankfort plane position, the landmark was located at the broadest (bulging) part of the thigh. This landmark served as a guide for measuring the lower hip circumference (appearing broadest), and as one of the points used to obtain the side seam line (profile trunk line) (ISAK, 2001:87). It also guided the calculation of the thigh bulge, which was obtained by subtracting the hip circumference from the lower hip circumference (hip appearing broadest).
- **Knee level (tibiale laterale):** With the subject assuming a relaxed standing position and with the arms hanging by the sides or folded across the trunk and the head in the Frankfort plane position, the site was identified by palpating to locate the lateral condyle of the femur and the antero-lateral portion of the lateral border of the head of the tibia. Although it is a difficult site to locate, the subject was requested to flex and extend the knee several times to ensure that the correct point has been located; alternatively, the subject could bend the knee slightly to define the crease line; the mid-part on the side was then identified and landmarked (RMSS, 1994; ISAK, 2001:46). This landmark served as one of the points used to obtain the side seam line (profile trunk line).
- **The ankle (malleolus):** The subject assumed a relaxed standing position, arms hanging by the sides or folded across the trunk, and the head in the Frankfort plane position. The lower edge of the tibial bone was located and landmarked. This landmark served as one of the points used to obtain the side seam line (profile trunk line).
- **Trunk line (side seam):** With the subject assuming a relaxed standing position, the ear's hole served as the head's landmark, while the shoulder, armpit, natural waist indentation, hip (trochanterion), knee (tibiale laterale) and the ankle (malleous) served as landmarks for the lower part of the body.

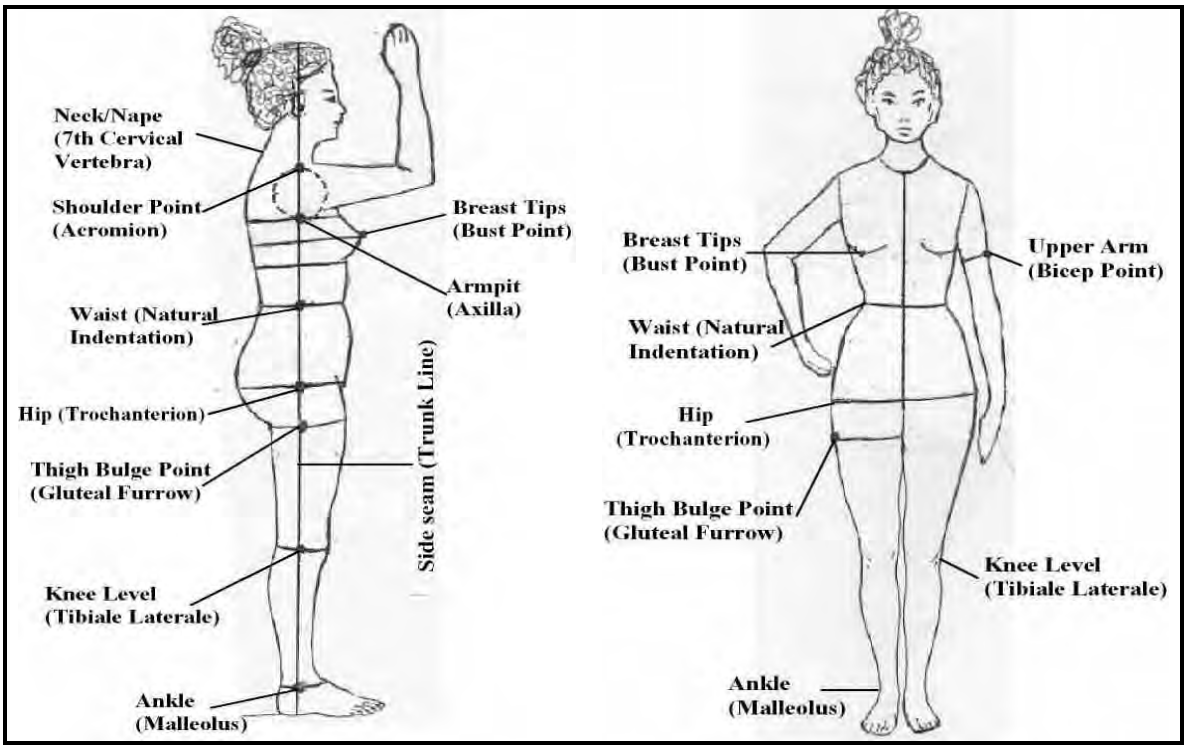


FIGURE 4.3: LANDMARKS AND BODY DIMENSIONS OBTAINED FOR BODY SHAPE IDENTIFICATION

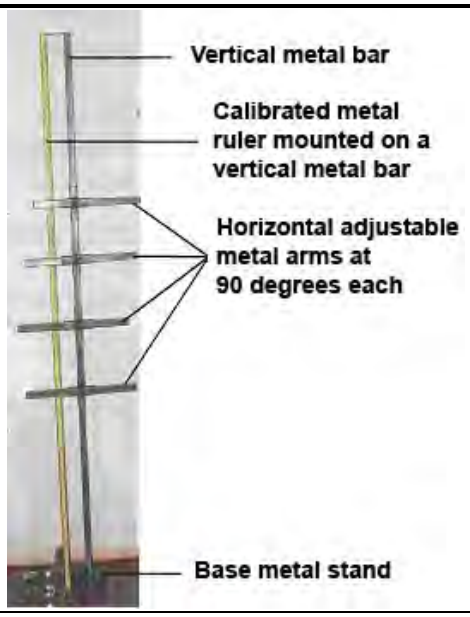
Instruments used for measuring: Apparel anthropometry studies specifically use apparatus that have been developed to produce reliable and valid measurements. An anthropometer (measuring stand), consisting basically of a graduated rule in millimetres, that is vertically mounted and has a moveable arm, is used for measuring straight linear distances, while callipers are used to measure linear depths and widths. Calibrated measuring tapes are used to measure depths and widths (Beazley, 1997:58; Ashdown, 2000).

According to Morse (in Schurink, 1998:253), the nature of the research problem statement and the resources available determine to a certain extent the data-collection methods to be used in a study. For the purposes of this study and due to the available resources, the researcher consulted professional anthropometrists from the company Ergotech in South Africa for training on how to take body dimensions professionally, and on suitable instruments to be used. The Ergotech Company is well known for their anthropometric surveys. In this regard, Ergotech's measuring techniques and the instruments that they use were considered reliable and valid. To further enhance reliability when taking body dimensions, the researcher underwent a one-week training on anthropometry as a level 1 Kinathropometrist, offered by the International Society for Advancement of Kinanthropometry, ISAK (**Appendix 3C**). Based on the expertise and experience of Ergotech

South Africa, the researcher's training with ISAK and a thorough review of the literature, the decision was made to use specific instruments for this study (**Figure 4.4**). The techniques of taking body dimensions of ISO (1989), ASTM (1999), Beazley (1996) and Simmons and Istook (2003) were also consulted before that decision was taken.

Due to limited funds available and the unavailability of an anthropometer, the researcher opted to use an improvised standing anthropometer, with approximate resemblance to a real anthropometer. It basically consists of a measuring stand of a graduated rule in centimetres and millimetres. It contains two parallel metal bars held at right angles from the base and has rods mounted at right angles on the fittings that slide/move along one of the vertical primary rods, as shown in **Figure 4.4**. It was designed according to the specified measurements of an ordinary anthropometer. After it was assembled, it was subjected to critical testing for accuracy and reliability. The improvised standing anthropometer was used for measuring all the straight vertical linear distances as shown in **Figure 4.5**. A stature meter was used interchangeably with the anthropometer for the height measurements. All the contour measurements were measured using a 200 cm long dressmaker's metal tape to avoid stretching and tear during the exercise. A set square was used for locating the trunk line on the side, while a segmometer was also used interchangeably with the metal or fibre glass tape to measure widths (**Figure 4.4**). All these instruments were used after consultation with an anthropometrist and anthropometry books and standards such as the Republic of South African Military Standards (RMSS) (1994), Norton and Olds (1996) and ISAK (2001).

Other tools necessary for the body dimensions exercise included landmarkers; these were white stickers with a circular hole in the middle. They were placed on the relevant positions of the body and body suits (leotards) to signify the landmarks (Beazley, 1996). Elastic tapes were used for locating the natural waist indentation. Hair clips were required to hold hair away during measuring of the subjects. Body suits were provided in standardised sizes and brassières were provided whenever necessary. The measuring area was prepared well in advance for convenience and speed of handling equipment, and to reduce the fatigue of both the subject and the measurer. A table on the right-hand side of the measurer had all the equipment and tools arranged according to the sequence of the measurements given on the body measurement form.



Improvised standing anthropometer

Metal measuring tape

Segmometer

FIGURE 4.4: MEASURING INSTRUMENTS

Stature, nape and waist heights from the ground

Shoulder, waist, hip and knee heights from the ground

Hip, thigh, Knee and calf heights from the ground

FIGURE 4.5: HEIGHT MEASUREMENTS USING STANDING ANTHROPOMETER

Actual body measuring: It has been observed that a person's measurements (dimensions) can only be accurate and representative if they are taken accurately by employing the correct methods, instruments and techniques (Ashdown, 2000; Simmons & Istook, 2003; Bye, LaBat & DeLong, 2006:66). However, accuracy could be improved if the subjects were landmarked

prior to taking the measurements. This ensures conformity and consistency (Simmons & Istook, 2003). Since a landmarking exercise requires palpitation, touching and sometimes bending of limbs to determine the appropriate positions for taking the measurements, participants' privacy is violated in the process (Simmons & Istook, 2003; Istook *et al*., 2003). Having observed the resistance of the career women to participate in the exercise, it was necessary to continue with negotiations throughout the practice, as recommended by Neumann (2000:352). Most of the participants preferred as little contact as possible and this demanded that the landmarking positions planned earlier be adjusted to include only the most important points. The procedure used for landmarking followed the standardised methods stipulated in Beazley (1996), ISAK (2001) and Simmons and Istook (2003).

The researcher took all measurements and called them out loudly to her research assistant for recording. To confirm that the measurements were correctly recorded, the research assistant also loudly repeated what she had heard. The research assistant was also skilled in apparel design, and had been trained prior to the fieldwork. She also assisted with the aligning of the metal tape measure at the back of the subjects when circumferential measurements were taken, and thus acted as a mirror for the measurer where she could not see or reach.

Photographing: Based on the study of somatography (Salusso-Deonier *et al*., 1991; Gazzuolo *et al*., 1992; Kuma, 1999) and the concept of imagery with the body-scan technologies, it was decided to use photography for this study as an alternative method to body scans technologies. Female participants were photographed using standardised methods while dressed in minimal apparel (body suits/leotards) and assuming different positions/views (front, back and side/profile). The different views would facilitate accurate judgements on body units/components that are critical to the fit of apparel. Those components within the body would then be visually analysed and categorised to facilitate the production of ready-made apparel with a better fit.

In order to achieve consistency and reliability when photographing, all sets of photographs were taken from the same distance, with subjects and the photographer taking the same postures and positions. Six-meter guiding grid paper was mounted on the wall and extended to the forefront on the floor. The extended section on the floor had two sets of footprints marked on it. The first set was close to the wall and indicated the subject's position, while the second set was further away from the wall and indicated the photographer's position. The grid paper was divided up into 15 cm squares with a bold line down the centre, which served as a balancing point when photographing. The background (grid paper) was to standardise all the photos taken and to allow ease of judgement concerning each shape later in the

analysis. All the sets of photographs were taken from the same position and distance, while the subjects took specific standardised poses and were dressed in similar styled and neutral (gray) colored body suits/leotards, in order to ensure uniformity and clarity during the evaluation later (**Figure 4.6**) (Gazzuolo *et al.*, 1992; Kuma, 1999:39; Anderson *et al.*, 2001).

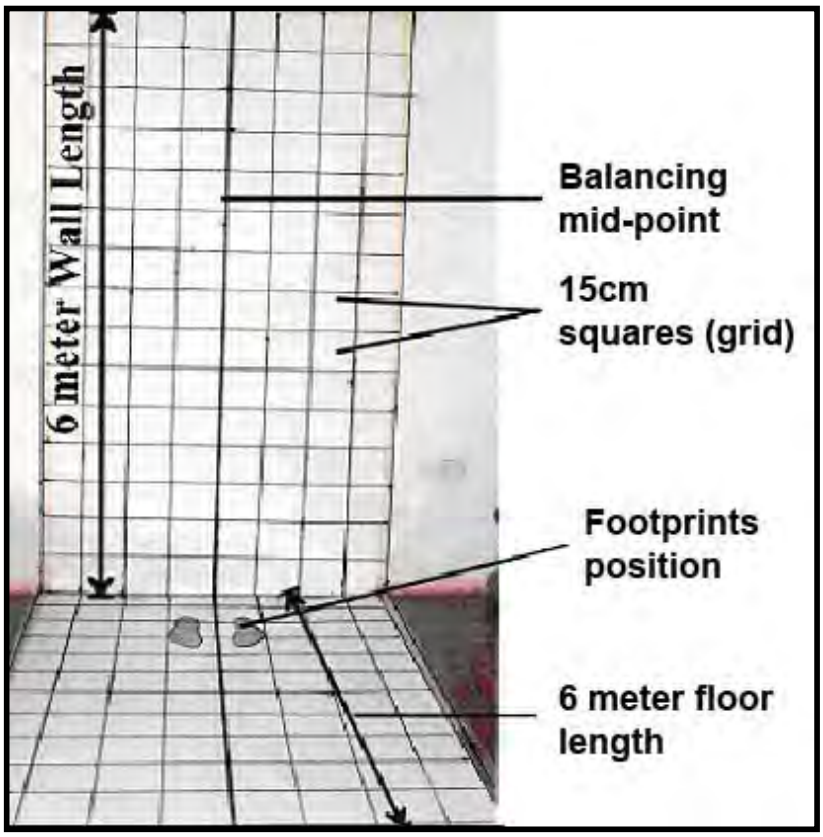
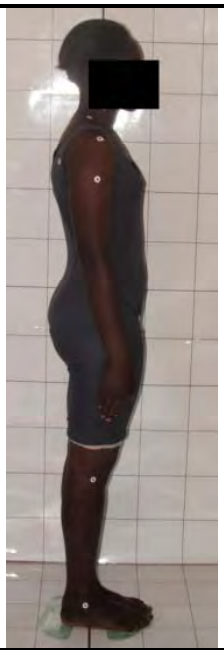


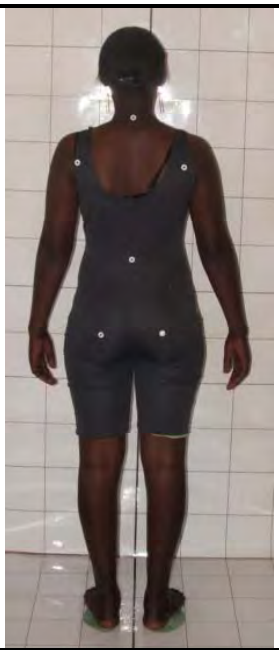
FIGURE 4.6: PHOTOGRAPHING STUDIO SET UP

To facilitate the easy identifying of the sets of photographs later during the analysis, numbers (two digits) were assigned to the subjects (photos) as they were photographed, while their privacy was ensured by having their heads masked (Kuma, 1999:39). Photographs were taken from the front, side and back, as shown in **Figure 4.7**. Subjects were requested and assisted regularly to stand erect and directly on the footprints, with the head in the Frankfort plane position and, with the grid central line passing through their mid-points. A good quality digital camera was used and standardised distance positions as well as focus points were observed consistently during the entire exercise. With the training experience of the researcher, the reliability of the study was ensured. All the photographs were later subjected to evaluations by trained sensory evaluators for the purposes of sorting out and identifying the most distinct body shapes.

Front view



Side view



Back view

FIGURE 4.7: DIFFERENT VIEWS OF BODY SHAPES

4.5.2 Structured questionnaire (Second phase of the study – Objectives 2, 3 and 4)

For the second phase of the study, a structured questionnaire (**Appendix 1A**) was used to address Objectives 4, 5 and 6. Other researchers have successfully used structured questionnaires to measure fit problems, fit preferences as well as preferences for instructive size labels (Objectives 4, 5 and 6) (LaBat, 1989; Chun-Yoon & Jasper, 1995; Anderson *et al*., 2001; Otieno *et al*., 2005). Alexander, Connell and Ulrich (2005) also tested consumers' knowledge about their key body dimensions, which are necessary for identifying the correct apparel sizes. Since testing of career women's knowledge about the meaning of the communication of size and fit (Objective 5) is a new venture, the use of structured questions was also deemed appropriate to address the problem.

The questionnaire was compiled after studying literature on fit problems with apparel regarding sizing systems (size tables and the female body shapes), the communication of size and fit (size labels), and career women's fit preferences. Dimensions that would influence such fit problems were identified from all the areas studied, as presented in a schematic framework in **Chapter 3 (Figure 3.24)** of this study.

The questionnaire's top page had the University of Pretoria's logo (letterhead) and an introductory letter stating the purpose of the research, giving an assurance of anonymity, an appeal for participation in the study and acknowledgement for participation (Delport in De

Vos, 2002:170). The questionnaire was scrutinised by the researcher's study leader, the co-study leader, the statistician and the subject specialist lecturers at the Department of Consumer Science, University of Pretoria (peer evaluation). This was done to determine the clarity of the questions used and whether the intended meanings were clear. Suggestions that arose were used to adapt and revise the questionnaire. The corrected questionnaire was then pilot-tested (First pilot test) on twenty third-year students enrolled for Apparel Management at the University of Pretoria, for further refinements (e.g. the time it takes to complete) and to improve the reliability of the questionnaire.

The questionnaire was developed to get information from career women about a variety of aspects related to the stated objectives of the study. These included asking the career women about their satisfaction/dissatisfaction with the ready-made apparel available in the market place, testing their knowledge about the meanings of the size codes presented on the size labels/tags attached to the ready-made apparel, and about their own key dimensions as well as their own body shapes (communication of size and fit). It also questioned the career women on their fit preferences for differently fitted skirts and jackets. The questionnaire contained questions that were randomly arranged, but were originally derived from different sections, using different indicators as shown in **Table 4.2**.

TABLE 4.2: THE STRUCTURE OF THE QUESTIONNAIRE (SECOND PHASE)

SECTION		ASPECTS MEASURED	QUESTION NUMBERING	TYPE OF SCALES
1. Demographics		Age	Question 1	Nominal (Reporting)
		Background profession of the participants	Question 2	Nominal (Yes or No)
2. Career women's perceived fit problems		Rating fit quality of different categories of ready-made apparel sold in Kenya	Question 3	Five point Likert-type scale
		Rating fit quality of ready-made apparel sold in different retail stores in Kenya	Question 4	Five point Likert-type scale
		Career women's fit problems at critical fit points	Question 22	Nominal (Yes or No)
		Career women's satisfaction with ready-made apparel	Question 21	Five point Likert-type scale
		Perceived sources of fit problems	Question 20	Five point Likert-type scale
3. Career women's knowledge about communication of sizing & fit	Sizing issues (Key body dimensions)	Knowledge about reported own key dimensions	Question 6	Nominal (Reporting)
		Knowledge about reported own sizes	Questions 13 & 14	Nominal (Yes or No)
		Familiarity with size labels	Question 15	Nominal (Yes or No)
		Knowledge about the meaning of size labels	Questions 16 & 17	Nominal (Yes or No)
		Effectiveness of size labels	Question 18	Nominal (Yes or No)
	Fit issues (body shape)	Familiarity with body shape terms presented on the label/tag	Question 5	Nominal (Yes or No)
		Knowledge about the meaning of body shape terms presented on the label/tag	Question 5	Nominal (Reporting)
		Knowledge about sketched body shapes	Questions 7 & 8	Nominal (Reporting)
		Knowledge about reported own body shape	Question 7	Nominal (Yes or No)
		Techniques applied to establish own body shape	Question 9	Nominal (Yes or No)
		Knowledge about style selection for the reported own body shape	Question 12	Nominal (Yes or No)
		Preferred ideal body shape	Question 10	Nominal (Yes or No)
		Knowledge about own body proportions compared to those of the ideal	Question 11	Nominal (Yes or No)
4. Fit preferences		Fit preferences for differently fitted Jackets & skirts (fitted, semi-fitted & loosely fitted)	Question 19	Five point Likert-type scale

The questionnaire contained 22 questions, which were randomised to avoid biased responses as a result of closely related questions, and the explanatory sketches. Clear instructions were given for each question. Most questions were closed-ended, except where the respondents were required to self-report their year of birth (question 1), their key dimensions (question 6) and where they were required to give a brief description of the terms that represent different body shapes on size labels/tags (question 5), and to give a brief explanation of the sketched body shapes (questions 7 and 8). The closed-ended questions were specifically used because they are easier and quicker for the respondents to answer, as the response choices provided could clarify the meaning of the questions for them, while data-analysis is also easier. It is easy to code and analyse statistically and it permits easy comparison of different responses (Neumann, 2000:260-261). Varied scales were used to provide more flexibility in the design of items while making the questionnaire generally interesting. The reported answers permitted respondents to express themselves without any

restriction. This enhanced the exploration of career women's knowledge about size and fit issues. Closed-ended questions were applied where a number of possible responses were reasonably obvious, with the predetermined response options in place.

For the purposes of data management and presentation of the results, all the questions had been pre-coded in advance. Although the questions were randomised in the questionnaire, the questions were derived from the four sections given below:

- Demographic information was to address factors such as the consumer's age, background and profession, as these might influence the purchasing decisions of the career women.
- Career women were asked to determine the fit quality of different apparel categories and apparel items that are sold in different retail stores. This was also to try and identify approximately where fit problems lie in Kenya's ready-made apparel, to evaluate career women's awareness of the critical fit points of their upper and lower torsos, to assess career women's satisfaction with the fit of the ready-made apparel and to explore career women's perceived sources of fit problems.
- Career women's knowledge about the communication of sizing and fit was tested to establish whether they were knowledgeable about the meaning of the size codes, the body shape terms presented on size labels/tags and about their key dimensions – all necessary for identifying their own sizes and body shapes.
- Career women's fit preferences were used to determine how the career women would prefer their skirts and jackets to fit their bodies. Questions were asked to determine how they would prefer differently fitted skirts and jackets (from fitted, semi-fitted to loosely fitted). This was to determine whether the career women's fit preferences were within the available styles and sizes in relation to their critical fit points (as their needs would affect the fit of the apparel if not in harmony with the critical fit points), and whether these needs are being catered for.

While in the field (in Kenya), the questionnaire was further pilot-tested (Second pilot test) on 10 career women between 28 and 40 years . This was purposely done to determine whether items were worded properly and specifically for the target people. A research assistant, who had knowledge about apparel and experience in textiles, was chosen and trained how to handle participants and administer the questionnaire. Both the researcher and the research assistant administered the questionnaires to a group of career women in one sitting, ensuring that no discussion took place between respondents. Any problems/questions that arose, as the respondents completed the questionnaire, were clarified and answered (Bless & Higson-Smith, 2000: 108-110). This method of data collection had the advantage of time- and cost-effectiveness, because the groups of respondents were handled at the same time, and

exposed simultaneously to the same stimulus material (Delport in De Vos, 2002:175). Three hundred and one (301) questionnaires were administered, but only 201 (67%) were returned and could be used. Although all the questionnaires were administered, about 50% of the questions in 100 questionnaires were left blank, thereby forcing the researcher to consider them spoilt and not include them in the data analysis.

Mouton (1996:107) refers to the recording of data as a form of quality assurance prior to the fieldwork. Therefore, the questionnaire (**Appendix 1A**) was divided into two sections for the purposes of edge coding. The larger section was to be used by the respondents, while the smaller sections contained numerical coding in the margins for official use (Babbie & Mouton, 2001:415-416).

4.6 DATA ANALYSIS

4.6.1 Data obtained from phase one

4.6.1.1 Data obtained from career female's body dimensions

The researcher ensured that the body dimension forms were all available and complete without any missing data (Neumann, 2000:419). Mouton (1996:107) refers to the recording of data as a form of quality assurance; thus prior to the fieldwork, the body dimension form was divided into two sections for the purposes of edge coding. Larger sections contained the list of body dimensions to be obtained, while the smaller sections contained numerical coding in the margins for official use (**Appendix 3A**). On the official sections of the body measurement form, blank spaces were left to facilitate the eventual data entry and computing (Babbie & Mouton, 2001:415-416).

The captured data was compared with every completed body measurement form to ensure that the information of each measurement form was correctly captured. Mistakes and errors that emerged were managed and cleaned up (Babbie & Mouton, 2001:41). After the data cleaning and management were done, the useful data was statistically analysed using appropriate statistical methods. Statistics used were descriptive methods that integrated simple percentiles to combinations of uni-variate and bi-variate. Un-ivariate analysis refers to the analysis of one variable at a time. Example is a frequency/percentage table (Bryman & Bell, 2007:357). Bi-variate analysis is concerned with the analysis of two variables at a time in order to uncover whether or not the two variables are related (Bryman & Bell, 2007:360). These analyses were employed for the purposes of dividing the study population into

subgroups. The data was normalised, giving ranges of two standard deviations either side of the mean value, which covered 95% of the population where applicable. This removed the extreme dimensions in a range, which could cause distortion. The mean values ± the standard deviations (SD) facilitated the classification of height groups (short, medium and tall), and the body shape categories of distinct characteristics (small, medium and large). The medium categories were classified by “Mean ± SD”. Values above the “Mean ± SD”, were classified as large, whereas values below the “Mean ± SD" were classified as small. Beazley (1998:269) and Gupta and Gangadhar (2004) applied descriptive statistical techniques in their studies. Chi-square tests and Pearson’s correlation coefficient were also used for hypothesis testing and for the correlation of measurements.

A literature search was done to identify descriptive parameters to define the five prevalent shapes (hourglass, triangle, inverted triangle, apple and rectangular), for the purposes of setting up standards within the maximum and minimum dimensions of the drop values. The drop values used were the difference between the bust and the hip dimensions and the difference between the bust and waist dimensions. Since the five main body shapes only served as guide for the purposes of identifying the body shapes in this study, it was not possible to classify body shapes using the concept of “Mean ± SD”, because the rule allows classification into only three categories (small, medium and large). However, Shin and Istook (2007) report that the waist measurement for the rectangular shape is nine inches (23 cm) less than the bust. Rasband and Liechty (2006:25-26) state that the waist of an hourglass body shape measures more than 10 inches (25 cm) less than the hip or the bust. Using the range (maximum and minimum) dimensions of the drop values within the context of the anthropometric data of this study, in combination with the recommendations of Shin and Istook (2007) and Rasband and Liechty (2006), it was possible to identify the different body shapes of this study.

To process the data in a logical and direct meaningful manner, the first printouts were converted from a random order to a grouped height order, as body height has been reported as one of the control dimensions for most apparel (Winks, 1997; Gupta & Gangadhar, 2004). The data was then re-arranged into the different body shapes within the range of drop values. The drop values of the bust and the hips facilitated the identification of triangle and inverted triangle body shapes, while the remaining body shapes (rectangle, hourglass and the apple) were identified by the drop values of bust and waist dimensions (the difference between the bust and the waist dimensions). Hip-bust drop values were used to establish the sizes of the hips and bust in relation to each other for the purposes of sorting out the inverted triangle shapes and the triangle shapes respectively. Drop values or key dimensions are considered to be the best predictors of all the other body dimensions and have been widely

used for body shape classifications (Winks, 1991:74; Gupta & Gangadhar, 2004; LePechoux & Ghosh, 2002:20).

***The descriptive statistics**:* Descriptive statistics describe basic features of the data, providing simple summaries about the sample and the measurements (Kranzler, 2007:48). They provide a powerful summary that enables comparison across different variables (Trochim, 2005:212:212). It uses the range value to measure the dispersion of variables. The mean value measures the central tendency, and the standard deviation summarises the dispersion by calculating the amount of deviation from the mean value (Bryman & Cramer, 1997:80; Bryman & Bell, 2007:357). The standard deviation used in conjunction with the mean, reflects the degree to which the values in a distribution differ from the mean, and summarises the amount of dispersion in a distribution (Bryman & Cramer, 1997:85). Height, for example, can be summarised/categorised into different groups based on the means, standard deviations and the range values obtained from the height dimensions. The population can be classified into: Short = < (Mean ± SD), Medium = (Mean ± SD), and Tall = > (Mean ± SD) – as done by Winks (1991), Beazley (1998); and Gupta and Gangadhar (2004) in their studies.

4.6.1.2 Data obtained from the career female's photographs

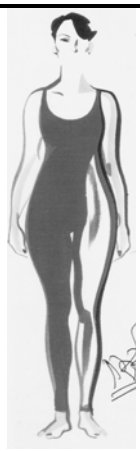
- **Development of female body shape assessment formula**

Body shape analysis is the theoretical underpinning for the development of apparel sizing systems (Connell *et al*., 2006). In order to identify and sort the most distinctive body shapes from the sample data, digital photographs served as stimulus material to allow for analysing and sorting them by a trained panel of evaluators. This was done through visual sensory evaluations done in five different steps. Sensory evaluation is the assessment using human good judgement with the sensitivity of human senses. It implies the evaluation of selected characteristics of a product under controlled conditions by a panel of judges (ASTM, 1981:3; Leibowitz & Post, 1982:4; Lyon, Menneer, McEwan, Metheringaham & Lallemand, 2000:1). The use of panelists as measuring devices is perceived to be similar to the use of any scientific strategy to bring out the dimensions of specific subjects under investigation (ASTM, 1981:3; Leibowitz & Post, 1982:9).

The testing methods of evaluation are based on the concept of *difference threshold*, which is the least amount of stimulus change that is detectable to human assessment (Ashdown & DeLong, 1995). A stimulus is defined as any chemical or physical activator, which causes a response in a receptor (ASTM, 1968:7). An effective stimulus produces a sensation, the

dimensions of which are quality, intensity, and extension – among others. For this particular study, the difference threshold implied the differences in size and shape of the body shapes' components that appeared different from the characteristics of the Western established female body shapes. Visual sensory evaluation provided an orderly framework to evaluate perceived physical characteristics within different body shapes. In order to ensure the utmost validity and reliability of this method of study, the quality of the evaluators, the assessment procedure, assessments scaling as well as methods of analysis were carefully considered. The following steps were carried out to ensure that the outcome of this study, which involved categorising preliminary subgroups with similar body shape characteristics, were reliable and valid. In order to ease and make the evaluation process easy and faster, the first three preliminary steps were done entirely by the researcher with assistance from computer technical assistant. This was done to make the images simple and as clear as possible to facilitate ease and quick assessments later by the trained professional evaluators.

***First step (preliminary - done by the researcher)*:** There is no known research that has been carried out on Kenya's female body shapes. Therefore, this being a virgin study on female body shapes, the researcher subjected all the photographs to a thorough scrutiny by examining and studying each body shape's components from the front, back and – more critically –the side view. Using the Western established body shapes (**Figure 4.8**) as point of departure and as a launching ground for this study (Rasband & Liechty, 2006:25), the researcher and the study leaders were able to identify a distinct (rectangular) body shape (**Figure 5.5** in **Chapter 5**) appearing to contain a long torso and strong features – and to take note of those characteristics that differ from the Western established body shapes. The body shapes provided were compiled, based on descriptions as well as illustrations found in: Harper and Lewis (1983: 29, 31); Salusso-Deonier (1989:373); Zangrillo (1990); Rasband (1994:12-13); Armstrong (1995:33); Spillane (1995:33); Fiore and Kimle (1997); Kuma (1999:65-68); Connell *et al*. (2003); Simmons, Istook and Devarajan (2004a); Devarajan and Istook (2004), and Rasband and Liechty (2006:23-29).

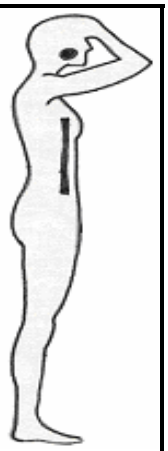

Triangular shape (front view)


Triangular shape (side view)


Inverted triangle (front view)

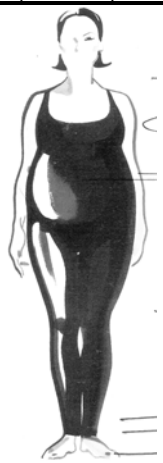

Inverted triangle (front view)


Rectangular shape (front view)


Rectangular shape (side view)


Hourglass shape (front view)

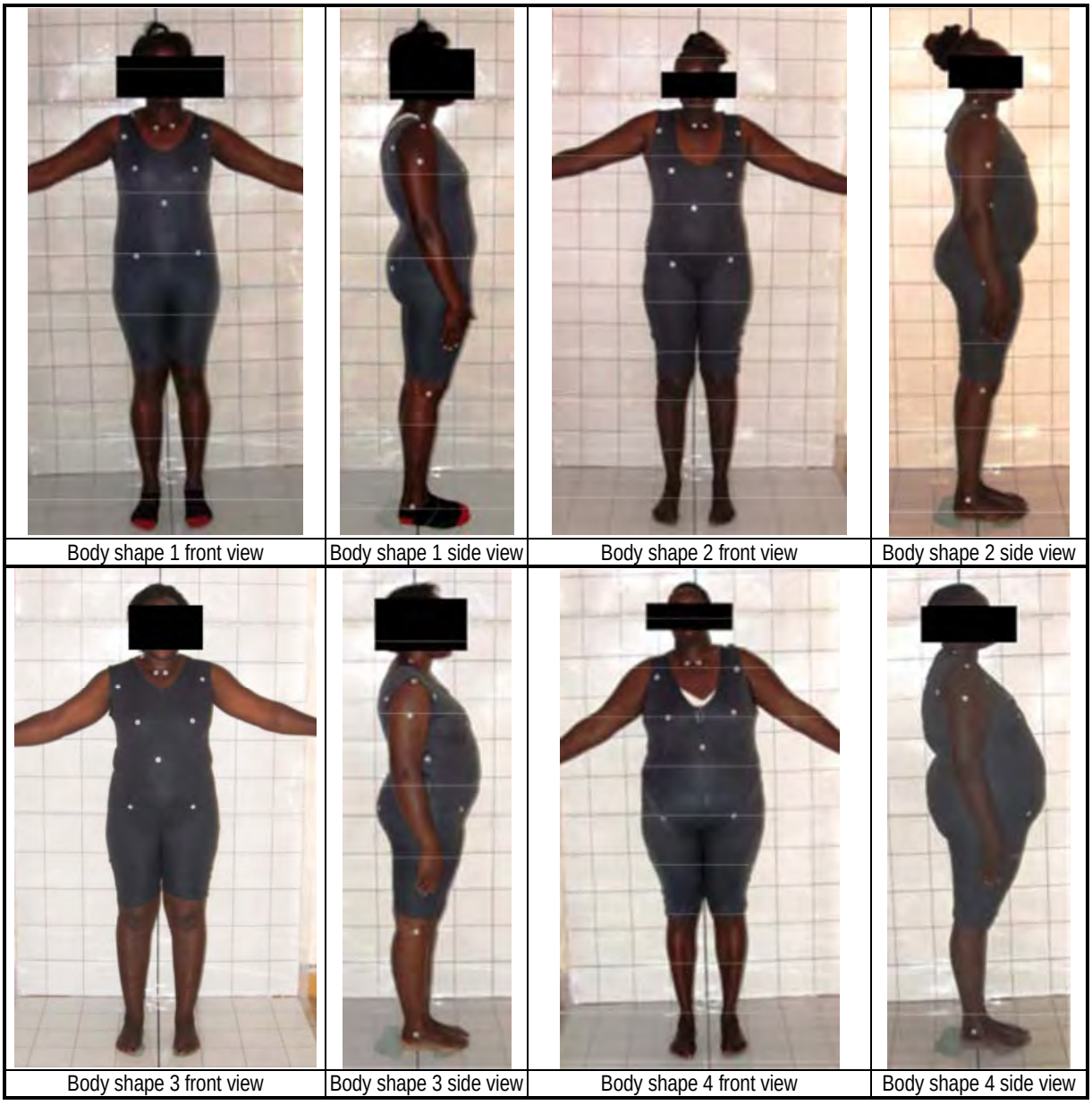

Hourglass shape (side view)


Apple (front view)


Apple (side view)

FIGURE 4.8: ESTABLISHED BODY SHAPES IN WESTERN SOCIETY

Body characteristics that were uncommon for the Western established rectangular shapes, were the thigh bulge that seemed to be situated at approximately two inches below the normal hipline (trochanterion position), the strong (rounded) upper shoulder blades and strong buttocks, contributing to a deep hollowed back waist. The stomachs appeared like a strong block extending from just below the bust to below the waistline, down to the crotch line region at the front (**Figure 4.9**).



Body shape 1 front view	Body shape 1 side view	Body shape 2 front view	Body shape 2 side view
Body shape 3 front view	Body shape 3 side view	Body shape 4 front view	Body shape 4 side view

FIGURE 4.9: UNREFINED PHOTOS

Second step (preliminary - done by the researcher): From the raw photographs, it was almost impossible to extract all the details as exhaustively as possible. The researcher, with the help of the computer Microsoft Office photo editor, was able to get the photographs edged, as shown in **Figure 4.9**. This permitted a clear outline of the body for more additional scrutiny. From the negatives and the edged shapes, pronounced details such as a stomach shape from just below the waistline (appearing as the letter “b”), to another shape with more weight concentrated below the waistline (and appearing more like the letter “D”), and to shapes where the weight extended from above and below the waistline to the crotch at the centre front. The back shape became clearly outlined, ranging from a less hollow waist to a sharp deep hollow at the back waist (lordosis), depending on how rounded the upper

shoulder blades and the depth of the buttocks were (appearing like the letter “d” when they conspicuously protrude beyond the rest of the body).

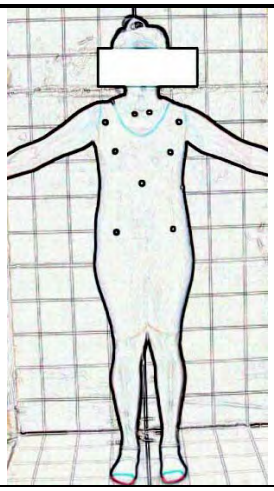
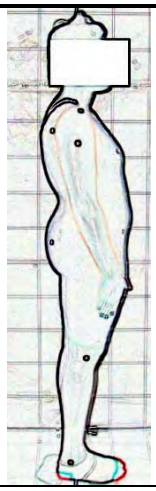
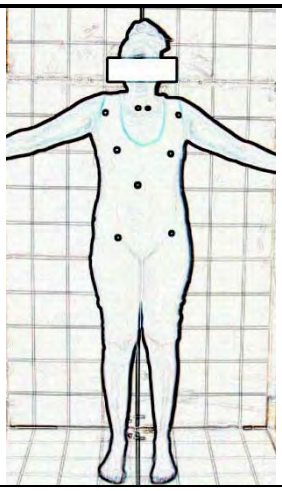
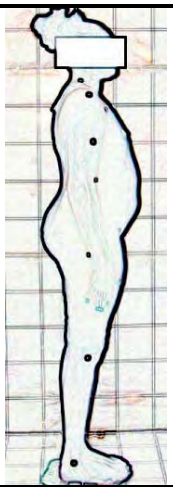
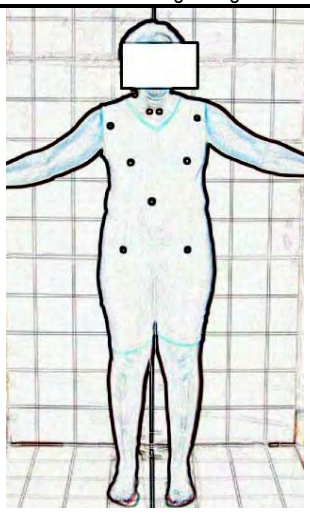
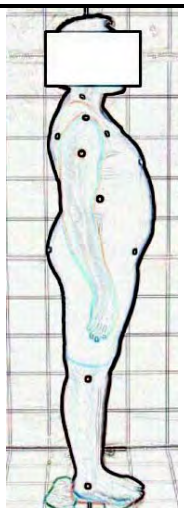
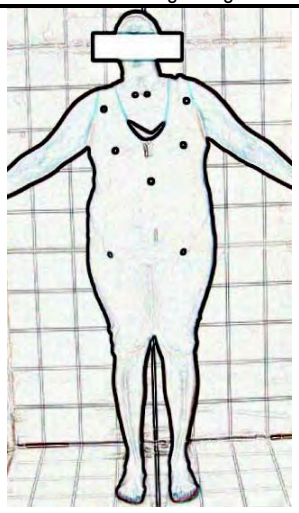
			
Body shape 1, front view. Rectangular shape, no waist indentation and a noticeably moderate thigh bulge	Body shape 1, side view. Rounded upper back, hollow waist, “d” buttocks and “D” stomach	Body shape 2, front view. Rectangular shape, little waist indentation and a noticeably moderate thigh bulge	Body shape 2, side view. Less rounded upper back, hollow waist, “d” buttocks and “D” stomach
			
Body shape 3 front view. Rectangular shape, no waist indentation and a noticeably moderate thigh bulge	Body shape 3 side view. Rounded upper back, less hollow waist, “d” buttocks and extreme “D” stomach	Body shape 4 front view. Rectangular shape, no waist indentation and a noticeably moderate thigh bulge	Body shape 4 side view. More rounded upper back, hollow waist, “d” buttocks and extreme “D” stomach

FIGURE 4.10: EDGED PHOTOGRAPHS

***Third step (preliminary - done by the researcher with assistance from computer technical assistant)*:** The IGRAFX Designer 5 software was used to extract only the important characteristics that were identified in the first and the second steps above. This decision was reached for the purposes of developing preliminary subgroups with similar characteristics. With the help of an expert in computer apparel/pattern design, each individual picture was copied into Adobe Photoshop CS. The resolution was increased to 762

pixels per square inch and the pictures were saved as *.bmp (bitmap) files so as to improve the quality and to make them manageable while being manipulated when drawing and extracting specific characteristics. With the use of IGRAFX Designer 5 software, the software scale was set to 1cm = 5 cm, and 1cm by 1cm grid-lines were drawn over the blank page. This page was saved as a template. The pictures were then imported individually onto the blank template in IGRAFX Designer 5 and saved as *.dsf (designer) files. The picture size was then reduced and the pictures were manipulated by means of rotation so that the grid-lines on the template and the grid-lines on the pictures matched perfectly.

With the use of the dimension tool in IGRAFX Designer 5 software, the measurements between specific points that were predetermined by the researcher were drawn in. White lines were used in drawing and marking specific points because the background was dark, and thus a lighter colour was used for visibility reasons. All the markings and drawings made were scaled as shown in **Figure 4.11**, to assist in the proportional comparisons and assessments to be made later. The picture was then manipulated by means of rotation back to its original position. The picture and all the measurements were selected and then re-exported and saved as a *.jpg (jpeg) file. The compound line tool in IGRAFX Designer 5 software was used to make the silhouette outline. The designer technician used the picture with the measurements and drew the silhouette over it, and then extracted that silhouette to an open space on a blank page template as shown on **Figure 4.11**. This was then exported and saved as a *.jpg (jpeg) file. These steps were done on all the pictures' views of back, front and side. Once all the pictures were completed, the *.jpg (jpeg) files were then re-inserted into Microsoft Word 2003 for accessibility and presentation in a versatile format.

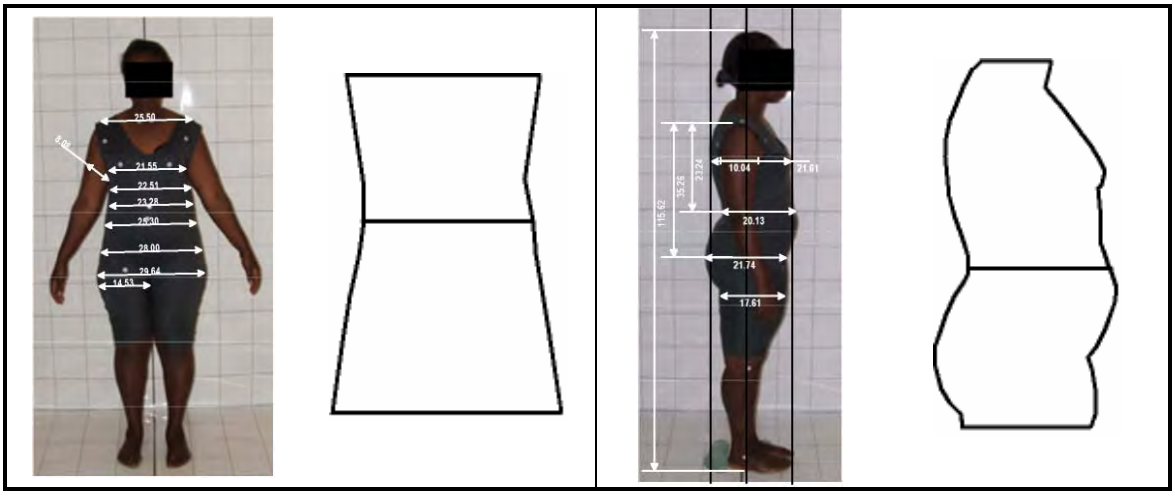


FIGURE 4.11: SILHOUETTES EXTRACTED BY IGRAFX DESIGNER 5 SOFTWARE

From Photoshop, it was easy to evaluate each shape (photo) and assign it to one of the five prevalent body shape categories (rectangle, hourglass, triangle, apple and inverted triangle). The researcher prepared a comprehensive training manual and a body shape assessment scoring sheet/scale to enhance trustworthiness and reliability of this study (evaluations of the photographs). It was reasoned that accuracy in evaluations could be achieved if there were some form of agreement between different evaluators and if they worked according to a uniform method of assessment. Standardisation would be achieved once the universal body shapes' characteristics were identified and well understood. The development of the training manual was therefore necessary to facilitate some form of uniformity and standardisation between different evaluators in their assessments of the body shapes. According to Fan (in Fan *et al*., 2004:28), assessors who do subjective assessments may have different internal assessment scales to rate an observation; therefore, it is vital to train them so as to bring each member of the panel as near to the same, standard scale as possible. Based on a thorough literature search and the outcomes of the preliminary preceding steps of the female body shape assessment formula, it became possible to develop a comprehensive training manual for the purposes of developing an assessment scale (**Appendix 3D**).

- **Evaluating females' body shapes by professional evaluators**

Slater (1997) highlights that in subjective assessment, results could be affected by factors such as the subject's personality, skills, state of mind and health. In order to ensure utmost validity and reliability of this method of study, the quality of the evaluators, the assessment procedure, the assessment scaling and the analysis methods were carefully considered. It has been pointed out that using trained professional assessors ensures that the differences perceived are smaller (Slater, 1997). An expert panel in a testing atmosphere works as a sensitive test instrument, capable of providing valid and reliable responses to the sensations being studied (ASTM, 1981:5). This implies that well-trained professional evaluators would give more reliable judgements.

Three judges are recommended for reliability in any subjective assessments only, if visual parameters are established and clearly defined for the judges (AATCC, 1999; Fan & Liu, 2000: Lyman-Clarke, Ashdown, Loker, Lewis & Schoenfielder, 2005). The training and the subsequently developed assessment scale, in this case, set out clearly defined body characteristics, which served as visual parameters. In this study, two professionals in the field of apparel design and manufacture were believed to be experts and qualified enough for the assessment of the body shapes in this study. Their professional experience ranged from 14 to 25 years of field experience, respectively. However, as both evaluators were experts in apparel design and manufacture, which involves an understanding of the human figure and

translating it into apparel, each evaluator independently studied the training manual and practised with similar stimulus material (sample photos). This helped them to understand the clearly defined visual parameters necessary for the assessment of the images. The professional evaluators later met to resolve any misunderstanding arising from the training manual and to develop an assessment scale sheet (scoring sheet). This provided a standardised and sequential way of assessing and recording evaluations of the photos.

***Development of an assessment scale/sheet**:* According to Trochim (2005:49), measurement is a process of observing and recording the observations that are collected as correctly and precisely as possible. However, the measurements must be both reliable and valid. Having consulted the comprehensive training manual and the literature on female body shape scales (Armstrong, 1995; Rasband & Liechty, 2006:19-30; Connell *et al*., 2006:80-94), the two professional raters in collaboration with the researcher, developed the assessment scale (**Appendix 3D**). It has been reported that an assessment scale – like any other measuring instrument – should be devised very carefully, ensuring that all the important elements of the study are well covered to ensure its reliability (Fan in Fan *et al*., 2004:28). The assessment scale/scoring sheet covered all the areas of the female body shapes' characteristics that were deemed critical to the fit of ready-made apparel (all that emerged in the preceding steps).

For the purposes of inter-rater reliability, and due to uncertainty in deriving a valid scale, the researcher and the evaluators decided to use ordinal measurements for all the items where attributes such as small, medium and large were assigned points according to the order of their sizes. A point system was used (1 = small, 2 = medium, 3 = large and 4 = extra large). In cases where assessors were unable to differentiate between two attributes (choices given in the assessment form), they could select an adjacent choice, which is still close to the actual choice. If evaluators were to differ in agreement between attributes (choices given), they would do so because adjacent choices are not far from each other (Connell *et al*., 2006; Fan in Fan *et al*., 2004:28-30).

Evaluation of female body shapes using the assessment scale: With the use of the evaluation guiding principles highlighted in the training manual and the assessment scale, the two trained professional experts evaluated all 89 sets of photos within 7 to 14 days. The data was analysed and inter-rater reliability tests were performed using Kappa statistics, to estimate the degree of consistent agreement between the two raters. After inter-rater reliability tests and data analysis had been done, it was observed that the degree of consistent agreement between the evaluators had Kappa values that ranged from 0.2 to 0.9. Landis and Koch (1977) suggest that Kappa values of 0.00 reflect poor agreement, 0.01-0.20

slight agreement, 0.21-0.40 fair agreement, 0.41-0.60 moderate agreement, 0.61-0.80 substantial agreement, and 0.81-1.00 almost perfect agreement. In this study, it was decided to use a Kappa value of 0.75 as the cut-off point for acceptable agreement. This implied that all the evaluations with Kappa values of > 0.75 were accepted, while evaluated attributes with < 0.75 agreement were rejected on condition that they were to be further subjected to a professional group of experts' evaluations for a final decision. The group of experts comprised three professionals who are experts in apparel design-related careers. Their respective professional experience in the field of apparel design ranged from 10 to 20 years, which ensured the reliability of their judgements.

Before the professional group of experts evaluated the photographs, they underwent one day's training on female body shapes evaluation techniques, using the comprehensive training manual and the assessment scale/scoring sheet. During the training session, they used similar stimulus material (sample photos) for practice. The training was to ensure that they fully understood the sensory tests that they had to perform, and that they were familiar with the specific knowledge required to actually perform the tests correctly. The training was also aimed at improving their ability to recognise and identify the sensory attributes within the body shapes, thus determining a level of consistency in evaluating visual differences which may have escaped the first two expert evaluators (ASTM, 1981:18; Leibowtz & Post, 1982:3, Bye & DeLong, 1994:5; Lyon *et al*., 2000).

The attributes that emerged with poor inter-rater reliability and were further subjected to the professional group of experts for re-evaluation, were: the overall body shape's identity, the bust size/shape, the back curvature, both the hollow waist region and the rounded upper section of the body, the shoulder slope and the two stomach shapes ("**D**" and "**b**"). Where there was no agreement at all, all the members resolved the conflicting ratings and final decisions were made. The bust shape/size and the stance of the figures proved difficult to assess for all the members, and therefore it was decided to eliminate them from the study to avoid biased results. The technique of using a professional group of experts for the assessments and identifying of body shape and body characteristics has been applied in similar studies such as the ones by Kuma, (1999); Lyman-Clarke *et al*. (2005) and Connell *et al*. (2006:85-86).

***Data analyses from the assessment scale*:** The scoring sheet had two sections to be used by the evaluators and an official section with blank spaces corresponding to numerical variables in the margins to facilitate the eventual ease of data entry and processing by the computer (Babbie & Mouton, 2001:415-416). Scores obtained from the judges' ratings were entered in the corresponding blank spaces provided in the official section. The captured data

was compared with every completed assessment scale form to ensure that the information of each questionnaire was correctly captured. Mistakes and errors that emerged were managed and cleaned up (Babbie & Mouton, 2001:410-412; Trochim, 2005:211).

Quantifying the qualitative data from the scoring sheet, the last question in the assessment scale/scoring sheet was semi-structured with pre-formulated questions that would summarise the whole assessment scale. The panellists defined visual parameters of size and form for the different females' figures, measured their physical properties and assigned each body shape to a category, based on the five prevalent body shapes (hourglass, rectangle, apple, inverted triangle and triangle) obtained from the literature. The assignments were done in a qualitative sense through verbal descriptions, incorporating profile characteristics that were common among the photos. These were used later to facilitate comparison between the distinct body shapes emerging from the sample data and the prevalent Western body shapes. The stimulus materials (photographs in different views), already pre-coded using two-digit numbers, were described in terms of the body's characteristics critical to apparel's fit. Although data analysis is a challenge in the qualitative paradigm, the last question of the assessment scale was a summary of the preceding questions, and therefore categorising the descriptions was made easy based on the previous existing terms within the scale. These descriptions were edited and encoded so as to eliminate any errors before placing them into meaningful categories, to facilitate easy tabulation and interpretation while computing.

The inter-rater reliability tests were performed to establish the degree of consistency of agreement between the two evaluators, and so to measure or assess the reliability and trustworthiness of the study. The value of a reliability estimate should indicate the proportion of variability in the measure attributable to the true score. A reliability score of 0.5 would indicate that about half of the variance of the observed score is attributable to truth and half is attributable to error (Trochim, 2005:62). According to Rust (2001), using percentages between judges is not the best method, as it allows some agreement to occur by chance, and if the numbers of categories were fewer, it would even make reliability appear better than it really was. Therefore the Kappa coefficient of agreement between the two raters was calculated as recommended by Rust (2001), to determine the reliability or consistency of agreement between the raters. The results showed Kappa values that ranged from 0.24795 to 0.9460, indicating very poor to very strong inter-rater reliability between the two raters (Landis & Koch, 1977). Significance tests with Kappa ($p < 0.0001$) suggested that there was no complete disagreement between the two evaluators. As earlier discussed, where the inter-rater reliability was below the Kappa value of 0.75, the researcher decided to subject them to the professional group of experts' evaluations.

The Kappa statistics: Kappa measures the percentage of data values in the main diagonal of the table and then adjusts these values for the amount of agreement that could be expected due to chance alone (Landis & Koch, 1977; Simon, 2005). It provides a measure of inter-rater reliability by focusing on the diagonal variables in a table to see whether it contains more counts than is expected by chance (Dixon, 1992:286). It compares the agreement against that which might be expected by chance. Kappa can be thought of as the chance minus the corrected proportional agreement, and its possible values range from +1.00 (perfect agreement) via 0.00 (no agreement above that expected by chance) to –1.00 (complete disagreement) (Chuang, 2001). Reliability with Kappa statistics is essentially the extent of the agreement between repeated measurements, and validity is the extent to which a method of measurement provides a true assessment of that which it purports to measure. The following formula was used in this study. Statistical significance associations of Kappa is based on a zero (complete disagreement between the two evaluators), thus there is high or significant correlation when the p-value ≤ 0.05.

$$\textbf{Kappa} = \frac{(O - C)}{(1 - C)}$$

O = Observed agreement, C = Chance agreement

- **Operationalisation for phase one**

The central concepts on the identification of body shape were expressed in the research framework, and the theoretical definitions for the concepts concerning females' body shapes and apparel fit implications were given in **Chapters 2** and **3**. The concepts related to the identification of body shape were also indicated clearly on the body measurement form, the photographing guidelines (**Figure 4.6**) and the body shape assessment scale. Theoretical clarity and descriptions of the relevant concepts help to facilitate the development of measures or activities that allow the researcher to observe the construct empirically (Neumann, 2000:160; Babbie & Mouton, 2001:128).

It was also important to assess the pattern of prominent body shapes' characteristics, such as the rounded upper back, hollow back waist and the stomach shape between different age groups (Objective 3). Chi-square tests and Fisher's exact statistical testing of hypotheses were performed; where the null hypothesis (H_o) states that there is no significant association between prominent body characteristics and age group (young adults of 25–32 years, middle-aged 33–40 years, and mature 41 and above). The alternative hypothesis (H_a) states that there is a significant association between prominent body characteristics and age group (young adults, middle-aged and the mature). Acceptance of the alternative hypothesis would

indicate that prominent body shapes' characteristics among different age groups differ and hence their apparel fit needs would also differ.

Table 4.3 on the next page indicates how the primary objectives and successive sub-objectives for phase one were operationalised.

TABLE 4.3: OPERATIONALISATION OF PHASE ONE DATA IN TERMS OF PRIMARY OBJECTIVES, SUB-OBJECTIVES AND STATISTICAL METHODS

Primary objective 1 To identify and describe distinctive female body shapes of career women in Kenya from body dimensions and photographs			
Sub-objectives		Null Hypothesis	Statistical analyses
1.1	To identify and describe distinctive female body shapes of career women in Kenya from the body dimensions	There will be no significant association between bust size from bust extensions' dimensions and cup sizes.	Descriptive statistics, uni-variate, bi-variate, means, standard deviations, and range values. Hypothesis testing was not possible due to sparse cells in some categories; therefore, descriptive methods (frequencies and percentages) were used.
1.2	To identify and describe distinctive female body shapes of career female in Kenya from photographs	There will be no significant associations between one evaluator's assessment concerning body shapes and body characteristics, and the other evaluator's assessments of body shapes and body characteristics. There will be no significant associations between the distinctive body features and the age group of the career women.	Trained experts' sensory (visual) analyses, inter-rater reliability using Kappa statistics. Professional group of experts' evaluations were used where the Kappa value was < 0.75. Hypothesis testing was done at a 5% level of significance.
1.3	To establish and describe associations between the distinctive shapes emerging from body dimensions and those emerging from the photographs of the career women	There will be no significant associations between the distinct body shapes emerging from body dimensions and those emerging from the photographs.	Hypothesis testing was not possible due to sparse cells in some categories; therefore, descriptive methods (frequencies and percentages) were used.
Primary objective 2 To distinguish and describe differences between the emerging distinctive body shapes (from measurements and photographs) and the Western distinctive body shape.			
Statistical analyses		Descriptive methods (frequencies and percentages)	
Primary objective 3 To scrutinise and describe the implications for apparel's fit associated with the emerging distinctive body shape of the career women			
Statistical analyses		Descriptive methods (frequencies and percentages)	

4.6.2 Data obtained from the second phase of the study (Questionnaire – Objectives 4, 5 and 6)

The researcher ensured that the questionnaire transcripts were all available and usable, as suggested by Neumann (2000:419). The questionnaires were coded manually and the data

was then electronically entered and captured at the Department of Statistics, University of Pretoria.

The captured data was compared with every completed questionnaire to ensure that the information of each questionnaire was correctly captured. Mistakes and errors that emerged were managed and cleaned up. Babbie and Mouton (2001:417) state that “no matter how or how carefully the data has been entered, some errors are inevitable”. Although efforts were made to avoid errors arising from the data, it was not possible to eliminate them completely. All the coded data was entered into the computer. This enabled the researcher and the statistician to pinpoint errors and eliminate them. Most of the errors found were as a result of incorrect coding and incorrect reading of written codes on the questionnaires. Babbie and Mouton (2001:417) highlight two possible types of cleaning that may be undertaken, namely possible-code cleaning and contingency cleaning. For this particular study, both cleaning methods were applied.

Possible-code cleaning: Question 5 needed two answers (**Appendix 1A**). Participants were asked to report whether the terms provided (junior, junior-petite, women’s, women’s petites and misses) were familiar to them, and they had to give an answer in one section and to give the meanings of the terms in the adjacent section. The variables for this question were the familiarity of terms, which was coded with 1, and the meaning of the size label terms, which were coded with 1 (for correct answer) and 2 (for incorrect answer). The third option of “none of the above is familiar” was coded with 3. The three different codings got mixed up, with 3, 2 and 1 entered in the wrong places. The distribution of responses to each item in the data was examined, the problem identified and the necessary corrections were made.

Contingency cleaning: Question 1 (**Appendix 1A**). The year of birth was to be coded as it was reported. The study was limited to career women aged between 25 (career starting point) and 55 (age of retirement). Out of 201 questionnaires administered, the following years of birth emerged from the data, 1982 (23 years), 1985 (20 years), 0 years and 1987 (18 years). Considering the age limits set for the study and having conducted the research, there was nobody among the participants who appeared under-age or over-age within the set limits of this study. It was assumed that respondents did not want to disclose their ages. In this case, all the affected ages were excluded from the study because age, as demographic factor in this study was not the main focus of the study, therefore it was reasoned that it would not significantly affect the results. There were other cases where age was left blank completely, so these were treated as blank also. All the necessary changes were made and data that was not applicable for the present study was ignored.

Data management is important because it is done to enable the researcher to organise and bring meaning to large amounts of data (Bailey, 1994:339; Miles & Huberman, 1994: 428-430). It becomes pointless if one cannot understand the data presented, thus the necessity to actually simplify and refine the information by summarising the data into few, but holistically legible/interpretable categories (Babbie & Mouton, 2001:428). Collapsing or combining categories that have a very close denotation when interpreted, could achieve more legible and interpretable presentations. If the information to be reported does not essentially require precise difference between two terms that have very close connotation such as “very good” and “good”, it would be wise to combine the two terms for the purposes of simplifying the presentation further (Babbie & Mouton, 2001:430). The terms used in this study with close connotation and where it was felt that their precise differences did not matter in the presentation, were combined. Those terms included: “excellent” and “good” in questions 3 and 4 of the questionnaire, “extremely effective” and “effective” in question 18 of the questionnaire, “more often” and “often” in question 19 of the questionnaire, “strongly agree” and “agree” in question 20 of the questionnaire, and “most frequent” and “frequent “ in question 21 of the questionnaire. The initial five-point scales were then collapsed into four-point scales after the related variables were combined.

Babbie and Mouton (2001:429) suggest that it would be advisable to give respondents the option of saying, “don’t know” or “no opinion”. However, in cases where knowledge was being tested as in questions 5-8, 11-14, 16 and 17 of the questionnaire, the option of “don’t know” was provided, but some respondents decided to leave the question unanswered. In such cases, the researcher decided to combine all the “don’t know” options together with the blanks and they were all treated as “don’t know”. The reduction and streamlining of the data were done for the purposes of greater clarity. To facilitate meaningful conclusions, brief and precise, systematic presentations of legible and essential data that represents only the objectives and concepts of this study, were used. All the necessary changes were made while data that was deemed not applicable for the present study was ignored. Nonetheless, detailed raw data and tables of the entire questionnaire are available as hard and soft copies in the researcher’s data files, while electronic versions are also available in the database of the Department of Statistics, University of Pretoria.

After data cleaning and management were done, the data was statistically analysed, using appropriate statistical methods. Descriptive statistics (frequency distributions) were used to describe basic patterns and the relationships among variables. They were used to summarise and organise sets of sample observations for easier comprehension. Pearson’s correlation coefficient was used to establish meaningful associations between variables such as reported body key dimensions with the actual measurements obtained from the

participants. Chi-square and Fisher's exact tests were used interchangeably to investigate significant associations between two categorical variables.

4.6.2.1 Explanations of statistical methods used for the second phase

The choice of statistical measures in a given circumstance depends on the number of variables involved, the measurement scales used and the nature of the relationships between variables (Agburu, 2001:85). The ultimate goal of most statistical tests is to evaluate the observed relationships by comparing them to the maximum imaginable relationship between those specific variables – comparing what is common in those variables to what potentially could have been common if the variables were perfectly related (Mamahlodi, 2006). In this study, the SAS statistical program, which calculates exact probabilities for each statistic, was used for all the statistical analyses carried out. The exact probabilities can be directly compared to the 0.05 cut-off value, with a p-value ≤ 0.05 indicating statistical significance.

The statistical significance of a result is the probability that the observed relationship (e.g., between variables) or a difference (e.g., between means) in a sample occurred by pure chance ("luck of the draw"), and that in the population from which the sample was drawn, no such relationship or difference exists. In other words, stating the statistical significance of a result tells us something about the degree to which the result is "true" (in the sense of being "representative of the population") (Babbie & Mouton, 2001:487). The value of the p-value represents a decreasing index of the reliability of a result; the higher the p-value, the less we can believe that the observed relationship between variables in the sample is a reliable indicator of the relationship between the respective variables in the population. A p-value of 0.05 is customarily treated as a "border-line acceptable" error level (Ryan, 2005). Due to the exact probabilities calculated by the SAS computer program, it was not necessary to determine critical values for the statistics (Chi-square, Pearson's correlation coefficient and Kappa) applied in this study. However, brief explanations on how each of the statistical methods brings about the results, are given below.

Chi-Square statistics: A Chi-square (X^2) test is used to investigate whether distributions of categorical variables differ from one another as it compares the tallies or counts of categorical responses between two (or more) independent groups. It evaluates the significance of the discrepancy between the observed and expected results in research, and it assumes that the participants were randomly selected and that the expected frequencies are not very low. Chi-square tests can only be used on actual numbers and not on percentages, proportions or means. There are several types of Chi-square tests, depending

on the way the data was collected and the hypothesis being tested. However, it analyses responses based on nominal (Yes or No responses) or categorical (Likert-type scales) questions, and it was tested at the 5% level of significance in the case of this study (Warrack, 2000; Babbie & Mouton, 2001:481; Ryan, 2005).

Calculation of Chi-square (X^2) used the following formula for this study:

$$X^2 = \Sigma[(O - E - 0.5)^2/E]$$

***O* = Observed responses**
***E* = *E*xpected responses**

The Fisher's exact test: This test is an extension of the Chi-square test, and may be used when the numbers of responses in some categories are low, particularly when the expected number of responses is not more than 5 – as required by the Chi-square test. It is tested at the 5% level of significance (Agburu, 2001:140).

Pearson's correlation coefficient: The correlation coefficient is a numerical measure of the degree or extent of relationship between variables (Agburu, 2001:149, 153). The coefficient of correlation, r (product moment correlation coefficient) ranges from –1.00 (perfect negative correlation) through 0.00 (no correlation) to +1.00 (perfect positive correlation) (Wegner, 1998:311-312). In this study, it implied relationships between the measured key dimensions of the career women and the self-reported key dimensions. These were considered as having good correlation when the correlation value was greater than 0.6, which is above the mid-point between 0.00 (no correlation) and +1.00 (perfect positive correlation). Testing the significance of a correlation is actually testing whether the real correlation is at zero or not. When at zero, it means that there is absolutely no correlation between two variables. The following formula was used for this study:

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{N\Sigma X^2 - (\Sigma X)^2} \times \sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$$

N = Number of paired (obtained and reported measurements)
***ΣX* = sum of all the obtained measurements**
***ΣY* = sum of all the reported measurements**

4.6.2.2 Operationalisation for phase two data (Questionnaire)

The central concepts were expressed in the research problem and the research framework. Theoretical definitions for the concepts concerning the fit problems that career women are experiencing with ready-made apparel, their knowledge about the communication of size (body dimensions) and fit (body shape), and their fit preferences for differently fitted jackets and skirts, were given in **Chapters 1, 2** and **3**. As was mentioned, theoretical definitions and descriptions of relevant concepts help to facilitate the development of measures or activities that allow the researcher to observe the construct empirically (Neumann, 2000:160; Babbie & Mouton, 2001:128).

To determine the general fit problems encountered by career women with ready-made apparel (Objectives 1 and 4), it was necessary to investigate their perceptions of fit with different apparel categories and apparel sold in varied retails stores in Kenya. It was also important to examine the body shape characteristics (of the distinctive body shapes that emerged from phase one), and to compare these with the career women's reported frequent fit problems at critical fit points and also with their fit preferences. Statistical testing of hypotheses were performed; where the null hypothesis (H_o) is that there will be no significant associations between the fit of different ready-made apparel categories (imported, second hand and local). The alternative hypothesis (H_a) stated that there would be a significant association between the fit of different ready-made apparel categories (imported, second hand and local). Acceptance of the alternative hypothesis would indicate that the ready-made apparel categories in Kenya have similar fit problems, and therefore that fit problems could be addressed from a collective point of view, rather than addressing specific categories differently. Another null hypothesis (H_o) to be addressed is that there would be no significant association between career women's fit problems at critical fit points and the emerging distinct body shape characteristics that are critical to the fit of apparel. The alternative hypothesis (H_a) states that there would be a significant association between the career women's fit problems at critical fit points and the emerging distinctive body shapes' characteristics that are critical to the fit of apparel. Acceptance of the alternative hypothesis would indicate that the fit problems that the career women frequently encounter could be due to their body shape characteristics deviating from the characteristics of the so-called fit model/ideal shape.

To determine career women's lack of knowledge about the communication of size and fit (Objective 5), it was important to compare the knowledge of those consumers who had professional backgrounds of Home Science or Clothing and Textiles, to those without any such professional background. This required the testing of statistical hypotheses, where the

null hypothesis (H_o) was that there would be no significant association between professional backgrounds in Home Science/Clothing and Textiles and knowledge about the communication of size and fit. The alternative hypothesis (H_a) states that there would be a significant association between professional backgrounds in Home Science/Clothing and Textiles and knowledge about the communication of size and fit. Acceptance of the alternative hypothesis would indicate that educating career women on the communication of size and fit would be valuable in their selection of ready-made apparel that would be better fitting and appropriate for their varied body shapes and sizes.

To be able to determine career women's fit preferences for differently fitted apparel (Objective 6), it was necessary to examine consumers' fit preferences among different age groups (young, middle-aged and mature). To establish whether different age groups would require differently fitted apparel items, the null hypothesis (H_o) was that there would be no significant association between the different age groups and their fit preferences for differently fitted apparel items. The alternative hypothesis (H_a) is that there would be a significant association between age group and fit preferences for differently fitted apparel items. Acceptance of the alternative hypothesis would indicate that different age groups require differently fitted apparel items and therefore, the apparel industries as well as the retailers should cater for these different needs.

Table 4.4 on the following page, indicates which objectives were used to test the hypotheses. Specific questions related to different sub-problems are also indicated, as well as the types of statistical measures used for the analysis.

TABLE 4.4: OPERATIONALISATION OF THE PHASE TWO DATA (QUESTIONNAIRE)

Primary objective 4 To assess the general fit problems that career women encounter with the ready-made apparel in Kenya			
Sub-objectives		Null Hypothesis	Statistical analyses
4.1	To investigate career women's perception of fit with different apparel categories that are sold in varied retails stores in Kenya (Questions 3 and 4)	There will be no significant associations between the career women's perceived fit of ready-made apparel categories that are sold in different retail stores.	Hypothesis testing was not possible due to sparse cells in some categories; therefore, descriptive methods (frequencies and percentages) were applied.
4.2	To describe fit problems that career women in Kenya encounter regarding specific critical fit points of different parts of their bodies (Question 22)	There will be no significant associations between the reported fit problems and the critical fit points of different parts of career women's bodies.	Chi-square and Fisher's exact test. Fisher's exact test was used where the Chi-square statistical test could not be applied, and descriptive methods were also used where statistical analysis was not possible due to sparse cells in some categories. Hypothesis testing was done at a 5% level of significance.

4.3	To describe career women's satisfaction with the process of finding appropriate ready-made apparel items in Kenya (Question 21)	There will be no significant associations between career women's satisfaction with ready-made apparel selection, the way most apparel fit their sizes and the shapes and availability of latest fashion in their sizes.	Hypothesis testing was not possible due to sparse cells in some categories, therefore descriptive methods (frequencies and percentages) were used.
4.4	To explore career women's perceptions concerning the sources of fit problems in Kenya (Question 19)	There will be no significant association between career women's perceptions concerning their body shape as the source of fit problems and their perception concerning the apparel industry as the source of the fit problems.	Chi-square and Fisher's exact test: Fisher's exact test was used where the Chi-square statistical test could not be applied. Hypothesis testing was done at a 5% level of significance.
Primary objective 5 To determine and describe Kenyan career women's knowledge about the communication of size (key body dimensions) and fit (body shapes)			
Sub-objectives		Hypothesis	Statistical analyses
5.1	To explore Kenyan career women's knowledge about the communication of size (Questions 6, 13, 14, 15, 16, 17 and 18)	There will be no significant associations between the home science profession and knowledge of size (labels and key body dimensions. There will be no significant associations between age group, knowledge about and familiarity with size labels.	Chi-square and Fisher's exact test: Fisher's exact test was used where the Chi-square statistical test could not be applied, and descriptive methods were also used where statistical analysing was not possible due to sparse cells in some categories. Hypothesis testing was done at a 5% level of significance.
5.2	To explore Kenyan career women's knowledge about the communication of fit concepts (Questions, 5, 7, 8, 9, 10, 11, 12)	There will be no significant associations between the home science profession and knowledge about fit concepts (labels and body). There will be no significant associations between age group, knowledge about familiarity with size labels.	Chi-square and Fisher's exact test and Pearson's correlation coefficient: Fisher's exact test was used where the Chi-square statistical test could not be applied, and descriptive methods were also used where statistical analysing was not possible due to sparse cells in some categories. Hypothesis testing was done at a 5% level of significance.
Primary objective 6 To determine and describe career women's fit preferences for differently fitted apparel items in Kenya			
Sub-objectives		Hypothesis	Statistical analyses
6.1	To assess and describe career women's preferences for differently fitted skirts in Kenya (Question 19)	There will be no significant associations between age group and fit preference for differently fitted skirts. There will be no significant associations between career women's critical fit points and their fit preferences for differently fitted skirts.	Chi-square and Fisher's exact test: Fisher's exact test was used where the Chi-square statistical test could not be applied, and descriptive methods were also used where statistical analysing was not possible due to sparse cells in some categories. Hypothesis testing was done at a 5% level of significance.
6.2	To assess and describe career women's preferences for differently fitted jackets in Kenya (Question 19)	There will be no significant associations between age group and fit preferences for differently fitted jackets. There will be no significant associations between career women's critical fit points and their fit preferences for differently fitted jackets.	Chi-square and Fisher's exact test: Fisher's exact test was used where the Chi-square statistical test could not be applied, and descriptive methods were also used where statistical analysing was not possible due to sparse cells in some categories. Hypothesis testing was done at a 5% level of significance.

4.7 QUALITY OF THE DATA

4.7.1 Validity and reliability of phase one data (body dimensions and photographs – Objective 1)

4.7.1.1 Body dimensions

While preparing for the field study, the researcher consulted professional anthropometrists, from the Company of Ergotech-South Africa, for training in body measuring techniques, particularly in identifying and locating landmarks on the body, and how to take the measurements accurately. The training was based on the standardised anthropometric measuring techniques, using appropriate (recommended) measuring instruments (Beazley, 1996; ISO, 1990; RMSS, 1994).

The researcher underwent further training in the form of an Anthropometry Accreditation Course (AAC) – level one (**Appendix 3C**). The course consisted of both theory and practical sessions on landmarking and measuring the human body. The techniques used were based on the International Standards for Anthropometric Assessment (ISAK, 2001). The measurements that were taken were carefully prepared (after consultation with professionals in the field of apparel – study leaders and Ergotech experts), consulting different literature and different anthropometric standards. Traditional anthropometry together with specific tailoring techniques of taking body dimensions have been used in many studies (stipulated in most sizing standards), and also ensured reliability and validity of this study (Winks, 1997; Beazley, 1998; Simmons & Istook, 2003). The same approach was adopted in this study, which strengthened its reliability and validity.

4.7.1.2 Photography and sensory evaluation methods

Before commencement of the fieldwork, the researcher underwent photography training, which was administered by a professional photographer. The objectivity and trustworthiness of this study were enhanced by purposefully sampling (negotiations) techniques used while selecting the samples for obtaining measurements and photographs. Selecting, training, and screening the judges for evaluating body shapes based on their professional skills and long-term service also ensured trustworthiness of the outcome. Using a comprehensive training manual and an assessment scale, which was subjected to an inter-rater reliability test, further enhanced the reliability of this study as recommended by Trochim (2005:62).

The standardised photographing studio with a predetermined distance and various guiding

points, the standardised photographing techniques with the predetermined, standardised focus point, the position, the dress code and postures of the subjects while being photographed and the positioning of the camera, also enhanced the reliability of the photographs.

Inter-subjectivity of phase one data: Objectivity regarding the qualitative approach refers more to the generation of truthful and credible inter-subjectivity than the control over external variables (Babbie & Mouton, 2001:273; Fouché in De Vos, 2002:274). The researcher is central to the research process, and in being responsible for the collection of primary data (through taking body dimensions and photographs), is in a sense the primary research instrument; the researcher therefore developed a strong rapport and relationship of trust with the participants. This was done to gain access to them, and to avoid making biased descriptions and interpretations later on. The challenges encountered in the field, as stated earlier, enabled the researcher to be more vigilant and attentive to the sensitive techniques of approach, and to develop more versatile techniques that were suitable to every group of people approached for the study.

Triangulation of phase one data*:* The researcher and trained assistants used different methods of data collection (taking body dimensions and photographing for the purposes of identifying distinct body shapes from the sample data). Body measurement techniques alongside photography, involved the use of standardised measuring instruments and standardised photographing techniques. Both the techniques were aimed at distinguishing the most prevalent female body shapes more exhaustively as opposed to using only one technique. The use of a digital camera to capture images of different views and the different measuring instruments also facilitated accurate capturing of data in this study.

4.7.2 Validity and reliability of phase two data (Questionnaire – Objectives 2, 3 and 4)

4.7.2.1 Reliability

Pilot-testing was carried out on professional experts and some career women in South Africa and then adjustments were made from the responses. Another pilot study was conducted in Kenya, on a convenient sample of career women, to further determine the clarity of instructions, items, language, and the time taken to complete the exercise. This facilitated further corrections and adjustment of items accordingly, before the actual field events. The group that the questionnaire was pilot-tested on, for example, did not understand the term “custom-made”, thus it was translated to a Kiswahili (Kenya’s national language) term of equivalent meaning (“Fundi”). This was provided in brackets next to the term “custom-made”,

as suggested by Neumann (2000:138-141).

4.7.2.2 Validity

In order to ensure that the measurements accurately reflected the concepts they intended to measure (measurement validity), the following different types of validity were observed in the questionnaire instrument for the purposes of Objectives 4, 5 and 6:

***Face validity**:* The instruments were subjected to the scrutiny of members of the scientific community (study leaders, experts in the apparel profession, and the statistician). Questionnaires were also subjected to a group of career women as a pilot test, to ensure that the measurement items, actually measured what they purported to measure. For this study, only those items were used that measured fit problems of females' ready-made apparel (Mouton, 1996:111; Delport in De Vos, 2002:167).

Content validity: Measures used in ensuring content validity represented all the concepts in the conceptual framework presented in **Chapter 3 (Figure 3.24)**. The contents were specified in a construct definition, while sampling was done from all areas of the definitions, and then indicators were developed from all the parts of the definitions, as recommended by Neumann (2000:142-143) and Babbie and Mouton (2001:122-123).

Criterion validity: Due to the lack of standardised criteria to measure the construct validity accurately and to compare with measurements for this study, the researcher selected the experts in the apparel profession with specific skills and knowledge (characteristics related to the phenomenon in question), and predicted how they would score (very high or very low) versus the construct (Neumann, 2000:144).

***Construct validity*:** To determine the degree to which the instruments used for this study successfully measured the theoretical construct that they intended to measure, definitions with clearly specified conceptual boundaries were provided (**Figure 3.24** and **Table 4.1**) to isolate the convergent validity. This implies that multiple measurements of the same construct are related, or operate in similar ways (mutually exclusive and exhaustive attributes (Mouton, 1996:111; Neumann, 2000:144; Delport in De Vos, 2002:167-168).

4.8 ETHICS AND POLITICS

Based on the scientific epistemology, a research project must be as accurate and truthful as

possible (Bless & Higson-Smith, 2000:11). However, because scientific research is a source of power, it could easily be abused (Neumann, 2000; 443). The process and results of the research require strict ethical choices and careful thought on the part of a social researcher (Babbie & Mouton, 2001:256; Apeagyei *et al*., 2007). For the purposes of this study, the researcher observed the following measures:

4.8.1 Training

The researcher underwent training on research methodology, for the purposes of preparation of the research proposal, data collection and presenting of the results. Since the researcher was still inexperienced, the preparation of the research proposal, data collection instruments and analyses and presentation of the data were supervised by two senior research professionals as well as experts in the field of apparel design and manufacture (study leader and core study leaders). In preparation for the data collection, the researcher underwent anthropometry and photographic training sessions to equip her with the necessary knowledge and skills to photograph and take body measurements. This ensured that the research project that was undertaken, was professionally conducted – as highlighted by Neumann (2000:444) and Babbie and Mouton (2001:5).

4.8.2 Plagiarism

The researcher did not under any circumstances indulge in scientific misconduct such as plagiarism or fraud regarding other people's work. The procedures laid down for citation and quoting other people's words have been observed carefully, and the authors of referenced literature were acknowledged throughout the research process (Neumann, 2000:445).

4.8.3 Participants' privacy

All the participants involved were consulted and comprehensive explanations of the objectives of the study were given during the negotiation stage. Hygiene and health issues were observed so as not to violate the participants during this study. A strong rapport was also established with the participants before commencing the activity and throughout the measurement and photographing exercises. Participants' faces were masked to ensure that their privacy was not violated. Their rights were fully respected and their permission obtained whenever necessary. Permission to take their photos and measurements were obtained before the research commenced (Bless & Higson-Smith, 2000:12; Babbie & Mouton, 2001:522; Apeagyei *et al*., 2007).

The leotards/body suits that were used by the participants while being measured were laundered after each use and sealed in plastic papers before re-issuing to the next persons. In cases where a participant demanded total hygiene, the researcher provided a new leotard. The researcher washed her hands after every measurement to ensure hygiene for the next participant as well as for herself.

4.8.4 Accountability

The results of the study will be made available to the scrutiny of the scientific community and thereafter will be disseminated for public use. Since the researcher is accountable to both a sponsor and her employer, the researcher will provide copies of the thesis to them too, as recommended by Babbie and Mouton (2001:526-527).

Data analyses and discussions of the findings of this study are presented in **Chapters 5** and **6**.