The interactive contribution of resources with regard to the operation and outputs of a clothing production system

CAROLINE PRINSLOO (née WATSON)

Dissertation

M Cons Sc (Clothing Retail Management)

Supervisor: Mrs BM Jacobs
Co-supervisior: Prof AC Erasmus

July 2011

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

The interactive contribution of resources with regard to the operation and outputs of a clothing production system

by

CAROLINE PRINSLOO (née WATSON)

Dissertation submitted in partial fulfilment of the requirements for a

Master's Degree in Consumer Science (Clothing Management)

in the

Faculty of Natural and Agricultural Sciences

Department of Consumer Science

University of Pretoria

Study leader: Mrs BM Jacobs
Co-Study leader: Prof AC Erasmus

July 2011

Celebrate life

"This is the day the Lord has made; we will rejoice and be glad in it."

Psalm 118:24

In dedication and loving memory to Spencer Watson and Marie Watson

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DECLARATION

I, **Caroline Prinsloo**, hereby declare that the dissertation for the **Master's degree in Consumer Science** at the University of Pretoria, hereby submitted by me, has not previously been submitted for a degree at this or any other university, that it is my own work in design and execution, and that all reference material contained herein has been duly acknowledged.

CAROLINE PRINSLOO

04 July 2011

ACKNOWLEDGEMENTS

I have the deepest gratitude to the following people and organisations for supporting me in this study, and contributed to the success and completion of the study:

- Mrs Bertha Jacobs for her patience, knowledge, time, professional guidance and encouragement;
- Prof Alet Erasmus, co-study leader, for her professional guidance and inputs;
- the Department of Consumer Science for their administrational help and support;
- the University of Pretoria for awarding me a bursary;
- National Clothing for giving me the opportunity to conduct the study on their production system;
- my family and friends for their interest and support;
- especially, Ilona, Beverly and Narika, thank you for editing the language;
- my late father, Spencer Watson, for your initial enthusiasm, encouragement and financial support;
- my husband, Jurie Prinsloo, you were with me daily on my journey to complete my studies, for your emotional help, sacrifices and love; and
- to my Lord, my Saviour.

SUMMARY

The interactive contribution of resources with regard to the operation and outputs of a clothing production system

by

CAROLINE PRINSLOO (née WATSON)

Supervisor: Mrs BM Jacobs
Co-supervisor: Prof AC Erasmus
Department: Consumer Science
Degree: Masters in Consumer Science: Clothing Retail Management

The clothing and textile industry has a significant impact on the world economy and has secured itself as one of the six most important industries in South Africa. This industry faces many challenges and over the years has been branded by economical changes, company closure, extensive job losses, low productivity, lack of investment in machinery, intensive competition from low-priced imports, trends toward outsourcing and growth in the informal sector (Pride & Ferrell, 1993:34). All of these factors had a direct impact on the South African clothing industry's overall output. This study's focus is primarily on the South African clothing production industry that has, despite its prominence in the country's economy, shown considerable decline in the last decade. For South African clothing production to survive, it is important to connect to global value chains and to increase exports. To do this, clothing manufacturers and operational managers have to improve operational productivity and overall plant performance. Although companies are unable to control external and environmental factors, they can adjust internal factors within the company. Therefore this study explores the utilisation of a company's resources in relation to their productivity

In this study the aim was to explore and describe the interactive contribution of resources (human, operational and physical) with regard to the operation and outputs of a South African clothing production system from a management's and employees' perspectives to formulate recommendations whereby the clothing industry could become more competitive in the current cut-throat environment.

A clothing production company can be viewed as a social system with constant interaction with the environment. It does not operate in a vacuum and consists of a collection of interrelated parts of various subsystems (Spears & Gregoire 2004:24). The systems theory was adapted as a theoretical framework for this study, as it provides a basis for understanding how the various interactive resources are interrelated to the clothing production system and contribute to the overall outputs thereof (Spears & Gregoire, 2004:24). A case study research design was followed, which permitted a more flexible and multi-perspective approach to understand the phenomena under study (Maree, 2007:5). A combination of qualitative and quantitative data collection techniques was used with relevant data analysis procedures. The unit of analysis was a clothing production company in the Bronkhorstspruit area in Gauteng. The operational management, line supervisors as well sewing machine and cutting room operators participated in the study. Purposive sampling was used to select the case, and the individuals within the case study (Babbie & Mouton, 2003:166). Individual interviews were held with the operational management. From the focus group interviews, with the line supervisors, a questionnaire was developed. The sewing machine and cutting room operators participated in the completion of the questionnaire. Qualitative data analysis was done on the interviews and focus group interviews according to Miles and Huberman's (1994:10) data analysis process. Overall 137 questionnaires were completed and was thereafter analysed by a statistician. descriptive data analysis was done by a statistician.

Findings indicated that the internal resources in this factory were interrelated. Thus the optimisation of each resource individually contributed to a more efficient overall production output. Human resources were the core and heartbeat of any production company. Employees' needed, employees' satisfaction, training, and communication and feedback were crucial for optimal outputs. Resources that had a direct relation to human resources were performance appraisal, motivation, training and ergonomics. Optimum training was facilitated by motivating workers. Performance appraisal was directly influenced by training as management trained employees through a performance appraisal system. When the trained employees knew how to operate their equipment effectively it contributed to ergonomic posture and the optimum usage of equipment. Thus all four of these resources were closely interrelated on all levels. Operational and physical resources (technology, production planning, material handling and production system used) were all related to ergonomics and indirectly related to the other human resources mentioned. Quality control was incorporated into all the resources within the company and played a role within the use of every one of the above-mentioned resources. Human resources implemented quality

control in their work on hand, which was facilitated by technology, production planning, material handling and the production system used.

An investigation of a single resource would therefore not have reflected a true scenario in terms of strengths and shortcomings that could be attended to, to improve the outputs of a clothing production system. This study revealed the pertinence of all of the resources in terms of the success of a clothing production system but clearly indicated that failure to control one resource could jeopardise the entire system unless other resources are able to compensate for such shortcomings. In this particular study the potential role of human resources in terms of the success of a clothing production system was confirmed. Although not conducive in the long term, when properly trained and well-treated, employees could be motivated to overcome frustrations caused by poor working conditions created by poor ergonomic features and dated machinery. The hierarchy of resources and the interactive contribution of resources towards the output of the system should therefore be understood and acknowledged by management in order to succeed and to survive in a cut throat industry.

Key words: South African clothing production, systems theory, human resources, operational resources, physical resources, optimum utilisation of resources

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ADDENDA

CHAPTER 1

AN OVERALL PERSPECTIVE OF THE STUDY

1.1 INTRODUCTION AND DEMARCATION OF THE STUDY FIELDS

The clothing production industry is one of the six most important industries in South Africa (Morris, Barnes & Dunne, 1997:1). The South African clothing and textile industries generate annual sales of R34 billion with the textile industry contributing R17.4 billion and the clothing industry contributing R16.6 billion respectively. South Africa's clothing retailers yield considerable buying power, but due to the surge in imports by retailers, South African clothing manufacturers' turnover has unfortunately dropped dramatically (Vlok, 2006:6).

The drop in sales can be blamed on the Agreement on Textiles and Clothing reached in the industry, which provided for the reduction of quotas and the integration of the clothing and textile industry into the General Agreement on Tariffs and Trade (GATT). The first stage began in 1995, and by January 2005 the clothing and textile industry was completely subjected to GATT rules. This had a negative effect on sub-Saharan African countries that previously benefited from preferential trade, because of global competition in the marketplace. As a result, sub-Saharan African countries saw their industries being decimated (Truett & Truett, 2008:2). As soon as the GATT agreement was implemented in South Africa, the doors were opened to the international economy. This South African economy was then obliged to focus on productivity, performance and competitiveness in order to be competitive in the world market (Nordas, 1996:716).

South African manufacturers benefited because of logistical reasons: they had an advantage over foreign manufacturers. If South Africa can improve performances that currently do not meet local retailers' demands, then it can be assumed that the South African manufacturer will increase its market share within the local market.

1.2 OVERVIEW OF THE SOUTH AFRICAN CLOTHING PRODUCTION INDUSTRY

To understand the current textile and clothing industry of South Africa in a global context, global trends need to be considered. The South African industry was always protected from international competition by government policies, tariffs, quotas and export incentives.

1.2.1 South Africa's clothing production industry's development within the international marketplace

When South Africa joined the World Trade Organisation (WTO) in 1994, a gradual reduction in trade barriers opened the South African market to international trade. The African Growth and Opportunity Act (AGOA) bound the United Sates (US) to a system of preferential access to qualifying African countries until 2008. More developed countries were faced with a rule of origin requirement, e.g. clothing garments had to be produced from textiles and yarn produced in the particular region or in the US. Sub-Saharan African countries that benefited from the AGOA agreement were exempted from this by the Multi-Fiber Agreement (MFA) and its successor, the Agreement on Textiles and Clothing (ATC), in 2005 (Truett & Truett, 2008:2).

South African clothing exports have grown very slowly over the last decade and new investments have not been substantial (Kaplan, 2004:633). Therefore this situation causes concern for the South African clothing and textile industries. When trade restrictions were suspended it was to the advantage of China, forcing the local industry to lower labour cost to ensure a competitive advantage (Nordas, 1996:717). Truett and Truett (2008:2) state that by joining the World Trade Organisation (WTO) in 1994, South Africa opened its economy to international trade and as a result South Africa needed to become more competitive.

Three phases of the South African clothing production industry were identified by Vlok (2006:3), who supports Truett and Truett's (2008:2) statement:

- Phase 1: The South African clothing industry must target import substitution. The industry has been protected and focused mainly on the domestic market. In this phase South Africa has failed to become internationally competitive.
- Phase 2: The second phase came after apartheid when South Africa joined the WTO in 1994 and opened its market to international trade.
- Phase 3: Following this period, i.e. since 2002, the South African currency depreciated significantly, which caused exports to be concentrated in low-value-added products.

Considering these three phases the South African government had to contend with two new economic realities: firstly the end of apartheid, opening the doors to international trade; and secondly the inflow of capital which weakened the rand (Salinger, Bhorat, Flaherty & Keswell, 1999:8). During phase three (since 2002), much of the export performance evaporated. By the signing of the Marrakech Agreement in 1994 (referred to as GATT, General Agreement on Tariffs and Trade), as discussed by Truett and Truett (2008:2), the WTO accession has caused a very rapid and sustained surge in imports, The previous agreement managed by the Agreement on Textiles and Clothing (ATC), signed as part of GATT 1994, established rules of trade for a subset of manufactured products that included clothing (Salinger *et al.,* 1999:8). Vlok (2006:9) supports these statements by stating the following: '*the combination of incentives, a depreciating currency and preferential access to the markets of certain developed countries (the US and European Union through the African Growth and Opportunities Act and the SA-EU trade agreement), resulted in a significant rise in exports during the late 1990s and 2000s. However, with the appreciation of the currency, exports performance has weakened drastically and the exports have dropped*.' Competition between South Africa and other countries has therefore intensified. China is currently flooding the South African marketplace with its low-cost products after the quotas on textiles and clothing exports have been removed in the beginning of 2005 (Business report, 2005/01/15).

1.2.2 Background on South African apparel production and its different geographical regions

The South African clothing industry concentrates itself in particular regions such as KwaZulu-Natal (KZN) (52%), followed by the Western Cape and Gauteng (Dunne, 2000:12). Geographical statistics from Dunne (2000:12) and Vlok (2006:7) are: 35% of the manufacturing workforces are in KZN, 25% in the Eastern Cape and 20% in the Western Cape. The Western Cape tends to be more export-orientated because of a smaller proximity market, unlike Durban and Johannesburg, which are mainly focused on the domestic market. Durban and Johannesburg are focusing on the lower-end market, whereas Cape Town focuses mainly on the higher market segment (Fakude, 2000:5). Cape Town's aim is to focus on a niche market as a clothing manufacturer, which provides them a competitive edge. When the World Trade Organisation (WTO) agreement came into effect the firms that would survive were those firms that had a niche market, which made it possible to compete with the low-cost imports from the East (Salinger *et al.,* 1999:14). The Western Cape's labour market is more flexible than the other provinces in the South African labour market, as they have

moved towards a 24-hour shift seven days a week. Asian clothing producers have always operated this way, and to be competitive in the global market it is necessary that the South African clothing producers operate the same way. The positive effect of working in shifts is that more people can be employed (Salinger *et al.*, 1999:64).

Durban represents the largest clothing cluster in KZN, with 416 out of 525 clothing companies being based in Durban (Morris *et al.,* 1997:12). According to Morris *et al*. (1997:12), the existence of a relatively skilled labour force in Durban and lower wage rates than in Gauteng, makes KZN ideal for clothing manufacturing. The KZN industry is mostly influenced by low-cost imports from the East. One of the reasons for this may be the geographical position of KZN, i.e. its wide national borders and its busy ports, and secondly KZN caters for the lower market segment (Fakude, 2000:15).

In the last two decades textile and clothing manufacturers established themselves in non-metropolitan areas. It was estimated in 2002 that there were 40 000 clothing workers and a growing number of informal clothing workers in these areas (Vlok, 2006:8). The clothing manufacturer chosen for this study is located in a non-metropolitan area. It is situated on the outskirts of Bronkhortspruit lying on the border between the Gauteng and Mpumalanga provinces, 50 kilometres outside Pretoria. The factory is situated in Ekandustria, an industrial area established in the 1980s. Two informal settlements that are within close proximity are Ekangala and Kwamhlanga.

1.2.3 Employment background in the South African clothing production industry

Clothing manufacturing has been difficult to mechanise, because it requires mostly manual labour and productivity improvements have been slow (Lin, Kincade & Warfield, 1994:20). For this reason the clothing industry still remains one of the most labour-intensive and complex of all production operations. In spite of the problematic issues surrounding the mechanising of labour and increasing of productivity the clothing production industry has had a positive impact on the overall South African clothing industry in terms of being a source of employment, particularly to the workforce, consisting of previously disadvantaged groups such as Blacks, Indians and Coloureds (Vlok, 2006:3).

Within the different geographical regions the clothing industry is more often than not the only form of formal employment in the rural areas. The textile and clothing industries are considered vital to developing countries because of their high labour intensity. For this reason such industries play an important role in the South African economy. The South

African textile and clothing industries accounts for 14.7% of the total manufacturing employment in South Africa, with clothing manufacturing accounting for 10% of the total manufacturing employment in South Africa. Together the two industries on average contributed 8.1% of total manufacturing salaries and wages. Although the textile and clothing industries are substantial generators of employment in South Africa, they are less important in sources of wages and salaries, due to the fact that clothing and textile labourers earn minimal wages (Truett & Truett, 2008:1).

After the turn of the century the South African clothing industry found itself in a crisis. Imports from China alone increased by 335% from 2002 to 2004 in US Dollar value, which resulted in job losses (Vlok, 2006:10). The South African Clothing and Textile Workers Union (SACTWU) recorded more than 55 000 job losses since 2003, and statistics show a 37% reduction in employment since 1996. Being labour intensive, the clothing industry is more severely affected by increasing imports than most other industries, within the existing labour-friendly industrial environment. Due to the South African clothing industry's main competitors, for instance China, and most of the Eastern countries have a greater labour flexibility and wages that are substantially lower than ours (Clothing Federation of South Africa: Richards, 1999:1).

Different sources confirmed this job loss scenario that the South African clothing industry is faced with. According to Vlok (2006:6), Moodley, Morris and Barnes (2001:6), Pride and Ferrell (1993:34) and Fakude (2000:5), job losses in South Africa were due to reduced demand by industries. In KZN alone employment has declined from 45 000 jobs to 19 000 jobs since 1990. Statistics show that employment in the SA clothing manufacturing industry declined from 228 053 people in 1996, to only 142 863 people in March 2005. By 2005, job losses had affected 277 875 people directly. The manufacturing industry consists of 1 600 manufacturers which employ 133 000 people, and if the informal sector is included this figure could rise to 200 000 people. Job losses occurred largely in the poorer rural areas; this made the possibility for retrenched workers to find alternative work almost impossible. Considering that breadwinners in this industry on average have at least five dependants, the social implications of job losses were severe.

This unemployment manifests itself into the informal sector, for example one man businesses were established to sustain a viable income for retrenched workers. Thus the informal sector created sufficient jobs to be able to accommodate new entrants into the labour force (Fakude, 2000:13). Environmental factors affected the South African clothing industry over the last 15 years; job losses, company closure, increasing trends toward

outsourcing, subcontracting arrangements, and growing of the informal sector of the industry played a large role in the low output of the SA clothing manufacturing industry (Pride & Ferrell, 1993:34). All of these factors had a direct effect on the South African clothing industry's employment figure. This forced the South African clothing manufacturers to improve production output to ensure sustainability.

1.2.4 Differentiation between the South African formal clothing production sector and its informal sector

The response to the job loss scenario in the formal sector was different from one company to another. Some companies closed down, others diversified into other more promising sub-sectors of the clothing industry; such as informal retail or domestically produced clothing by supplying the informal traders or selling on their behalf. Other companies relocated some of their activities to other regions; manufacturing activities were moved to areas where labour cost is lower. In recent years there has been a shift to outsource work to lower wage bills, with strategies such as staff retrenchment, job casualisation and subcontracting as the main drivers (Fakude, 2000:14).

This gave birth to Cut Make and Trim (CMT) companies. The CMT industry can be defined as an industry that is solely concerned with the production process in clothing manufacturing, as opposed to full manufacturers who focus on both the pre-production and production aspects of manufacturing, design houses or independent retailers who specialise in pre-production functions and distribution activities (Morris *et al*., 1997:12). CMTs would typically provide only the labour, and the customer (i.e. the retailer) would for instance provide the material. CMT companies experience the same problems in terms of company closure, therefore the CMT industry also needs to improve production output to be sustainable.

Unless the South African clothing manufacturing industry improves productivity, it cannot compete with international markets and cannot obtain an international market share (Truett & Truett, 2008:1).

1.3 SOUTH AFRICA'S GLOBAL COMPETITIVENESS

To eliminate or minimise the unemployment and retrenching problem, South Africa must enter the global market. Therefore the South African clothing and textile industries must globalise. Globalisation can be defined as a reduction in the barriers to the cross-border flow

of factors (capital, labour and technology), products, ideas and values (Kaplinsky, Morris & Bessant, 2003:19). Globalisation centres are on the increase in communications and other links that bind the distant corners of the world together (Morris *et al.,* 1997:6). Globalisation firstly affected consumer tastes and consumer demand. Secondly globalisation of trade is reflected in global policy, and South Africa limits itself by insulating the economy from foreign economies. Thirdly, decreased trade barriers have led to a global competitiveness; this means that South African clothing manufacturers are faced with an increased number of competitors. Unfortunately, South Africa is not the only country that targets the global market and competition is tight; manufacturers can only survive if they increase their productivity or improve their products. However, Kaplinsky *et al.,* (2003:20) speculate why globalisation will be of value to the South African clothing industry. First the problem of unemployment is addressed. The reality remains however that the domestic market cannot provide enough demand to keep the industry alive and the economic growth has been held back by persistent balance of payments deficits.

The South African clothing industry is not on par with international counterparts regarding key performance indicators, such as quality and price of the product. This means that the South African clothing industry has to upgrade external and internal indicators to be globally competitive. South Africa is faced with competitive challenges. The clothing industry needs an investment in technology. By not investing in capital equipment that is globally comparable, South Africa suffers a dynamic disadvantage. The industry remains concentrated in the less sophisticated CMT sector. The clothing industry secondly needs to invest in skills-based training. Since apartheid, the industry has been neglecting this part of training. The current workforce does not meet the rising quality and high-value-added production demands. The capability of management at all levels is also not up to standard. Another shortcoming is that the South African industry's design capability is based on a follower rather than a leader basis. The South African clothing industry needs to focus on product development, design and marketing. An additional indicator is that the South African clothing industry is not at all competitive regarding key performance indicators such as operational performance and inventory holding. Lastly, South Africa does have cotton producing capability and has access to growing capacity in the South African agricultural regions, which can be developed into a more valuable chain. Lack of investment in this regard has however weakened the competitive side of this sector (Vlok, 2006:18).

The SA Clothing and Textile Workers Union (SACTWU) proposed solutions to address the crises that the South African clothing industry is facing. These proposals are structured into four packages, containing twelve programmatic areas for industry restructuring. The first

proposed package is to introduce limitation measures on specific Chinese imports to help reduce imports and to improve control over illegal imports. The second package is the reorientation of consumer buying toward local products, hence the 'Proudly South African' brand name. The third package of proposal addresses the need to strengthen the performance on the supply side of the industry, through dealing with management, quality, design and product innovation, raw materials and cost reduction. The final package is focused on human resource development: training of workers and managers, improving sustainability of employment and conducting workshops (Vlok, 2006:21).

Where SACTWU refers to import control, reorientation of consumer behaviour, dealing with management, quality, design and product innovation and human resource development, various other literature sources also refer to factors within the clothing industry that need attention to make it possible for South African clothing manufacturers to be internationally competitive. These factors are human resource development, product niche opportunities, upgrade of technology (Salinger *et al.*, 1999:3) and retailers' influence (Dunne, 2000:17).

Human resource development refers to training development, which increases the competitive edge both at management and worker levels, as well as product niche opportunities for Afro-centric clothing, wildlife attire and sportswear. This could also be marketed as 'Proudly South African' (Salinger *et al.*, 1999:3).

Technology upgrade and investment also warrant attention as an input that is crucial for sustained competitiveness. These are both cost and non-cost factors in determining a company's competitiveness (Salinger *et al.*, 1999:3). World-class manufacturing is characterised by low costs achieved through high volume production, and attention given to a more rapid change-over by machinery which is simpler and more flexible. Instead of inspecting quality at the end of the line, quality is assured at each stage of production. Work organisation also becomes more flexible and boundaries between skilled and unskilled workers are narrowed; this implies a focus on training (Kaplinsky *et al.,* 2003:22).

Another factor which is external in nature is retailers that can provide useful information to help guide South African clothing manufacturers to understand domestic retailer perceptions – particularly in areas of performance where local manufacturers might develop a competitive advantage over foreign manufacturers. The statement is explained by means of figures 1.1 and 1.2. Figure 1 depicts how South African manufacturers meet South African retailer demand. Figure 1.2 demonstrates how South African manufacturers meet foreign retail demand.

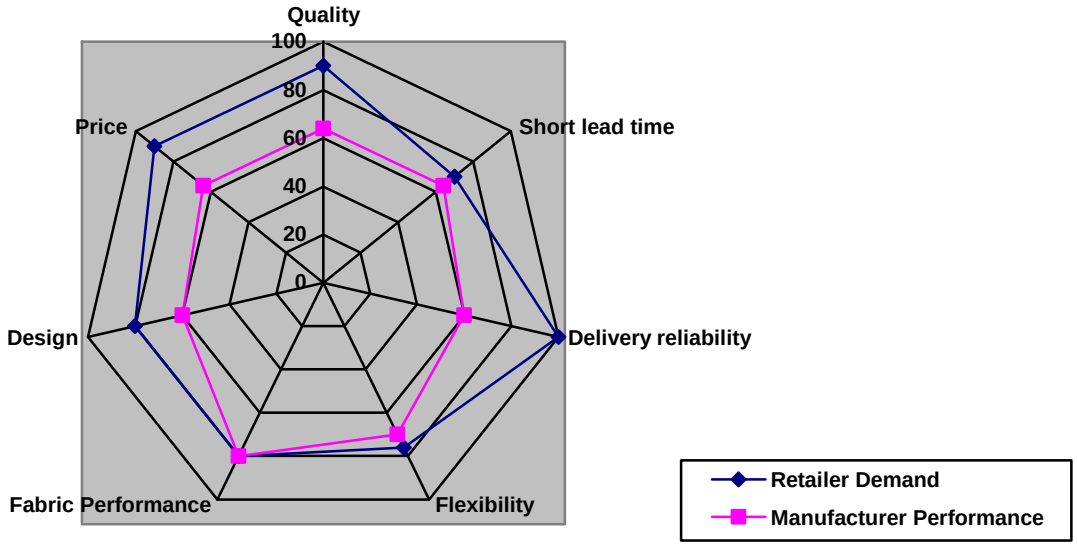

FIGURE 1.1: RETAILER DEMAND VERSUS LOCAL MANUFACTURER PERFORMANCE (Dunne, 2000:17)

Local manufacturers do meet some local retailers' demands and needs. Demands that are met are: fabric performance, flexibility and short lead times. The other four performances that do not meet local retailers' demands are delivery reliability, quality, price and design.

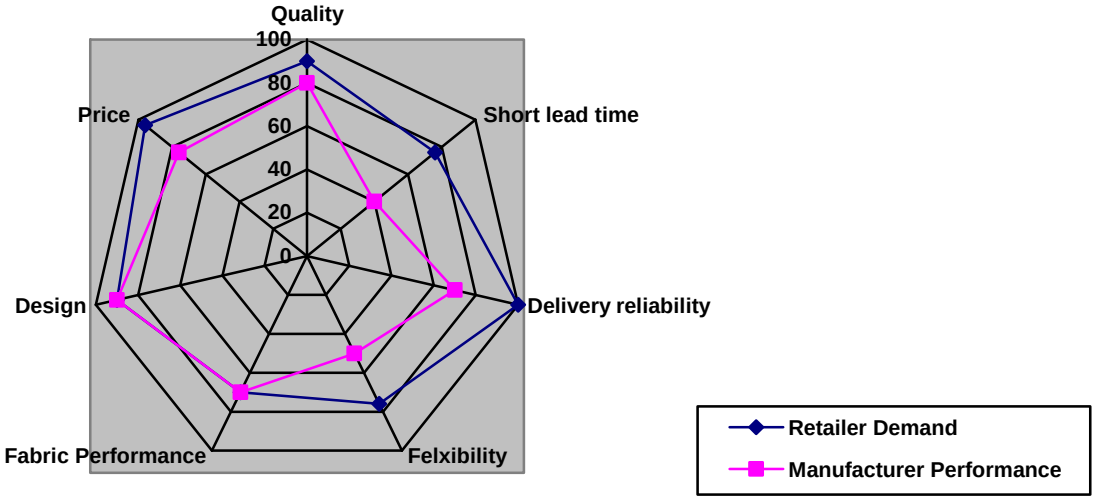

FIGURE 1.2: RETAILER DEMAND VERSUS FOREIGN MANUFACTURER PERFORMANCE (Dunne, 2000:17)

Figure 1.2 explains that local manufacturers do measure up to some foreign retailer demands. Design, fabric performance, and quality are demands that measure up. The other

four performances that do not meet retailers' demands are flexibility, delivery reliability, short lead time and price. South African manufacturers are set back because of logistics (Far from trade market), compared to the foreign markets. These are factors that cannot be easily overcome; however, if South African manufacturers can improve quality and price, the South African manufacturing industry will have an advantage over other foreign markets. This might imply a more competitive advantage in the global market, which might have a ripple effect to benefit the labour issue on hand in South Africa. The challenge for an apparel manufacturer is to minimise input for an improved output, while remaining flexible and meeting retailers' demands (Lin *et al*., 1994:20).

1.4 JUSTIFICATION OF THE STUDY

In order for the South African clothing production industry to survive, it is important to connect to global value chains, thus to increase exports. For the South African clothing production industry to be able to do this, clothing manufacturers and operational managers have to improve operational productivity and overall plant performance (Pragma Africa, 2005/04/27). Although companies are unable to control external or environmental factors due to constant environmental fluctuations and changes, they can manipulate or adjust internal factors (resources) within the company in order to adapt to or create new market opportunities. Thus the clothing industry is faced with a challenge because of the rapidly changing business environment with respect to global competition, market performance and changing technology (Pride & Ferrell, 1993:34). For this reason, it is important to study the internal factors within a clothing manufacturing company in a South African context. Companies do not necessarily have the capital to invest in internal factors (resources), but any company can optimise the utilisation of their resources to ensure productive output. Therefore this study explores a South African clothing production company's utilisation of its resources (human, operational and physical) with regard to the optimising of its operation and outputs.

According to Visser (1998:3), there are two major obstacles within the clothing industry regarding internal factors prohibiting the industry to expand into international markets: firstly, high material input costs, and secondly, a perceived decrease in labour productivity, which means a constant increase in unit cost. It is not only high material input costs and decrease in labour productivity that have a negative effect on the South African industry, but the following factors also influence a clothing production company's productivity: employee competence, work environment, communication, work scheduling, work continuity and

ineffective time management. The solutions suggested to these related to human resources are training and the motivation of employees (Hinzelman & Smallwood, 2004:36).

When taking into account the current economical trends, it is clearly of the utmost importance for a South African clothing production company to utilise its given resources to their full potential. Thus this study aims to explore the following interactive contribution of resources and the utilisation of these resources within a clothing production company**.** What differentiates this study from other studies is the fact that this study aims to understand the interrelationship of the given contributing resources within a South African clothing production company, in terms of the optimisation of these particular resources and, in the end, production potential. By selecting a potential exporting clothing production company, the study might contribute to the company's success and enable it to utilise its given resources in such a way that it might facilitate the company to export into foreign markets.

What differentiates this study from other studies is the new approach that the study follows by examining the utilisation of these resources and the interactive contribution of these resources, and not only the resources by themselves.

1.5 THEORETICAL CONTEXT OF THE STUDY

The main interest of this study is to conduct a case study to explore the chosen clothing production company's utilisation of resources. Therefore a systems theory was adapted as theoretical framework for this study. The reason for choosing the systems theory as a theoretical perspective is because it provides a basis for understanding and integrating information from a variety of fields and sources (Spears & Gregoire, 2004:1). Management of clothing production companies are constantly seeking approaches to deal with the complexity of resource utilisation. The systems approach may facilitate problem-solving and decision-making for management. The systems approach focuses on the totality of the organisation; all the resources are considered, e.g. external and internal resources (Spears & Vaden, 1985:2). A system can be described as a collection of interrelated parts or subsystems unified by design to obtain one or more objectives (Spears & Gregoire, 2004:2). In this study, a clothing production system is defined as the integration of materials handling, production processes, personnel, and equipment, directing work flow and generating finished products (Glock & Kunz, 1995:315). A clothing production company as a social system has constant interaction with the environment and does not operate in a vacuum; it is thus an open system, which is a collection of the interrelated parts of various subsystems (Spears & Gregoire, 2004:2). In this study transformation can be identified as the clothing

manufacturing process. The concepts *open system* and *transformation*s are discussed in Chapter 3.

1.6 PROBLEM STATEMENT, OBJECTIVES AND SUB-OBJECTIVES

The SA clothing manufacturing industry is faced with various challenges. Due to cheaper imports from the East, the SA clothing manufacturing industry is not competitive; this escalated into job losses and has a direct influence on the economy and the welfare of unschooled workers who were already low paid workers. To better this situation, SA Clothing Manufacturing companies need to improve on production output with given resources.

1.6.1 Research objectives and sub-objectives formulated for the study

The following objectives and sub-objectives were formulated to investigate problems and possible solutions to the problems from the perspective of various role players within the system, i.e. management's and employees' perspectives of the clothing production system of the selected company.

1.6.1.1 Objective 1

To explore and describe the role that *human resources* (*performance appraisal, training and motivation)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

Sub-objectives

- To explore and describe from **management's perspective** the role *performance appraisal* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *performance appraisal* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *training* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *training* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *motivation* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *motivation* plays in the optimisation of a clothing production system's utilisation of resources.

1.6.1.2 Objective 2

To explore and describe the role that *operational resources (ergonomics, production planning, and quality control)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

Sub-objectives

- To explore and describe from **management's perspective** the role *ergonomic aspects* play in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *ergonomic aspects play* in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *production planning* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *production planning* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *quality control* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *quality control* plays in the optimisation of a clothing production system's utilisation of resources.

1.6.1.3 Objective 3

To explore and describe the role that *physical resources (technology, production system and material handling)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

Sub-objectives

- To explore and describe from **management's perspective** the role *technology* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *technology plays* in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role the *production system* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role the *production system* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *material handling* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *material handling* plays in the optimisation of a clothing production system's utilisation of resources.

The interrelationship of these inputs will be studied to explain what the influences are on the production outcome of the company

1.7 RESEARCH METHODOLOGY

This abstract of the methodology was used to gain a better perspective of the study. The details of the methodology are discussed in Chapter 4.

A case study was conducted on a clothing production company that is situated near Bronkhorstspruit in Gauteng. A combined qualitative and quantitative research design was used. During the first phase, the qualitative data collection technique that was used was a face-to-face open interview that was held with management. From the interviews, management's perspectives on possible problems which could affect the production outcome were formulated.

Secondly, the sewing machine operators were interviewed in the form of focus group discussions. The sewing machine operators (SMOs) (which consisted only of the direct line supervisors, jacket line, trouser line and the cutting room department) could speak their minds on various factors that could possibly affect the clothing production company. From this focus group interviews certain topics/themes were identified and formulated into a questionnaire. This quantitative measuring technique was applied to measure the perspective of the SMOs within the clothing production company. The questionnaire was administered to a group consisting of 100 sewing machine operators as well as to cutting room operators. The distribution of the questionnaires was done equally between the jacket line and the trouser line. Fifty (50) questionnaires were issued to the cutting room operators. First fieldworkers which consisted of the line and cutting room supervisors were trained. Together they all helped to complete the questionnaires within their own departments.

1.8 OUTLINE OF THE STUDY

To conclude this chapter an outline of the study follows:

In **Chapter 2** a literature review is presented to give an in-depth perspective of where the different concepts (e.g. internal and external inputs) and the problem formulation of this study are formulated from. This literature review includes again some background of the study. However, the literature review also defines most of the concepts used in the conceptual framework for this study.

The conceptual framework is explained in Chapter 3 on the basis of the literature review. The systems theory which defines the research style for this study is explained in **Chapter 3**.

Chapter 4 explains the research methodology used in this study. This chapter describes and justifies the research design and style. The qualitative and quantitative research techniques

that were used are also explained in this chapter, together with the justification for these techniques. Triangulation is the focus point in this discussion. The interviews, focus groups and questionnaires are discussed, together with the limitations of each.

Data analysis and the presentation of the results are set out in **Chapter 5**. These results are discussed by using the research objectives as an outline for the discussion.

In **Chapter 6** the results, as presented in Chapter 5, are interpreted and the implications of these results are then discussed. These implications are discussed and connected to the literature review and the research objectives. Recommendations are made to the apparel manufacturing company. Chapter 6 contains the summary of the research; each objective is then concluded in this last chapter. Future research possibilities are discussed and an evaluation of the study is done.

CHAPTER 2

LITERATURE REVIEW FOR THE STUDY

2.1 INTRODUCTION

To be able to construct a good theoretical base on which to build a rationale for this study a literature review was conducted and is set out in this chapter. Reading the literature helped to put the research problem into perspective, namely *to understand the role that resources as input, as well as the interrelationship between these inputs, play in the optimisation of a clothing production system's utilisation of resources*.

This chapter explains and defines the relevant concepts for the research to ultimately construct a conceptual framework that depicts the coherence of the different concepts and their relationship towards the outcome of the research, i.e. to gain an understanding of the production system's utilisation of resources.

2.2 RESOURCES INVOLVED IN A CLOTHING PRODUCTION SYSTEM

Resources are the 'things' a business use to pursue its ends. They are also defined as the inputs that the business convert to create the outputs it delivers to its customer (Wickham, 2004:200). Different resources have a number of characteristics in common. Resources are consumed; they are converted by the production process into products a customer wants, and there is competition to get hold of resources. The cost of resources is an indication of how a production company might use the resource. The value of a resource, however, lies in the way a business will use this resource. One resource can be converted into another resource, for example one resource can be sold for cash. What gives a company its competitive advantage is the innovative utilisation of resources to be able to give new value to their customers (Wickham, 2004:202).

A variety of resources (inputs) have a direct relation to the production outcome of a clothing production company. From the literature it is clear that there are specific resources, and they are clearly classified into subcategories namely human resources, operational resources and physical resources.

The respective resources identified for the relevant subcategory human resources are: performance appraisal, training, and motivation. Resources identified for the subcategory operational resources are: ergonomics, production planning, and quality control. Lastly, resources identified for the subcategory physical resources are: technology, production planning, and material handling. The literature review further explicates these resources and their relevance in terms of a clothing production system.

2.2.1 Human resources

Human resources refer to people and their efforts, knowledge, skills and the insight they contribute to the production system. Human resources can take a variety of forms. The first may be productive labour. People's technical expertise contributes knowledge to the product or system. Thirdly, their functional and organisational skills are vital to contribute insight into functional areas such as production activities. Lastly, communication and leadership skills can be contributed to the production line by both management and workers (Wickham, 2004:200).

For the purpose of this study human resources are classified into two groups, namely sewing machine operators and operational management. A sewing machine operator has to perform one of three types of tasks: an operation, a job, or a process (Solinger, 1980:258). Operational management is defined as the management of systems, i.e. a production system or processes that offer products and services (De Beer, Kritzinger, Venter, Steyn, Labuschagne, Ferreira,1997:64). Both parties, i.e. management and sewing machine operators need to be investigated in terms of the interrelationship between the two parties during production.

Both capital and business inputs are important in the optimum utilisation of human resources. Because of the labour intensity of clothing manufacturing, the educational and skills levels of workers and managers are important to the performance of the manufacturing company (Salinger *et al.,* 1999:10), which explains why the first resource (input), to be addressed by this study is human resources The high labour intensity in apparel production (30 – 50% of the final garment cost) literally forces clothing producers to seek locations with lower wage employees in order to reduce production costs (Lin, Moore, Kincade & Avery, 2002:46). High labour cost and the opening up of the economy to foreign competition have had a negative effect on the domestic clothing industry (Wadud & Nair, 2003:325). It is imperative to stress that labour is the only resource that reacts when reacted upon. It can be said that with

relatively little effort, human resources can easily be managed (Gerber, Nel & Van Dyk, 1998:3). Thus with little effort such as performance appraisal, training and motivation, human resources can be more easily managed that other resources, i.e. capital resources.

Literature describes the influence that employee training, employee motivation and employee competence (which relates to training) have on the production outcome (Hinzelman & Smallwood, 2004:36). Employee training, employee motivation and employee competence can be implemented in terms of performance appraisal, motivation and training that are pertinent inputs of a clothing production system through which the same or better production outputs can be achieved, without increasing cost (Gerber *et al.*, 1998:223).

2.2.1.1 Performance appraisal

Performance appraisal is defined as a process through which human performance is identified, measured and developed. The performance appraisal system can be used as a motivational tool to communicate performance expectations and provide feedback to production line workers. Performance evaluation and compensation have a direct influence on meeting company goals and the motivation of employees (Spears & Parker, 2002:13).

Performance appraisal can furthermore be defined as a system whereby employee efforts over a period of time are recognised and rewarded. It is of great importance to link performance appraisal to the employee's job description (Appelbaum, Nadeau & Cyr, 2008:295).

A five-step process is suggested for performance appraisal evaluation:

- Conduct a job analysis.
- Write a job description.
- Transfer task areas.
- Establish appraisal policies.
- Train the management on how to rate employee performance.

By rating employee performance according to job description, misguided expectations can be avoided. Appelbaum *et al.* (2008:297) suggest two types of rating techniques, namely a multi-rater system, and a self-appraisal performance evaluation. A multi-rater system is one where an employee is rated by not only his/her superiors, but also by his/her co-workers. The advantage of this rating system is that the employee is not evaluated by one individual only, but rather by the organisation as a whole. The self-appraisal performance evaluation is one

where an employee can compare his/her own ratings to ratings of his/her peers and managers. This gives an employee a better understanding between raters and ratees with respect to the job itself, and the expectations of the job.

The elements that form the basis of performance appraisal are objectives, performance, evaluation, feedback and, in the end, the forming of new objectives. The aim of performance evaluation is to verify that the employees are performing at their best. There are three different approaches that can be used at a company's own discretion. In the 'top-down' evaluation the employee reports to, and is evaluated by his/her direct higher-level superior within the organisation. The second 'bottom-up' approach is used less often and implies that the supervisor of a team is judged by the employees working below him/her. The last option is the '360-degree of evaluation' where any employee is placed in the middle and is evaluated by everybody concerned.

There are many different approaches to performance evaluation. Evaluation can be informal or formal. This is so, because evaluation occurs consciously or subconsciously on a daily basis. Performance evaluation can be based on personality traits such as creativity, withstanding stress, good nature, ambition and intelligence. It is however much more constructive to rate an employee for his/her effort rather than on his/her results because it is difficult to evaluate personal traits such as *intelligence*. Such an evaluation calls for high subjectivity. Task-based evaluation, on the other hand, focuses on the content of the task being carried out instead of the character of a person, which is much more substantial, compared to character-based evaluation. On the other hand, the disadvantage of such evaluation is that specification may be very limited and may cause delays. A target-based approach takes task-based methods a step further. As the global community is rapidly changing, task-based evaluation becomes redundant, as will evaluation criteria that are no longer relevant. Target-based evaluation is set on goals and laid down by management's objectives. Result-based evaluation goes hand in hand with target-based evaluation. The advantages of target- and result-based evaluation are that they are both flexible and strategically relevant, which grants them a high degree of objectivity. The disadvantage of these two types of evaluation is that concentrating on business results makes it difficult to concentrate on individual highs and lows. Also, objectives that can only be measured qualitatively cannot be evaluated by these methods. One can therefore conclude that these different methods/approaches to performance appraisal have different aims. The business focus should clarify which method should be used (Kressler, 2003:47).

Reward forms an intrinsic part of a business personnel policy. The aim of reward strategies is to make the most of what employees can contribute. Reward always brings financial matters to mind, but financial payment is not always the most effective way of reward. A non-financial reward strategy is difficult to calculate and measure, but is far more effective (Kressler, 2003:47). The efficiency of rewards is determined by different external and internal influencing factors. Reward depends on the individual needs of an employee. Although pay is important, motivation is generated from other sources, as is discussed in section 2.2.1.3.

Kressler (2003:132) argues that incentives cannot be linked together with motivation. Incentives can however build upon existing motivation. Employees must never become accustomed to incentive payouts, because then the higher salary, for example, will become the norm.

2.2.1.2 Training

Training can be defined as the process of imparting job-related knowledge to the employees (Glock & Kunz, 1995:12). Training prepares employees to improve their performance in present jobs, and is usually regarded as an expensive item necessary to make the organisation more effective and to increase productivity (Spears & Parker, 2002:12). Training precedes good performance. Sewing machine operators must have good skills and knowledge before good performance can be expected; only then can performance appraisal take place (Deller, 1998:136).

Training of employees and managers is a tool that can be used to improve the utilisation of human resources. Management must adopt modern practices to achieve a higher production output; this can be achieved if the management and supervisors are trained to implement these changes. In-house training or sponsored external training can be used to facilitate the training of management and supervisors. Extant research indicates that companies who invested in operator training had a higher production output. It is also recommended that operators get in-house training because it makes them cognisant of what is expected to meet world-class performance and to be globally competitive (Bheda, Narag & Singla., 2003:21).

Technology improvement relates to research and the development of new product ideas. As South Africa is currently a developing country the research and product development inevitably depends on training. There are, however, very limited prospects for career development for black workers, as most of them in the industry do not have the basic education that research and development require (Nordas, 1996:718).

Training is difficult to evaluate, because there is always a possibility that training might fail. Reasons for failure of training include: lack of planning and doing training for the wrong reasons. Managers generally focus on increased performance while it might have been better to seek increased learning that would result in increased performance. Skills and knowledge gained in training are often not applied directly upon completion of training (Berge, 2008:390).

Berge (2008:391) explored some purposes of training, namely: focusing energy on issues, supporting other inventions, promoting change, reducing risks, building teams, rewarding past performance and developing skills – to mention only a few. It is difficult for any business to identify performance improvement after a training session because the goal of training is to prevent mistakes, errors and defects. To actually show the impact of training on the business would be to stop training, but this is not advisable.

The following table shows the relationship between training and performance improvement:

TABLE 2.1: TRAINING VERSUS PERFORMANCE IMPROVEMENT (Berge, 2008:392)

	TRAINING	PERFORMANCE IMPROVEMENT
Purpose	Individual learning	**Improved productivity and profitability for the company.**
Role	Provide effective winning training with an environment that promotes learning	**Improves the job performance**
Goal	Close skill gap	**Achieve business goals**
Task	Make training enjoyable	**Fill performance gap in the organisation**
Evaluation	**Reaction and learning**	**Increased job performance and business improvement**

Table 2.1 shows how the actual training influences the job performed in terms of purpose, role, goals, tasks and evaluation of training and indicates how training should be evaluated. Evaluation of training also coincides with performance appraisal. Performance appraisal comes into play with training, in that training should always be supported by performance expectations and adequate performance feedback, together with employee incentives availability (Berge, 2008:392).

Companies with a more complex garment construction, for example ladies underwear, have more intense in-house training programmes. Other sectors are also criticised for lack of training: indications are that South African designing skills need to improve considerably if they aspire to be internationally competitive (Salinger *et al.*, 1999:65). Companies also have to realise that most of their sewing machine operators are more skilled than to perform only

one operation. Ideally operators should therefore be used to their full potential (Salinger *et al.,* 1999:65).

Competencies management and competency-focused learning are terms that are often used. Competencies are specific qualities, specific fields of knowledge or skills that a population, group or organisation has (Korsten, 2002:367). People's motivation is considered. The competency motivation is, however, another entity. Human competencies can be grouped into the following: at the bottom of the hierogram are self-image, motives, commitment, enthusiasm and persuasiveness. At the second level are values, standards, professional ethics and moral standards; thirdly, intermediary skills, and at the top of the hierogram are professional knowledge and skills.

Four layers of skills are relevant: the fourth layer of skills refers to deep characteristics of a person and cannot easily be learned. The third layer of skills cannot be learned in a working environment; the person either has them or not. The last two layers of skills namely, professional and knowledge skills can be learned through training. Intermediary skills are, however, not easy to acquire. They include social, communication, organisational, general and professional skills. A company must decide what its training goal is, and then work towards that goal and the competencies that are specifically relevant and important for the job. Competencies can also be achieved, not only by training, but with proper recruiting and selecting employees during hiring (Korsten, 2002:369).

The following training myths may be used by some companies not to conduct training:

- "Training is too expensive." Training should be considered not a cost item but an investment.
- "Gaining knowledge and skills is something for less educated employees."
- "It is the responsibility of the instructor or trainer to impart and enhance knowledge and skills."
- "Training does not work." Training alone does not help. Management has to incorporate training in the daily workplace. The focus should shift from corrective behaviour to preventative behaviour (Korsten, 2002:369).

Although the extremely labour-intensive workings and technology improvement in clothing manufacturing have lowered its dependency on labour, mass production techniques still require a large labour force. Technological and organisational change has led some employers to believe that success relies on employee development. In reality, training is

costly and the effect of training on productivity is not immediately tangible. The organisational goals of the company should be linked to training and development programmes, for example products of high quality. Training has always been the concern of the human resource departments within companies. There has now been a shift in this responsibility, away from the human resource personnel to line managers. Line managers who play an active role in the production process are responsible for the day-to-day implementation of programmes, and have a responsibility for linking the programmes to the actual implementation. There are, however, problems when delegating training to line managers, for instance, ownership of the training and development programme, language relating to the problem of cognition outside the specialist area, role clarification in terms of the degree of line involvement in training and developing activities, and the competency of line managers. The effectiveness of training is subsequently difficult to measure. In the clothing sector evaluation occurs on an informal basis and companies place great value on feedback from line managers and trainees (Morrow, 2001:80).

2.2.1.3 Motivation

Motivation indicates a feeling of accomplishment, a desire to learn, and can be derived from work-completed recognition by peers or management (Glock & Kunz, 1995:359). Other factors that could serve as motivation are responsibility recognition, self-respect recognition, fair rewards, possibility for promotion, and feedback on performance, praise, salary increase and self-actualisation (Hinzelman & Smallwood, 2004:38).

Incentive schemes as an employment motivational scheme are difficult to manage, because of high rates of absenteeism in the clothing industry (Salinger *et al.,* 1999:66). Some styles are more complex than others, and within a style some operations may be more difficult and time consuming to rate in terms of an incentive scheme, which gives rise to the free-rider phenomenon. Some workers do not work as hard as their peers in a team, but get the same incentive bonus.

Employees' work motivation relates to their response behaviour, for example, their absence rate, leave rate, quit rate, and the get-to-work speed. It can be assumed that anyone works in expectation of some reward. A relationship can be drawn between the scale of reward and the performance of an employee. This means that the employer needs to decide what the maximum reward can be to ultimately encourage work motivation and productivity (Hong, Yang, Wang, Chiou, Sun & Huang, 1995:10). Hong *et al.* (1995:10) concluded that financial benefits are the most influential benefits, with year-end bonuses first on the list and

dividends, pensions, individual annual vacations and working disease compensation following in order of importance. They used Maslow's hierarchy theory as a basis to classify employees' benefits, which is more or less the same as Korsten's (2002:367) classification of employee competencies and motivation regarding training requirements. Maslow's hierarchy suggests specific hierarchical stages of needs. First physical demand benefits, e.g. year-end bonuses, savings subsidies, emergency subsidies, annual vacation, housing benefits, food and drink subsidies. Secondly security demand benefits, e.g. day care facilities, medical subsidies and commuting subsidies. Thirdly employees' needs involve social demand benefits, which include entertainment facilities, travelling facilities, maternity and parental leave. Lastly, employees have a need for self-actualisation demands, opportunity for further educational studies and flexible working time. It is of utmost importance for line managers to remember that employees with different education levels perceive different employee benefits differently: physical demands have a greater influence on sewing machine operators' needs, and thus can have an influence on the motivation of the sewing machine operators. However, implementing employee benefit programmes has a greater impact on work motivation than on productivity.

There are eight motivation theories that need to be acknowledged when management wants to increase employees' motivation:

- The first theory for motivation to work was formulated by Abraham H Maslow, which is popularly referred to as Maslow's pyramid of needs. As discussed above, human needs are classified hierarchically as level 5: the need for self-actualisation; level 4: esteem needs; level 3: love needs; level 2: security needs; and level 1: physical needs. Basically only unsatisfied needs are 'motivators' (Kressler, 2003:15).

- The McGregor theory in Kressler (2003:17) emphasises the breach between human conditions and the conditions that can be found in a workplace. Most organisations have insufficient opportunities for employees to fulfil their needs. Employees seek to satisfy their needs as formulated by Maslow, but organisations offer dependence, control, obligation and conflict. This explains the lack of motivated workers in most organisations.

- Motivators and hygiene factors are included in the Herzberg theory in Kressler (2003:20). Hygiene factors refer to dissatisfactions. Herzberg investigated what triggers employees to feel satisfied and fulfilled in their job, and the factors that frustrate job satisfaction

- Achievement is performance that produces something. The McClelland theory in Kressler (2003:23) states that most of human behaviour is developed during childhood, through positive or negative feedback. Needs are ingrained by rewards and thus there is a behavioural cycle. McClelland discuss three needs that regulate motivation: the need for achievement, the need for power and the need for affiliation. The need for achievement is important in a working environment; it can give birth to performance. The need for power gives rise to responsibility, and lastly, the need for affiliation gives birth to teamwork.

- The Valence-Instrumentality-Expectancy (VIE) theory in Kressler (2003:25) is somewhat related to McClelland's theory. The VIE theory holds that motivation is not brought forward by needs, but rather that people choose from various options which yield success. Valence can be described as an important personal goal; instrumentality as a milestone on the way to reaching this goal, and expectancy is the probability that this milestone can be reached. These three concepts explain how people are motivated to reach a certain goal. Valence means value, instrumentality means assistance, and expectancy means expectation.

- The Locke Latham theory in Kressler (2003:27) explains motivational behaviour at work, together with personal targets, related moral concepts and value judgement. Goals raise performance at work, and furthermore it is important to agree upon mutual goals. Employees must be willing to agree upon a goal, to be able to set a target.

- When taking into account all the above theories as discussed, there is an additional factor that plays a role, namely fairness, equivalence or equality. A person always needs confirmation that success stands in line with hard work. When not much is received in return for hard work, a cognitive discord arises which is mostly not an objective experience. Employees' notion of fairness, equivalence or equality is not based on sheer concepts, such as own pay, but on related concepts, i.e. comparison to the work of others. This can result in negative feelings. Openness, appraisal, and feedback on performance generally provide more objectivity (Kressler, 2003:28).

- The last point of discussion from Kressler's (2003:29) motivational theories is the 'sixteen basic desires'. Steven Reiss concludes after research that there are sixteen possible desires that determine motivation. These key concepts vary from person to person and are based on experience and genetics. Each person possesses their own

key to motivation. These sixteen desires or motives are power, independence, curiosity, acceptance, order, savings, honour, idealism, social contact, family, status, vengeance, romance, eating, physical activity and tranquillity. These factors have an impact on human behaviour and thus on motivation at work.

As confirmed by the above literature, performance appraisal, training and motivation form part of human resources. Human resources *per se* is therefore a very intricate input that could and should be managed with utmost care and sensitivity in order to optimise the production line's outputs. The following resource to be discussed is operational resources and its sub-resources.

2.2.2 Operational resources

Operational resources, according to Spears and Gregoire (2004:7), can be seen as resources which can be subdivided into three resources that a clothing manufacturing company makes use of. In terms of this study the three operational resources are: ergonomics, production planning, and quality control. The following literature review validates the sub-resources to be conceptualised as operational resources.

2.2.2.1 Ergonomic aspects

The word "ergonomics" is derived from the Greek words *ergo* (work) and *nomos* (laws). Ergonomics has its roots in work psychology, biomechanics and workstation design (Helander, 2006:3).

Ergonomics refers to the study of the interaction between workers and their work environment (Glock & Kunz, 1995:332). Tasks are not independent from one another. Ahasan and Imbeau (2003:71) associate ergonomics with human factors adapting to new machinery or industrial systems within a particular society, relating to various aspects of the user's physical, environmental and cognitive capacities. The application of ergonomics to a system may involve matching technology, inexpensive and productive methods, tools and equipment to support the base technology. The author relates human factors to characteristics such as culture, language, skills, educational levels and standards of living. This statement coincides with training, because if one understands the concept of human factors, one understands the person's capability to learn and this can lead to an adequate training program. The interaction between user and machine (sewing machine) takes place within some workspace (sewing machine operator and sewing machine), which in itself is

located in an environment (production system), (Galer, 1987:19). This is why the research encompasses machines (technology), workspace, environment and the user (sewing machine operator). As seen from the interdependent relationship of the environments, if one of the environments is neglected it could affect productivity. For example, if the machine is not in good working condition it affects productivity, or if the sewing machine operator is not well trained to use the machine, it has an effect on the utilisation of ergonomics as a resource (Galer, 1987:19).

'The application of simple ergonomics standards, checklists and codes of practice can pay rich dividends' (Ahasan & Imbeau, 2003:71).

Ergonomics has three goals, namely human health and safety, productivity, and operator satisfaction. Safety regulations may be assessed by comparing performance requirements of the environment with the performance limitations of the operator. It is always better to work proactively and to foresee safety problems. The following factors can be used as indicators for management to ensure a safer environment that would be conducive to optimise the production line's outputs:

- Poor work posture indicates that redesign of the work posture and process may be advisable;
- If the ambient environment is uncomfortable, i.e. when the illumination, noise levels, vibration and or temperature of the working environment is not at a comfortable level for the operator, it can cause stress and affect work performance negatively. Design features of a machine can also be adjusted to improve the situation.

The second goal is productivity. Ergonomic design will improve the performance of the clothing production system, for instance by enhancing the skills of the employee through control-response compatibility. The relationship between safety and productivity works both ways. When an operator works faster, because of better lighting, the safety component and quality factor are not addressed, because the operator has less reaction time. Thus the old approach to enhance productivity by an improvement in speed is not always advisable; it would be better to associate improved quality with improved productivity (Helander, 2006:15).

The third goal of ergonomics, as discussed by Helander (2006:15), is operator satisfaction. Job satisfaction can only be understood if the operator's needs are understood. After extensive research it was found that job satisfaction is not related to productivity and job safety, which poses new challenges to management.

In recent years there has been a significant increase in musculo-skeletal disorders (MSD) in the manufacturing industry, which is a concern in terms of health and economic burdens for the industry (Tuncel, Genaidy, Shell, Salem, Karwowski, Darwish, Noel & Singh 2008:94). The relatively high incidence of MSD can be the cause of physical and non-physical characteristics of the manufacturing industry. In clothing manufacturing the worker may not work with heavy equipment, but does the same movement over and over during a normal work day while being stationary in one position (Tuncel *et al.*, 2008:94). Task, technology, environment and workstation, together with personal capacity, can have a detrimental effect on the human body. If there is a chronic strain – either biochemical, physiological or psychological – the worker may develop a disorder, which could be MSD (Tuncel *et al.*, 2008:94).

The following factors play a role in muscular disorder, namely bad posture, insufficient lighting, height of workstation surface, and an inadequately supporting sitting position. The sitting position can be evaluated by the following factors; seat height, seat angle, seat rocking, seat swivel, back rest distance, backrest height and back rest angle. As 90% of the workforce in clothing manufacturing is women, the seat height should be between 51 and 61 cm, the back rest distance between 10 and 15 cm, and the back rest height at 25 cm. As research shows, the standing position in the modular production systems has more advantages over the sitting position. The standing sewing machine operators have an open range for movement, the operator exercises greater control over the task area; the work method can more easily incorporate most of the characteristics of easy movement and the operator develops a rhythm through ballistic motion, using searches in sewing and handling material (Dillard & Schwager, 1997:290).

Clothing mass production has always been a labour-intensive process, with sewing machine operators performing a single operation, using the same repetitive motion. To execute a repetitive motion throughout the day holds a risk to the operator's health. As a result of health problems, absenteeism becomes prevalent. To combat these problems, changes that are based on ergonomics need to be made. Ergonomic principles are based on finding what stressors place strain on the body, and what can be done to eliminate this stress on the body. Preventative strategies can include the following:

- training of workers to ensure that they are cognisant of ergonomic factors that may affect their performance;
- redesigning the workstations to make it more conducive for optimum performance;
- changing methods of the operation where the incidence of injuries are high;

- using modular or team production systems for workers to be able to change work so that they do not become bored and/or tired; and
- investing in equipment that are designed keeping ergonomic characteristics in mind.

By using preventative strategies, the production company needs to adjust workstations to meet the needs of the sewing machine operators, thereby enabling the workers to be highly productive without stressing their bodies. To be able to develop these strategies one needs to look at medical science so as to determine what specific muscular disorder occurs in clothing production workers (Dillard & Schwager, 1997:285).

To design a good manufacturing workstation, four design principles have to be met: work height, normal and maximal reach, lateral clearance and angle of vision and eye height. The height of the surface should maintain a relationship with the operator's elbow height. The normal reach is defined by the tip of the thumb, while the forearm works in a circular motion. The maximum reach is the boundary of the surface, while the arm is kept in a relaxed downward position. A provision for eye height is 143.6cm cm for standing females. By using trigonometry, the angle of sight can be calculated from the horizontal distance of the display from the operator's eye position (Karwowski & Salvendy, 1998:50).

Safety responsibilities within a company are related to the workers' tasks and duties, therefore these persons have different needs to safety information. Safety information should be based upon these needs. Safety in the workplace is one criterion to assess the quality of the workplace (Karwowski & Salvendy, 1998:89).

A sewing machine operator performs static as well as repetitive work. Static muscle work is required when the operator maintains his/her working position. Good working posture is of the utmost importance when working in a static position. Repetitive work with small muscle groups resembles static muscle group work according to a circular motion. In repetitive work muscles contract 30 times per minute. Even light work such as working in front of a computer may cause increases in intramuscular pressure, which may lead to swelling of the muscle fibre and in the end, pain (Karwowski & Salvendy, 1998:50). Five sewing machine operators were observed, and even by making small changes to the sitting position, a definite difference was observed in these operators. When the working surface was adjusted to a 10-degree slope and the pedal was moved 10 cm back, the operators experienced relief in body strain. Press operators who had to work beyond their ready length developed physical problems. For standing positions the hand positions were defined as percentage shoulder height and percentage arm reach in a standing upright position. Positions below 50%

shoulder height cause discomfort in the lower back. For postures at or below 100% shoulder height, the shoulder and arms are critical (Karwowski & Salvendy, 1998:50).

Noise levels are indicated in decibels (dB). Most meters incorporate different types of weighting of a sound, known as A, B and C scales. The A or dBA scale approximates the sensitivity of the human ear. Examples of typical noise levels that one can easily associate with are:

- jet-aircraft at take-off: 125 dBA;
- quiet manufacturing: 75 dBA; and
- a silently operating washing machine : 50 dBA
- a library: 20 dBA.

The noise limit in a clothing factory varies from 85 to 90 dBA. Four factors that make noise unacceptable in the working place: it can cause hearing loss, affect hearing, reduce productivity, be annoying, and can interfere with verbal communication between workers and managers during the course of the day (Helander, 2006:237).

2.2.2.2 Production planning

Production planning can be grouped as follows:

- work-in-process planning,
- capacity planning, and
- work-study and fabric planning.

Due to production-related problems such as large inventory quantities, long lead times, and high levels of work-in-process, production planning is an important factor influencing productivity (Bowers & Agarwal, 1993:36). Production planning can be defined as an integrative process of coordinating plant resources with the demand of finished goods (Glock & Kunz, 1995:342). However, production planning cannot take place without capacity planning. The capacity of a business is the greatest possible workload that a business can handle within a certain period of time (De Beer *et al*., 1997:67). This capacity is known as theoretical capacity. It is the maximum capacity which can be produced under ideal circumstances. Capacity planning can be divided into two types of capacity, namely effective capacity and actual capacity. Effective capacity forms part of the design capacity after provision has been made for interruptions, maintenance and exchanges. Effective capacity planning will enhance the clothing production system, and will eventually provide a higher profit outcome. Actual capacity is the actual output per unit per day (Kroon, 1998:135).

Furthermore an apparel manufacturer must implement a productivity measuring system; this is where the concept work-study was introduced. The manufacturer will be able to measure, compare and communicate performance (Bheda *et al*., 2003:21).

Clothing manufacturing is more complicated than many other manufacturing industries. It involves a number of machines, employees and bundles of sub-assemblies producing different styles simultaneously. The manufacturing processes consist of different substations, each performing a specific task. The execution of this task is influenced by the properties of the fabric and human factors. Work-study is used in the development and control of workstations. Work measurement techniques such as time study and work sample are used to forecast the work rate for a specific style. Allowance time is also calculated to determine the actual working time, for example, allowance for personal needs, fatigue and unavoidable delays. Work sampling can be defined as simply observing the operator and operations at a random time, and then note whatever was going on at the time the operator or operation was observed (Gunesoglu & Meric, 2006:147).

Gunesoglu and Meric (2006:147) conducted a research study on a clothing manufacturer and presented an example of work-study calculation. They found that 72.7% of working time was spent on productive activities and 23.2% on personal and unavoidable time. Work control operations accounted for 11% of non-productive activities. Unavoidable activities came to 20.5%. From the above study, it is clear that work-study studies can help management plan to reduce avoidable activities and thus in the end increase productivity.

Fabric planning forms a fundamental part of overall production planning, as fabric accounts for 30-40% of the selling price of the garment. Apart from the fabric loss due to fabric flaws, there are two main factors that should be taken into account during production planning:

- Firstly, marker loss or markers falling out, because of gaps between pattern piece layouts.
- The second type of loss occurs during the actual spreading of material. It includes the end losses, width loss, slicing loss and remnant loss. As each style uses different roles of material, it is difficult for the cutting supervisors to determine optimal roll sequence for a cutting lay to minimise spreading loss. They only select the rolls randomly. By careful marker planning in the design room this problem can already be minimised halfway. There is, however, a new computerised planning option, whereby optimal roll planning can be obtained by using a genetic algorithms (GA) approach (Patrick, Frency & Chan, 2000:50).

Production planning therefore entails multiple planning components that form a whole, from which a production manager must operate.

2.2.2.3 Quality control

Quality standard control is the phrase for the designer's specifications regarding aesthetics, durability and utility. Quality standard control should include the following specifications: raw material specifications, processing specifications, plus packaging and shipping specifications (Solinger, 1980:503). Quality control is an important factor that influences the export market. It is important for apparel manufacturers to implement a daily quality control system for the total organisation. The aim should be to eliminate rejects and to reduce repair levels substantially. Quality control can also be seen as part of operational resources (Bheda *et al*., 2003:21). Quality is defined as a perceived level of value. Using this concept, quality can be visualised as a range of intrinsic product characteristics and extrinsic quality cues, any combination of which satisfies a particular customer (Glock & Kunz, 1995:228). Product quality can be viewed from two different perspectives: by comparing products to other similar products, or by comparing product characteristics to the company's standards and specifications (Glock & Kunz, 1995:228). This gives any production company a competitive edge (Loker, 2002:28).

Every company, including clothing manufacturing companies, is required to state its policy on quality, together with outlines for implementation. A formulated quality policy and the facilities to enable the implementation of such quality policies are basic requirements. The second step would be to train employees and management on the principles and tools required for implementing quality management. The extent to which management participates in quality activities is a measure of how committed the company is to implementing quality procedures. Quality motivation can only be ensured when combined with a number of methods to ensure that everyone participates. Methods that are used after product development, that will form an integral part of manufacturing, are the following:

- quality circles
- cause and effects diagram
- control charts
- experimental design
- demanding suppliers to use Control Charts

When Western countries are compared to Eastern countries (South Africa can be classified as a Western country), Western Countries lag behind in the formulation of quality standards,

and Western countries invest fewer resources in education and training in quality per employee. A higher proportion of managers participate in quality aids in the East than in the West. The following suggestions can close this gap between the two. Top management should sustain their commitment to quality improvement, a programme of on-going, on-the-job education and training needs must be developed, a culture of teamwork and co-operations should be enforced, and lastly, application of applicable tools and methods to ensure good quality should be encouraged (Dahlgaard, Kristensen, Kanji, Juhl & Sohal, 1998:812).

The quality of sewn garments is checked against many factors, for example puckering in the seam, which is influenced by different factors such as the sewing thread and fabric, process of needle penetration, stitch formation and sewing thread tension and fabric feeding.
Seam puckering mostly occurs when sewing with lightweight materials. Evaluation of the seam is done immediately after the construction of the seam. Inherent pucker can be a result of fabric yarn displacement, when the needle penetrates the fabric and the upper and lower loop insert within the fabric. The fabric yarns are bended, stressed and attempting to return to their original positions, but are prevented by the sewing thread. Tension pucker also occurs when the over-stretched sewing thread shrinks to its original length and herewith gathers up the fabric along the line of the seam. Universal sewing thread seems to be ideal for sewing lightweight material (Dobilaite & Juciene, 2006:335).

The evaluation of the quality of a sewn product includes the evaluation of the construction and the pattern, the structure, the composition and the properties of the material used, and the quality of the passed seams (Germanova-Krasteva & Petrov, 2008:57). Germanova-Krasteva and Petrov focused their study on the appearance of the seam in the constructed garments. Several reasons may be given for bad seam construction, for example inadmissible curving of seam lines, poor tightening of the seams' ends, leading to incompactly joining and torn threads and uneven density.

To optimise quality on the seams, the following can have an effect on the strain on the upper or lower thread: seam's density, sewing speed, load on the presser foot, height of the transport teeth, size of the needle and shuttle and elastic spring and brake. Management and sewing machine operators should firstly be familiar with these causes and be able to follow up on these factors to ensure a good quality product.

Ergonomic aspects, production planning and quality control all form part of so-called operational resources of a clothing production system. The following resources to be discussed are physical resources and the sub resources that form part thereof.

2.2.3 Physical resources

The resources identified by Spears and Gregoire (2004:7) are physical resources, namely technology, production systems and material handling. For companies to be more compatible with international clothing production companies, the South African clothing production industry can improve itself with regard to the current rapid advancements in the area of efficient manufacturing technology (Sproles & Burns, 1994:7). The above-mentioned components are interdependent, because the behaviours of the components exhibit mutual influence (Boss, Doherty, Larossa, Schumm & Steinmetz, *et al*., 1993:330). What happens to one component affects the other components.

2.2.3.1 Technology

For many apparel manufacturers, the use of appropriate technology can improve productivity and lower associated production costs (Lin *et al*., 1994:20). This is helpful as apparel manufacturing has a high input cost regarding labour, but technology can help reduce labour costs.

According to Loker (2002:26), a flexible clothing production system uses technology that is controlled by a skilled and flexible workforce. A company accomplishes flexibility and ultimately compatibility by means of technology that can produce different products in a short period of time. Better technology might include different computer software ranges (Loker, 2002:26). In addition to this, Bheda *et al*. (2003:21) also feel that apparel manufacturers should draw up a strategic plan for technology upgrading. As investment in technology is an expensive exercise, every investment needs to result in substantial productivity gain.

The technology growth in a country depends on the product life cycle. The northern and eastern countries are the innovators in product development. Product development takes place in developed countries, and when the technology eventually becomes known to developing countries, this comes down to the trickle-down theory. South Africa has built a significant technology base; however, the industry is to some extent not in touch with consumer demand, probably as a result of insufficient technology resources (Nordas, 1996:717). Technology is not only increasing capital expenditure for the company, e.g. better

technology to the labour force will in itself not necessarily have a positive effect on productivity; it has to be incorporated with training of the labour force. More will be needed with hands-on training and formal education (Nordas, 1996:720). Salinger *et al.* (1999:30) state that it will be important for South African companies to pursue competitive-enhancing strategies such as improved computer-aided marketing and business plans. The acquisition of new design, manufacturing, inventory management and technologies add value to the company.

Investment in equipment with good ergonomic features can also be seen as an expensive but necessary investment into a clothing manufacturing company. The investment improves quality through greater consistency, and reduces fatigue, and in the end reduces workplace injury. Investment in equipment with good ergonomic features will increase productivity, improve worker morale, increase quality and lower workers compensation costs (Dillard & Schwager, 1997:295)

All the technology upgrading discussed does have a positive effect on a company's production output. Companies need to calculate the effectiveness of such technology improvement, because improvement of technology must add value. For example, if of the workforce needs to be retrenched because of new technology, the company needs to calculate whether the investment was worthwhile.

2.2.3.2 Production system

The core of a plant and production environment is the production system. A production system can be defined as the flow of goods through the system and the layout of machinery, as well as the relationship of the workers to the flow of goods and the machinery (Lin, *et al*., 2002:46). An effective sewing system, combined with a new layout of sewing machines, should give an apparel manufacturer a significant advantage in many market areas now dominated by producers with lower cost labour, but it has to be emphasised that the best sewing system is the system that gives the apparel manufacturer a competitive edge in meeting consumer demand (Lin *et al*., 1994:21). Apparel manufacturing is more complicated than many other industries. It involves different types of resources (inputs), for e.g. different machinery, people, and different bundles of sub-assembly units producing different styles. In apparel manufacturing, garment components are assembled through various sub-assembly processes until they are assembled into a finished garment (Gunesoglu & Meric, 2007:145).

There are five main sewing systems, namely a single hand sewing system, a progressive bundle system (PBS), a unit production system (UPS), modular manufacturing and kanban or any combination of the above (Burns & Bryant, 1997:301-306).

The Bundle System (BS), also known as the Progressive Bundle System (PBS), is the source of work; the system is named after the bundle that flows through the work flow. The 'bundle' consists of pattern pieces that are grouped together. Each workstation is highly specialised and performs only one operation on a bundle of garments. Sewing machine operators receive basic training as they perform one action only. The Bundle System is the oldest system and is still widely used in clothing production. However, there is a variation in the Progressive Bundle System. In PBS the machines are grouped together to form a skills centre. Machines that perform similar operations are grouped together. Machines and operators are still highly specialised. BS and PBS are associated with increased productiveness, as each sewing machine operator performs only one task; these systems are viewed as appropriate for standard products with few changes (Lin *et al.,* 2002:46).

The kanban and modular production systems are defined as follows: the kanban system is a market-driven production system in which demand pulls the product through all the processes (Oliver, Kincade & Albrecht *et al.*, 1994:45). The modular production system (MPS) (also known as the teamwork production system) is described as a work unit of people whose task is to complete garments as a team, and is usually used by production systems that have a small unit output (Oliver *et al.*, 1994:45). The unit of work is not the bundle but the garment. Different machines are grouped together in a team area for a self-enclosed work flow. Cross-training of employees is needed, as they perform more than one task. MPS is associated with quality and flexible dimensions, with hand-to-hand work flow and in-line decision-making. The outcome of this is higher quality (Lin *et al.*, 2002:50).

A bundle production system and a unit production system are basically the same. The unit production system is a type of line layout using an overhead system of transporters to move individual units, whereas a bundle production system uses units that are bundled together and transported manually (Glock & Kunz, 1995:315). These production systems are both mainly used for a large unit turnover (Oliver, *et al*., 1994:45). Research by Chen (1998:11) compared flexible production systems in the apparel and metal-working industries. This comparison shows what definite advantages there are to the different sewing systems used in the apparel industry. Strategic flexible manufacturing may lead to reduced production lead time. Chen (1998:12) performed a survey on the use of flexible work group (FWG) and unit production systems (UPS). FWG constitutes the incorporation of work groups, while UPS

could be regarded as an FWG with automated material-handling mechanisms. FWG can also be descried as a modular production system which is used as an alternative to the traditional progressive bundle system. The modular production system requires sewing machine operators that are interchangeable within the different tasks that are being performed within a cell. Chen's study shows the following improvements for using the FWG and the UPS systems within a clothing production system, as opposed to a progressive bundle system or without the use of technology (UPS):

TABLE 2.2: EFFECTS OF IMPLEMENTING FWG AND UPS IN CLOTHING PRODUCTION (Chen, 1998:15)

	(FWG)	(UPS)
Quality	Defects reduced by 12-97%	Quality improved by 11%
Direct Labour	Reduced by 0.3%	Reduced by 9.7%
Productivity	Increased by 13.4%	Increased by 18.4%
Indirect/Direct labour ratio	Reduced by 10%	Reduced by 11%
Through-put time	Reduced by 71%	Reduced by 60%
Flexibility	Easier product style change and easier regrouping additions and replacement	Not reported
Morale	Accelerated work pace and less time spent in tearoom/break rooms etc.	Not reported
Turnover rate	Reduced by 39%	Reduced by 29%
Attendance/absenteeism	Improved by 2.6%	Improved by 1.1%
Space	Reduced by 36.9%	Reduced by 28.7%

This table shows a definite positive effect by implementing FWG and UPS. Ultimately one wants the company's output to reflect an increase in productivity and cost savings. The productivity increases were considerably better for the UPS system.

Good machine layout shortens the moving distance among materials and machines, and is important for reducing costs. Clothing manufacturing requires a small pattern piece to be grouped together, and that requires changes in machine layout when the style is different. By quick machine re-arrangement, labour requirements and moving distances are reduced. A linear, single-row flow machine layout can consist in different configurations such as a straight line, U-shaped, a serpentine line and a loop. The selection of a machine layout depends on several factors that include minimal moving time, minimal total moving distance, minimal moving distance between parts and minimal moving costs of materials and minimal return times (Lin, 2008:32)

The four line layouts can be illustrated as follows (Lin, 2008:32):

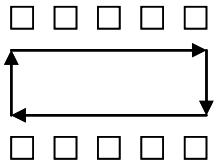

FIGURE 2.1: LOOP LAYOUT

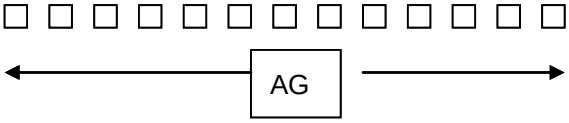

FIGURE 2.2: STRAIGHT-LINE LAYOUT

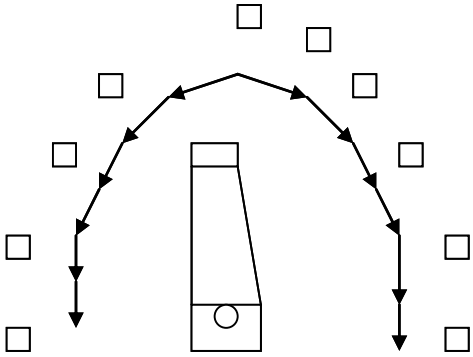

FIGURE 2.3: U-SHAPED LAYOUT

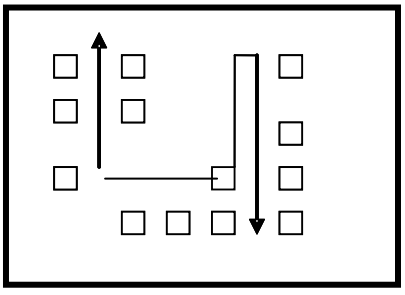

FIGURE 2.4: SERPENTINE LAYOUT

The research by Lin (2008:31) has proven that the U-shaped layout increases manufacturing effectiveness by 21% and thus improves productivity.

As seen from Chapter 1, the consumer demands are quality products, price, design, fabric performance, flexibility, short lead times, and delivery reliability. Other literature focused on a new perspective on production systems; with the Western world competing against the East, we need either a radical change in the system of production, or improvement in the current production systems.

In conclusion: good machine layouts that are able to shorten the moving distance among materials are important for reducing production cost, and in the end increasing productivity.

2.2.3.3 Material handling

Material handling concerns the efficient movement of goods through the transformation process. The cost of handling material does not add value to the product, but may run as high as 30% of direct labour cost, thus has an effect on productivity. Material handling has a direct effect on the through-put time, thus on the flexibility of a clothing production system (Glock & Kunz, 1995:314). Material handling cost can be reduced by focusing on the handling and processing of incoming goods, the movement of goods through the production process, and the distribution of the finished goods (Glock & Kunz, 1995:314). This study focuses mainly on the movement of goods through the production process.

Plant layout and material handling affect productivity. Material handling is simply described as moving material within a plant. Material handling is one of the most important factors that influence workers in a production system. The cost reduction formulated from motion and time study is valuable for plant layout and material handling. Good material handling eliminates steps in the process, combines steps in the production process, changes the sequence in the process to reduce travel time, and simplifies the operation by moving steps closer together and by automating material movement (Meyers, 1993:2).

The different goals as set out by Meyers (1993:3) are the following:

- minimising unit cost
- the effective use of employment
- equipment
- space and energy used

- provide two ergonomic goals
- safety and comfort of employees
- calculate the cost of material handling

Effective material handling can be summed up by the following twenty principles (Meyers, 1993:160):

- Plan material handling to optimise operator efficiency.
- Integrate in the production system as many handling activities as possible, namely receiving, storage, packaging etc.
- Incorporate a flow layout that optimises material flow.
- Simplify handlings by combining movements in material flow.
- Utilise gravity to ease material flow.
- Make an optimum use of space.
- Increase unit size and weight per load.
- Mechanise handling operations as far as possible.
- Provide automation to include a production handling and storage function.
- In selecting handling equipment, consider all aspects of material being handled, the movement and the method.
- Standardise handling methods.
- Use methods that can perform a variety of tasks.
- Reduce the ratio of dead weight of mobile handling equipment to load carried.
- Plan to optimise the usage of manpower and equipment.
- Plan preventive maintenance on equipment.
- Plan to incorporate more effective equipment.
- Use material handling to improve control of production inventory and order handling.
- Use material handling equipment to improve production capacity.
- Determine effectiveness by determining the performance in terms of expense per unit cost.
- Provide suitable methods and equipment that provide safe handling.

2.3 CONCLUSION

In this chapter the resources (inputs) in relation to the clothing manufacturing systems were introduced. The resources discussed were human resources, operational resources and physical resources and an attempt was made to show the interrelationship between the

various resources (inputs). The interrelationship between these resources emphasises the importance of the resources functioning as a whole. The chapter also introduced the reader to concepts that are typical of the systems theory.

In Chapter 3, which provides the basic theoretic framework for this study, the systems theory is introduced and the relevant constructs obtained from literature are organised into a more integrated frame of reference. A conceptual framework is then drafted for the study. The resources discussed in Chapter 2 are reviewed, together with the sub-objectives.

CHAPTER 3

THEORETICAL PERSPECTIVE, CONCEPTUAL FRAMEWORK AND OBJECTIVES FOR THIS STUDY

3.1 INTRODUCTION

The systems theory and its multiple applications are discussed in various academic publications. It was chosen as theoretical perspective for this research because it allows a discussion of factors that influence the clothing production system (inputs) and their transformation into outputs that indicate how successful the particular system is. Research cannot be conducted in a theoretical vacuum; it needs to be done within a suitable and relevant theoretical perspective to provide a logic frame of reference for the study (Henning, 2004:12). The complexities of the systems theory are introduced in this chapter to provide the reader with the insight that is required to understand the interactive contribution of inputs in terms of the outputs of a clothing production system. The reason for using the systems theory is to address unstructured/ individual phenomena/ resources and structure them in such a way that it would enhance the outputs of a clothing manufacturing system. Following the systems theory discussion, the conceptual framework is presented to understand the interrelationship among the resources used in the study. The research objectives derived from the research problem conclude this chapter.

3.2 THE SYSTEMS THEORY

The systems theory is defined by Kast and Rosenzweig (1972:448) as '*an organized, unitary whole composed of two or more interdependent parts, components, or subsystems and delineated by identifiable boundaries from its environmental supra system*'. The systems theory is furthermore defined by Spears and Gregoire (2004:2) as a basis through which the researcher understands and incorporates knowledge from a variety of sources and fields.

The term 'system' is used to cover a wide range of conceptual constructs and other entities, for example philosophical systems, number systems, communication systems, control systems, educational systems and physiological systems. Against this background, the concept is defined as an entity which consists of interdependent parts. A system is a

collection of parts that interact with one another to function as a whole, to accomplish a pertinent unitary goal (Watkins, 2000:33). Four basic assumptions characterise a typical system:

- a system is designed to accomplish an objective for example the clothing production line aims to produce a specific quantity of quality garments;
- the elements of a system have an established arrangement which is hierarchical for example quality is considered more important than quantity;
- interrelationships exist between the various elements of the system for example the quantity of garments can be produced on the premise that all the operators are present and that all the machines are in working order; and
- the organisation of the objectives is more important than the objectives of the individual elements (subsystems), i.e. it is more important to complete a smaller quantity of good quality garments at the end of a working day than to have a larger quantity of perfectly cut but incomplete or inferior garments (Spears & Gregoire, 2004:7).

The systems approach encompasses different concepts: system philosophy, system analysis and systems management. System philosophy is a way of thinking of events as a whole, which is made up of subsystems and their interrelationships to one another, i.e. the cutting process, trimming process, pressing as individual activities in the system. System analysis is a method used for problem solving and decision-making and involves continual quality control; lastly, system management involves the application of a systems way of thinking to decision-making and problem solving, i.e. the ability to integrate the various subsystems into a coherent production line. '*Thus the system approach is a way of thinking, a method of analysis and a managerial style'* (Spears & Gregoire, 2004:10).

3.2.1 Open and close systems

According to Spears and Gregoire (2004:3), biological and social systems are in constant interaction with their environment and are thus open systems. Watkins (2000:48) elaborates on this definition, and uses a biological system as an example of an open system to explain how the elements exchange information and material to the environment (for example breathing). A clothing manufacturing process is non other than a social system and thus an open system. Clothing manufacturing can also be described as a people-machine system, where people interact with machines to achieve desired objectives.

A typical system consists of three major parts: inputs, transformation and outputs. The inputs are resources that are changed/converted during the transformation process into outputs of the system. Transformation is the collective change of inputs into outputs that represent the achievement/ success of the system (Spears & Gregoire, 2004:2).

A closed system can be defined as a system that is self-contained, and that does not exchange material or energy. Such an example would be a chemical reaction within a contained sealed environment (Spears & Vaden, 1985:26). A closed system has strict, impenetrable boundaries. In a physical or mechanical system the boundaries can be identified. In a social system (open system) the boundaries are not easily identifiable. A system grows through internal elaboration. In a closed system the system moves towards destruction (Kast & Rosenzweig, 1972:453). Boss *et al*. (1993:331) differentiate systems into hierarchical layers. The first observation is that things that are grouped together and labelled as an entity attest to be related to one another in more than one relationship. The seamstresses in a production line would typically represent a subsystem within the entire production line while the workers who press and do quality control form part of the same production line but distinguish themselves from the sewing machine operators because their focus and contribution within the system differ. The second observation proves that there is a dynamic relationship between the units within a system: one subsystem cannot surpass another in terms of outputs because that would hinder the flow of the production line. Where a system begins and ends is not always clear and systems are interactive, which means that one system may have an influence on another system if their activities are related to the same system (Nemeth, 2004:4). Absenteeism in one subsystem would inevitably impact negatively on the subsystem that is linked to it and that would affect the entire system.

3.2.2 Key concepts to the systems theory

Certain key concepts and characteristics are associated with the **general systems** theory. Katz and Khan (1966:30) explain:

- Importation of energy: open systems import energy from the external environment (supra-system), e.g. economical factors affecting the manufacturing system.
- The through-put: open systems transform the input/energy given to them during the transformation process, for example, training for sewing machine operators as an input to the system.
- The output: open systems export energy or products into the environment, for example, a constructed garment of good quality is an output to the system.

- Systems as cycles of events: The pattern of activities within the system has cyclic features, for example, the sewing operation repeats itself by completing multiple similar items and in so doing, forms a cycle.
- Information input: negative feedback and the coding process; inputs can be in the form of information as an input to a system. Negative feedback into a system can be seen as such an information source. This feedback is then incorporated and transformed and translated into a structured code.
- Differentiation: open systems move in the direction of differentiation and elaboration.
- Equifinality: a system can reach the same output/outcome in different ways, for example using competent sewing machine operators on machines that are in an imperfect condition or using novice operators on good quality machines. Both would experience problems that would negatively impact on the production lines' outputs.

The concepts through-put, output, negative entropy and information input are all covered by Kast & Rosenzweig 1972:450); these concepts are an elaboration of the concepts identified by Katz and Kahn (1966:30):

- *Subsystems or components* are defined as a system of interrelated parts, with each system having at least two components. When researchers consider systems smaller than the system unit it is called a subsystem (Boss *et al.*, 1993:331). Systems larger than the system unit is called a supra-system for example referring to the entire factory. This allows the researcher to ask questions interlocking the supra-system (Boss *et al.*, 1993:331). For the sake of this study resources are distinguished as subsystems.
- *Holism, synergy and gestalt.* The whole is the sum of the parts. The system can and need to be explained in its totality as well as its individual parts to fully grasp the transformation of inputs into outputs.
- *Input-Transformation-Output model.* The open system is in a dynamic relationship with its environment. It receives inputs (resources) and transforms these inputs into outputs.
- *System boundaries*. Systems have boundaries that separate them from their environment so that subsystems can also be examined individually in terms of their successes and failures.
- *Steady state*, *dynamic equilibrium and homeostatic*. A closed system must attain a state of equilibrium to ensure stability. An open system remains in a dynamic equilibrium where tension/problems in one subsystem can be absorbed/negated by the performance of another.

- The concept *feedback* is important for a system to maintain a steady state. Information regarding the elements of the system is fed back into the system as a resource, i.e. experience. Feedback can be negative or positive. Negative feedback as an input alerts the system that it is off course and must redirect.
- *Hierarchy.* There is a hierarchical relationship between systems. A system is composed of different subsystems which are part of a larger system and a supra-system, for example a production line within a large factory that produces different types of garments. A system can furthermore be arranged into layers of delegation, thus having a hierarchy of representations (Boss *et al.,* 1993:330). Although all subsystems are relevant, they are not of equal importance in terms of the output of a system.
- *Internal elaborations*. Closed systems move toward destruction and open systems move towards a higher level of organisation.
- *Multiple goal seeking*. Social systems seek multiple goals, because they are composed of individual and sub-units with different values and objectives.
- *Equifinality* of open systems. There is a relationship of direct cause and effect between the initial condition and the final state. Equifinality states that certain goals can be achieved in different ways. This view suggests that social systems can accomplish their objectives with a variety of inputs and varying factors. Thus, an open system is not as restrained as a closed system.

The following discussions provide a short outline of the concepts used for the purpose of this research.

3.2.2.1 Inputs to the clothing production system

Inputs to the clothing production system are the physical and human resources and are transformed through the transformation process (the actual sewing process) to produce the outputs to the system. These resources (inputs) have traditionally been referred to as men, machines and money. The four inputs for the clothing production system are human resources (labour and skills), materials (material for garments), operational resources (money, time, utilities and information) and facilities (space and equipment) (Spears & Gregoire, 2004:7). These resources are traditionally defined for a food service system, but can easily be adapted for a clothing manufacturing system, or any system for that matter.

3.2.2.2 Transformation

'Transformation has been defined as the unified diversion of inputs into outputs' (Spears & Gregoire, 2004:7). The transformation process includes subsystems of the clothing manufacturing system, e.g. managing functions, and is linked to the manufacturing process. It is important to note that these parts are all interrelated and interdependent parts in the transformation process, and that they function in a synergistic way to produce the output of the system (Spears & Gregoire, 2004:7).

The subsystems of a clothing manufacturing system may be classified according to function in the transformation process. The challenge is to optimise the utilisation of the resources during the transformation process. To accomplish systems' objectives it is important to coordinate subsystems, and this is where the management function comes to play an important role during the transformation process. Management functions are defined as planning, organising, staffing, leading and controlling. Management is furthermore defined as the coordination of human and material resources towards the accomplishment of the optimum utilisation of resources (Spears & Gregoire, 2004:7).

3.2.2.3 Outputs of a clothing manufacturing system

Outputs refer to the finished garments that result from the transformation process. The inputs into the system are transformed into the desired output. Together with the actual constructed garment as an output to the manufacturing system, there are other outputs that are closely linked to the end objectives of the manufacturing system. The first such output is client satisfaction, which is associated with a high quality product and services provided. The second output is personnel satisfaction: management must be concerned about assisting employees to achieve personnel's goals at work. The effectiveness of the system is connected to the quality of work done by the employees of the clothing manufacturing company. Financial accountability is the third output of a viable system. A clothing manufacturer must control cost in relation to revenue, regardless of the operation to abide with basic economic principles and to survive in a competitive market place (Spears & Gregoire, 2004:8).

3.2.2.4 The control element in the clothing manufacturing system

The control element within a clothing manufacturing system circumscribes all the objectives, policies, procedures, standards and programmes of the system. These are all the internal

control elements to the system. Contract, rules and regulations are examples of control elements used in a system. The control element provides the basis for the managerial process of controlling (Spears & Gregoire, 2004:9).

3.2.2.5 Feedback into the system

A system can also be seen as a loop diagram. The first diagram can be identified as a casual loop diagram; in a linear system the world is a series of un-directional cause and effect relationships. On the other hand, the circular loop system which incorporates feedback is interrelated. Feedback is the transmission and return of information. Feedback gives a system, which would otherwise be unstable, its stability. The reinforcing feedback within a system stimulates growth within a system. Feedback also has a balancing effect on a system, whenever the system is goal orientated (Watkins, 2000:57).

Some systems need to be controlled through negative feedback, thus through self-regulation. A feedback system is characterised by its closed loop structure. Negative feedback can also be seen as the margin of error within a system. According to Watkins (2000:81), there are four elements needed for negative feedback to function optimally, namely a desired goal, a sensor (sensing the current state of the system), a comparator, and an activator (a decision-making element that responds to any discrepancies).

3.2.2.6 Clothing manufacturing systems model

From the above discussion a model is constructed to illustrate the role of each element of the clothing manufacturing system.

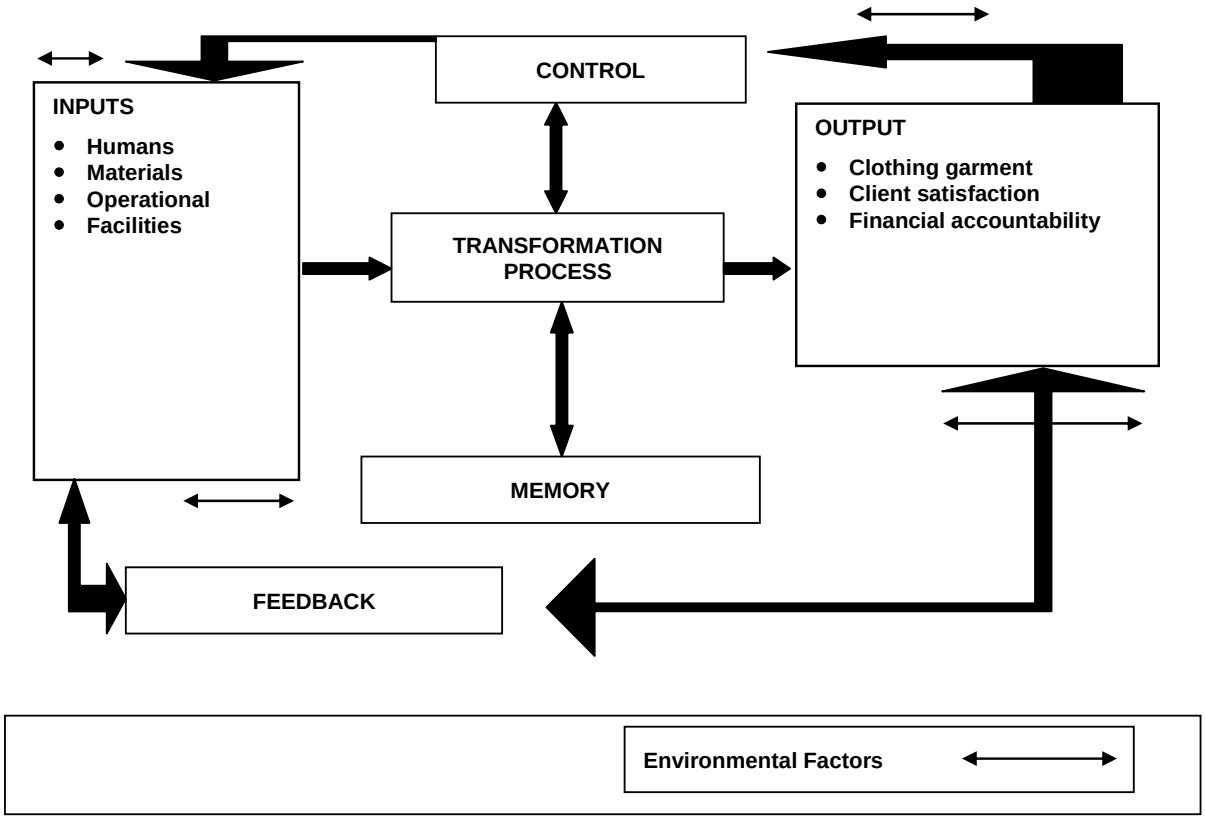

FIGURE 3.1: A TYPICAL SYSTEM MODEL (Spears & Vaden, 1985:32)

Inputs (human resources, materials, operational resources and facilities are utilised/transformed to produce garments within specific financial limitations and economic objectives that would satisfy clients. Experience gained is optimised (memory) to direct production in the future (feedback) and serve as a tool to pre-empt problems and losses (control).

3.3 CONCEPTUALISATION

Mouton (1998:114) defines conceptualisation as concept analysis and concept explication. Conceptualisation is therefore the process through which a researcher indicates what is meant when using particular terms and concepts, and it specifically refines and specifies concepts used in the study (Babbie & Mouton, 2003:111).

A conceptual framework is needed so that the researcher can organise the theoretical review in a format that clarifies the essence of the research (Marshall & Rossman, 2006:26). The conceptual framework for this research is organised in terms of the system's perspective as explicated by Spears and Vaden (1985:32), as well as Nemeth (2004:4). See figure 3.2

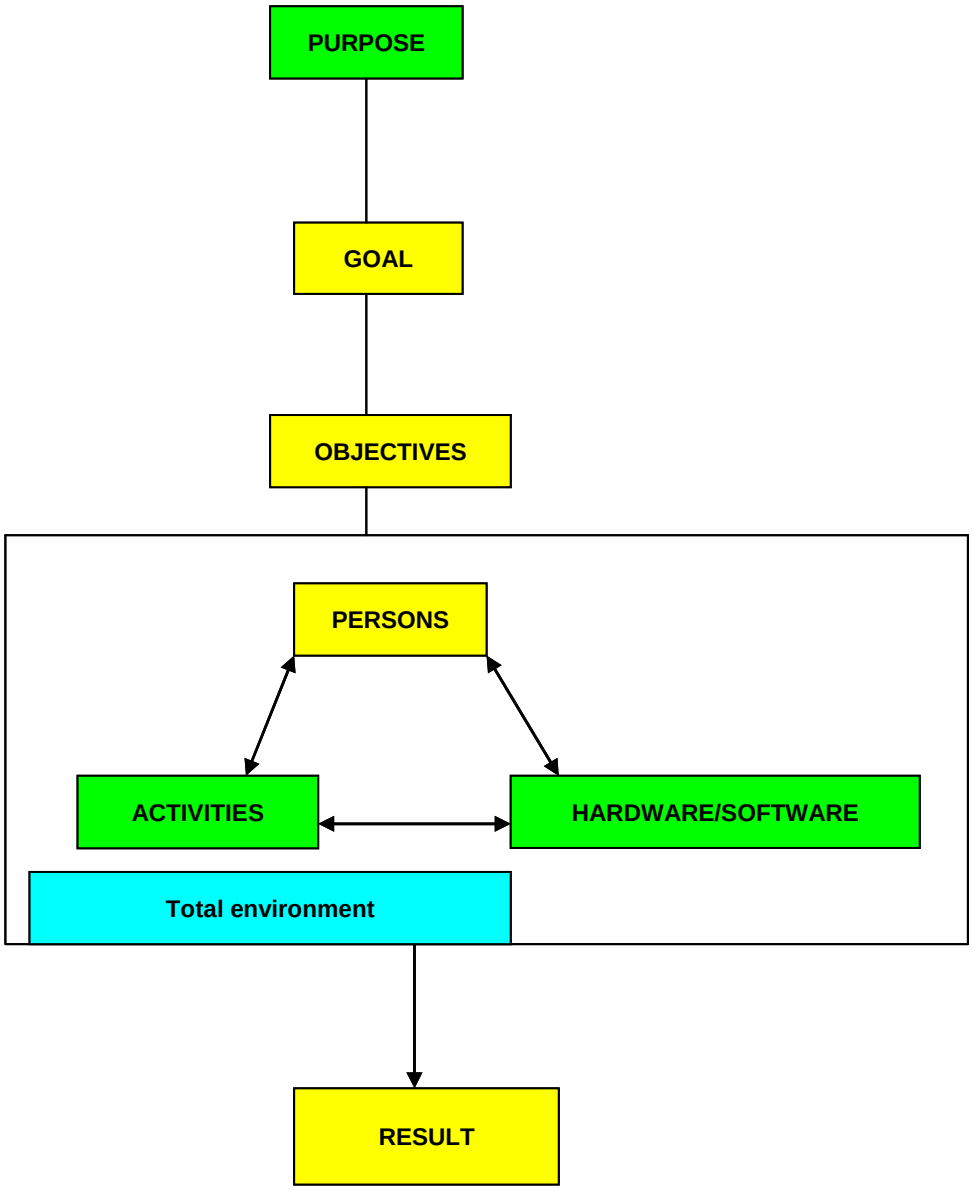

FIGURE 3.2: SYSTEM ELEMENTS AND FUNCTIONS (NEMETH, 2004:5)

Figure 3.2 shows a model of system composition, and shows three classes of elements, namely: hardware/software, personnel and procedures. Hardware/software, according to Nemeth (2004:4), includes machines and their controls. Personnel are the human resources, and procedures are the action that needs to be performed by either human resources or the hardware/software. True to the systems theory, all three classes of elements interact with one another while the system also exists within an external environment, and between the two there is also a relationship.

The elements within a system are configured to produce a certain outcome, or as shown in figure 3.2, a certain result, that is anticipated to satisfy a purpose or objective. The way these elements interact with each other and with the environment produces a result. The results are then evaluated in terms of the goals, and elements are adjusted if necessary to achieve certain goals (Nemeth, 2004:5).

The conceptual framework for the research was developed (see Figure 3.3) upon completion of a thorough literature review.

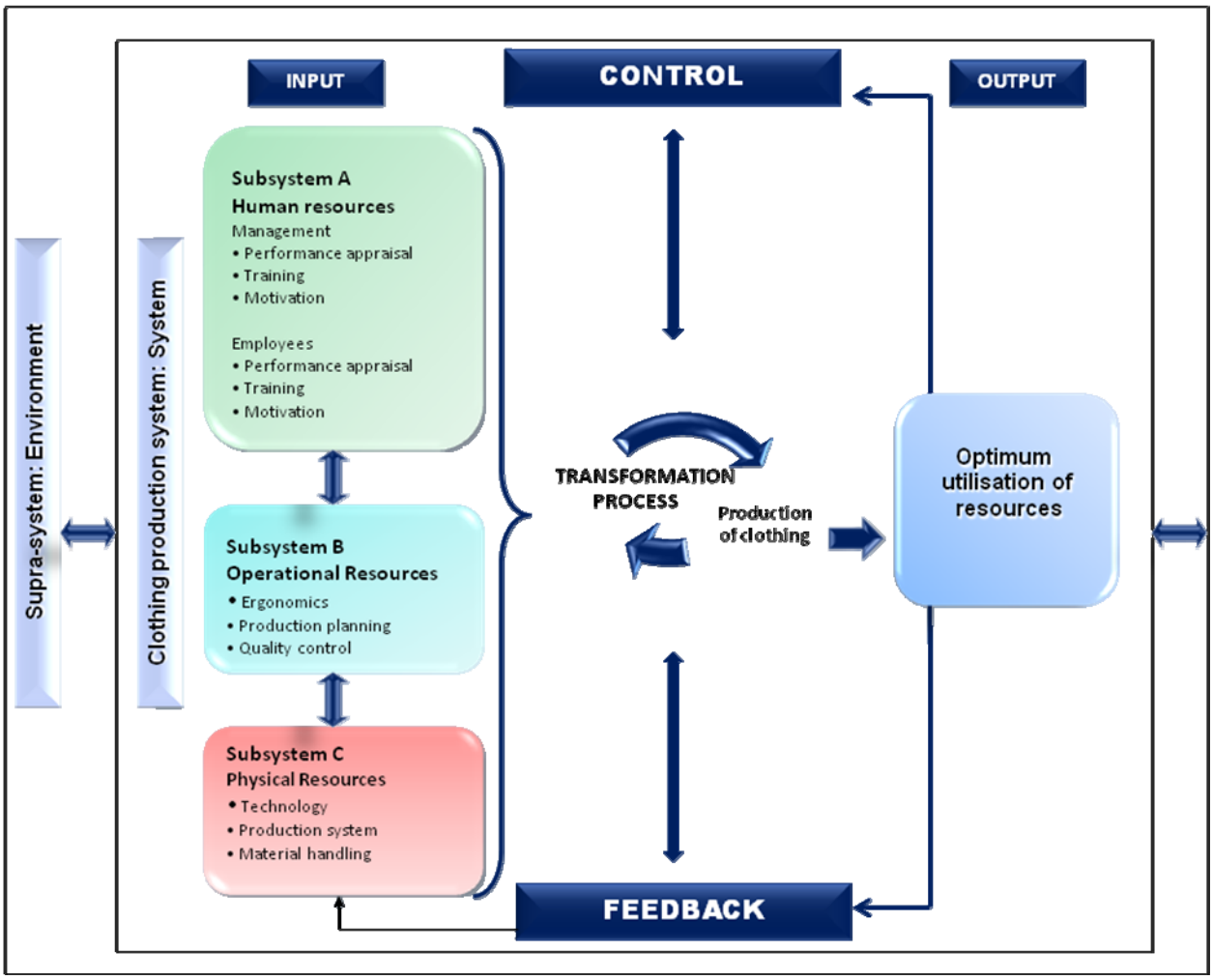

FIGURE 3.3: CONCEPTUAL FRAMEWORK FOR THE STUDY

This conceptual framework shows the relationship between the environment (supra-system), the apparel manufacturing unit (system) and inputs (subsystem). Note that within the diagram there is a definite interaction between the different layers of systems and an interaction between the subsystems. The supra-system classified in the study consists of the

physical environment, financial environment and the global clothing manufacturing industry. The actual system investigated as a case study is the chosen clothing manufacturing company. The subsystems (inputs) are also known as the resources available to the system: human resources, operational resources, physical resources and their subdivisions. The supra-system, the actual system and the subsystems are all related to one another and operate individually as well as a whole. The various systems are furthermore interrelated, for example, when the world economy goes down due to higher interest rates, the production system experiences the effect (machines cannot be replaced when problems occur) and the effect ripples out to the subsystems which struggle to cope with the work flow due to continual problems along the line where machines break down. The subsystems are also interrelated to one another and each within itself as a subsystem; the one cannot operate without the other. Machines cannot operate without sewing machine operators, thus operational resources cannot exist without human resources, and vice versa. The interrelationship in the systems theory can be viewed as two integrated gears of a gearbox working together to facilitate the system. As can be seen from the conceptual framework, the inputs have a direct effect on the transformation process, because the inputs feed the transformation process. The output, on which this study has focused, namely the optimum utilisation of resources, depends on the usage of resources in the transformation process. This in the end reflects the effectiveness of the system, if all the resources are taken into account.

Management within a systems theory is built upon the theory that the whole is more than its parts; this means that when all the necessary pieces are in place and the interrelations are as they should be, the whole possesses characteristics that go beyond those of the individual parts. For any process (human resources, operational or physical resources) within the system to succeed, the configuration of the entire system which represents the so-called whole is crucial (Roth, 1992:2).

The inputs were already defined in Chapter 2. In terms of this study, three input subsystems can be identified, namely human resources, operational resources and physical resources. Short definitions are given to afford the reader a recapitulated overview of the conceptual framework, together with the meaning of the input for the study.

The first subsystem, namely human resources, consists of management in the clothing production system and the **sewing machine operators**, otherwise referred to as employees. A sewing machine operator performs an operation, a job, or a process on a machine created for the job, a sewing machine, a pressing machine or a cutting machine (Solinger, 1980:258).

Management is defined as the management of systems or processes that are responsible for cost-effective goals, and forms an integral part of the transformation element (De Beer *et al*., 1997:64). Sewing machine operators are the employees of the company who physically stitch the clothing garments together. They do not have authority over any department in the workplace, and some of them are also temporary workers that are employed on a contractual basis. Management employed by the clothing production company are classified as supervisors, also known as line managers and departmental managers. Top management that is situated at head office is not included in the study – only management that have hands-on experience were included. Three inputs are relevant, namely performance appraisal, training and motivation. Gerber *et al.* (1998:223) define **performance appraisal** as a process through which human performance is identified, measured and developed. **Training** can be defined as the process of imparting job-related knowledge to employees (Glock & Kunz, 1995:12). **Motivation** may be compensation for work-completed recognition by peers or management, a feeling of accomplishment, a desire to learn (Glock & Kunz, 1995:359). All these inputs are evaluated from the sewing machine operators' as well as management's perspective, because the two parties perceive the inputs differently.

Operational resources consist of ergonomics, production planning and quality control. **Ergonomics** is the study of the interaction between workers and their work environment (Glock & Kunz, 1995:332). **Production planning** can be defined as an integrative process of coordinating plant resources with the demand of finished goods (Glock & Kunz, 1995:342). **Quality control** is the collation of the designer's specifications for aesthetics, durability, and utility. Quality standard control should include the following specifications: raw material specifications, processing specifications, plus packaging and shipping specifications (Solinger, 1980:503). Ergonomics, production planning and quality control are all traditionally management driven; the research evaluates this aspect from management's as well as the sewing machine operators' point of view.

The third subsystem, physical resources, refers to the resources that are physically part of the production process, namely technology, production system and material handling. Within clothing production there are mainly five different types of **technology**: cutting machines, pattern drafting machines, fabric layout machines, sewing machines and press machines. Within these three different divisions, namely the cutting, the sewing and the pressing divisions, the cutting division has been technologically the most advanced, with for example, laser cutting, plasma torch cutting and water jet cutting. Within the sewing division, straight-stitch machines, over-lockers and speciality machines similar to buttonhole machines are typically used (Carr & Latham, 1988:6). A **production system** can be defined as the flow of

goods through the production line and the layout of machinery as well as the relationship of workers to the production line (Lin et al., 2002:46). **Material handling** is defined simply as material moving within a production line (Meyers, 1993:2).

The **transformation process** involves the actual production process. The production process involves spreading the material, cutting the material, making sample garments, subcontracting decorative details on pattern pieces, sewing pattern pieces together, wet process if applicable, pressing, and the final finishing off of the garment (Brown & Rice, 1991:89).

For this study, the inputs (subsystems) are investigated using qualitative and quantitative techniques. The measuring indicators are the stipulated factors in the different subsystems. Then the influence that these inputs have on the transformation process and output is measured. As mentioned in Chapter 2, **productivity** can be measured in terms of output related to input. The output is usually measured in units produced, and the input is usually some variation of workers and hours worked (Lin *et al.*, 1994:21). Bheda *et al.,* (2003:12) link productivity to productiveness as well as efficiency. Effectiveness can be explained as the utilisation of resources to produce a given outcome, rather than simply the rate at which the output is generated.

For a system to operate effectively, the system has to encompass a **control** and a **feedback** element (Spears & Gregoire, 2004:9). Controls represent the standards for evaluating the system and provide the basis for the managerial process of controlling. A good example of control in a clothing manufacturing system will be quality control, whereas feedback provides information essential to the continuing effectiveness of the system (Spears & Gregoire, 2004:10), for example feedback from sewing machine operators to management as well as feedback from management to sewing machine operators.

3.4 RESEARCH OBJECTIVES AND SUB-OBJECTIVES FORMULATED FOR THE STUDY

The research problem, research objectives and sub-objectives were formulated to demarcate the study and were then conceptualised and operationalised:

3.4.1 Objective 1

To explore and describe the role that *human resources* (*performance appraisal, training and motivation)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives.**

Sub-objectives

- To explore and describe from **management's perspective** the role *performance appraisal* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *performance appraisal* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *training* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *training* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *motivation* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *motivation* plays in the optimisation of a clothing production system's utilisation of resources.

3.4.2 Objective 2

To explore and describe the role that *operational resources (ergonomics, production planning, and quality control)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

Sub-objectives

- To explore and describe from **management's perspective** the role *ergonomics* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *ergonomics* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *production planning* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *production planning* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *quality control* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *quality control* plays in the optimisation of a clothing production system's utilisation of resources.

3.4.3 Objective 3

To explore and describe the role that *physical resources (technology, production system and material handling)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees'** perspectives.

Sub-objectives

- To explore and describe from **management's perspective** the role *technology* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *technology plays* in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role the *production system* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role the *production system* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from **management's perspective** the role *material handling* plays in the optimisation of a clothing production system's utilisation of resources.

- To explore and describe from the **employees' perspective** the role *material handling* plays in the optimisation of a clothing production system's utilisation of resources.

3.5 CONCLUSION

The systems theory is a theoretical perspective that provides a basis for understanding complex phenomena and integrated knowledge. The systems theories accommodate open and closed systems and involve many concepts, of which a few are pertinent, specifically: interrelatedness of the systems and subsystems; equifinality; inputs; transformation and outputs.

Chapter four is devoted to the research design and methodology for the research. Data analysis is explained in brief for both qualitative as well as quantitative data collection methods. Trustworthiness, objectivity, transferability, dependability, confirmability and ethics are also attended to.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

4.1 INTRODUCTION

This chapter describes the research design and research methodology used for the study. Research procedures are accounted for in this chapter, considering the systems theory that was used to structure as the theoretical approach.

The research was designed as a typical case study. It focussed on a specific organisation, hence referred to as 'the clothing manufacturing company' that is believed to be a typical manufacturing company in the South African clothing industry.

The nature of the research problem required the use of a combination of qualitative and quantitative data collection methods that are distinguished and explained in this chapter. All the research methods and procedures are explained and justified in terms of their relevance in the study. Attention is also given to aspects such as reliability, validity, objectivity, trustworthiness, dependability, confirmability and transformability of data.

Problems can be resolved by asking relevant questions and seeking answers through systematic research (Leedy & Ormrod, 2001:3). The aim of this research was explorative-descriptive in kind. The researcher was able to collect information (lay knowledge) from World 1 which was based on actual experiences from employees and management in the production company, and to convert this knowledge through a scientific design or theory to the world of meta-science, or World 3 as it is known in the scientific world (Babbie & Mouton, 2003:7). Ordinary knowledge is based on first-hand experience, is mostly unsystematic and disorganised, and is often based on secondary sources such as financial statements from the production company. Scientific knowledge on the other hand is based on collective scientific validations of the scientific community. Thus the problem statement and objectives were formulated according to the literature review preceding the research. Scientific knowledge is also the outcome of an organised collection of knowledge that was explored in a methodical and systematic manner. At this stage the researcher takes world 2 (the observations and knowledge gained from interviewing management and after questioning employees) as the object of investigation and transfers this knowledge into 'world 3'

knowledge. The researcher takes information gained from the employees and management from world 1 and searches for the “truth”. The researcher sets out to systematically take the personal experience of these employees and management as an objective and redirect the information gained through theories, models, typologies, concepts, definitions, findings, data and ultimately instrumentations (e.g. scales, tests and questionnaires) into the world of meta-science to resolve the research problem (Babbie & Mouton, 2003:12).

4.2 RESEARCH DESIGN

This research called for a case study design. The case study chosen was a single case design with multiple units of analysis, or an embedded single-case design (Yin, 2003:40). This case study focused on one organisation (a South African clothing production company), and attention was given to the two separate units of analysis’s (management and employees) perspective and view on the use of company resources. The primary objective of this study was to understand the role that the resources (inputs) and the interrelationship between these inputs play in optimisation the clothing production company’s utilisation of resources to increase productivity (outputs). The research objectives gave a perspective of what the researcher aimed to achieve with the study. The purpose of a case study is to understand the context of the problem/situation. Case study design provides a holistic investigation into organisational practices and gives insight into the complex interaction between systems, people and technology (Dubé & Paré, 2003:598). This study can be classified as a “one-shot case study” as the aim of the study was being achieved by the collection of explorative-descriptive data. A one-shot case study can be a study of any one research subject or a group of subjects (De Vos, 1998:125). The case study research design also provided the researcher with flexibility and richness in terms of being able to use a wide range of data collection methods (Maree, 2007; Dubé & Paré, 2003:598).

Some social scientists view case studies as being less “scientific”, the concern being case studies where no pre-testing is available and only a few variables are measured (Babbie & Mouton, 2003:280). However, a case study as in this research could yield valuable information, as the study took place where many variables were measured. To name a few: performance appraisal, motivation, technology, ergonomics, production system etc. These inputs into a clothing production system already include a variety of variables. Contextual knowledge gained from these variables is already rich, thus needed in-depth exploration.

The general design principles for case study research as per Babbie and Mouton (2003:282) were taken into account: the role of conceptualisation, contextual detail and in-depth description, using multiple sources of data and analytical strategies.

- After formulating the research problem, research goals were set. The research question accompanying the research goals was displayed in a conceptual framework; thereafter each concept was defined. This structure performed the role of guiding the data collection process.

- For the researcher to understand the unit of analysis in this case study, an in-depth analysis was conducted of the surrounding environment of the unit of analysis. This environment included their direct and indirect environment. This led to variables that have an influence on the unit of analysis, and ultimately on the case.

- The researcher used multiple sources of data, by the use of multiple methods such as questionnaires, individual interviews and focus group interviews. The use of multiple informants within the company assured a broader view. This method also ensured triangulation as part of the research method.

- The research report of this case study accounted for the multidimensionality of the findings and their interrelationships, by using multiple data and thickly described data. The mode of this case study included pattern building. Patterns from the data are matched to data in theory.

The research design can be regarded as a ‘blueprint’ of the study, which flows from the research problem, and can be defined as a set of guidelines to be followed to be able to address the research problem (Mouton, 1998:107). The research design provided structure for the data and the data analysis (Leedy & Ormrod, 2001:91). The rationale behind the research design for this study was to structure the design for the researcher to be able to maximise the validity of the data collected, and to eliminate potential error. The aim of the study was to understand the context of the research problem and not to generalise the data.

In the last two decades textile and clothing manufacturers established themselves in non-metropolitan areas. It was estimated in 2002 that there were 40 000 clothing workers and a growing number of informal clothing workers in these areas (Vlok, 2006:8). The clothing manufacturer chosen for this study is located in a non-metropolitan area. It is situated on the outskirts of Bronkhortspruit lying on the border between the Gauteng and Mpumalanga

provinces, 50 kilometres outside Pretoria. The factory is situated in Ekandustria, an industrial area established in the 1980s. Two informal settlements that are within close proximity are Ekangala and Kwamhlanga providing workers/labour to this area. The 'case', as confirmed by management and records, did not produce at maximum output. The production company complied with the labour law of South Africa.

After selection of the case, determining the unit of analysis within the case is the next step during social research.

4.3 UNIT OF ANALYSIS

4.3.1 The unit of analysis in terms of the criteria for the study

The criteria used for choosing the unit of analysis were set by the researcher based on information obtained from management and employees as well as relevant literature, and were used to select a purposeful sample (Babbie & Mouton, 2003:166).

4.3.2 Selection of target population

The unit of analysis refers to the "what" of the study, for e.g. an object, phenomenon, entity or process. The unit of analysis can either be individuals, groups, organisations and institutions, social artefacts, social actions or interventions (Babbie & Mouton, 2003:84). The unit of analysis for this research study was difficult to identify. The unit of analysis was divided into two sub-unit of analysis namely the management and employees of the clothing production company. As data was collected from individual interviews, the unit of analysis will then be the operational management and the employees of the clothing production company (Yin, 2003:76). To understand the interrelatedness of the different subsystems of a clothing production system, only one case within a sample frame was studied. One clothing production company was chosen out of the South African clothing production industry. This has its own advantages and disadvantages. More time can be allocated to the study of the setting, but the representativeness could also be in doubt (Hammersley & Atkinson, 1995:42). The aim was not to find representative data but rather to understand the relationship between the different variables from the management and employees perspective and describe the context thereof.

The following table provides a better understanding of the unit of analysis being researched:

TABLE 4.1: SELECTION OF UNIT OF ANALYSIS FOR THIS STUDY (Yin, 2003:40)

CONTEXT: South African Clothing Production Industry		
CASE (A Clothing Production Company)		
Unit of analysis	Unit of analysis (1)	Unit of analysis (2)
Subset	Operational management: line managers, cutting room & design managers & line supervisors	Sewing machine & cutting room operators
Type of Data collection	Qualitative	Quantitative
Data collection technique	Individual interviews and focus groups	Questionnaire

Individual interviews were held with operational managers and supervisors. A focus group discussion was held with the line supervisors. From the individual interviews and focus groups a questionnaire was developed and the sewing machine and cutting room operators were asked to complete it. This in short sums up what the unit of analysis consisted of and how they were included in the sample. More detail about the inclusion

Selection criteria for unit of analysis (1 and 2) and the sample included in the study

TABLE 4.2: UNIT OF ANALYSIS (1)

Position in company	Criteria	Education	Age	Gender
Design room manager	-Time with factory -Experience in factory -Part of operational management or management position -Part of decision-making process	Formal	Late 20's	Female
Cutting room manager		No formal education	Late 20's	Male
Jacket line manager		Formal	Late 40's	Male
Jacket and trouser line supervisors		No formal education	35-50	Female
Jacket and trouser line supervisors		No formal education	35-50	Female
Trouser line manager		Formal	Early 30's	Male

TABLE 4.3: UNIT OF ANALYSIS (2)

Position in company	Criteria	Education	Age	Gender
Sewing machine operators	-Employed for more than 6 months Full-time employed Operational experience? All departments Randomly	No formal education	18-60 years	Female
Cutting room operators		No formal education	18-60 years	Female

4.3.3 Purposive sampling

A purposive sampling method was used to the individuals (operational management and sewing machine operators) within the case study. As the research made use of combined qualitative and quantitative data collection techniques, the samples were selected by using purposive sampling. The researcher selected the two sample on the basis of her own knowledge of the population (Babbie & Mouton, 2003:166).

The ‘case’ for this study was selected in South Africa. The criterion for selecting the ‘case’ in South Africa was: the ‘case’ had to have a workforce of more than 100 workers, because then the company would be more likely to manufacture mass-produced clothing. Mass-producing companies are currently experiencing problems, as may be seen from the literature review. This clothing construction company employs more or less 250 workers and can be classified as a mass-producing company.

Operational management respondents that were chosen consisted of the heads of the departments: human resources, production planning and supervisors within the apparel production system. For sample one, all the operational managers and supervisors of the clothing production system were chosen. It was advisable to interview all the operational managers. The reason for choosing all the operational managers was because management and supervisors are the decision-making force that steers the way for the clothing production company (the case).

For the second sample, the total workforce of the company amounted to 250 workers. A non-probability sampling method directed the selection of operators to complete the questionnaire. One hundred and three (N = 103) respondents were selected, consisting of 75 (n = 75) sewing machine operators and 28 (n = 28) cutting room operators. Only workers that worked for six months or more that were full time employed and had operational experience were chosen. All the operators were black women that worked on a full-time basis for the company and were from 18-60 years of age.

4.3.4 Gaining access to the unit of analysis

The researcher contacted various clothing production companies in the Gauteng region that matched the criteria for the unit of analysis. Permission for this study was given by National Clothing situated near Bronkhorstspruit, Ekandustria. A letter from the University of Pretoria

was presented to confirm that the information gained from this study was solely for academic purposes.

The researcher gained access by making appointments with each individual in management and interviews were conducted in a separate office to limit interruptions. Follow-up interviews were held if the researcher needed any other information. During the follow-up interviews, aspects that needed further explanations were covered to obtain a better understanding.

A name list of sewing machine operators was obtained from management, and the sewing machine operators were divided into three categories: trouser line, jacket line, and lastly the cutting room. One hundred and three (103) sewing machine operators were full-time employees. Employees working for more than six months at the clothing production system were randomly chosen from each department. In the end, 75 respondents of the sample were sewing machine operators, whereas 28 respondents were cutting room operators. Furthermore, the sewing machine operators were divided into jacket line operators and trouser line operators, the questionnaires were distributed equally amongst the trouser line and jacket line. The compensation that they would receive was not discussed with them; fieldworkers were compensated after the questionnaires were handed in. They were compensated R5 per questionnaire.

Another aspect that revealed itself during the research was that the sewing machine operators were sceptical at first, because they thought that the researcher was employed by the company to research this information about them for management.

4.4 THE RESEARCH APPROACH

To answer the research problem in a meta-science context it was found necessary to use a multi-data-collection approach. Qualitative and quantitative data collection techniques were used. Typical qualitative data collection techniques were used; however, to ensure triangulation of the data collected, these techniques were combined with quantitative data collection techniques (Leedy & Ormrod, 2001:149). During the first phase of the research, individual interviews were followed by two focus group interviews with members of operational management. Thereafter a questionnaire was constructed to evaluate information gained from the interviews and to test employees' views (sewing machine operators as well as cutting room operators) on the subjects that emerged from the interviews.

4.4.1 The first phase: Qualitative approach

During the first phase of the research the researcher made use of a qualitative approach. The aim was to describe and understand the utilisation of resources in the clothing manufacturing company (De Vos, 1998:240). The following considerations were taken into account to justify a qualitative research technique: the nature of the research question, e.g. explorative, secondly, the research focus, which was on one phenomenon, or one case with a relatively small number of participants, and lastly, the researcher needed to establish a prolonged interaction with the participants. (Leedy & Ormrod, 2001:113).

The key features of a qualitative research design were implemented: research was conducted in the natural setting of the social actors, within the clothing manufacturing system. The views of the actors included in the different subsystems were emphasised to get a better understanding of the actions and events within the subsystems. For the researcher to be able to get an insider's perspective, the researcher needed to put herself in the shoes of the employees and the operational managers who were interviewed. This was important because there were vast differences between the culture, race and language of the researcher and the people that were interviewed (Babbie & Mouton, 2003:270).

An **ideographic** research strategy was followed for this study. This meant that the case study needed to be understood in a specific context rather than the generalisation of the data. The ideographic study examined the case (a clothing manufacturing company) and its structural coherence within a larger context. This study is therefore focused on understanding the case (the clothing manufacturing company) within its own contexts (Babbie & Mouton, 2003:270).

By using a qualitative research approach, the research process was mainly **inductive**. The researcher gained information from world 1, with no prior existing theory or hypothesis. The researcher took this information and formulated a second-order construct that made it possible to ultimately formulate a theory to make sense of world 1. The researcher conducted a literature review to gather topics as points of reference during the basic individual interviews and focus group discussions.

This approach had it challenges, interviews needed to be transcribed and correctly interpreted, however this brought forward valuable information that set the basis for the research.

4.4.1.1 Qualitative data collection techniques: basic individual interviews with management

The primary technique of data collection for this phase was basic individual interviewing (face-to-face interviews). The interviews helped the researcher to understand the case being studied (De Vos, 1998:297). The interviews were in the form of a conversation and pursued specific topics raised by the respondent. Ideally the respondent should be allowed to talk freely (Babbie & Mouton, 2003:289). Kvale in Babbie and Mouton (2003:289) offers two metaphors for interviewing: the interviewer as a miner or as a traveller. The interviews can be classified as 'instructed interviews'. In essence, unstructured interviews can be described as social interactions between two people in order to obtain research-related information (De Vos, 1998:298). However, the type of unstructured interviews that were used could be described as an unstructured interview with a schedule (Greeff, 2011:349).

- **Interview procedure**

For this study the researcher can be classified as a miner: the researcher posed specific questions in order to gain an understanding from management (Babbie & Mouton, 2003:289). The interviews were conducted according to a research schedule (see also section 4.5.1); however, the unstructured interviews were scheduled as instructed interviews (De Vos, 1998:299).

Topics and themes that were important for the researcher were used to prepare the schedule and were used as a guideline. Questions were asked in no particular order and were used to guide relevant topics.

Topics and questions used in the interviews:

1) Can you tell me about the performance appraisal system in the factory?
2) How does performance appraisal take place in the system?
3) Is there a training system in place for the sewing machine operators?
4) Can you expand on the type of training given or whether any training was implemented, and what management's (M) view is on training?
5) Management's view on the motivation of workers.
6) How does performance appraisal and training fit into the motivation of workers?
7) Expand on the value of motivational tools used.
8) Ergonomic issues: difficulties? Suggestions?
9) How is quality control handled in the factory?

10) Can you expand on the type of production systems used?
11) How is production planning addressed in the factory? Who is responsible? When? Where? How?
12) Expand on technology used? Updating outdated technology?
13) Process of handling raw material. When? Who? How?

The listed topics and questions were only used as probes. The researcher was open to comments and suggestions which management considered being important.

- **Conducting the interviews**

Six interviews were held in September 2006, each interview lasting an hour to an hour and a half. Appointments were planned according to the time the respondents had available, so time was always limited. The researcher tried to maintain a relaxed atmosphere for interviews. A relaxed atmosphere needs to be quiet with the least amount of interruptions. For this reasons the interviews were conducted in a separate office at the production company.

During the interviews, the participants were encouraged to speak freely, and if the conversation went off-track the participants were guided back to the main topics of the interview. The interviews were tape-recorded and cryptic notes were taken during the interviews to preserve information. The first interview was held with the designing room manager, the second interview was held with the cutting room manager, the third interview was held with the jacket line manager, the fourth interview was held with the trouser line manager and the last two interviews with the supervisors. During the first set of interviews, the tape recorder was faulty and did not record. The researcher re-scheduled the appointments and the participants were interviewed again. During the second round of interviews, the participants were more comfortable and provided more information to the researcher, because the researcher was already familiar to them.

The researcher addressed the issue of the trustworthiness with the use of the following steps: To ensure credibility of the data obtained, the researcher conducted the information gathering in such a manner that the phenomena regarding the interrelatedness of the resources were accurately identified and described (De Vos, 1998:351). Transferability demonstrates the applicability of one set of findings to another context. Transfers were made by the use of the questionnaires. Dependability was addressed by attempting to account for changing conditions (De Vos, 1998:351). The researcher maintained a neutral point of view

and did not lead the participants into answers; the participants spoke freely. Confirmability was focused on the representativeness of information and whether the participating party could confirm the data (De Vos, 1998:351). The data collected was transcribes then the participant, afterwards transcriptions were confirmed as correct and true by the participants.

The aim of the interviews were not data saturation, as data saturations could not be obtained by four interviews, the aim was to collect information to construct the questionnaire for the sewing machine operators and cutting room operators.

4.4.1.2 Qualitative data collection techniques: focus group interviews with supervisors

After the completion of the individual interviews with management focus group interviews were conducted with supervisors and some sewing machine operators from each department. A focus group can be defined as a purposive discussion of a specific topic or related topics taking place between eight to ten individuals with a similar background and common interest (De Vos, 1998:314). The motivation for conducting a focus group discussion was to observe the interrelationship between the supervisors and the sewing machine operators. The supervisors did most of the talking as the sewing machine operators only participated when they were addressed directly.

An individual's attitudes and beliefs do not exist in a vacuum; people often listen to other people's opinions and understandings to form their own. The advantage of the focus group was that the technique is socially orientated and the atmosphere in a group discussion is more relaxed than in a one-on-one interview. There were disadvantages as well: with the power dynamics in the group itself, the interviewer had less control over the group discussion than would have been the case in a one-on-one interview (Marshall & Rossman, 2006:114). The researcher met up with the participants and provided them with the opportunity to speak for themselves. This was the case with the second focus group interview, in which only the supervisors participated. The main focus of this focus group interview was to access information that was not accessible from the interviews with management or the first focus group held and to get a feel for their unique opinions on the different variables. This is where the participants had their opinion about a subject, and discussed it within the group; during this discussion participants then supplied new information they might not have thought about earlier.

- **The focus group procedure**

Concerning trustworthiness and objectivity of the focus group interviews, it was important to keep the following in mind:

- The individual should never override the group dynamic.
- The researcher should steer away from friendship pairs, “experts” and uncooperative participants. The group should not be too large so that people form their own group discussions.
- The groups should be heterogeneous (Babbie & Mouton, 2003:292)

Examples of probes that were used to stimulate conversations during group discussions were the following:

- What type of work do you do?
- What do you like about your?
- What does your job entail?
- What do you enjoy about being a supervisor?
- What are your responsibilities in your job?
- About what do you want to learn more?

These were examples of probes or questions that were asked. Other topics did arise from the conversation and were addressed.

The focus groups were held in October 2006; the selection criteria, as seen in Table 4.2 and discussed in section 4.3.2, were used to select the participants. The focus group consisted of all the supervisors in the different departments and two of the sewing machine operators from each department.

For the first focus group meeting, the canteen was chosen as the most fitting location. The canteen provided adequate space and the respondents were able to face the researcher and each other. The disadvantage of using the canteen was that it was noisy, and the researcher had only half an hour to conduct the interview in, as she was not allowed to take up production time. With this focus group the study leader was present to support the researcher with the data collection.

The focus group interview was conducted on the same principles as the basic individual interviews. After a brief review and introduction by the researcher, the scheduled probes were used to direct the interview. During the focus group interview, field notes were taken

and group dynamics were observed. The themes for the focus group were the same as for the basic individual interviews. The schedule was drafted beforehand. During the interview the supervisors did most of the talking; the researcher then asked one or two questions directly to the not so eager participants.

The second focus group interview was done, by placing the participants in a circle and giving each participant a chance to give a brief review of the problems that they were experiencing in their department. This interview was conducted with the five supervisors of the clothing manufacturing company only. The focus group meeting was conducted during lunch time, which was also only 30 minutes long. The interview took place in a quiet location at the back of the factory and only the researcher was present.

The same strategy was followed by the researcher for both the focus groups to ensure objectivity, trustworthiness and objectivity, as with the basic individual interviews.

4.4.2 The second phase: Quantitative approach

Considering the issues related to validity and reliability, and addressing the issue of data triangulation, a quantitative approach was followed in phase two. The quantitative data collection technique used to collect data during the second phase was a questionnaire administered to sewing machine and cutting room operators with the help of fieldworkers.

4.4.2.1 Quantitative data collection technique – questionnaire for sewing machine operators and cutting room operators

A questionnaire can be defined as an instrument with open- and close-ended questions to which a respondent has to react (De Vos, 1998:89). Because of numbers it was not possible to interview each employee; a questionnaire was thought a quicker and easier technique to collect data. The questionnaires were simple in design: a series of questions were posed to willing respondents, and their responses summarised with percentage and frequency counts, and inferences were drawn about the particular population accordingly (Leedy & Ormrod, 2001:196).

The questionnaires were constructed after the individual and focus group interviews were held. The individual and the focus group interviews gave the researcher an idea of what management's and base level employees' views were on the topics that were discussed. The objective of the questionnaire was to obtain facts and opinions about the issues experienced

in the working environment by the sewing machine operators and cutting room operators, to achieve the research objectives.

Questionnaires may be used for descriptive, explanatory and exploratory purposes (Babbie & Mouton, 2003:232). The benefit of using questionnaires is that the questionnaires can be sent to a large population. As 103 sewing machine operators were questioned, this form of data collection was found to be appropriate.

The participants' responses remained anonymous, so that they could feel more comfortable discussing issues than they would have in a personal interview (Leedy & Ormrod, 2001:196). Although people do participate in the questionnaire their responses reflect their reading and writing skills. The participants for this study were not literate. This created the need for the researcher to train fieldworkers to help the participants answer the questionnaires. Line supervisors were trained to act as fieldworkers. The questionnaires were conducted over a period of a month, July 2008. Fieldworkers had the following characteristics: they were able to speak the same language as the respondents, and they matched the race and sex of the respondents. It was of the utmost importance that the fieldworkers were familiar with the questionnaire. They were trained individually for half an hour to an hour by the researcher.

The following factors were taken into account when the researcher formulated the questionnaire: questioned items had to be clear and unambiguous (Babbie & Mouton, 2003:234). It was important that questions had to be clear to the respondents. As the respondents were illiterate the questions were formulated in a world 1 language for them to understand.

- **Questionnaire criteria**

The following factors that may influence the reliability of the data were taken into account:

- Researcher orientations: the researcher and fieldworkers were familiar with the questionnaire, and followed the question wording. The researcher did not prompt the respondent into a certain answer, and recorded the responses correctly (Babbie & Mouton, 2003:252-253).

- The questionnaire was pre-tested. The items were clear and unambiguous. Double-barrelled questions, negative items and biased items were avoided. Questions were relevant and short, and terms used as well as the translation of the questions were correct (Babbie & Mouton, 2003:233-238).

- The participants did meet the specifications and were not forced to participate; respondents were competent to answer the questions, helped by the fieldworkers (Mouton, 1998:145).

- The participants did meet the specifications and participated out of their own free will.

- Respondents, who were incompetent to answer the questions, were assisted by the fieldworkers (Mouton, 1998:145).

The type of questions asked in the questionnaire was the same type of questions asked to management. Asking the same types of questions to the employees helped the researcher to gain information on how the employees perceived performance appraisal, training and motivation as implemented by management. After the information was attained from both parties within the human resources subsystem, the relationship between the two parties was clear. Certain problems, for example miscommunication, were identified.

It was important for the respondents to become familiar with and trust the researcher. The ideal was to keep a marginal position during the interviews, thereby providing access to participant perceptions but at the same time minimising the dangers of over-reporting (Hammersley & Atkinson, 1995:112).

- **The questionnaire procedure**

The questionnaire was administered to 103 sewing machine operators as well as cutting room operators. Management helped with distributing the questionnaires. The distribution of the questionnaires was done equally between the jacket line and the trouser line, and 28 questionnaires were issued to the cutting room operators. Only 30 minutes per day were available to spend with the respondents. It was therefore necessary to train fieldworkers to help with the collection of data. The fieldworkers, consisting of the line and cutting room supervisors, were trained by the researcher. Questionnaires were distributed equally between the different departments. The questionnaire (Appendix A) was divided into two sections. Section A had to be completed by both sewing machine operators and cutting room operators. Section B was completed by sewing machine operators only, and section C was completed by the cutting room operators. Seventy five (75) per cent of questionnaires were distributed to sewing machine operators, and 25% to cutting room operators. These percentages were formulated from the sample frame that was drawn from human resources.

The questionnaire was designed to have open-ended and close-ended questions. With the open-ended questions the respondents could give their own answers. Open-ended questions brought some surprising information to light. These questions were not compulsory to answer. No demographical questions were in the questionnaire as the demographical factors were the same for all participants and did not have an influence in this study. Close-ended questions were matrix questions. This type of question had its benefits: it saved space on the questionnaire, allowed respondents to answer the questions faster and increased the compatibility of responses. Matrix questions can however have a response set among respondents; respondents may develop a pattern in the answers that they give. This problem was overcome by alternating statements and by making them short and clear. The matrix questions were not in a Likert-scale format, but simply allowed Yes or No answers. This made it simple for the respondents to answer (Babbie & Mouton, 2003:242). Respondents were instructed to answer by making an X in the corresponding box, and to mark only one answer. The questionnaire was designed with the help of a statistics professional and the study leader. The questionnaire was pre-tested twice and reconstructed after each test. Testing indicated that the questions needed to be simpler and shortened for the respondents to understand. It was critical to shorten the questions without losing information.

The questionnaires were constructed with the processing of the questionnaire in mind. Each question was given a question number, and provided with an empty box, to ease the coding process.

As soon as the questionnaires were completed the questions were coded by the researcher. Numerical values were given to each answer. The answers to open-ended questions were grouped together, and were given a numerical value for every group of answers. Close-ended questions were done differently: the yes answers were given a numerical code of 1, and the no answers were given a numerical code of 2. Data was thus converted into numerical codes, to transform the data. Transformed data was recorded and analysed by the use of a statistical computer program.

Codes were transcribed into the computer program and the data was transferred onto a data sheet. The sheet provided frequencies and percentages for each set of answers. Conclusions and results were drawn from the statistically analysed data.

The next step was to eliminate errors, depending on the data processing technique; such errors may have resulted from incorrect coding, and incorrect reading of written codes or

incorrect sensing of blackened marks (Babbie & Mouton, 2003:417). An overview of the data proved that the data was in order. Analysing the data followed, and conclusions were drawn.

The only disadvantage for using questionnaire was that some of the employees were illiterate and the questionnaire needed to be translated by the fieldworkers, this may have caused misinterpretation of questions.

4.5 DATA ANALYSIS

Analysis is defined as the resolution of a complex whole into parts (Mouton, 1998:161). The purpose of conducting a qualitative study is to produce findings (Patton, 2002:432). Fundamental differences can be seen between qualitative analysis and quantitative analysis (Mouton, 1998:161). Therefore quantitative data analysis (statistical analysis) was discussed and quantitative data analysis was elaborated on. A discussion on both procedures follow for a better understanding.

4.5.1 Notions of qualitative data analysis

Data analysis is the process of brining order, structure and meaning to the mass of collected data (Schwandt, 2007:6). Qualitative data analysis is defined by Babbie and Mouton (2003:490) as a form of analysis of data that was gathered using qualitative techniques.

There is no right or wrong way to conduct qualitative data analysis; various methods exist to ensure the credibility, transferability, dependability and conformability of the data (Schurink, Fouche & De Vos, 2011:420). The reasoning of Huberman and Miles (1994:10) was followed for this study. Huberman and Miles (1994:428-444) are of the opinion that qualitative data analysis consists of three stages: data reduction, data display, and then the conclusion drawing and verification stage.

4.5.1.1 Data reduction stage

Category formation represents the heart of qualitative data analysis. This step requires a heightened awareness of the data, a focused attention to it, and openness to the subtle, tacit undercurrents of social life. (Schurink, Fouche & De Vos, 2011:410).

As posed by Miles and Huberman (1994:428), the first stage for data reduction is the organising of data. Data, e.g. in the form of field notes, was organised by the date and the name of the participant. Data was further reduced after transcribing the data, coding the data

and identifying themes. The scope of the data was narrowed according to the conceptual framework, objectives and sub-objectives. Highlighters were used to code the data.

TABLE 4.4: THEMES IDENTIFIED FROM INTERVIEWS AND COLOUR CODES

THEME	COLOUR CODE
Training of employees	Light blue
Performance appraisal and motivation of employees	Light green
Quality control	Red
Production planning	Yellow
Ergonomics	Light purple
Technology	Dark green
Production system	Teal blue
Material handling	Dark purple

The second stage of data reduction was done by creating a table in Microsoft Word. The eight identified themes served as headings for the table. The data was further organised and categorised for each respondent. The categorised data was moved to the correct headings within the table by making use of the cut and paste function of the computer program. The information in the tables was checked for correctness and relevancy (see Appendix A).

During the last stage of data reduction the data was refined and a short conclusion was already included. Irrelevant data was ignored.

4.5.1.2 Data display stage

The display of data should be organised, and concise, so that assembly of information permits conclusion drawing (Schurink, Fouche & De Vos, 2011:411). During this stage the researcher reduced the data, to set a basis of thinking about the significance of the data (Schurink, Fouche & De Vos, 2011:411). The presentation of the findings was done according to the predetermined objectives and sub-objectives.

Categories were formed based on the identified themes. Themes were identified and built into the categories. By identifying themes and concepts that were the same for different participants, a pattern was disclosed and the data synthesised. This phase of data analysis led to the classification, description, and discussion of the data (Miles & Huberman, 1994:428). Verbatim extracts from the interviews were transcribed to give a rich description of the data and eased the transferability of the data to the reader.

4.5.1.3 Conclusion drawing and verification of data

During verification and conclusion drawing of data, the researcher was involved in making interpretations and drawing meaning from the displayed data (Schurink, Fouche & De Vos, 2011:416). Noting patterns and themes, clustering, using metaphors and the use of triangulation were some of the strategies that were used (Schurink, Fouche & De Vos, 2011:416).

The researcher subjected the study to an audit trail (field notes and transcribed data) to enhance the trustworthiness and objectivity of the data: all the notes, raw data and audio verbatim data were supplied.

Triangulation, according to Babbie & Mouton (2003:275), refers to the use of multiple methods, sources and techniques to increase the objectivity of the study. The triangulation of data was done in the present study by making use of different sources (management and employees), and by making use of different techniques (qualitative data collection technique and quantitative data collection technique).

After data confirmation, conclusions were drawn by making use of verbatim extracts, and the data was triangulated with quantitative data.

4.5.2 Notions of quantitative data analysis

The aim of this paragraph is to introduce the reader to the techniques that were used for statistical analysis. Different terms that were used during the statistical analysis are also defined. Quantitative data analysis can be regarded as the techniques by which researchers convert data to a numerical form and subject it to statistical analysis. (Ruben & Babbie, 2005:552).

4.5.2.1 Analysis and interpretation of the quantitative data

Data analysis entailed data that were broken down into constituent parts to obtain answers to the research objectives. The data gathered for each variable was analysed, summarised and displayed in the form of a frequency distribution (Fouche & Bartley, 2011:254). These techniques lend themselves to nominal data, hence the use of unvaried analysis (Mouton, 1998:162). The results were electronically computed, with the help of a statistician. A simple frequency distribution was used; one variable was added up and was displayed in the form of a table. Direct interpretation was done. Descriptive stats were used to reduce data to an

interpretable form so that relations of the research problem can be researched (Fouche & Bartley, 2011:254).

4.5.2.2 Measures of central tendency and variation for the quantitative data

The measure of central tendency used for this study was the mode method. For this study the mode was the value or category with the highest frequency (Mouton, 1998:164). A frequency and percentage polygon was displayed in table 4.5 to visualise the appearance.

TABLE 4.5: TRAINING FREQUENCY N = 103

STATEMENT	YES	NO
When I started working here	n = 65 (63.73%)	n = 37 (36.27%)
When I have to work on a different machine	n = 57 (55.34%)	n = 46 (44.66%)
When you have to sew something new, different to what you are used to	n = 53 (52.48%)	n = 48 (47.52%)
Once a month	n = 24 (23.53%)	n = 78 (76.47%)
Once a year	n = 18 (18%)	n = 82 (82%)

From Table 4.5 it is clear that the researcher has made use of an unvaried analysis, displaying nominal data. The mode technique was used as a measure of central tendency, and frequency distribution was used.

4.6 OPERATIONALISATION OF SUB-OBJECTIVES

Conceptualisation of data is the refinement and specification of concepts, and operationalisation is the development of specific research procedures that would result in the in the representation of data in world 1, and the results are translated into world 3 knowledge for the reader (Babbie & Mouton, 2003:128).

The questionnaire used in this study mainly consisted of nominal measurements, with answers consisting of yes or no answers. The yes or no answers are then percentage based, to determine frequency correlations between the answers. Too be able to determine inter-relationships in the data. The interviews were transcribed after each interview. Transcripts were coded and themes were identified accordingly. Coding implies the application of numerical values to open-ended questions. Content analysis was applied to the coded data, by highlighting the relevant themes. Analysis after coding reduced the variety of idiosyncratic items of information to a more limited set of attributes, composing a variable (Babbie &

Mouton, 2003:413). All the relevant information was refined by the use of tables. Data not applicable to the study was ignored.

Firstly the operationalisation process on the qualitative data for each objective and sub-objective is discussed. To determine correlations and inter-relationships, the operationalisation of quantitative data is presented, together with the applicable sub-objectives in Table 4.6.

TABLE 4.6: OPERATIONALISATION OF SUB-OBJECTIVES

OBJECTIVE	SUB-OBJECTIVEs	RELEVANT DATA	VARIABLES	OPERATIONALISATION
To explore and describe the role that *performance appraisal, training and motivation* play in the optimisation of a clothing production system's utilisation of resources from management's and employees' perspectives.	**Sub-objective 1.1:** To explore and describe from management's perspective the role that *performance appraisal* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what type of performance appraisal is used, how do employees respond to a performance appraisal system, how is the performance appraisal system implemented, and what is the measured outcome of the performance appraisal system? Which measure do they use to measure work performance? Afterwards data was transcribed and themes were coded.
	Sub-objective1. 2: To explore and describe from the employees' perspective the role that *performance appraisal* plays in the optimisation of a clothing production system's utilisation of resources.	Section A (Q4), (Q5), (Q6)	V8-V16	(Q4) and (Q5) Open-ended questions, coding responses. (Q6) Nominal measure, percentage distribution between YES and NO answers. (Q4): *Are you happy in your job?* (Q5): Is a follow-up of (Q4): *If no, what can management do to make you a happy worker?* (Q6): *How do you get rewarded for doing more than your workload? Mark the (YES) block if you receive the reward, or the (NO) block if you do not receive the reward.*
	Sub-objective 1.3: To explore and describe from management's perspective the role that *training* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what training program is in place, is there a need for further training, what mistakes can be prevented with training, will training uplift worker morale, and what role does training play with regard to productivity? Afterwards data was transcribed and themes were coded.
	Sub-objective1.4: To explore and describe from the employees' perspective the role that *training* plays in the optimisation of a clothing production system's utilisation of resources.	Section A (Q2), (Q7), (Q8) Section B (Q12) Section C (Q16)	V2, V17-V24, V43, V49, V57, V58, V64, V96, V97, V100	(Q7), (Q12) and (Q16): Nominal measure, percentage distribution between YES and NO answers. (Q2) Ordinal measure, variable ranking between always and never. All questions percentage-based. (Q8) Open-ended question, coding responses. (Q2): *Do you know what you must do in your job?* (Q7): *When do you receive training?* Mark only (YES) or (NO), and mark every answer. (Q8): follow-up of (Q7): *What form of training do you feel you need at this stage?* (Q12): *Which of the following problems do you experience?* Mark the (YES) block if you experience the problems, and the (NO) block if you do not experience these problems. (Q16): the same formulation as for (Q12), but was asked to cutting room operators.
	Sub-objective 1.5: To explore and describe from management's perspective the role that *motivation* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: A descriptive process based on spontaneous remarks offered by the following probes: are the employees motivated to work hard, how do you motivate your workers, and what was the response to motivation? Afterwards data was transcribed and themes were coded.
	Sub-objective1. 6: To explore and describe from the employees' perspective the role that *motivation* plays in the optimisation of a clothing production system's utilisation of	Section A (Q4), (Q5)	V8 and V9	(Q4): Nominal measure, percentage distribution between YES and NO answers (Q5): Open-ended questions, coding responses. (Q4): *Are you happy in your job?* (Q5): *If not, what can management do to make you a happy worker?*

	resources.			
To explore and describe the role that *operational resources (ergonomics, production planning, and quality control)* play in the optimisation of a clothing production system's utilisation of resources from management's and employees' perspectives.	**Sub-objective 2.1:** To explore and describe from management's perspective the role that *ergonomics* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: the importance of creating a comfortable working environment for the workers, what shortcomings are there regarding ergonomics, how can ergonomics be implemented cost-effectively? Afterwards data was transcribed and themes were coded.
	Sub-objective 2.2: To explore and describe from the employees' perspective the role that *ergonomics* plays in the optimisation of a clothing production system's utilisation of resources.	Section B (Q9), (Q10) Section C (Q15)	V25-V36, V38-V40, V71-V82	(Q9): Nominal measure, percentage distribution between YES and NO answers. (Q10): Open-ended questions, coding responses. (Q15): Nominal measure, percentage distribution between YES and NO answers. Q9): *Which of the following can management do to help you not get tired when working?* Mark the (YES) block if you agree, or the (NO) block if you don't think it's necessary. (Q10): follow-up of Q9, *Any suggestion on how management can improve your workplace?* (Q15): the same as for (Q9), but was asked to cutting room operators.
	Sub-objective 2.3: To explore and describe from management's perspective the role that *production planning* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what does production planning entail, what role does it play in production? Afterwards data was transcribed and themes were coded.
	Sub-objective 2.4: To explore and describe from the employees' perspective the role that *production planning* plays in the optimisation of a clothing production system's utilisation of resources.	Section B (Q11), (Q12), Section C (Q16)	V41, V42, V45, V46, V47, V83, V86	(Q11), (Q12) and (Q16), Nominal measure, percentage distribution between YES and NO answers. (Q11): *Is the current flow of work fast and efficient in the factory?* (Q12): *Which of the following problems do you experience?* Mark the (YES) block if you experience the problems, and the (NO) block if you do not experience these problems. (Q16): the same formulation as for (Q12), but was asked to cutting room operators.
	Sub-objective 2.5: To explore and describe from management's perspective the role that *quality control* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what quality control system is in place, what are the current standards for good quality, what is done to meet good quality standards, if any? Afterwards data was transcribed and themes were coded.
	Sub-objective 2.6: To explore and describe from the employees' perspective the role that *quality control* plays in the optimisation of a clothing production system's utilisation of resources.	Section A (Q3), Section B (Q12), (Q14) Section C (Q16)	V3-V7, V52, V53, V54, V55, V56, V67-V70, V89, V90, V91, V92, V94, V95, V85, V87	Nominal measure, percentage distribution between YES and NO answers. (Q3): *Who checks your work?* Mark only Yes or NO. (Q12): *Which of the following problems do you experience?* Mark the (YES) block if you experience the problems, and the (NO) block if you do not experience these problems. (Q14): *When is your work checked in the factory?* Only mark YES or NO, and mark every answer. (Q16): the same formulation as for (Q12), but was asked to cutting room operators.

OBJECTIVE	SUB-OBJECTIVES	RELEVANT DATA	VARIABLES	OPERATIONALISATION
To explore and describe the role *physical resources (technology, production system and material handling)* play in the optimisation of a clothing production system's utilisation of resources from management's and employees' perspectives.	**Sub-objective 3.1:** To explore and describe from management's perspective the role that *technology* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what is the standard of the current technology that is in use, and what is the decision-making procedure that is followed when buying new technology? Afterwards data was transcribed and themes were coded.
	Sub-objective 3.2: To explore and describe from the employees' perspective the role that *technology plays* in the optimisation of a clothing production system's utilisation of resources.	Section B (Q12) Section C (Q16)	V44, V45, V48, V63, V88, V84	Nominal measure, percentage distribution between YES and NO answers. (Q12): *Which of the following problems do you experience?* Mark the (YES) block if you experience the problems, and the (NO) block if you do not experience these problems. (Q16): the same formulation as for (Q12), but was asked to cutting room operators.
	Sub-objective 3.3: To explore and describe from management's perspective the role that the *production system* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what production system is in place, what is the reason for using such a production system, and what shortcomings are there regarding this production system? Afterwards data was transcribed and themes were coded.
	Sub-objective 3.4: To explore and describe from the employees' perspective the role that the *production system* plays in the optimisation of a clothing production system's utilisation of resources.	Section B (Q11), (Q12), Section C (Q16)	V41, V42, V45, V46, V47, V83, V86, V93	Nominal measure, percentage distribution between YES and NO answers. (Q11): *Is the current flow of work fast and effective in the factory?* (Q12): *Which of the following problems do you experience?* Mark the (YES) block if you experience the problems, and the (NO) block if you do not experience these problems. (Q16): the same formulation as for (Q12), but was asked to cutting room operators.
	Sub-objective 3.5: To explore and describe from management's perspective the role that *material handling* plays in the optimisation of a clothing production system's utilisation of resources.			Interview with management: a descriptive process based on spontaneous remarks offered by the following probes: what material handling system is in place, what is the first step in production to the last step in production? Transcribing of data, grouping themes.
	Sub-objective 3.6: To explore and describe from the employees' perspective the role that *material handling* plays in the optimisation of a clothing production system's utilisation of resources.	Section B (Q12)	V50, V51	Nominal measure, percentage distribution between YES and NO answers (Q12): *Which of the following problems do you experience?* Mark the (YES) block if you experience the problems, and the (NO) block if you do not experience these problems.

4.7 QUALITATIVE NOTIONS OF OBJECTIVITY ACHIEVED

4.7.1 Credibility

During the research, the researcher applied strategies to demonstrate that the research was conducted in such a manner as to ensure that the phenomena were accurately identified and described (Schurink, Fouche & De Vos, 2011:419). The following strategies, as stipulated by Lincoln & Guba (1985:290), were followed by the researcher during the qualitative data collection stage:

- Prolonged engagement

The researcher stayed in the field until data saturation occurred. Follow-up interviews were conducted until the researcher was satisfied that the information reached a saturation point.

- Persistent observation

The researcher conducted the interviews with constant and tentative analysis. Questions were asked in different contexts to ensure the respondents were not led to an answer, and answers were confirmed by phrasing the same question differently.

- Triangulation

To elicit various and divergent constructions of reality is to collect information from different points of view (Babbie & Mouton, 2003:277). As mentioned, the researcher seeked different sources for gathering information, namely management and employees. The same types of questions were asked to both parties. The researcher asked management for example to elaborate on quality control, and who conducted quality control. In the questionnaire employees were asked who conducted quality control.

- Referential adequacy

The researcher used audio recordings to record the interview conversations, so as to be able to document the findings.

- Peer debriefing

Perceptions, insights and analysis were briefed by the study leader and the co-study leader. Before each interview the managers were briefed on what the study entailed and assured that information was solely used for academic purposes.

4.7.2 Transferability

Transferability refers to applicability and refers to the degree to which the findings can be applied to other contexts and settings (Schurink, Fouche & De Vos, 2011:420). The commitment for representing transferability, to the reader, rests on the study leader (Babbie & Mouton, 2003:277).

- Thick description

  To enhance the transferability of this study, the researcher used different data gathering techniques and had prolonged engagement with the clothing production system. Sufficiently detailed descriptions and explanations of data were ensured, together with intensive reporting and descriptions.

- Purposive sampling

  The researcher made use of a purposive sampling technique, as discussed in section 4.4.2. Transferability was ensured by purposively selecting the location and the respondents for the study.

4.7.3 Dependability

The researcher consciously strove to provide the reader with evidence that if the study would have been repeated, with the same and similar respondents in the same context, the findings would be similar (Babbie & Mouton, 2003:278). Since there can be no dependability without credibility, credibility is demonstrated in paragraph 4.7.1 (Babbie & Mouton, 2003:278).

4.7.4 Confirmability

Confirmability is a strategy to ensure neutrality (Schurink, Fouche & De Vos, 2011:421). Confirmability was mainly achieved by using audio methods and reflexivity by the researcher. An adequate audit trail was left by the researcher for the reader to confirm the conclusions, interpretations and recommendations made by the researcher (Babbie & Mouton, 2003:278). Conducting such a trail the following data was provided:

- Raw data: included recorded audio tapes and written field notes.
- Data reduction and analysis: written field notes were provided.
- Instrument development: in the form of a questionnaire.

TABLE 4.7: STRATEGIES TO ENSURE TRUSTWORTHINESS DURING THE STUDY

STRATEGY	APPLICATION
Credibility Inquiry should be conducted in such a manner as to ensure that the subject was accurately identified and described (Schurink, Fouche & De Vos, 2011:419)	- A pilot study was performed to test procedures and prepare for fieldwork - Participants took part in a projective technique exercise to help eliminate social response bias. - Focus group discussions were held until information was saturated for each participant group. - Extensive field notes were made and discussed with participants to ensure that it corresponds with their opinions - Recordings were made and transcribed verbatim and member checks were done - Various methods of data collection were used (projective techniques, focus groups and garment choice, as well as a questionnaire to ensure triangulation - Concepts and themes were identified during an open coding process based on the sub-objectives and theory
Transferability The extent to which findings can be applied to other contexts (Schurink, Fouche & De Vos, 2011:420)	- Conceptual framework guided research and the literature review was used as a basis for the study. - Detailed description of methodology is included to ensure that others are able to use similar methods to come to similar conclusions.
Dependability Refers to reliability, but takes into account instability as well as phenomenal or design induced change (Lincoln & Guba, 1985: 299) (Babbie & Mouton, 2003:278)	- Different methods of data collecting were performed. This is to create triangulation, a process of validating data by using different methods (Lincoln & Guba, 1985:283). Babbie & Mouton (2003:278) - Data was open coded - Analysis of themes and concepts was detailed based on sub-objectives and theory - Dependability audits of themes and concepts were done by more experienced researchers.
Conformability Refers to objectivity. Findings should be able to be confirmed by another person (Lincoln & Guba, 1985: 300)**.**	- Descriptive field notes and recordings were made - The conceptual framework guided research - All records will be kept safe for **5** years **as prescribe by the University of Pretoria.**

4.8 QUANTITATIVE NOTIONS OF OBJECTIVITY ACHIEVED

4.8.1 Internal validity

The validity of an instrument is the extent to which the instrument measures what it is supposed to measure (Leedy & Ormrod, 2001:31), or reflects the meaning of the concept being measured (Babbie & Mouton, 2003:122). Thus the definition of validity has two parts: the instrument actually measuring the concepts in question and the question of whether the concepts were measured correctly (De Vos, 1998:83). The researcher made use of three underlying measures of validity: content, face and construct.

- Content validity is concerned with the representativeness of the concepts in the measuring instrument (questionnaire) (Delport & Roestenburg, 2011:173). Content validation was undertaken by the researcher with the assistance of the study leader.
- Face validity refers to what the questionnaire appeared to measure in the study (Delport & Roestenburg, 2011:173). The researcher constructed the questionnaire so that no resistance was encountered by the respondents, which might have affected the results obtained from the respondents. For example, it was made clear that the researcher herself could not make changes to their situation, and was conducting the study solely for research purposes.
- Construct validity involves determining the degree to which an instrument successfully measures a theoretical construct (Delport & Roestenburg, 2011:174). Construct validity within the questionnaire was ensured by the prior literature review. Concepts from the literature review, was used to test if all the concepts were included in the questionnaire.

4.8.2 Reliability

To measure something accurately the researcher needs to measure it consistently. In order to have validity the measurement must have reliability (Leedy & Ormrod, 2001:100). Reliability is the consistency with which a measuring instrument yields a certain result, when the entity being measured has not changed. Instruments designed to measure intangible phenomena tend to be less reliable than those designed to measure physical phenomena (Leedy & Ormrod, 2001:100).

The researcher administered the questionnaire in a consistent fashion; questions were explained consistently, from one respondent to the next.

4.8.3 Objectivity

Objectivity refers to the proper distance between the researcher and the respondents that would minimise bias, and was achieved by instrumentation and randomisation (De Vos, 1998:350). The researcher tried to achieve a significant distance from fieldworkers and respondents.

4.9 ETHICS

Ethical issues arise from our interaction with other people and the environment, especially where there is potential for, or are, a conflict of interest (Babbie & Mouton, 2003:520). Thus the researcher has the right to collect data through interviewing people but not at the expense of the rights of other individuals in society (Babbie & Mouton, 2003:520). Social research requires people to reveal personal information. For this reason, the participation was voluntary. The voluntary participants were fully informed about the study.

Within the study there was a high concern for anonymity and confidentiality. The sewing machine operators did remain anonymous. The information gained from the apparel production system remained confidential. It was important for management that the researcher would not reveal any internal information to competitors.

To maintain objectivity and integrity in the study, the researcher adhered to the highest possible technical standards during the research. The researcher did not change the results of the data. The methodology and research techniques that where used as well as the research results were disclosed. One of the most important ethical principles was the acknowledgement of authors used in the study.

4.10 CONCLUSION

The research design, which is the blueprint of the study, was discussed. From the discussion it is clear that the research was done in two phases: qualitative data collection techniques were used in the first phase and a quantitative data collection technique in the second phase. The methods used for data collection were discussed, together with the advantages and limitations. Following data collection, data analysis was done. Data analysis and the discussion of the findings are presented in Chapter 5. The data analysis was grouped together in such a way that conclusions could be drawn for the final discussion in Chapter 6.

CHAPTER 5

FINDINGS AND DISCUSSION

5.1 INTRODUCTION

In this chapter data results are explicated and summarised. The results are presented according to the objectives and sub-objectives formulated for the study.

The qualitative data collected was coded according to identified categories and subcategories related to *human resources* (*performance appraisal, training and motivation), operational resources (ergonomics, production planning, and quality control)* and *physical resources (technology, production system and material handling)*. For the researcher to gain a better understanding of participants' comments categories and sub-categories were discussed and a possible relationship that may exist between the categories was also identified and described. Verbatim transcriptions are available. It was only necessary to translate one of the transcriptions to English.

Quantitative results were statistically processed and converted into percentage-based numerical results. Descriptive statistic results from the statistics were then tabulated for presentation, and thereafter discussed. Quantitative results were a direct result of the questionnaires that were completed by sewing machine operators and cutting room operators of the company.

After this, the two sets of results (qualitative and quantitative), were presented and discussed to provide a better understanding of the interrelationship between management's and employees' perspectives regarding each research objective.

5.2 DEMOGRAPHIC PROFILE OF THE SUBSETS OF THE SAMPLE

5.2.1 Profile of the sample for interviews

Four participants from management were individually interviewed, based on their position within the factory. Participants were selected and asked to participate in the research.

Participants participated voluntarily and were urged to speak for themselves. Some of the participants had extensive knowledge of the industry, which helped to create an overall perspective. Two focus group interviews were held with supervisors. These participants had more hands-on knowledge within the factory; thus each of the different sets of information contributed to an overall understanding of their working conditions and performance. A summary of the demographics of the participants from management selected for the interviews is presented in Table 5.1.

TABLE 5.1: PARTICIPANTS FROM MAGAGEMENT SELECTED FOR INTERVIEWS

Position in company	Number	Education	Age	Gender
Design room manager	(a)	Formal	Late 20's	Female
Cutting room manager	(b)	No formal education	Late 20's	Male
Jacket line manager	(c)	Formal	Late 40's	Male
Jacket and trouser line supervisors	(d)	No formal education	35-50	Female
Jacket and trouser line supervisors	(e)	No formal education	35-50	Female
Trouser line manager	(f)	Formal	Early 30's	Male

Six interviews were held in total, four interviews with individuals in upper/top management positions and two interviews with line supervisors. The sample of line supervisors that was chosen consisted of line managers from the trouser and jacket lines. The management sample also included the design room manager and the cutting room manager. Most of the managers had hands-on experience in production. The trouser line, jacket line, and cutting room operators were all men. The trouser line manager was an Indian man in his early thirties with no formal education, who had gained experience in clothing factories situated in KwaZulu-Natal. The jacket line manager was European and qualified as a clothing designer in Europe. He was in his late forties. The cutting room manager was an African man in his late twenties who also did not have any formal education and gained experience in clothing factories. The design room manager was a woman in her late twenties, with formal clothing design education. She started her career in this factory. Finally, the last interview was held with the line supervisors of the trouser and jacket lines. This group consisted of black women of different ages between 35-50 years who had all worked for the company for ten to 20 years.

5.2.2 Profile of the sample who completed the questionnaire

The questionnaire was completed by cutting room operators and sewing machine operators. The total workforce of the company amounted to 250 workers. A non-probability sampling

methods directed the selection of operators to complete the questionnaire. One hundred and three (N = 103) respondents were selected, consisting of 75 (N = 75) sewing machine operators and 28 (N = 28) cutting room operators. The reasoning behind the selected sample size was that the sewing machine operators had a better understanding of the functioning of the factory and were in the majority. The cutting room operators were a minority and to give a proportional representation of the factory all the cutting room operators were included in the sample. Sewing machine operators were randomly selected. All the operators were black women that worked on a full-time basis for the company and were from 18-60 years of age.

5.3 FINDINGS AND DISCUSSION FOR OBJECTIVE 1

Objective 1 set for the study was to explore and describe the role that *human resources* (*performance appraisal, training and motivation)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

5.3.1 The role of *performance appraisal* in the optimisation of a clothing production system's utilisation of resources from management's perspective

Interviews with management revealed pertinent categories for performance appraisal, e.g. the performance appraisal system, such as work-study, setting of targets, performance analysis and employee feedback. Participants in Table 5.2 correlate with participants in Table 5.1.

TABLE 5.2: PERFORMANCE APPRAISAL CATEGORIES

Categories	Verbatim	Participant
Performance appraisal system	*"When I came here they did not work on this concept, but first I had to get used to their system. For me to be able to implement this concept I have to know their system."*	**f**
Targets	*"Then after 6 months I pulled a stopwatch and started timing them. I started setting targets, because when somebody works to a target they work harder."* *"… you see I give them a target for the day, I also give them time for rest, because you see they cannot work all day. I always give the target 20% more. If they reach 80% of the target I am happy.*	**f**
	"I have spoken to my boss. I asked if we cut more a day than what is required of us, if we can work on the bonus system. So whatever is produced more than the target is the bonus."	**b**
	"*…yes we got the bonus system, we got targets, but*	**c**

	sometimes we do not achieve the work for the bonus."	
Work-study	*"This factory is currently working at 45/40% of the production capacity. I am now trying to pick production up to 85%, I am trying. So this is where work-study plays an important role."*	**f**
Performance analysis	*"Then you can also see who is working and who is not working. You get people in the same job but some people are doing double to what the others are doing."*	**f**
	"... not everyone will be the same, this one will give you 80, that one will give you 70 per hour. So you know what each lady is supposed to give, and you know that she is supposed to give you 80 but she gives you 60, you know there is a problem."	**f**
	"We do ourselves, and sometimes the operators do check the work, they also know if it is wrong or not."	**a**
Employee feedback	*"Then you know there is something wrong, you pull her file, take her to the office and ask her, hey, what is happening? Then you give her a verbal warning and tell her, hey, you have to pick up your production. That is how we work with these people."*	**f**
	"Previously we had a white lady doing that job, now the customer sends it back, and they blame us, but we do not really know what to do."	e

Transcripts from mainly participants a, b, c, f and e were integrated in the discussion on performance appraisal. From the transcripts in table 5.2 it seems that there is not a performance appraisal system in place. The employees' performance analysis is based merely on timing the operator per operation, from which targets per operator were set, and the operator then had to perform according to the set timing. Work-study was suggested as a form of a performance appraisal system that incorporated the setting of targets for individuals and allowed for performance feedback to the individuals. Feedback to the employees is in a reprimand form, which gravitates more to the negative side of feedback than to constructive feedback; constructive feedback might be a more positive way to do this. A proper performance appraisal procedure might encourage employees to perform better, which means that they might be motivated to utilise other resources better. Performance appraisal inevitably impacts on other resources as well because resources do not operate in a vacuum, they are inter- dependant.

5.3.2 The role of *performance appraisal* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

When asked whether they "were happy in their job", 66.9% (N = 103) answered positively to a binominal yes/no scale: 70 of the employees also indicated that they were satisfied in their job and 33 were not satisfied.

Thereafter the employees were asked what incentives were awarded to them for outstanding work. This gave an indication of the performance appraisal system in place, if any. An incentive is a form of appraisal and appraisal is a critical aspect when motivating employees to maximise production. The type of incentives received for work performance is presented in Table 5.3 in descending order for all the positive responses.

TABLE 5.3: INCENTIVES FOR EMPLOYEES (N=103) (Q6)

Type of incentive for good performance	YES		NO	
	%	n	%	n
Salary increase	31.0	31	69.0	69
Bonus on your salary	21.5	22	78.4	80
Day off	19.8	20	80.2	81
Receive a cool drink or something to eat	16.6	17	83.3	85
Longer lunch or tea breaks	16.5	17	83.5	86
Get promoted to a better job in the factory	12.7	13	87.2	89

The incentive most often received, was an increase in salary (31.0%), followed by a bonus on salary (21.6%) – both reflecting monetary incentives. Incentives such as having a day off, receiving a cool drink or something to eat, or having longer tea breaks do not compare favourably to the monetary incentives, but may contribute to a positive attitude amongst workers. Also, having a day off and having longer tea breaks would jeopardise productivity which should not be encouraged in terms of the outputs of the production system. Only 12.8% indicated that they have received a promotion to a better job in the factory, and this could probably be pursued as a motivating factor for work performance in the future.

5.3.3 The role of *training* in the optimisation of a clothing production system's utilisation of resources from management's perspective

From the interviews, three categories emerged as to how training is managed in the company by the respective managers, namely: the type of training employees received, the quality of training, and limitations to training. The categories and sub-categories regarding how training is managed are presented in Table 5.4 with the managers' supportive verbatim to verify the categories.

TABLE 5.4: TRAINING CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Type of training - **On-the-job training**	*"… most of the people start off with straight stitching, and from there the line managers take over and tell them what to do, then she is basically trained in this way."*	**a**
	"… we are currently trying to teach them in the	**f**

	line, because we have not got any other space to train them; we are fighting for space at the moment."	
	"… I learned from school. All the training that I have received here was on-the-job training. While I was working they have trained me."	**d**
- **Previous training/ experience**	*"… taking about 150 people working here, when we get busy we only try to re-employ the people that are already experienced. At least, that's how we work. So what we do we give them an easy job to start, and after a few months, if they can handle the machine we put them in a proper job, you know."*	**c**
- **Formal/informal training**	*"No, I started working on the machine, and then they sent me on a course to become a supervisor."* *"I learned from school.*	**d**
Quality of training - **Level of training**	*"They teach us well but there are certain things that they can teach us that we do not know about, like in the production, how can we get the quality better. for example, because then we can do our job better."*	**d**
	"I tell you, I can take one of them out they will not know how to sew a pair of trousers completely. They only know the job that they are supposed to do.	**f**
	"So what we do, we give them an easy job to start, and after a few months if they can handle the machine, we put them in a proper job, you know."	**c**
- **Multi-skill**	**"***They are used to one operation, but some of them are very multi-skilled."* *"Now you get that they do only one operation and they still make mistakes from the operation when they sew it. Operations that they are doing, they have been doing it for 10-15 years, but they still make mistakes."*	**f**
- **Preventative training**	*"They can teach us, like for example, the lining, the lining must fit in the jacket, and then it does not always fit well. We just make it fit as we know. Well, … it will help us not to make mistakes in the production, like for example …"* *"If the marker is wrong … we cut the cloth from the marker, but we do not know that the marker is wrong… so if they teach us a little more about the marker."*	d
Imitations to training - **Space**	*"… because we have not got any other space to train them, we are fighting for space at the moment. But in the clothing industry it is tough out there; we are fighting and we are surviving."* *"… I want to get a training school up and running, together with the government, and for the training school we need to have space."*	f
- **Time and cost**	*"... my problem is not always training the people, because I train them myself. Like when I get a*	f

	style I must know exactly what to do, and every step of the trousers, that's my responsibility. I can sew on every machine. I can cut for you."	

The following comments indicated what type of training took place, how often and when it took place. The type of training was further sub-categorised into on-the-job training, previous training and formal or informal training. More than one manager/supervisor explained that on-the-job training (informal) is the main type of training employees received. Employees started off with uncomplicated work for example, pressing pockets, and when the employees had sufficient training on this operation, they could then move on to the next step, working on a sewing machine. They normally started off with straight stitching, and were then incorporated in a later stage into stitching, for example, doing buttonholes. As time and space are limitations within the factory, there was no formal training applied within the factory. Although some of the managers spend some time to train employees in the production line. The company aims to recruit and appoint mainly experienced workers in order to minimise the intensity of on-the-job training.

Quality of training was furthermore sub-categorised as level of training, multi-skill and preventive training. The level of the training was only basic; employees were only trained in what they need to know for the specific job, because of limited time. As seen from the quoted phrases, formal training was not done on a frequent basis, although informal, in-line training was applied as the need arises. The only form of formal training that was provided was the training for supervisors when they were promoted to supervisor positions. These supervisors have been working for 16 to 18 years in the factory, which meant that they had received formal training a considerable number of years ago.

The current knowledge of employees was limited to on-the-job experience. Employees only knew what they needed to, for example, if they were trained in straight stitching, they were not able to stitch a whole garment. Employees' knowledge on preventive actions and how to improve quality was limited.

Training limitations according to management were space and cost. Management did not have suitable space for a training station within or outside the factory. Space within the factory was consumed by sewing machines that were utilised within the production line; therefore no additional space was available for training purposes. The cost factors involved in terms of training entail the following: direct costs such as salaries to trainees, time that management occupy for training also have a cost implication and also mistakes made during the production process.

5.3.4 The role that *training* plays in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

When assessing the employees' job knowledge, 89.3% responded positively. They were comfortable in applying their job skills and knew what to do on a day-to-day basis. This may have been because they were doing the same thing over and over, and did not necessarily mean that they were optimising training as a resource in their job.

This question evaluates the current training standard of employees. The employees were asked when they received training. Their responses follow in Table 5.5.

TABLE 5.5: TRAINING RECEIVED (N=103) (Q7)

Training received in sewing, cutting and pressing a garment	YES		NO	
	%	n	%	n
When I started working here	63.7	65	36.2	37
When I have to work on a different machine	55.3	57	44.6	46
When you have to sew something new, different to what you are used to	52.4	53	47.5	48
Once a month	23.5	24	76.4	78
Once a year	18.0	18	82.0	82

Employees were employed from the streets and had no formal training on how to sew a garment or how to use a sewing machine. The minority of employees received training when they were employed by the company. The lesser form of training (e.g. when they had to work on a different machine and had to sew something new) was received when employees had a different job to do, than what they were used to.

Furthermore, the need for training was investigated through an open question to employees whereby they were asked to stipulate what type of training they felt they would need at a later stage. This was a voluntary question to answer and only 83 respondents responded to this question. Different opinions were raised and only the top five were discussed. Suggestions made by employees regarding training are presented in Table 5.6.

TABEL 5.6: TRAINING NEEDS (n = 83) (Q8)

Training suggested by employees	%	n

Train to be a designer	22.0	19
Physical hands-on training	10.0	9
Trained to be a supervisor	10.0	9
Trained on how to work the cutting machine	6.0	5
Trained on a different machine	6.0	5
Trained to be a machinist	6.0	5

The majority of the respondents preferred to be trained as a 'clothing designer' which seem a bit idealistic and not of value to the factory or relevant in terms of their job performance. The best option might be to evaluate their weaknesses and then focus on their training, so as to improve their job performance. The respondents might not have interpreted this question correctly.

Suggestions that were made by 5% of the responses were the following: training on different machines, training when employees have to sew a new style, training on how to work the cutting machine, cross-training within the factory, how to prevent mistakes, sewing of a complete garment, quality control, training on how to be a manager. It seems as if there is a call for more advanced and diverse training from the employees.

The following responses depicted in Table 5.7 were given by sewing machine operators regarding problems related to current training.

TABLE 5.7: PRODUCTION PROBLEMS RELATED TO TRAINING (n = 74) (Q12)

Production problems related to training	YES		NO	
	%	n	%	n
Some sewing machine operators stitch too slow	75.6	56	24.3	18
I do not always know how to correct my mistakes	62.5	45	37.5	72
I do not always know how to prevent my mistakes	26.0	19	73.9	54
I do not know which pattern pieces to group together	18.6	14	81.3	61
I do not know how to operate my machine	10.6	8	89.3	67

The fact that machine operators were of the opinion that some sewing machine operators stitched too slow might be due to the fact that some machine operators (10.6%) did not know how to operate their machines. Many sewing machine operators did also not know how to correct their mistakes which have implications for the following operator in the line. From Table 5.7, training might be a valuable investment with regards to preventative action. Employee training in quality checks, design and overall construction techniques might help to prevent mistakes. A more global perspective on how to sew a complete garment might also provide the employee with the necessary skills on how to prevent and correct mistakes.

Table 5.8 reflects the responses of the cutting room operators regarding problems they experience due to a lack of training.

TABLE 5.8: CUTTING PROBLEMS RELATED TO TRAINING (n= 28) (Q16)

Cutting problems related to training	YES		NO	
	%	n	%	n
I do not always know how to correct my mistakes	53.8	14	46.1	12
I do not always know how to prevent my mistakes	50.0	14	50.0	14
I do not know what is expected of me in a day's work	50.0	14	50.0	14

Only problems related to the topic were listed in Table 5.8, this apply to the rest of the discussions in this chapter. Respondents were not consensual in terms of their responses: in all three categories almost half of the workers were positive while the other half was negative. The fact that some cutting room operators did not know how to correct their mistakes could be because most of the time cutting mistakes could not be fixed. Half of the respondents did not know how to prevent their mistakes. Mistakes, for example, laying the fabric incorrectly or cutting pattern pieces of the wrong size, can be prevented through proper training, which confirms the interactive contribution during the transformation of various resources on the outputs of the production line. Problems originating from the design room and reflecting on the marker could be prevented by a cutting room operator. The last statement in Table 5.8 reflects solely on training, when an operator feels uncertain about what to do, it may indicate a communication problem on the part of management or inadequate training.

5.3.5 The role of *motivation* in the optimisation of a clothing production system's utilisation of resources from management's perspective

From the interviews that were conducted with management, motivation were analysed three subcategories were identified, as indicated in Table 5.9, namely type of incentives, human relations, promotion and limitations of motivation.

TABLE 5.9: MOTIVATION CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Type of incentives	*"… what we sometimes do to get an order finished, we buy the workers a coke basically out of our pockets. Otherwise they just get their normal payment, and we just have to push them as hard we can."*	**a**
	"… we want to introduce a production bonus. I need to motivate them with a production bonus, and this means better prices to the customer, which means more jobs."	**b**
	"… the money is always a factor you know, because we work on a bonus system: the more they produce the more they get.	**c**
	" … we have a target per week, there is a certain way how to work this production bonus. You work out the costing of the garment and you can work out how much bonus you can afford to pay, because if you pay somebody R10 extra per week, that is a lot of money. For them to get R10 extra per week, in an hour we are looking at 15 extra units, and R10 for them is a lot of money. ...with CMT it all depends on the price of the garment, that's how it works, like for example, we charge R26 for the pants, then most probably it will work out 15 units, then maybe we get 10 for a R50 CMT. Then you have lower units per hour, but then you can still pay them R10 extra. So this production bonus I leave to the admin people; me I'm only here to produce."	**f**
Human relations	"*No, not really, they must also trust you. They must like you, then they will work for you. Not like the man next door that shouts on the people – you can hear him shout."*	**f**
	"You must not dictate to them, because if you dictate, they will come with bad attitude, and when they come with bad attitude, nothing will come out. And you will fight with the boss."	**b**
Limitations **- cost**	"*The bonus does work, you see, the thing is we do not always have the work. Let me tell you, we are actually very lucky to be alive because a lot of factories have closed down, so we basically have not been making a lot of money, so the bonus is totally out of question."*	**c**
- Absenteeism	"*For a bonus system you have got to have everybody present, because for that it does not help to have 20 people absent. And now you set up the lines with less people."* *"Now because the next day another 20 people are absent, and then we can't make the target, and then they lose. That's why the bonus system does not really work."*	**c**
Promotion	*"Look, we try to motivate them … but look, you*	**c**

	know, not all people have that kind of ambition. It is really difficult to motivate."	
	"Nobody really gets promoted to supervisors, because the supervisors have been here for 10 years or longer, so nobody gets to fill their jobs, unless they resign."	**a**

These quoted phrases indicated that the only real incentive that was used was the purchasing of a cool drink. Although management wanted to introduce a bonus system a production bonus system was not yet in place. The reasons given by management were that a bonus on production is costly, required every employee to be present, and that the employees' attitude towards production was not positive. Thus motivating employees was negatively perceived by most of the management. Respondent f gave an example on how to implement a bonus system, and respondent f is positive that it will work. As mentioned, monetary incentives were perceived as being difficult to implement, as the factory itself was barely surviving. Cost factors might have been the main reason for management to be hesitant to introduce monetary incentives. Lack of opportunity might also have been a problem for employees, as they can only be promoted into supervisor positions. There were limited opportunities for promotion within the factory.

5.3.6 The role of *motivation* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

To get an overall idea if employees were motivated employees, they were asked a simple yes or no question if they were 'happy' in their job. As previously mentioned, 66.9% of workers were 'happy' in their job and 33.0% were not 'happy' in their job. Employees completed an open-ended question voluntary, giving their opinion as to what management could do to improve employee job satisfaction. At 60.8% employees wanted a bonus on their salary to increase job satisfaction. Secondly (5.8%) employees wanted more training and to be able to operate a new sewing machine. There were other suggestions, scoring on average 2%, such as better safety, opening a canteen, better equipment and that workers must be treated equally. Also refer to Table 5.3 on incentives received by employees.

5.4 FINDINGS AND DISCUSSION FOR OBJECTIVE 2

Objective 2 set for the study was to explore and describe the role that *operational resources (ergonomics, production planning, and quality control)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

5.4.1 The role of *ergonomics* in the optimisation of a clothing production system's utilisation of resources, from management's perspective

From the interviews, the following categories and sub-categories for ergonomics were identified: suggestions made by management, safety, comfort, breaks, lighting and anatomy. The categories and sub-categories regarding ergonomics are presented in Table 5.10 with the managers' supportive verbatim to verify the categories.

TABLE 5.10: ERGONOMIC CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Suggestions	*"I think they can improve the environment. There are places where the hot water of the boiler leaks into a bucket next to a worker, where she's working in the trouser line."*	**a**
	"What I am doing, is time them when they start to reach for the work …. You know sometimes they have the work at the back of them, and then you can make it simpler to them just by bringing the work closer to them."	**f**
	It could be better, more modernised, and better light, but it costs money to look at all those things, and at this stage it is out of question …"	**c**
Safety	*"... we got the big board there by the tea room. They know what they are supposed to do and what they can do, you know. They know, for example, they cannot go and cut an electrical wire."*	**c**
Comfort **-Working position**	*"It's not always a matter of how comfortable the workers are, but more about the production output" "In work-study it is important for them to be comfortable in the way they sit and work."*	**f**
-Temperature control	*"The problem: here it is hot in summer and cold in winter ..."*	**d**
Breaks	"*Yes, they have, they got 15 minutes in the morning and 30 minutes lunch time."*	**c**
	"No, they are not allowed to eat in the factory, because then you can damage the clothing and then you can lose one garment because of a fatty stain. They do get enough time to eat, 20-minute tea break in the morning, and 30 minutes lunch in the afternoon. That I think is more than enough. They work from seven to four and Fridays till twelve."	**f**

Lighting	*"The lighting is also important, because they must be able to see the work, you cannot get too bright light on white, because of the glare, so the light must be a fair distance from the machine …"*	**f**
Anatomy	*"They can handle the work easier because you see, this is why our people get the needle in the finger and things like that. They can for example fold the work easier; it is an interesting thing, because no one knew that. The smaller the hand, the quicker they can produce. China, India, Indonesia, all those places, the people have small fingers, they produce five times more."*	**f**

All of the above categories and suggestions were relevant to the ergonomic needs and circumstances within the factory. Suggestions were made regarding safety, lighting and material handling. Safety suggestions were related to general maintenance, for example hot water leaks. Better lighting was also a point of discussion. The lighting itself could be an issue it could however also have been due to poor eyesight. Regarding general maintenance and lighting, cost was a limitation.

Management focused on production output and not on the ergonomic comfort of the workers. Comfort involved the working position and material handling, which were of concern to the management. One manager stated that employees should not be overly comfortable. Temperature control is a consideration of improvement in the factory. Temperatures in the back of the factory were higher due to the boiler room, and the cutting room was also situated in the back of the factory, which contributed to uncomfortably high temperatures in the cutting room. The factory is a big open space and is generally cold in winter. Temperature control throughout the year would however be a costly challenge to overcome. The breaks that the employees got seemed adequate. According to management, they had a break of 15 minutes in the morning, and a 30-minute lunch break. Workers worked from seven to four daily but from seven to twelve on Fridays.

Management need to keep in mind that equipment used is ergonomically designed for Eastern people that are smaller than African people and this creates limitation for employees. For example hand sizes of the two ethnic groups are different.

5.4.2 The role of *ergonomics* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

Table 5.11 reflects the responses of the sewing machine operators regarding the ergonomic problem areas and difficulties experienced by them. The various ergonomic aspects for sewing machine operators are presented in Table: 5.11 in descending order for the positive responses.

TABLE 5.11: PROBLEMATIC ERGONOMIC ASPECTS FOR SEWING MACHINE OPERATORS (N = 75) (Q12)

Ergonomic aspects for sewing machine operators	YES		NO	
	%	n	%	n
Better safety, e.g. dust mask for fluffy materials	67.9	53	32.0	25
Cool down the factory in summer	59.7	46	40.2	31
Warm the factory in winter	57.1	44	42.8	33
Better lighting	55.8	43	44.1	34
Change to standing to stretch your legs	55.2	42	44.7	34
Less noise in the factory	53.2	41	46.7	36
More breaks e.g. lunch or tea breaks	51.9	40	48.0	37
More fresh air	49.3	37	50.6	38
Bring material bundles closer to your machine	46.0	35	53.9	41
Check the vibration on the machines	43.4	33	56.5	43
Give you a lower chair to sit on	24.6	19	75.3	58
Give you a higher chair to sit on	21.0	16	78.0	60

The top three categories that employees felt that management could attend to, were safety, temperature control and lighting. This corresponded to what management mentioned in the interviews. Almost half of the respondents indicated that the factory needed to be warmed up in winter and cooled in summer (climate control), and that the noise in the factory was disturbing and needed to be reduced.

Half of the respondents thought that they needed more breaks; for example, toilet breaks were identified as a problem. Workers were not allowed to take toilet breaks 15 minutes before they went home, or before lunch started. The other statements were of minor importance. The main factors identified were different chair heights, more fresh air, bringing material bundles closer to the workstations, and checking the vibration on the machines.

The same question that was asked to sewing machine operators was asked to cutting room operators, differentiating between the different ergonomic needs of the two groups.

Table 5.12 reflects the responses of the cutting room operators regarding the ergonomic problem areas and difficulties experienced by them. The ergonomic aspects for cutting room operators are presented in Table: 5.12 in descending order for the positive responses.

TABLE 5.12: PROBLEMATIC ERGONOMIC ASPECT FOR CUTTING ROOM OPERATORS (n=28) (Q16)

Ergonomic aspects for cutting room operators	YES		NO	
	%	n	%	n
Cool down the factory in summer	85.1	23	14.8	4
Better safety, e.g. dust mask for fluffy materials	77.7	21	22.2	6
More fresh air	75.0	21	25.0	7
Warm the factory in winter	75.0	21	25.0	7
Check the vibration on the machines	71.4	20	28.5	8
Change to sit when standing for a long time	67.8	19	32.1	9
Give more breaks	66.6	18	33.3	9
Less noise in the factory	65.3	17	34.6	9
Better lighting	62.9	17	37.0	10
Raise the cutting table	57.1	16	42.8	12
Lower the cutting table	50.0	14	50.0	14
Cutting blade too heavy to handle	46.4	13	53.5	15

The main difference between the sewing machine operators and the cutting room operators was that the sewing machine operators worked in a sitting position while the cutting room operators worked in a standing position. Sewing machine operators worked with stationary sewing machines, and cutting room operators worked with manual, electrical cutting blades.

The ergonomic aspects that stood out were climate control – a factor that needed to be taken in account as the cutting room was near the boiler room and was warmer than the rest of the factory. Safety and fresh air were also mentioned. Seventy one per cent (71%) of operators thought that the vibration on the machines should be checked. Sixty six per cent (66%) of the operators needed more breaks; the same concern was raised by the sewing machine operators. Sixty seven per cent (67%) of the respondents needed more time, so as to alternate between standing and sitting down. More than 60% thought that the noise should be reduced. More than half of the respondents thought that the cutting room table's height could be altered, either lower or higher; this may be attributed to a difference in the height of the people.

Sewing machine operators provided various suggestions. As this was an open voluntary question, only some respondents answered the question. The top three suggestions are set out in Table 5.13.

TABLE 5.13: SUGGESTIONS FOR IMPROVING ERGONOMICS FOR SEWING MACHINE OPERATORS (n=56) (Q10)

Suggestions for a better working environment	%	n
Better safety	53.5	30
Clean factory	28.5	16
Warm up/ cool down factory	3.5	2

Thirty (30) respondents suggested a cleaner factory (working place); 17 respondents suggested a safer work environment – the cutting room operators also mentioned this issue. Other suggestions given by one or two respondents were the following: management should verbally express their gratitude, the factory should be warmed up in winter and cooled down in summer, they could open a canteen, provide better ventilation, workers must be able to use toilet facilities whenever they needed to, they should exchange operators, service the machines more regularly, change the system of work, and check the vibration on the machines. They also complained of an overload of work and needed help or a new machine to work with. The only suggestions that were not covered by questions 9 and 15 were the following: toilet breaks, exchange operators, regular servicing of machines, workers are overloaded and need help and new machines to work with. As can be seen ergonomic principles have a direct influence on human resources, employees get tired and stressed. This influence the output of the system as it influences the quality of the product and production outset.

Question 13 was asked as an open-ended question for respondents to be able to respond to question 9. The cutting room operators also provided various suggestions. As this was an open voluntary question, only some respondents answered the question. The top three suggestions are set out in Table 5.14.

TABLE 5.14: ERGONOMIC-RELATED SUGGESTIONS SPECIFIED BY SEWING MACHNE OPERATORS (n=47) (Q10)

Ergonomic suggestions	%	n
Extend break times	19.15	9
Clean the factory	2.13	1
More space to put the work	2.13	1

Suggestions were limited and less than 20% of the workers made effort to recommend improvements. Hesitance to do so should be investigated. Nine respondents (19.15%) wanted extended tea and lunch breaks and more frequent toilet breaks. Only one worker suggested more working space, and another individual suggested that the factory should be cleaner.

5.4.3 The role of *production planning* in the optimisation of a clothing production system's utilisation of resources from management's perspective

From management's perspective, there are three different aspects in the factory that influence production planning. The first: production was planned according to customer needs (first come, first served), secondly production was planned according to different styles, and lastly, production was planned according to work-study principles. Production planning was therefore categorised according to these three aspects. The categories and sub-categories regarding production planning are presented in Table 5.15 with the managers' supportive verbatim to verify the categories.

TABLE 5.15: PRODUCTION PLANNING CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Customer needs **- Seasonal needs**	*"Yes, by the end of the year our production normally peaks, because schools order more school uniforms for January, because of new children enrolling into school, and then they need more school uniforms for the New Year, and we also build on stock for the next year."* *"We work together with head office – they do the production planning."*	**a**
- Delivery dates	*"I get orders from head office with delivery dates, and then I plan the cutting time of the orders to balance the work. ... we decide for ourselves what to do, it works on a delivery date system: first come, first served."* *"to plan the production line to be able to balance the trouser and the jacket lines. Then after the planning of the production line, you can give a delivery date to the customer. Where we currently give the customer a delivery date as the orders come in. And then, as a result of this, the jacket and trouser lines are not balanced."*	**a**
Balancing of different lines	*"The trouser line must produce 3500 units and the jackets 500 units per week. Then I receive 6000 trousers in orders and 500 jackets in orders in a week, with the same delivery date – and then it is not possible to balance the lines. As a result of the delivery date."*	**a**
	"What I normally do is I balance the fabric and lining to give it simultaneously to the jacket line. You have to manufacture the lining and fabric at the same time. You cannot manufacture them separate as the jacket line got a section for lining and a section for fabric. With fabric you have to cut, fuse and sew-bar, whereas with	**b**

	lining you only need to sew-bar, and then it can go straight to the line. So I have to make sure that the fabric and lining are balanced in the production line."	
Work-study **- Timing of operator**	*"They will check one operator to see how long she takes to finish one operation. If you stand next to the operator and you see she can finish 100 units in an hour, and you leave her alone, she must also be able to stitch a hundred units in an hour. If she doesn't, the manager will know that she is not working according to her full capacity."*	**b**
	"With work-study you take the time in motion, you time the operator in motion, it must be 5 full operations but it must be a fluent operation, there must be no machine breakdowns or cotton snapping. So, I also give them 15% allowance of production time to use the toilet, for example, so what you basically do is you stand there and take their time. You take the 5 cycles; it will give you a time, and divide that by 5 and add your 15% and then you have the target time."	**f**
- Production line planning	"*Normally how it works with work-study, we have a bench balance. Let's say you take all the operations of the garment and then you measure how long one operation takes. ...then add up all the times together, and then you get to a total time of how long the production will take for that garment. Then you know you get a three-minute or a five-minute garment. You use this method when you run different styles in the factory. But here we mostly do the formal trousers so we do not normally do a bench balance calculation.* *"It basically means a balance of the line. When it comes to formal trousers we don't use them, but when it comes to ladies wear or kiddies wear, where you have a line change all the time, because of the different style changes, then you have to do this calculation."*	**f**
	"*It all depends on the style, because you get different styles. Some styles go slower than others, so we have to change machines from one style to the other."*	**c**
• **Benefits of work-study**	*"… It is easy to spot the bottleneck."* *"… The manager will know this operator is not up to full capacity, or she needs somebody else to help because the stitching might be time consuming, and you might need two people for that type of stitching."*	**a**
	"*...with work-study you can also see what time is their most productive time."*	**f**
Bottlenecks	*"This results in the lining coming in the production line two or three bundles behind the fabric, then there is not enough work for the*	**d**

	fabric operators."	
	"..it is because they cut lots of jackets without a lining." *" ..the other problem that I have is that the fronts differ from the lining*	**d**
Quantity	*"The trouser line must produce 3500 units and the jackets 500 units per week."*	**a**
	"Uhm … ja, I know. I cut roughly 70 garments per hour, pants and jackets. It depends on the marker as well. If the marker requires 1500 units and it is in the same colour, it is much easier than a garment that comes with stripes in three different colours. On this type of marker we just lay 50 layers on top and cut 6 times, then you cut 70 an hour very quickly, then you just cut all in one."	**b**
Production layout	*"I have got a lining table and a fabric table. I got two cutters, 4 cutters for the fabric table; there are two tables for the fabric."*	**b**
	"*It all depends on the style because you get different styles. Some styles go slower than others, so we have to change machines from one style to the other. We try to plan it. When we get the styles ready to produce, you can't get to the work, and when you get the work, you want to change everything and then it takes you 2 to 3 hours to change the work."*	**c**

Production planning started off at head office; head office received orders and decided on delivery dates for customers. Then the orders were given to the factory, together with the delivery dates. Management in the factory and trouser and jacket lines needed to plan the work to balance production lines and avoid bottlenecks.

From the quoted phrases it is clear that production is planned mainly according to customer needs, which are being based on seasonal needs or on delivery dates. The factory did have its peak seasons. By the end of the year production normally peaked, because of school uniforms. A second suggestion was to plan according to the production line: first plan the production, and then determine a delivery date.

Bottlenecks are caused because cutting of pattern pieces was not planned properly, and due to marker problems, hence the problem for wrong fabric fronts matching a lining front.

Again, work-study was suggested for production planning. In short, work-study can be explained as a system that facilitates production planning. All the operations of a garment were timed and the operator was individually timed. Management used these times to plan

the line. Management might then decrease bottlenecks, and might help to utilise human resources more effectively. Standard production output was 3500 trouser units and 500 jacket units per week.

5.4.4 The role of *production planning* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

The following statements were given to the employees to gain their perspective on production planning. Employees were not actively involved in production planning, but they were the operators who were physically involved in the production. Employees had an effect on the efficiency of production and production output. Sewing machine operators' responses to these statements are presented in Table 5.16.

TABLE 5.16: PROBLEMS RELATED TO PRODUCTION PLANNING: SEWING MACHINE OPERATORS (n=75) (Q12)

Production problems experienced by sewing machine operators	YES		NO	
	%	n	%	n
The cutting room does not cut fast enough; I wait for work from the cutting room	60.0	45	40.0	30
The machine layout is wrong, work does not go through the line fast enough	54.6	41	45.3	34
There is not enough work inside the factory	48.6	36	51.3	38
I always have an overload of work	44.5	33	55.4	41
Here is not enough machines for the work	41.3	31	58.6	44

Sewing machine operators were asked whether the current flow of work was fast and effective in the factory. Again, workers did not agree about the work flow as fifty percent thought that the work flow was fast and effective while the rest disagreed.

Most of the respondents complained about waiting for work which poorly reflects on production planning. Utilisation of human resources was therefore not maximised. Sewing machine operators stated mostly that they waited for work to come from the cutting room. This might again be due to the fact that the cutting room waited for markers from the design room, or that they waited for material to arrive, or it could be because the cutting room cut too slowly. Forty-one (41) (54.6%) respondents responded that the machine layout is wrong and the work does not go though the line fast enough. Only 36 respondents (48.6%) thought that there was a shortage of work within the factory, and 31 respondents (41.3%) contradicted this by stating that there were not enough machines for the work. Thirty-three (33) (44.5%) complained that they were always overloaded with work. This confirms the interactive negative effect of different sub systems on the overall output of the production

line. The factory's output can therefore not improve unless all the different sub systems are attended to in terms of how they affect one another.

To establish a relationship between sewing machine operators and cutting room operators the same statements were also given to the cutting room operators. Cutting room operators' responses to these statements are presented in Table 5.17.

TABLE 5.17: PROBLEMS RELATED TO PRODUCTION PLANNING: CUTTING ROOM OPERATORS (n=28) (Q16)

Production problems as experienced by the cutting room operators	YES		NO	
	%	n	%	n
I often re-cut because of bad markers	71.4	20	28.5	8
I always have an overload of work	57.1	16	42.8	12
The markers are wrong most of the time	46.4	13	53.5	15
There is not enough work coming from the marker room	44.4	12	55.5	15

A vast majority (71.4%) of cutting room operators complained that they had to re-cut because of bad markers which are totally unacceptable in terms of the cost implications. Markers are the layout of pattern pieces (templates) from the design room, that cutters place on top of the fabric and cut according to the outline indicated on the marker. This might confirm the above discussion, relating to the design room. More than half (57.1%) thought that they had an overload of work. The overload of work might also be because of re-cutting and waiting for work from the design room.

Over (46%) of the cutting room operators confirmed that most of the time markers were wrong, and (44.4%) of the cutting room operators stated that there was not enough work coming from the design room. This bottleneck might also reflect back to poor planning in the design room, or miscommunication, or could also reflect on ineffective planning by head office.

5.4.5 The role of *quality control* in the optimisation of a clothing production system's utilisation of resources from management's perspective

After conducting the interviews, certain factors were identified that played important roles in quality control: training, quality checkpoints, quality control by members. From the interviews, the following categories were identified that played a role in quality control: training, quality checkpoints, quality control by supervisors. The categories and sub-categories regarding quality control are presented in Table 5.18 with the managers' supportive verbatim to verify the categories.

TABLE 5.18: QUALITY CONTROL CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Negligence **- Sewing operators**	*"They do not sew-bar accurately. Then it happens that they size the pattern pieces inaccurately, and then the workers sew different sizes together. They will also sew without checking the quality of their work. They will stretch a size-40 panel to fit a size-42 panel, and then they will not really care if the panel piece puckers.* *"...most of the time the problem only features at the end of production."*	**a**
-Cutting room operators	"*Sometimes you find that on the cutting sheets they write the wrong information and then we must go into the cutting room to fix that information."*	**d**
	"*...when they cut they do not count the layers to what is on the marker. But sometimes we do experience problems with the markers, but most of the time it is the people that cut here in the back. They do not check their work. They must cut and check that they have the correct marker for the correct size, before they cut. And they also do not check the size number before they cut, because sometimes there are more of one size than what there are supposed to be."*	**e**
Quality control points	*"There are no real quality control points in the line, only at the end in the despatch. If there really is a big problem we will know about it in the line, otherwise we will only notice it by the hemming. Then there is not always time to check the work after each step."*	**d**
Quality control members **-Worker**	*".. there is nobody to check the work. The people that are working in despatch, only put the size and price ticket. We do not check the work.* *"... you only send something back for repair when you see something is wrong."*	**e**
	"We are supervisors and quality controllers at the same time, but the people must also check each other's work. We do not have the quality controller in the factory."	**d**
	"The worker herself is also a quality controller; they must control the quality themselves."	**c**
-Supervisor	*"Well, we got a supervisor for every 20 machines, so she got to check the quality for that 20 machines. And then we have the final checkers that go through everything and they must then check everything that goes through their work, at despatch."*	**c**

-In line quality controller	*"In-line quality which we haven't got at the moment. We do it ourselves. So when you check quality when the work is finished, people that are in the line check quality and after each 5 garments you must check quality, and you also do random checks."*	**f**
Quality standards	*"...it plays a very important role here. Mass production has to do with score, but also with quality, so the customer will not expect 2000 units but without quality."* *"Do you check every stitch? You see, that's where we check the stitches and make sure that the quality is 100%."*	**f**

One of the respondents indicated that the reason for poor quality work was a lack of training. Supervisors said that they do not always know the right way. Operators making mistakes, for example, stretching a size-40 panel to fit a size-42 panel resulted in poor quality because the seams pucker.

Cutting room managers sometimes wrote the wrong information on the cutting sheets. In the cutting room, cutting room operators did not count the layers and did not match the amount of layers to what the marker prescribes. Cutting room operators also did not check size numbers before they cut.

At the start of production, during the cutting stage and through the sewing stages, there were no formal quality control points within the production line. From the interviews it was understood that there were no formal quality controllers. Workers checked the work themselves, and supervisors mostly multi-tasked their supervisory tasks and quality control tasks.

The supervisor's job did not only consist of normal supervisory duties. One supervisor was assigned for every 20 machines. The supervisor fulfils the role of quality controller too. It was suggested by respondent (f) to have an in-line quality check controller, as supervisors and sewing machine operators do not always have the time to check the work, and also suggested that the quality controller check production after every five production steps. Respondents represented only a general overview of their quality standards. The company did not represent formulated standards to which quality could be measured.

5.4.6 The role of *quality control* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

Table 5.19 reflects employees' responses regarding who was responsible for doing quality checks within the production company.

TABLE 5.19: EMPLOYEE RESPONSIBLE FOR QUALITY CHECKS (n=96) (Q3)

Employee responsible for quality checks	YES		NO	
	%	n	%	n
Line supervisors	89.8	88	8.1	8
Department managers	45.1	42	54.8	51
Co-workers	32.2	30	67.7	63
Quality controller	19.3	18	80.6	75
Nobody	12.9	11	87.0	74

A large majority (89.8%) of the respondents indicated that line supervisors were responsible for quality checks. One member of management confirmed that supervisors had the duty of conducting quality checks. According to 42 (45.1%) respondents, quality checks were the responsibility of department managers, and 51 respondents (54.8%) were of the opinion that quality checks were not the responsibility of the department manager.

Only 18 (19.3%) respondents however stated that quality controllers were responsible for quality checks, and according to management there were no formal quality controllers employed. The reason for this response might be that supervisors were also perceived as managers. Thirty (30) respondents (32.26%) were of the opinion that the co-workers were responsible for quality checks, and 63 (67.74%) respondents responded that co-workers were not responsible for quality checks. Lastly, 11 (12.94%) respondents indicated that nobody was responsible for quality checks.

In Table 5.20 the results of overall problems experienced by sewing machine operators due to no or poor quality control in the production system are presented.

TABLE 5.20: PROBLEMS EXPERIENCED BY SEWING MACHINE OPERATORS DUE TO QUALITY-RELATED FACTORS (n=73) (Q12)

Problems related to bad quality checks	YES		NO	
	%	n	%	n
I often unpick work because of bad sewing	65.7	48	34.2	25
I often unpick work because of bad cutting	64.8	48	35.1	26
I often unpick work because of bad quality material	62.1	46	37.8	28
I often unpick work because of bad quality checks	59.7	43	40.2	30
Quality checks are done too late	56.9	41	43.0	31

Bad quality did have a direct effect on the production outcome. Bad sewing, bad cutting and bad quality material had an effect on the production unit outset, and employees' motivational levels. Unpicking slowed down production and employees got tired when unpicking and re-sewing garments.

Table 5.21 depicts the results of when quality checks are done in the production system.

TABLE 5.21: TIMING OF QUALITY CHECKS (n=74) (Q14)

Timing of quality checks	YES		NO	
	%	n	%	n
After the garment is finished	83.7	62	16.2	12
After a piece of the garment is finished, e.g. waistband	34.2	25	65.7	48
After every stitching step	24.3	18	75.6	56
After every 3-4 steps	20.5	15	79.4	58

Quality checks were mostly done after the garments were finished. Quaity checks were done to late. If the quality of the garments were checked in line during production, quality problems could be eliminated. Another 25 (32%) of the employees stated that quality was checked after each production step, this is already an improvement on checking the garment at the end.

In Table 5.22 the results of overall problems experienced by cutting room operators due to poor quality control in the production system are presented.

TABLE 5.22: PROBLEMS EXPERIENCED BY CUTTING ROOM OPERATORS BECAUSE OF QUALITY-RELATED FACTORS (n=28) (Q16)

Quality problems related to the cutting room	YES		NO	
	%	n	%	n
I often re-cut because of bad cutting	78.5	22	21.4	6
I often re-cut because of bad sewing	75.0	21	25.0	7
The material cuts difficult	70.3	19	29.6	8
I often re-cut because of bad quality material	60.7	17	39.2	11
Bad material quality makes me cut slower	53.5	15	46.4	13
Material has bad colour shading; this makes me cut slower	53.5	15	46.4	13
Material is full of flaws	50.0	13	50.0	13
The markers are wrong most of the time	46.4	13	53.5	15

The two main causes for re-cutting were bad cutting and bad sewing. Both these causes received more than 75% of the responses. Nineteen (19) (70.3%) responded that the material sometimes cuts difficult. This reflects on a material problem. Material problems could also be the cause for re-cutting, as first mentioned. Fifteen (15) respondents (53.5%)

replied that bad quality material made them cut slower. More or less half of the respondents replied that material flaws and material shading made them cut slower. Thirteen (13) respondents were of the opinion that the markers were wrong most of the time. Thus bad cutting and bad sewing might also be due to a lack of training or ergonomic related factors. Material shading is a external problem that have a direct influence on the production system.

5.5 FINDINGS AND DISCUSSION FOR OBJECTIVE 3

Objective 3 set for the study was to explore and describe the role that *physical resources (technology, production system and material handling)* play in the optimisation of a clothing production system's utilisation of resources from **management's and employees' perspectives**.

5.5.1 The role of *technology* in the optimisation of a clothing production system's utilisation of resources from management's perspective

From the interviews, the following categories and sub-categories were identified that played a role in technology: maintenance, technology investments, cost. The categories and sub-categories regarding technology are presented in Table 5.23 with the managers' supportive verbatim to verify the categories.

TABLE 5.23: TECHNOLOGY CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Maintenance	"Material shrinks and machines break down frequently. We have old equipment in the factory and then we need to get machines from outside to assist with production."	**a**
	"Only one fusing machine works. That is why the production is slow."	**c**
	"No, not always, because we experience problems, like for example, the machine breaks and they cannot fix the machines quickly, and we must wait for them to come and fix the machines – which can take a day."	**d**
Technology investment	*"You see, this is where you have to keep up with technology. In this factory okay, now we are starting to get under-bed trimmers, that cut the cotton for you, and then you don't have to cut the cotton, that is minus one problem. And in the cutting room you get the Gerber cutters, the automatic layers, which we still need."*	**f**
Cost	*"Those machines are very expensive, they are*	**f**

- employment	*in the millions, and you see why we do not want to get those machines; it is because, if we do get those machines, a lot of people will be out of work. Then we will only need 4 people in the cutting room. It automatically lays the fabric and automatically cuts the garment. So that's why we do not want to implement these machines right now."*	

The machinery within the company was mostly outdated – which clearly had an influence on production. The company suffered frequent breakdowns because of outdated and badly maintained machinery. There was no mechanic based on the premises, which resulted in a long lead time before a broken machine could be mended.

Management did consider investing in new technology. They were considering sewing machines with under-bed cutters. This specific sewing machine cuts the yarn after stitching, which saves time in despatch when cleaning up the finished stitched garments. Technology investment should be considered carefully, according to management. There are costs involved and the question is whether the cost that will be incurred is actually cost-effective. As it will in the long run put some employees out of work, the question remains whether the cost of implementing new technology accounts for employees losing their jobs due to technology investment.

5.5.2 The role of *technology* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

Problems with production output relating to technology were stated in two questions: the first question was put to sewing machine operators, the second to cutting room operators. The various production problems related to technology in the sewing department are presented in Table: 5.24 in descending order for the positive responses.

TABLE 5.24: PRODUCTION PROBLEMS RELATING TO TECHNOLOGY IN THE SEWING DEPARTMENT (n=74) (Q12)

Technology-related problems in the sewing department	YES		NO	
	%	n	%	n
Machines often break	60.8	45	39.1	29
Here are not enough machines for the work	41.3	31	58.6	44
My sewing machine is too slow	10.6	8	89.3	67

Forty five (45) (60.8%) of the respondents noted that machine breakdowns were a factor that needed consideration. Thirty one (31) respondents (41.3%) stated that there were not

enough sewing machines for the amount of work, and eight (10.6%) of the respondents complained that the sewing machines stitched too slow. Frequent machine breakdowns seemed like the main factor for concern; this could be due to outdated machinery, or machinery that was not well maintained. If the machinery had been in good running condition then respondents might have responded that there were enough machines for the work.

The various production problems related to technology in the cutting room department are presented in Table: 5.25 in descending order for the positive responses.

TABLE 5.25: PRODUCTION PROBLEMS RELATED TO TECHNOLOGY IN THE CUTTING ROOM DEPARTMENT (n=28) (Q16)

Technology-related problems in the cutting room	YES		NO	
	%	n	%	n
The cutting blade often breaks	60.7	17	39.2	11
Here are not enough cutting tables and cutting blades	55.5	15	44.4	12

The main machinery and tools used within the cutting room were electrical cutting blades and cutting tables. The cutting room had two cutting tables, one table for lining and the second for fabric. Each table had a roller at the end of the table. The roll of material was placed on the roller, then rolled open on the table and stacked in layers. Thereafter the material and the marker were clamped together. Cutting room operators commented on machinery, tools and facilities available in the cutting room – see table 5.25. Seventeen (17) respondents (60.7%) were of the opinion that cutting blades break, and 15 respondents (55.5%) stated that there were not enough cutting tables and cutting blades. Cutting blades are replaceable; the only disadvantage was damaged material and time being wasted. Space is a limitation, so bringing in more cutting tables would not be possible.

5.5.3 The role that the *production system* plays in the optimisation of a clothing production system's utilisation of resources from management's perspective

From the interviews, the following categories were identified regarding the production system: fabric lining, small to large pattern pieces and bundle system. The categories regarding the production system are presented in Table 5.26 with the managers' supportive verbatim to verify the categories.

TABLE 5.26: PRODUCTION SYSTEM CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Fabric lining	*"What we do is we make the front for the jacket and then the pockets and assemble the fabric together. At the same time we make the lining and then at a certain point it will get together, and then we will assemble them together."*	**c**
Small to large pattern pieces	"*We start with the small pattern pieces, like for example, the trims, the flaps that must first be ready, and then we move over to the panel, and the trimmings are ready to be assembled by the time the panel comes by. Every thing has to be synchronised."*	**c**
Bundle system	*"It does not always work like that, because the one person only makes loops, the other pockets, the other sew-bar, so no one person finishes a garment by herself."*	**a**

Any production line within the factory started with the small pattern pieces. Flaps and pockets were pressed and stitched, thereafter the individual pattern pieces (flaps and pockets) were sewn onto the bigger pattern pieces (front and back). During final assembly the garment got put together and was finally trimmed in the cutting room. During production the fabric of the jackets gets assembled together and then the lining, separately. From remarks made by the respondents it seems that the company makes use of the bundle production system. 'Progressive Bundle System' gets its name from garment parts that are moved sequentially from operation to operation. Bundles consisting of garment parts needed to complete a specific operation (Glock & Kunz, 1995:315).

5.5.4 The role of the *production system* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

Problems with production output relating to the production system used are indicated in Table 5.27. The various production problems related to the production system is from the sewing machine operators' perspective. Employees rated 53.5% negatively that the current flow of work in the factory was not fast and effective.

TABLE 5.27: PRODUCTION PROBLEMS RELATED TO THE PRODUCTION SYSTEM USED, FROM THE SEWING MACHINE OPERATORS' PERSPECTIVE (N=75) (Q12)

Production problems related to production system used	YES		NO	
	%	n	%	n
The cutting room does not cut fast enough; I wait for work from the cutting room	60.0	45	40.0	30
The machine layout is wrong; work does not go through the line fast enough	54.6	41	45.3	34
I always have an overload of work	44.5	33	55.4	41

Most of the sewing machine operators (60.0%) responded that the cutting room did not cut fast enough, and they always had to wait for work from the cutting room. Machine layout was a problem for 41 (54.6%) of the respondents, as they felt that work did not move fast enough through the production line. The minority of sewing machine operators, (33) (44.5%) indicated that they had an overload of work. Bottlenecks that occurred in the cutting room could be due to material shrinkage, which caused re-cutting and a duplication of work. It could also be due to a lack of machinery and facilities within the cutting room. Machine layout could be planned better, or machine layout could be the problem for bottlenecks. Idling of sewing machine operators also contributes to machine layout. Work-study per operator could clear this matter.

Problems with production output relating to the production system used from the cutting room operators' perspective are indicated in Table 5.27.

TABLE 5.28: PRODUCTION PROBLEMS RELATED TO THE PRODUCTION SYSTEM USED, FROM THE CUTTING ROOM OPERATORS' PERSPECTIVE (n=28) (Q16)

Production problems related to production system used	YES		NO	
	%	n	%	n
I always have an overload of work	55.5	16	39.1	12
There is not enough work coming from the design room	44.4	12	58.6	15

More than half (55.5%) of the cutting room operators stated that they had an overload of work. Less than half (44.4%) of the cutting room operators felt that there was not enough work coming from the design room. This might be proof that there is a production bottleneck within the cutting room. The majority of the cutting room operators said that there was enough work coming from the marker room. This might suggest that the origin of the bottleneck might not be from the marker room.

5.5.5 The role of *material handling* in the optimisation of a clothing production system's utilisation of resources from management's perspective

From the interviews, the following categories and sub-categories were identified regarding material handling: transport of bundle pieces, bottle necks (shrinkage, duplicate work, adjust garments, damages and misplaced pattern pieces). The categories regarding material handling are presented in Table 5.29 with the managers' supportive verbatim to verify the categories.

TABLE 5.29: MATERIAL HANDLING CATEGORIES

Categories &Sub-categories	Verbatim	Participant
Transport of bundle pieces	*"Here they work in a straight line where they pass the pattern pieces on forward by hand; they do not have buckets or a conveyer belt or something else to pass the pattern pieces forward."*	**c**
Bottle necks • **Shrinkage**	*"But we found a solution to the material shrinking. They deliver in batches and each batch has a lot number, so now Phillip will issue material and we will write down from which lot the material batch came, and on each lot we will do a shrinkage test. And then we cut the material together that has the same amount of shrinkage, and those that are different, we cut them separately."*	**d**
• **Duplicate work**	*"The only problem now is that we have to cut one order two or three times, whereas we used to cut only once. And I then have to make two to three different markers because each marker has got different percentage shrinkage."*	**d**
• **Adjust garments**	*"It sometimes happens that the jacket's material did not shrink back to the shrinkage percentage originally planned, and then it does not fit the lining, and then you have to shorten the lining."*	**d**
• **Damages**	*"Yes, sometimes it does occur, because the fabric is damaged, Sometimes it might be machine or cutting. Sometimes we have to re-cut because of damages. Some of the damages you cannot tolerate. Sometimes with fusing you have to re-cut. There might be a hole or the yarn frays."*	**b**
• **Misplaced pattern pieces**	**"***Sometimes the people mix the work."* *"Sometimes the problem is on all the pattern pieces that we put the sew-bar tickets on. So sometimes it starts from 1-50, right? So now that's the front. So then they take the sleeves.*	**c**

	If they don't start from exactly 1-50 on the sleeves, then they can mix up the whole production." "The operators; the operator has got to check what she is doing."	

Pattern pieces were transported by hand, by pushing the pattern pieces forward. For the factory the absence of technology, for example, conveyer belts and an overhead transportation system, was not always necessary. The sewing machine operators still had to be aware not to get pattern pieces mixed up.

Material purchased by the factory was not always of the same quality, and this created problems regarding shrinkage percentages. For this reason each batch of material was coded. Each batch of material was then allocated to a size. This created duplicate work. The same jacket needed to be cut three or five times, and duplicated markers with a different percentage shrinking were made. The question then comes to mind: would it not be more economical to rather purchase more expensive material, so as to save time and money?

Material wastage was mostly due to damaged material. Damages were present because of material flaws, and occurred during fusing. Management could not always foresee flawed material. Some material wastage could be managed by training the employees. If the employees were trained properly on how to use a fusing machine, damages could be minimised.

Each pattern piece was numbered with a ticket. The ticket displayed the size and lot number of each pattern piece. The sewing machine operator then needed to match the correct pattern pieces together by making use of the tickets. Confusion and a mix-up of pattern pieces were a concern for respondent (c). Training of employees could also minimise this problem.

5.5.6 The role of *material handling* in the optimisation of a clothing production system's utilisation of resources from the employees' perspective

Problems related to material handling in the production system are presented in Table 5.30 from the sewing machine operators' perspective.

TABLE 5.30: MATERIAL HANDLING RELATING TO PRODUCTION FROM THE SEWING MACHINE OPERATORS' PERSPECTIVE (n=75) (Q12)

Material handling related to sewing machine operators	YES		NO	
	%	n	%	n
Some materials are difficult to sew	77.3	58	22.6	17
Running out of material, yarn, buttons etc.	58.3	42	41.6	30

Fifty eight (58) (77.3%) respondents were of the opinion that materials were difficult to sew, and 42 (58.3%) respondents thought that they had a shortage of material, yarn etc. Material being difficult to sew could have been due to different reasons: incompetence of a sewing machine operator, faulty sewing machines, or the material itself. All of these aspects needed to be considered. Running out of yarn and material could also have been due to re-cutting or poor production planning.

5.6 CONCLUSION

The results reflected that employees did not have the same viewpoint on important aspects. They have different view points on training, the type of training they need and the type of training they received. Monetary payouts were the motivational incentive mostly mentioned by employees. Not all employees were negatively orientated, thus with little effort from management, they can implement motivational incentives and a performance appraisal system to motivate and optimise utilisation of employees. Not all employees gave suggestions when asked in the questionnaire; this might be due to that they were concerned about their confidentiality.

Management were eager to participate in the interviews. As they were of different cultural and educational backgrounds, their view points on production planning differed. Their view on employee motivation was also different and their management style reflected this.

From the results it was clear that management and employees had different view point, because they spoke from a different viewpoint, especially on the subject of production planning. Employees had hands-on experience and management refer more to the cost and time aspects.

CHAPTER 6:
CONCLUSIONS AND EVALUATION OF THE STUDY

6.1 INTRODUCTION

In this chapter the conclusions and recommendations regarding the findings are made, based on the objectives and sub-objectives of the study. The study is evaluated in terms of objectivity, trustworthiness of the data, and data collection methods. The quantitative instrument used – the questionnaire – is evaluated for validity and reliability. Furthermore the objectives and sub-objectives for the study are discussed. The possible contribution of this study to the clothing manufacturing industry is also discussed.

The aim of this research was to study the interactive contribution of resources with regard to the operation and outputs of clothing production systems. As mentioned in **Chapter 1,** the South African clothing industry is a significant provider of employment. Therefore the success/productivity/output of the manufacturing industry is critical for the South African economy, and has the potential to increase exports. For the South African clothing manufacturing industry to be internationally competitive, the focus should be on the improvement of the utilisation of resources; this concept is explained later on in this chapter. The author aimed to recommend how to optimise the use of resources in a specific clothing construction company, and thus how to utilise resources more effectively and efficiently. The reason for investigating all instead of only one or a selected number of resources is reinforced by the systems theory: one resource (input) does not operate in a vacuum. The effect of one resource affects the effect of other resources on the clothing production system; one resource may compensate for the other; the different resources are thus interdependent. This interrelationship of different resources can deliver different production outcomes. This can be explored statistically in another study.

The research objectives were formulated from the literature review conducted in **Chapter 2**. The research objectives formed the outline for the interpretations and implications of the findings. To recapitulate the conceptual framework was set as reference point for the discussion. The conceptual framework is illustrated in Figure 6.1.

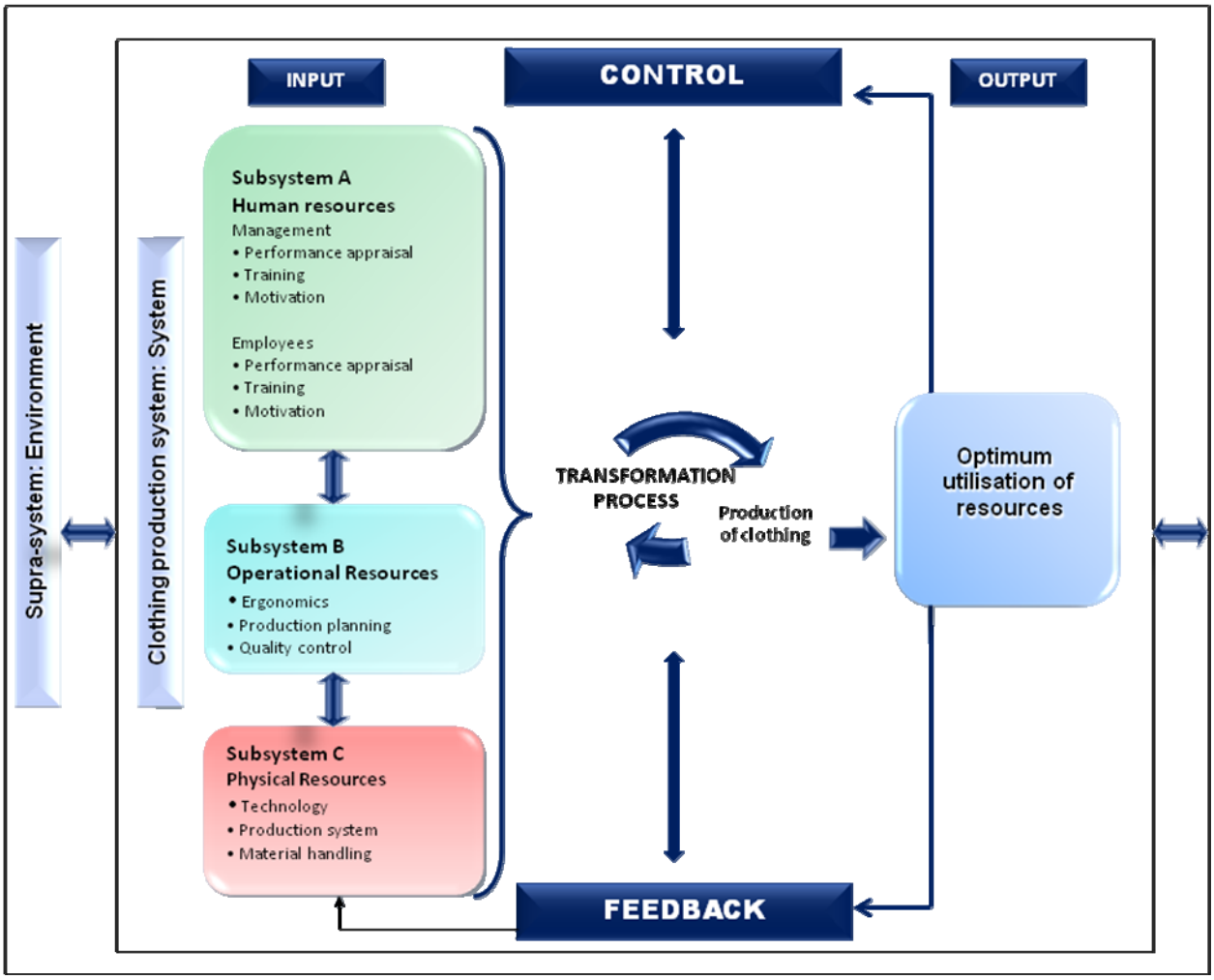

FIGURE 6.1: CONCEPTUAL FRAMEWORK FOR THE STUDY

This chapter is structured according to the conceptual framework. Interpretation and implications were made according to the resources set out in Figure 6.1. The interrelationship between management and employees is shown by discussing the qualitative and quantitative research perspectives.

6.2 OBJECTIVE 1: IMPLICATIONS, RECOMMENDATIONS AND CONCLUSIONS

Objective 1: To explore and describe the role that *performance appraisal, training* and *motivation* play in the optimisation of a clothing production system's utilisation of resources, from management's and the employees' perspectives. The aim of this objective was to determine the interrelationship between management's and employees' perspectives. It incorporates the interrelationship between human-related resources: performance appraisal, training and motivation. Each of these resources had an influence on production output. All of

them had an individual influence as well as a combined influence relating differently to one another. The following suggestions are based on the results from **Chapter 5**.

6.2.1 Results and implications of motivation and performance appraisal in the optimisation of a clothing production system's utilisation of resources

After the research was conducted, it was found to be more appropriate to discuss motivation and performance appraisal together, as the two concepts were discussed as a unit by the participant in the specific case. Motivation is a form of performance appraisal. Motivation of employees is a direct mechanism that management used to show appreciation (performance appraisal) for outstanding work from employees, usually in the form of an incentive.

It was clear that management did not operate according to a formal performance appraisal system or any incentive scheme system whatsoever. Management had tried and tested an incentive scheme system, and found that it was not worth the effort because of absenteeism of employees. The fact that the full workforce was not present most of the time complicated incentive calculations and payouts for management.

Findings indicated that training can be used as an incentive to offer employees the opportunity to develop within the company. From the responses in the questionnaire it became clear that employees were not interested in developing their working position within the company. To the existing workforce within the factory, a promotion was not always perceived as an advantage, because the perceptions were that supervisors worked harder, and supervisors had to bear with more criticism from management. Almost 70% of the employees claimed to be satisfied in their job. For most of the employees an incentive payout in the form of money for excellent performance, would be a good motivator. Monetary incentives could be a good motivator; however, it would obviously have a direct influence on cost. For monetary payouts to work there had to be some form of performance system in place, to record performance and keep track of payouts.

Management's point of view was in contrast to this. According to management, monetary incentive payouts bought satisfaction, but satisfaction is only short term. The reason for employees selecting monetary incentives as an option may be due to the fact that they were all low-wage employees, who would appreciate a higher monthly income.

To be able to find a golden mean regarding a motivational tool, it was necessary to find a performance appraisal and incentive-based system that would force a better production

output, without affecting the capital and time input of the company. It was critical that the performance appraisal and incentive system be regarded as a long-term investment, by both management and employees.

6.2.1.1 Recommendation for motivation and performance appraisal

From the interviews and the questionnaire, the different views of employees and management on motivation, incentives and performance appraisal could indicate conflict and it was recommended that this issue be addressed as a priority. From the interviews and questionnaires it was clear that the main issues regarding performance appraisal and motivational systems are cost, communication, and the performance system that was implemented. The aim with performance appraisal and motivation should be to increase employee satisfaction and cost-effectiveness. Satisfied employees aimed for the optimum utilisation of human resources. For the company to realise that human resources are their main investment, they needed to re-evaluate their methods of performance appraisal and motivation of employees. The company needed to use performance appraisal not only as a tool to motivate employees but also as a legal defence for selection. This meant that management can defend choices made regarding retrenchments and as part of strategic planning (Woodford & Maes, 2002:1).

The best suggestion would be to evaluate each employee individually; however, this would be a timely and costly process, as it would entail a vast amount of administration. The alternative solution would be to evaluate key performance employees and the employees as a group, for example, one section of a production line. Performance appraisal is a formal evaluation done by management to which employees need to improve to be able to improve the company. The objectives by management consist of **four** key elements (Woodford & Maes, 2002:4):

- **A job review agreement**: together the employee and manager review the job of the employee and the key elements of the employee's job; for example, a job review is conducted by a supervisor and a sewing machine operator in his/her department.
- **Development of performance standards**: this phase identifies mutual agreement on a satisfactory level of performance and how to measure the performance. The satisfactory level would include units produced per hour output by the employee. The line managers of the two different departments have to agree with the supervisor on a respectable performance standard.

- **Setting of goals**: mutual goals are set by management and the employees. The goal should be linked to a time frame, within which the employee will be able to reach this level of accomplishment.
- **Performance discussion:** The employee and manager must set formal times to discuss the progress of the employee, for instance, twice a year. The time and frequency of such performance appraisal should be reasonable to the employee and effective for production output.

It is of great importance to management and employees that management is properly trained on how to conduct performance appraisal with employees. This training should include aspects which management can do to be able to have a positive effect on the company. Training is specifically important for evaluators who are from a different national or cultural background to the employees, as is the case in this company (Woodford & Maes, 2002:5).

There are certain key elements that management need to be trained on. Management should be trained in how to create the correct setting for performance appraisal. This should be in a setting where the manager can give his/her full attention to the employee. Feedback is an important factor. Thus management should be trained to give feedback after/during the evaluation process. Management and employees should be given a chance to comment during the evaluation process. Management should be trained on how to address performance problems as they arise, and not only address them, but also how to detect performance problems. Performance problems should be addressed in a positive way and management should give positive feedback. This can be a powerful tool to motivate employees. Management's expectations should be communicated clearly to employees. Furthermore, management should receive training on cultural differences and communication style; training should also include cultural awareness, on how the employees' culture affects their behaviour. Lastly, evaluators: evaluation should be constant. They should not allow outstanding performance on the one side to overshadow bad performance on the other (Woodford & Maes, 2002:6).

The question now arises: what incentive should be in place to motivate employees? The first recommendation would be to open a canteen for the workers. The canteen can be outsourced to an external company, and the meal cost will then be minimal. As the employees are minimally paid employees, most of them do not eat a wholesome meal every day. The canteen will then be a tool to provide the employees with a wholesome meal at the same or less than the cost of any take-away meal in the area. If the employees are provided with wholesome, nutritious food their work might be of a higher standard. The incentive idea

for management would then be to select the best employee of the week, and that employee could receive free meals for a week. However a canteen can not be linked to performance appraisal in the narrow sense, but may be motivational. Employees with different educational levels perceive the impact of employee benefits differently. This relates back to Maslow's hierarchy of needs. For employees with low educational levels (as is the case here), physical and security measures are more important than social and self-actualisation models. Thus, workers with minimal education value incentive payouts and a free lunch (Hong *et al.*, 1995:14).

As mentioned, 'employee of the week' would be a viable idea; however, there should be a system in place on how the performance of the employee is rated. The employee of the week/month can be rewarded in different ways, e.g. being allowed to leave work earlier granted a training opportunity or given a bus ticket for a week. Management should take into account that the workforce mainly consists of women and women have different benefit demands than men. Women have a different social role and would value a leave system more than men. Thus management can incorporate shorter work hours or a few days' leave for outstanding performance, rather than monetary payouts (Hong *et al.*, 1995:14) (which would negatively impact on the output of the system),. If leave were decided on, workers need to be multi-skilled and rotated within the production line to compensate for absent employees.

Rotating employees will keep their motivational levels up. If a person does the same repetitive work every day, tiredness sets in. It was found that when the work is not attractive or mere routine work, the company should introduce a performance-based incentive system, but a non-monetary incentive system (Matsumaru, Kijima, Nakano & Takahasi, 2003:511), thus as mentioned before, a free meal, shorter work time or a free bus ticket.

Management did mention absenteeism as a problem for setting motivational incentives. To overcome absenteeism, presence at work should be one of the performance indicators on how the employee is rated. Absenteeism is always a direct outflow of people's health and employees' attitude towards their work. Incorporating a good nutritional meal a day, might limit some of the health problems. To help management to provide the most viable incentive to employees, the employees should be given a chance to communicate their needs to management, and then a compromise should be established. Employees would be motivated to be present at work if the work environment is positive and if the employees feel wanted and comfortable to go to work daily.

Another incentive system that could be investigated is a **team-based incentive** system. The production system functions in smaller working units, which make it possible for a team incentive system, as employees could then motivate each other and support each other to work harder. For example, the cutting room, jacket line or trouser line could be classified as a team. A team-goal-based incentive system is viable if the inputs of all team members are interdependent on one another, where the co-workers will motivate and drive each other to work harder. It is important that management sets a goal for the team, for instance, to improve the existing company standard in production output, quality, ratio of labour hours to product output, and so on (Hoffman & Rogelberg, 1998:22).

The focus of such a team-based incentive is mostly monetary based; however, a non-monetary based system was also found advisable. Team-based incentives are necessary to facilitate optimal team performance. However, the two most important factors that management should consider for a team-based incentive scheme are team interdependence and the type of team (full-time or part-time). If the team is a full-time team with a high interdependence between the team members, management should consider implementing a reward that is distributed equally amongst team members. The aim of the reward should ensure maximal team performance (Hoffman & Rogelberg, 1998:29). Some employee benefit programmes proved to have greater impact on worker satisfaction than on productivity; therefore management should test the incentive medium that they use, and the influence on production output (Hong *et al.*, 1995:14).

6.2.1.2 Conclusion for motivation and performance appraisal

Performance appraisal is a tool that can help management to motivate employees. Performance appraisal is a guide that could help employees to acknowledge mistakes and help improve production performance of employees. Improvement of production performance is only possible when employees are motivated. From the above discussion, motivation and performance appraisal are directly related to training. Management needs to be trained on performance evaluation and motivation. Employees are trained through performance appraisal and motivation. All three resources play a vital role in the production output of the company.

However, what management should keep in mind (motivational tool, will not serve as a performance appraisal tool) is that the best incentive and motivation is not necessarily an advantage; it could be simply listening to the employee, valuing their contributions, and valuing them as individuals with unique strengths and weaknesses.

6.2.2 Results and implications of training in the optimisation of a clothing production system's utilisation of resources

Training is one resource that requires a considerable amount of time and capital investment. The interviews clearly showed that these aspects are main issues, from management's point of view. Because of the fact that any type of production company operated on a fixed schedule, a finished garment's cost is calculated by the time taken to produce the garment. Depending on the implementation of training, meant loss of production time, which had a direct influence on the production cost per unit.

Training had many aspects, e.g. the type of training, the frequency of training, current knowledge of employees and limitations to training.

- **Type of training received**

The current training of employees was administrated in a reactive rather than a proactive manner. Thus, according to the interviews, employees were trained as needs for training was identified. Nothing was ever formally planned into a time schedule and/or as part of a long term plan to improve the workers' outputs. This inflicted more demand on management, employees, and on production time. If employees were trained before production took place, then there would not have been any hold-up in production.

In this specific company, training took place as soon as the employee was hired. The training that the employee then received was in line, on-the-job training. The employee was placed at the simplest job which is easy to learn. The hired employee was then trained by line managers and supervisors. As the job was mainly repetitive they were easily trained because the employee did the same operation over and over, on a typical work day. This could be an advantage to production output as employees then worked faster and faster. As the employees then developed their skills and as the need arose, they received further in-line, on-the-job training by line management and supervisors.

The need may be defined as a different sewing machine for the employee, for instance, if he/she gets relocated from a straight-stitch machine to an over-lock machine, or the employee needed to stitch a different operation to that which he/she was used to. To simplify training, management mostly re-hired experienced employees; this minimised the need for training. Rehiring employees meant less training needed, and production flow was faster.

The question aroused whether members of management had received any training themselves on how to conduct training in a working environment, and this was a crucial element of their job. Often this was neglected. Some managers were good trainers, and others were not; if not, their training skills needed improvement. An important concept for trainees is 'self-efficacy'; this concept was based on a social learning theory. According to this theory, in one's capability to organise and perform, the courses of action need to achieve given accomplishments. People learn by observing other people whom they believe in (Tai, 2006:53). If supervisors should attend training beforehand, trainees who attended the programme would have a higher self-efficacy than those who did not. A higher self-efficacy will increase the trainees' self-motivation. In a training context, motivation can influence the trainee's willingness to learn (Tai, 2006:53).

- **Quality and level of training**

Employees were trained only on a need-to-know basis, e.g. if their job is to stitch a hem, they were only trained in that one operation. If employees were trained on a need-to-know basis, they did not always know how to prevent their mistakes, and this could limit production output. Lack of training could be a factor when it comes to utilisation of human resources, because the workers made more mistakes or do not know how to prevent their mistakes.

From management's perspective, it seemed to be the best option to train employees in line, if costs and space were taken into account. It would be better to select certain employees in a certain amount of time, e.g. three months, and rotate them within the line. This would provide the employee with multiple skills, and the employee would learn to produce the garment in full, which would provide them with an overall view of the job. Rotating of employees can also provide management with knowledge as to the strengths and weaknesses of an employee. When the employee had a holistic view of the job, the employee works proactively in the workplace. The focus should shift from corrective behaviour to preventative behaviour (Korsten, 2002:369). The employee should be given an opportunity to communicate his or her training needs to management. Employees were not always aware of their training needs. Management needed to introduce them to new operations by rotating employees; this would open other needs to employees and in the end develop them in the workplace.

From the employees' perspective, their knowledge of on-the-job training was adequate; however, there were needs that were identified through the questionnaire. The first need that arose was the **need to prevent mistakes**; employees did not have the necessary skills to

prevent their mistakes, or how to correct them most of the time. What might have been a possible reason for this was that employees did not have a holistic view as to the construction of a garment, e.g. stitching the lining of a jacket can have a direct influence on the fit within the jacket. If the employee was aware of the influence the incorrect stitching of the lining had on the fit of the jacket, the employee would have been conscious of mistake prevention. Their focus is mainly on a single operation and does not comprise the effect of this one single operation. If the employee's knowledge could be expanded to knowing how to sew the whole constructed garment, they might work proactively to prevent mistakes, because they would understand the importance of their contribution towards the output of the production line and have the correct knowledge to correct mistakes. Another advantage to multi-skilled employees was that absent employees did not restrict the production process line. With multi-skilled workers, problems of absenteeism could be overcome, as the employees would be interchangeable in their different job functions.

- **Limitations to training**

According to management, another restriction for training was the fact that there was **not enough space in the factory to be able to set up a separate training station**. It all had to take place during production within the production line. The downside to training is the fact that training did not provide instant results. Training firstly made use of the capital resource as well as time; the positive effects of training were only visible at a later stage.

Some of the negative aspects about training were the following: **investment in employees can be risky** – the employee might be trained to later move to a different company, taking all the knowledge and skills to competitors. Some supervisors might perceive a well-trained employee as a threat to his/her own job. These perceptions of management and supervisors were restricting the training of employees.

Although training could be **costly**, according to Spears and Parker (2002:12), training prepared employees to improve performance and is usually regarded as a necessity to make the organisation's production process more effective and increase productivity. After the cost and the effect of formal training were calculated on the productivity of the company, it was found to be not advisable or of a high cost. In-house training could be the next consideration. Line managers were directly involved with employees and were more experienced than the supervisors. It was clear that the training of employees was not a priority with management. Management relied on previous experience and the experience gained during employment**.** As employees were mostly employed for a considerable number of years, they did not

partake in training programmes. However, there were benefits that could be met if management were to use this approach. The first step would be to identify those benefits that were most needed. The key to this is a training audit at three levels (Reeve, 1994:30). This audit is beneficial for the identification of training needs and for ensuring that training actually addresses the training needs. A training audit should be conducted at all levels: corporate, group and individual. The areas of training that needed attention and the responsible persons for the training should be identified (Reeve, 1994:30). Together with a training audit the cost calculation can be beneficial for management to make an informed decision.

6.2.2.1 Recommendations for training

The first recommendation, training has to incorporate cost, time and the question of formal or informal training. First of all, a cost calculation should be conducted by management. Costs involve production time missed by an employee, cost (if any) paid out to a trainee, and cost of training material. After the cost calculation is done the effect of training on productivity must be calculated. As part of the calculation of cost, a training audit should be conducted at all levels within the company. Cost is a constraint to management; training is the first resource that is restricted, as the benefits of training are only visible at a later stage. However, management has to justify training expenditure with documented benefits for the company. Documented benefits can be production output of the trouser line, and production output of the jacket line, after training has been implemented. The last stage should include a planned follow-up, which would test the effectiveness of the training (Campbell, 1994:32).

The **second** stage of cost-effective training is more challenging than the first stage. There are four levels to measure the effectiveness of training (Campbell, 1994:32):

- the first level: measuring the trainee's reaction to the training (feedback);
- the second level: measurement of knowledge gained and skills acquired;
- the third level: measurement of trainee's behaviour, the use of their knowledge and skills on the job; and
- the fourth level: the measurement of business results, the return on investment.

The first level is accomplished by testing an employee on the same operation and determining what the difference is in output time and quality after training was conducted. The second level can be accomplished by testing the employee's skills acquired on the training course. During the third level, management can ascertain whether the knowledge gained is applied to the job. During the last level, management can determine what effect the benefits had on the company's performance.

The key for collecting proof of training is to establish up-front a link between specific production problems within the company and performance deficiency. For example, rejected work pieces: management must determine the current reject cost; after training was conducted the reject cost must again be calculated. The benefit cost of the rejected items and the training cost can then determine whether the training was cost-effective. The following benefits should be documented by management: increased quality, increased productivity, workforce flexibility and lower absenteeism (Campbell, 1994:37).

Secondly, employees needs to be cross trained this will empower employees to detect mistakes earlier in the production line, and it will also empower them with the necessary skills to correct their mistakes.

Thirdly, educate employees on the basic principles for quality checks. Teach them what to look for and what are the consequences of bad quality on the end product and production outset.

6.2.2.2 Conclusion for the role of training

From the above discussion it is clear that training is a vital resource within human resources. Training does have a direct influence on space, time and costs; however, if these limitations are managed, production can be improved. Training has a direct link to resources within the company. The training of employees will ensure optimum utilisation of technology used. Employees will know how to optimise the use of their sewing or cutting equipment. Motivation and performance appraisal will also be directly influenced as a trained worker is more focused and motivated to perform well in their job, when the employee feels certain of what is expected of him of her, and knows what to do. Production can be planned more easily as management knows how to calculate production output for trained employees. Trained employees can also participate in production planning.

6.2.3 Conclusion to human resources

Around the globe, companies are making changes to meet the challenges of the ever changing global market. If human resources have an impact on production they can bring the company closer to a production output that will meet global challenges. Therefore, focusing on human resource development and worker and management satisfaction would have a positive effect on the production output for the company. Management should treat employees as their most valuable resource. The human resources of a company are not only

its most important resources but the most difficult resources to manage. Motivation, performance appraisal and training are all emotionally based. Thus there are more factors influencing these resources and no literature can really teach one how to manage these resources. Mostly experience and trial and error are the main facilitators in human resources. However, without human resources it will not be possible to have a clothing construction company, as it is a high labour-intensive industry. Also, human resources and the quality of human resources determine how other resources e.g. machines, fabric etc are utilised. Excellent human resources can in fact negate the frustration created by machines that are outdated or that break down frequently because they could improvise to overcome such problems.

6.3 OBJECTIVE 2: IMPLICATIONS, RECOMMENDATIONS AND CONCLUSIONS

To explore and describe the role that *operational resources (ergonomics, production planning, and quality control)* play in the optimisation of a clothing production system's utilisation of resources from management's and the employees' perspectives.

6.3.1 Results and implications of ergonomic aspects in the optimisation of a clothing production system's utilisation of resources

After an in-depth discussion with management, it was confirmed that ergonomic aspects were adhered to. From interviews the following aspects were discussed: suggestions, safety, comfort, breaks, lighting and anatomy.

- **Suggestions**

The following suggestions were made, to bring work closer to the operator, to improve maintenance within the factory and to modernise equipment.

- **Safety**

Safety complaints embraced the need for dust masks and warm water dripping near the machines. When stitching fluffy materials, the fluff in the air had a definite effect on employees with respiratory symptoms. Safety had a direct influence on employees' health. The impact on production output was absenteeism, which caused a negative output.

- **Comfort**

The aim of ergonomic aspects is to keep the employee comfortable at his or her workspace. Results from interviews and the questionnaire showed that the following factors related to comfort: working position, temperature control and breaks. Comfort in the workspace may have been misinterpreted by management as being overly comfortable, to the extent that the employees would fall asleep. However, this is not what comfort aims at; comfort in the workplace refers to limiting the amount of strain on the body for different tasks (e.g. heavy lifting, strain on the eyes and ears, and incorrect sitting position). Comfort is simply the absence of discomfort, for instance, the absence of pain, excessive noise, glaring light, extremes of temperature and obnoxious odours (Rowan & Wright, 1994:9). Comfort not only focuses on physical aspects, but also refers to psychological and social influences. However, for the purpose of this study comfort is referred to as physical comfort. Management's focus was on production output and not on comfort. A viable point that management should keep in mind is that the ergonomic comfort and health of the employee played an important role in human resource utilisation.

Employees complained about the pressing machine contributing to their fatigue levels as the machines were too heavy to lift. This could be overcome by rotating employees in daily shifts. Rotating of employees would positively affect motivational levels of the employees. Ergonomic solutions do not have to increase company costs; by production planning some of these obstacles can be overcome.

Employees that completed the questionnaire were divided into two groups, namely the sewing machine operators and the cutting room operators. The following components seemed to affect the sewing machine operators: safety, lighting, breaks and passive sitting positions.

Climate control was a significant problem for the cutting room operators. This might be because of the fact that the cutting room is situated in the back of the factory, near the boiler room. The other complaint that cutting room operators was an environmental aspect: more fresh air was needed inside the factory.

- **Breaks**

One of the biggest complaints was that management restricted workers to use restroom facilities 15 minutes before lunch or teatime and 15 minutes before the end of day. This

added up to an hour and a half per day that the usage of restrooms was not allowed. This was an inconvenience to employees, but management's point of view was that employees used this time to stretch their lunch or tea breaks. These rules regarding bathroom breaks forced employees to limit time spent in the restrooms. This was a situation that should be resolved between management and the employees. Again, this matter boiled down to communication between management and employees. Fifty per cent (50%) of the sewing machine operators requested more time for stretching legs, which may lead to some production lost.

The main difference between the cutting room and sewing machine operators was that the cutting room operators were in a standing position and the sewing machine operators were in a sitting position, and the parties used different technology to perform specified operations.

6.3.1.1 Recommendations regarding ergonomic aspects

The cost factor for ergonomic factors can be overcome by applying simple solutions. Good job design and planning involve the utilisation of ergonomic principles. The following are some issues that need to be considered by management:

- **Force**: There is not an excessive amount of physical force required by the workers to perform their daily task. The only force that workers apply is when they make use of the pressing machine. The pressing machine itself is not heavy; the tiredness sets in when the employee uses the machine repetitively during the day. Suggestion: rotation of workers, as this is not a complicated action and can be done by any operator.
- **Repetition**: The cycle time for clothing production was high, normally less than 30 seconds for most of the operations. Too much repetition can lead to boredom, inattention and cumulative trauma disorders (CTD) (Rowan & Wright, 1994:9). The recommendation: rotation of workers, e.g. cross-train workers to rotate with over-locking and straight-stitching operations. Sewing machine operators should be rotated too, at least once a week.
- **Breaks**: Management have to consider the input of the employees, to determine whether the breaks were frequent enough and long enough. The issue of restroom breaks, which the sewing machine operators complained about, needed to be resolved with management. Breaks can be an effective way to avoid and reduce mental as well as physical stress (Rowan & Wright, 1994:9).
- **Tools/Equipment**: The tools that employees used were fixed tables and chairs. It is advisable to design the workstations to meet the workers' needs, and ergonomically comfortable for operators. Adjustable ergonomic chairs can be considered by

management when planning the budget. The height of a chair should be adjustable between 51 and 61 cm, the backrest distance should be adjustable between 10 and 15 cm, and the backrest height should be fixed at 25 cm. Studies show that one company reported an improvement in production output, but another did not show any improvement (Dillard & Schwager, 1997:289). This recommendation appeals to management's discretion, as it is a costly investment.

- **Lighting:** Lighting was a problem for most of the employees. The company did, however, provide efficient lighting. Lights were situated above the production line. The problem could be that employees might be struggling with a lack of visual capacity. It is highly recommended that the employees get their eyes tested on a regular basis. This is a free service that is provided by the company's external optometrists, who visit the factory annually. The employees pay for spectacles when needed. The company could pay for the spectacles, and then deduct it from their wages. These employees live in the rural areas and are not familiar with the facilities that are available. When the operator has difficulty to see, the operator leans into the work area, resulting in a hunched posture (Dillard & Schwager, 1997:290).
- **Safety**: Dust masks and protective glasses must be freely available, to help protect the eyes and repertory functions of employees in the case of excess fluff and needle breakages.

True to the systems theory, if ergonomic principles are neglected; even 'good' employees are negatively effected, they get tired, their eye sight are influenced and thus have a negative influence on human resources. All the ergonomic principles and tool issues can be implemented by management; however, if an employee does not know how to use the equipment and tools, the implementation is a dead loss. This calls for the training of employees to optimise the use of the equipment and tools.

Management can always use the proposed guidelines for ergonomic programmes, which advise companies to identify high-risk jobs on record (e.g. repetitive work, awkward work posture etc.) (OSHA's Occupational Health & Safety Act).

6.3.1.2 Conclusion for ergonomic aspects

Ergonomics is also directly related to human resources. It has a direct impact on human resource relations, motivation, and training and performance appraisal. From the above discussion it is clear that, when ergonomics is optimally used, it will ease the production process. Production planning should incorporate ergonomic planning as well. As technology

also has a direct influence on production output, technology should be an extension of production planning and human relations. Furthermore, training of human resources has a direct influence on the utilisation of ergonomics as a resource, due to the fact that trained employees would know how to operate machinery correctly.

6.3.2 Results and implications for production planning in the optimisation of a clothing production system's utilisation of resources

Garment making is more complicated than many other operations. What complicates this is the intensity of human resource involvement. Thus production planning can simplify the process and is an important resource for production output – as can be seen from results. Production planning can be defined as an interactive process of coordinating plant resources with the demand of finished goods (Glock & Kunz, 1995:342). Production planning and capacity planning go hand in hand. The capacity of a business is the greatest possible workload that a business can handle within a certain period of time (De Beer *et al.,* 1997:67). In the following sections the results and implications of production planning are discussed, an outline of how a production company should conduct their production planning is given, recommendations are made and conclusions are drawn.

Production planning is a study on its own. Production planning, especially in a clothing production company, covers an immense range of factors. The discussion touches on the basics concerning production planning. Production planning influences productivity directly, and is directly concerned with the production process. Production planning furthermore influences ergonomic planning, and material handling, the production system and the technology used. Human resources also influence production planning by determining training needs, and so indirectly affecting the time and goals set for production planning.

From the interviews with management, certain categories came to the fore. Production planning took place in two different ways, according to customer needs and according to delivery dates. Head office planned according to customer needs, for example seasonal needs, and within the factory planning took place according to delivery dates. Delivery dates were then used as a guideline to balance work within the production lines. Within the production company there were two line managers, a trouser manager and a jacket manager, and also one cutting room manager and one manager operating the design room. The trouser manager mentioned work-study during the interview, which works according to production step planning. The procedure that this manager uses is to time operators and plan according to time per sewn operation. When there is no coordination between

managers, production planning as a resource can have a negative effect on the production outcome. Thus it was found that the utilisation of this resource was not optimal, as managers did not work as a team, but individually.

From the questionnaires it was clear that the current production planning situation lacked communication – especially between the cutting room and the sewing room operators. The cutting room was loaded with work most of the time. Yet the sewing floor often waited for work that was supposed to be cut in the cutting room, e.g. a jacket could have been finished while the sewing floor was waiting for the lining to be cut. This bottleneck could be due to cutting markers that were wrong, bad quality material or poor planning within the cutting room. Fifty three per cent (53%) of the workers were of the opinion that the current work flow within the factory was not fast and efficient enough. To recapitulate: management did not concur on a production system, and sewing machine operators and cutting room operators felt that the current production planning was not up to standard. The result of this is a de-motivated workforce; each department influenced the other negatively when the one department was holding up the other department. Equipment utilisation was not optimal as employees waited for work, sewing machines were vacant and not in use during production time. Thus, as with the production planning recommendation, these recommendations aim to fully utilise production resources.

6.3.2.1 Production planning: recommendations

The first recommendation would be to get a system in place. A three-tiered hierarchical and daily plan is proposed to management. The plan consists of three levels. The first: addressing the long-term aspects of production planning; the second: focusing the assignment of production to the manufacturing lines or units; the third: a plan seeking the appropriate job applications through the required operations (Bowers, Agarwal & Anurag, 1993:36). Management needs to establish a formal link between long-term, short-term and daily planning. By doing hierarchical planning management will reduce work in progress, lead times and inventory levels. The problems and bottlenecks as mentioned are all a manifestation of improper planning.

Long-term planning usually extends over a period of six to twelve months. The main purpose of long-term planning is to establish overall capacity, among regular time and overtime. Long-term planning will help management to budget for a higher capacity of workers when temporary workers need to be employed. Management also needs to plan according to the use of machinery demand, using quieter periods to overhaul and service machines, to

ensure that all machines are in working order to reach full working capacity with a maximum output.

The second step (short-term planning) combines the material on hand with the customer's order, and assigns production to the various production lines. Within this planning stage, the production needs to be balanced. A formal production plan needs to be conducted each week, by the four different managers to balance the work, especially between the cutting room and the sewing lines on the sewing floor. There needs to be a four-way verbal and written communication between the four managers to determine what styles are in production for the week, and which style needs to be cut first and which style needs to be sewn at what particular date and time within the week. Stage two is dependent on feedback from the sewing and cutting operators. Management needs to be coherent as they have to decide whether they are planning on a forward scheduling basis or a backward scheduling basis. By using a forward scheduling basis, management would schedule all the operations from the actual starting date of the production and would aim to finish the job as soon as possible (Yeh, 2000:184). Management can determine a starting date for production and then see whether the completion date will satisfy the customer's needs. By using backward scheduling, management could schedule the operations from the delivery date and work backwards. By providing the customer with a delivery date the actual production starting time can be determined (Yeh, 2000:184). Forward scheduling can be applied to rush jobs, and backward scheduling can be applied to higher income jobs.

The last and final stage of production planning mainly consists of the day-to-day production planning and is administered by the line supervisors. However, the last and final stage of production planning cannot take place without the prior two planning stages. Within the final stage of the production planning it is recommended that management and supervisors make use of work-study to be able to set goals and make sure that production output is met. The main aim with work-study is to assign tasks to a workstation to make sure that the cycle time is not exceeded and that some measures of effectiveness are optimised (Betts & Mahmoud, 1992:28).

6.3.2.2 Conclusion for production planning

Production planning is the core for any clothing production company. Production planning is a resource that requires trained managers and adequate communication between management and employees. Management requires formal training in production planning.

Management furthermore needs to be coherent in production planning, should decide on a standard and keep to the same production standard.

It is essential that production planning is communicated to employees. Employees need to be incorporated in production planning, and they should give their inputs as they have hands-on experience. As can be seen from the recommendations, there are different systems to calculate the production output. There are no right or wrong systems. Management should decide on the best system that suits the company's production needs and that would enhance the output. When production planning as a resource is optimised, production planning can minimise the utilisation of other resources. If production planning is utilised correctly, it will directly ensure the optimal utilisation of human resources, technology and material handling.

6.3.3 The results and implications of quality control in the optimisation of a clothing production system's utilisation of resources

Quality is defined as a perceived level of value. Using this concept, quality can be visualised as a range of intrinsic product characteristics and extrinsic quality cues, any combination of which may satisfy a particular customer (Glock & Kunz, 1995:228).

- **Negligence**

As observed in the interviews and questionnaires, there was some room for improvement in quality control. There were no effective quality control systems in place. Sewing machine operators sewed at their own pace, and worked according to what they perceived as good quality. If there were no set standards for quality control, the produced garments could be of an inferior quality, and would result in clothing garments being rejected. Quality control thus has a direct influence on cost. The quality aspects of a product relate to the degree to which products conform to previously agreed product characteristics (Van der Bij & Van Ekert, 1999:675). Product quality can be viewed from two different perspectives: by comparing a product to other similar products, or by comparing product characteristics to the company's standards and specifications (Glock & Kunz, 1995:228). This could give any production company a competitive edge (Loker, 2002:28).

- **Quality control points**

From the questionnaires it was clear that the only time a quality problem was noticed, was when it already was a problem and needed to be fixed. There were no formal checkpoints on the sewing floor, and no communication of what needed to be checked – as 58% of the employees stated that quality control was done too late. Sewing machine operators and cutting room operators thought that the despatch area should verify the quality of the product. Despatch was at the end of the production line. There definitely needed to be quality control points earlier on in the production line.

- **Quality control members**

The quality of the products also reflects the level of training of the employees. Sixty five per cent (65%) of employees stated that most of the unpicking occurred because of bad sewing or cutting that went wrong in the cutting room.

Quality checks were mostly done by the supervisors. The sewing machine operators were not actively involved. Management felt that there was not always time to check for quality in the sewing process. The sewing machine operator also blamed the cutting room for most quality flaws. They blamed it on bad quality material and cutting room planning that was not up to standard. The cutting room planning referred to the marker layout and the number of pattern pieces that needed to be cut, and the number per size.

Within the cutting room it was clear that not much attention was given to the number of layers that needed to be cut, and the sizes were not correctly checked. Bad quality material influenced the cutting, because some pattern pieces needed to be re-cut, due to flaws in the material and shading that differed. Shading differences occurred, e.g. when the loops for the trousers were cut from one roll and the front and back pattern pieces from another roll. This was not the norm and was solely due to bad quality material. There were complaints that the cutting room cut too slow, which could have been due to bad quality material, poor planning or equipment.

6.3.3.1 Quality standards

Quality standard control should include the following specifications: raw material specifications, processing specifications, plus packaging and shipping specifications (Solinger, 1980:503).

The first recommendation would be to get a quality control system in place. A quality control system consists of a system of tasks, methods and means, which the company can use to agree and maintain the product characteristics to the expectation of the customer (Van der Bij & Van Ekert, 1999:676). Process specification needs to be set and inspection plans need to be implemented:

- Firstly if the product or process technology has changed, extra time needs to be built in by means of inventories, the planning of a lower degree of capacity utilisation, or longer set-up time planning of a lower degree of capacity in the utilisation of the human resource. In the end, a plan needs to be in place to cut away with initial set-up time. This first suggestion goes hand in hand with production planning.
- If the process specifications have changed, for example, a suggestion would be that employees check their own work after each production step; a second suggestion in this regard would be to incorporate quality control stations. These stations could consist of a red overhanging arrow in the line, with a visual notice to what needs to be checked. An example would be a pocket that is reinforced in the corners. There can be one or two formal quality control stations within a line. At this formal quality control station it will the responsibility of a trained quality controller to do a quick quality check. The visuals need to be removable and must be replaced with new visuals whenever there is a style change. This will reinforce the importance of quality to the employees, and is cost-effective. Therefore time needs to be incorporated for this.

Management might perceive the reduction of capacity as a loss. This is where management needs to calculate the cost of cutting back on capacity versus the cost of cutting back on control, for example, the cost of time and money lost in rejected work.

The second suggestion would be to train every employee in quality checking. That needs to be done throughout production, before they start sewing their part of the garment. Management might perceive this as an enormous task to undertake. But when the task is divided amongst the supervisors, it is easily do-able. When the employees are holistically trained they will know in advance what to look out for when sewing their piece, and will work in a proactive manner.

Where the cutting room is concerned, material quality needs to be upgraded; if not, more production time will be lost, due to re-cutting pattern pieces, even if the cost per running metre might be higher. The second suggestion for the cutting room would be that the marker

and the amount of layers need to be confirmed by a supervisor before cutting takes place. With such a control point within the system, wrongly cut pattern pieces might be eliminated.

Lastly, communication plays a critical role within quality control. The lack of communication between management and the cutting room, and management and the sewing floor, is a matter of great concern. If these parties could communicate in a day's work, some of the unnecessary cutting could be reduced.

6.3.3.2 Quality control: conclusion

Quality of the final product is a direct result of the training that the operator received. As mentioned above, with training and experience, the quality of the product improves and mistakes due to a lack of knowledge will be fewer. Production and quality control are regarded as two controlling points that have a direct influence on quality (Van der Bij & Van Ekert, 1999:674). Production and quality control are the two aspects that have a direct influence on the competitiveness of a company. Given that humans will remain an integral part of the industrial system, in integration with technology, it is clear that ergonomics as an operational resource also has an influence on the quality of the product. As was pointed out, if lighting is a problem for sewing machine operators, mistakes will occur – and they did. The third resource that had a direct influence on quality control is technology. If the technology that was used, e.g. a sewing machine, was not in good working condition, then the product will be of inferior quality. These three resources have a direct influence on quality control. The other resources within the conceptual framework had an influence, although to a lesser extent.

The influence of quality control on the transformation process had an effect on time, and cost. If the quality was not up to standard, and the product needed to be unpicked, this could have an influence on time as well as cost. The product often needed to be re-cut, which did not only had an effect on time, but the cost of the product escalated. Because of the time and cost factor, quality control was not optimised.

6.3.4 Conclusion to operational resources

The three operational resources (ergonomic, production planning and quality control) all had a direct relation on one another. Operational resources can however not operate without human resource input. The two main factors that needed to be in place are planning and

communication. A formal system for production planning and quality control will optimise human resource utilisation.

6.4 OBJECTIVE 3: IMPLICATIONS, RECOMMENDATIONS AND CONCLUSIONS

Objective 3: To explore and describe the role that *physical resources (technology, production system* and *material handling)* play in the optimisation of a clothing production system's utilisation of resources from management's and the employees' perspectives. Physical resources can be classified as the physicality's that are available for the employees to use to transform the raw materials into a wearable garment. Physical resources on their own cannot be utilised if human resources and operational resources are not present. The results, implications and recommendations to optimisation of physical resources in the production company are now discussed.

6.4.1 Results and implications of technology in the optimisation of a clothing production system's utilisation of resources

Using correct technology helps to reduce labour costs, can improve productivity and lower associated production costs (Lin, Kincade & Warfield, 1994:20). This is helpful as clothing manufacturing has high input costs regarding labour, but technology can help reduce labour costs.

From the interviews, technology was classified as a capital investment. The technology investment, cost-employment and maintenance of equipment were factors that were discussed.

- **Technology investments**

The technology adoption level was an issue for management; they considered both the installation cost and the utilisation of new technology by employees. The management's point of view was that there were not enough funds to provide for new technology.

- **Cost – employment**

Management also commented that new advanced technology did not always provide the solution. If, for example, a laser cutter were to be implemented in the cutting room, instead of

the electrical manual cutters, those employees would be out of a job, because the new invested technology will do the work of the employees. Not only will the employees be out of a job, the cutting room will be in use for two working days in a week only; this is not efficient utilisation of space and human resources. Thus the utilisation of the laser cutter does not justify the capital cost investment. This is only one example of many such technology investments.

- **Maintenance of equipment**

Sewing machines were between ten and twenty years old. New sewing machines may perform more sufficiently if machine breakage time is taken into consideration. Sixty per cent (60%) of the sewing machine operators did find machine breakages a recurring problem.

Management needs to find the reason behind machine breakages. Cutting blades need attention as they did not perform at their full potential. This might have been because cutting blades were blunt and were misused by the operators. The cutting blades needed sharpening or the employees needed training on how to use the blades properly. The lack of maintenance of equipment, as previously mentioned, also contributed to machine breakages.

6.4.1.1 Technology: recommendations

The apparel industry has been a mass production industry with a limited focus on the use of technology. The industry runs on three basic operations, namely: cutting, stitching and pressing/finishing (Varukolu & Park-Poaps, 2009:203). The first issue that needs to be addressed is the optimisation of the sewing machine settings. This is and will always be one of the most important requirements for the textile and garment industry (Stylios & Sotomi, 1996:44). The quality of the constructed garment is directly related to this. The correct setting of the machinery will result in a balanced stitch, without seam puckering or seam slippage. Factors that influence machine settings and that need to be taken into account by the person setting the machines, are the fabric thickness, fabric compression, fabric bending, fabric yarn and tensile strength (Stylios & Sotomi, 1996:44). There are levels of variables that are available to assist machinists. This issue also has a direct influence on the production output of the company.

A flexible clothing production system uses technology that is controlled by a skilled and flexible workforce. A company accomplishes flexibility and ultimately compatibility by using technology. With up-to-date technology, different products can be produced in a short period

of time. Better technology might in the long run include different computer software ranges (Loker, 2002:26). For the purposes of the study and this resource, it is advisable to determine when new technology is applicable and when not, because new technology is costly and may put employees out of a job.

The sewing machines of this company were not maintained in a good working condition. Breakages might have been because of employee misuse or because the machines were outdated. Systematically replacing the machines is a recommendation that will affect costs; however, it might save the production time regularly lost. The next solution will then be to invest in maintaining the sewing machines; this also has an effect on costs, but does not demand the same amount of capital output as new machines. Still, new machines might be the solution in the long run. Maintenance of production units has a great bearing on the quality and the quantity of production (Duffuaa & Ben-Daya, 1994:37). A suggestion that is made is to overhaul a group of machinery together, instead of individual minor overhauls. This would result in the saving of the set-up cost.

6.4.1.2 Conclusion to technology

Technology is the means that human resources use to be able to transform raw material into wearable garments. Technology does have a direct influence on the transformation process and in the end on productivity. To acquire a global perspective of where technology fits into the whole spectrum, the influence of technology on the system should be analysed as well as the effect of other resources within the system on technology. If the technology that is used by the system is optimised, it will have a direct effect on other resources within the production system.

If human resources are not trained and capable to use the given technology, then the technology is not utilised efficiently and does not benefit the production output of the system. Production planning, ergonomics, production system and material handling are all planned based on the technology provided. Thus all these resources have an effect on technology. Technology that is not maintained does have an effect on the quality of the product produced. In the end technology is interrelated to all the resources used within the system.

6.4.2 Results and implications for the role that the production system plays in the optimisation of a clothing production system's utilisation of resources

In the interviews, management compared production to a bundle production system. Bundles of material were grouped together and then stitched according to the sew-bar ticket on each panel. Smaller pattern pieces were produced first, followed by the assembly of the rest of the garment. The lining was stitched together as one garment, and at the same time the fabric garment was stitched together. Nearing the end of production, the lining and fabric garments were then matched and stitched and constructed into one garment. This provided an overview of production and material flow within the factory. As an operator performed one performance only in a bundle system, bottlenecks did occur. Sixty per cent (60%) of the sewing machine operators were waiting for work from the cutting room. This resulted in those sewing machine operators being idle, i.e. not utilised as a resource in that point in time. This might be due to material flow within the production line or production layout, as 54.6% of sewing machine operators complained that the machine layout was not adequate.

6.4.2.1 Recommendations for production system in the optimisation of a clothing production system's utilisation of resources

Line management is under constant pressure to shorten the operation time, as productivity, production capacity and cost of each clothing item depend on it. As clothing companies adopted new, innovative ways to manufacture, and as customer demands increased, any improvements to the assembly process within the company will be welcomed and should result in a more positive output.

The plant layout forms the basis of any clothing manufacturing company's production planning. Plant layout procedures determine how to arrange the various sewing machines and departments to achieve optimal output (Djassemi, 2007:281). There are two recommendations regarding plant layout. The first, the distance between departments can be closer together; the larger the amount of material flow between departments, the closer they need to be, and this could minimise the total handling of material. The second suggestion is to utilise the overhead space between production lines. By not utilising overhead space, the development of the plant layout within the company may result in a plant layout that would perform below its optimum level. An overhead transport system for material bundles could facilitate the operator holding material bundles in transit, and secondly the overhead space could balance the workload between departments (Djassemi, 2007:283).

6.4.2.2 Conclusion for production system.

Production output will benefit if management were to maintain the machinery better, implement an effective production layout, and optimise material flow (See material handling 6.4.3). When the production layout is effective, the sewing machines as well as the human resources are utilised more effectively.

6.4.3 Results and implications for the role that the material handling play in the optimisation of a clothing production system's utilisation of resources

From the discussions and results material handling incorporated material flow and the material itself. The material itself sometimes caused bottlenecks as shrinkage occurred. This resulted in duplication of work within the cutting room as the same pattern piece needed to be cut more than once. The result was time wasted and costs increased through time and material wastage.

Employees (77.3%) stated that often the material was difficult to sew. This might be due to equipment or poorly trained workers. More than half of the employees stated that they ran out of material. This had a direct influence on human resource utilisation as well as equipment utilisation.

During the interviews, respondents explained that bundle pieces were transported manually; no mechanical transport system was in place. This sometimes resulted in pattern pieces being misplaced and wrongly matched, thus resulting in re-cutting of pattern pieces.

6.4.3.1 Recommendations for material handling in the optimisation of a clothing production system's utilisation of resources

As the company is classified as a 'Cut Make and Trim' company, customers buy material and deliver it to the factory; thus management does not control the quality of the material purchased. Management can do a shrink test on the material before production and plan for percentage shrinkage in the designing stage.

The only way to improve material handling is to train employees in how to sew difficult materials and have the correct equipment to accompany the material, such as the correct needle size en yarn size and make.

In terms of production output, the material flow should have the capability to enable the production line to handle work bundles in an effective way, complying with general requirements; dynamic re-routing should be possible, real-time changes should be allowed in

production volume, simultaneous assembly of different products should be permitted, the production system should cope with unplanned events, and the transportation time of bundles should be minimised (Ho & Ranky, 1995:15). Production output and production planning can be advanced by using proper material handling equipment, providing effective utilisation of human resources, and improving system flexibility (Chan, 2002:58). As discussed previously a overhead transport system would be ideal.

6.5 CONCLUSION

The resources in this factory have a definite interrelationship with one another. Thus the optimisation of each resource individually contributes to a more effective production output overall.

Human resources are the core and heartbeat of any production company. Employees' needs, employees' satisfaction and training, and communication and feedback play a crucial role. Resources that have a direct relation to human resources are performance appraisal, motivation, training and ergonomics. Optimum training is facilitated by motivating workers. Performance appraisal is directly influenced by training as management trains employees through a performance appraisal system. When the trained employees know how to operate their equipment effectively it contributes to ergonomic posture and the optimum usage of equipment. Thus all four of these resources are closely interrelated on many levels.

The next group of resources, namely technology, production planning, material handling and production system used, are all related to ergonomics and indirectly related to the other human resources mentioned. Production planning includes and incorporates material handling, the production system used for the specific garment. Production planning and the production system used determine technology usage within the systems, e.g. the number of machines and the type of machines used.

Quality control is incorporated into all the resources within the company and plays a role within the use of every one of the above-mentioned resources. Human resources implement quality control in their work on hand, which is facilitated by technology, production planning, material handling and the production system used.

The following figure provides a visual understanding of the interrelationship of the resources within the company and of the effect of the optimum utilisation of these resources. The figure is a culmination of all the aspects of the study.

Recommendations for other studies could be to experiment on these resources within a specific case, so as to measure the input of one resource on the output of another and determine the relationship to one another.

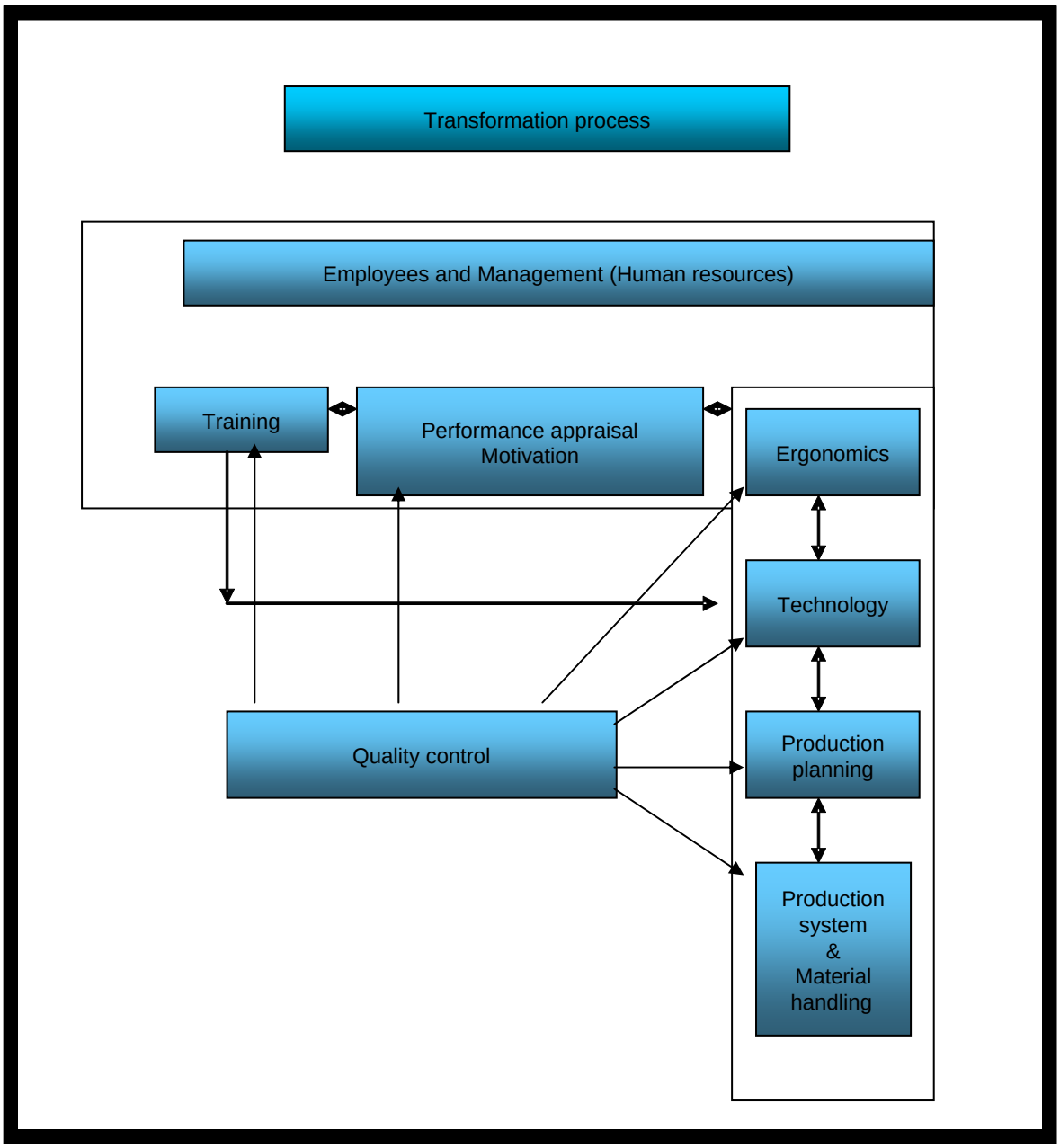

FIGURE 6.2: IN CONCLUSION: THE INTERRELATION OF RESOURCES

In conclusion, Figure 6.2 represents the interrelationship between the company's different resources. This figure is a revision of the conceptual framework in Chapter 3. Employees and management also referred to as human resources, work together as a unit, alongside one another. This is the ideal toward facilitating communication and feedback. Furthermore training, performance appraisal, motivation and ergonomics are all resources placed on the same level as human resources, because they each have a direct relation to one another. All these resources are interrelated and interdependent, and cannot work separately from one another.

Ergonomics, technology, production planning, production system and material handling are all resources that are not directly related to human resources, but are indirectly related. However, these resources do have a direct relation to one another and cannot be separated. Production planning and material handling are also placed in the same section, because of their interrelatedness to one another.

Quality control is placed in the centre of the figure and represents the core of any production company; it has a direct relation to all the other resources.

An investigation of a single resource would therefore not have reflected a true scenario in terms of strengths and shortcomings that could be attended to, to improve the outputs of a clothing production system. This study revealed the pertinence of all of the resources in terms of the success of a clothing production system but clearly indicated that failure to control one resource could jeopardise the entire system unless other resources are able to compensate for such shortcomings. In this particular study the potential role of human resources in terms of the success of a clothing production system was confirmed. Although not conducive in the long term, when properly trained and well-treated, employees could be motivated to overcome frustrations caused by poor working conditions created by poor ergonomic features and dated machinery. The hierarchy of resources and the interactive contribution of resources towards the output of the system should therefore be understood and acknowledged by management in order to succeed and to survive in a cut throat industry.

REFERENCES

AHASAN, R. & IMBEAU, D. 2003. Social-technical and ergonomic aspects of industrial technologies. *Work study*, 52(2):68.

APPELBAUM, S.H., NADEAH, D. & CYR, M. 2008. Performance evaluation in a matrix organization: a case study. *Industrial and Commercial Training*, 40(6):295.

BABBIE, E. & MOUTON, J. 2003. *The practice of social research.* South African edition. Cape Town: Oxford University Press.

BERGE, Z.L. 2008. Why it is so hard to evaluate training in the workplace? *Industrial and Commercial Training*, 40(7):390.

BETTS, J. & MAHMOUD, K.I. 1992. Assembly line balancing in the clothing industry allowing for varying skills of operatives. *International Journal of Clothing Science and Technology,* 4(4):28.

BHEDA, R., NARAG, A.S. & SINGLA, M.L. 2003. Apparel manufacturing: a strategy for productivity improvement. *Journal of Fashion Marketing and Management,* 7(1):12.

BOSS, P.G., DOHERTY, W.J., LAROSSA, R., SCHUMM, W.R. & STEINMETZ, S.K. 1993. *Sourcebook of family theories and methods: a contextual approach.* New York: Plenum.

BOWER, M.R. & ARGARWAL, A. 1993. Hierarchical production planning: scheduling in the apparel industry. *International Journal of Clothing Science and Technology,* 5(3):36.

BROWN, P. & RICE, J. 1991. *Ready-To-Wear Apparel Analysis*. Second edition. New Jersey: Merril.

BURNS, L.D. & BRYANT, N.O. 1997. *The business of fashion. (Designing, manufacturing and marketing)*. New York: Fairchild.

Business report. [WWW document – 15/1/2005]. URL http://www.businessreport.co.za/index.php

CAMPBELL, C.P. 1994. A Primer on Determining the Cost-Effectiveness of Training – Part 1. *Industrial and Commercial Training*, 26(11):32.

CAMPBELL, C.P. 1995. A Primer on Determining the Cost-Effectiveness of Training – Part 2. *Industrial and Commercial Training,* 27(1):17.

CARR, H. & LATHAM, B. 1988. *The technology of clothing manufacturing.* Oxford: Blackwell.

CHAN, F.T.S. 2002. Design of material handling equipment selection system: and integration of expert system with analytic hierarchy process approach. *Integrated Manufacturing Systems*, 13(1):58.

CHEN, F.F. 1998. Communication, Flexible production systems for the apparel and metal-working industries: a contrast study on technologies and contributions. *International Journal of Clothing, Science and Technology*, 10(1):11.

CLOTHING FEDERATION OF SOUTH AFRICA [WWW document – 08/06/2001]. URL http://www.clofed.co.za/productdir.htm

DAHLGAARD, J.J., KRISTENSEN, K., KANJI, G.K., JUHL, H.J. & SOHAL, A.S. 1998. Quality management practices: A comparative study between East and West. *International Journal of Quality & Reliability Management*, 15(8/9):772.

DE BEER, A.A., KRITZINGER, A.A.C., VENTER, C.H., STEYN, J.M.C., LABUSCHAGNE, M., FERREIRA, E.J. *et al*. 1997. *Management of a small business*. Pretoria: Juta & Co Ltd.

DE VOS, A.S. 1998. *Research at grass roots*. Pretoria: JL van Schaik Publishers.

DELLER, K.A. 1998. Human resource plan. In *Entrepreneurship: starting your own business.* Edited by J Kroon. Pretoria: Kagiso, p 129-138.

DELPORT, C.S.L. & ROESTENBURG, W.J.H. 2011. Quantitative data-collection methods: questionnaires, checklists, structured observation and structured ineterview schedules. *Research at grass roots. For the social sciences and human service professions*. Edited by A.S. De Vos, H Strysom, C.B. Fouche & C.S.L. Delport. 4th ed. Pretoria. Van Schaik. p. 171-205

DILLARD, B.G. & SCHWAGER, T.F. 1997. Ergonomic equipment investments: benefits to apparel manufacturing. *International Journal of Clothing Science and Technology*, 9(4):285.

DJASSEMI, M. 2007. Improving factory layout under a mixed floor and overhead material handling condition. *Journal of Manufacturing Technology Management*, 18(3):281.

DOBILAITE, V. & JUCIENE, M. 2006. The influence of mechanical properties of sewing threads on seam pucker. *International Journal of Clothing Science and Technology,* 18(5):335.

DUFFUAA, S.O. & BEN-DAYA, M. 1994. An extended model for the Joint Overhaul Scheduling Problem. *International Journal of Operations & Production Management,* 14(7):37.

DUNNE, N. 2000. *Understanding the South African clothing manufacturing sector from the perspective of leading South African clothing retailers*. Industrial restructuring project school of development studies (incorporating CSDS). University of Natal.

FAKUDE, G. 2000. *Informalisation in Kwazulu-Natal's clothing sector*. Research report No. 37. University of Natal. Industrial Restructuring Project School of Development Studies (SDS).

FOUCHE, C.B. & BARTLEY, A. Quantitative data analysis and interpretation. *Research at grass roots*. *For the social sciences and human service professions*. Edited by A.S. De Vos, H. Strysom, C.B. Fouche, C.S.L. Delport. 4th ed. Pretoria. Van Schaik, p. 248-276.

GALER, I.A.R. 1987. *Applied ergonomics handbook*. London: Butterworths.

GERBER, P.D., NEL, P.S. & VAN DYK, P.S. 1998. *Menslike hulpbronbestuur.* Kaapstad: International Thomas.

GERMANOVA-KRASTEVA, D. & PETROV, H. 2008. Investigation on the seam's quality by sewing of light fabrics. *International Journal of Clothing Science and Technology*, 20(1):57.

GLOCK, R.E. & KUNZ, G.I. 1995. *Apparel manufacturing: sewn product analysis.* New Jersey: Prentice-Hall.

GREEFF, M. 2011. Information collection: interviewing. In *Research at grass roots. For the social sciences and human service professions*. Edited by A.S. De Vos, H. Strydom, C.B. Fouche & C.S.L. Delport, 4th ed. Pretoria. Van Scaik. p. 341-375.

GUNESOGLU, S. & MERIC, B. 2006. The analysis of personnel and delay allowances using work sampling technique in the sewing room of a clothing manufacturer. *International Journal of Clothing Science and Technology,* 19(2):145.

HAMMERSLEY, M. & ATKINSON, P. 1995. *Ethnography.* 2nd edition. London: Routledge.

HELANDER, M. 2006. *A guide to human factors and ergonomics*. 2nd edition. London: Taylor & Francis Group.

HENNING, E. 2004. *Finding your way in qualitative research.* Pretoria: Van Schaik.

HINZELMAN, J. & SMALLWOOD, J. 2004. Declining and lack of motivation among site managers: medium-sized contractors perceptions. In: Root, D., Massyn, M. & Shakantu, W. (Eds.). *2nd Postgraduate conference on construction industry development proceedings, Cape Town*, 10-12 October 2004, pp. 36-46.

HO, J.K.L. & RANKY, P.G. 1995. An object-oriented and flexible material handling system. *Assembly automation*, 15(3):15.

HOFFMAN, J.R. & ROGELBERG, S.G. 1998. A guide to team incentive systems. *Team Performance Management*, 4(1):22.

HONG, J.C., YANG, S., WANG, L., CHIOU, E., SUN, F. & HUANG, T. 1995. Impact of employee benefits on work motivation and productivity. *The International Journal of Career Management*, 7(6):10.

HUBERMAN, A.M. & MILES, M.B. 1994. *Qualitative data analysis.* London: Sage Publications.

KAPLAN, D. 2004. Manufacturing in South Africa over the last decade: a review of industrial performances and policy. *Development South Africa*, 21(4):8.

KAPLINSKY, R., MORRIS, M. & BESSANT, J. 2001. Developing capability through learning networks. *International Journal of Technology Management and Sustainable Development*, 2(1):19.

KARWOWSKI, W. & SALVENDY, G. 1998. *Ergonomics in Manufacturing: Raising Productivity Through Workplace Improvement*. Georgia: Engineering & Management Press.

KAST, F.E. & ROSENZWEIG, J.E. 1972. General Systems Theory: Applications for organization and Management. *The academy of Management Journal,* 15(4):447.

KATZ, D. & KAHN, R.L. 1966. *Organisations and the system concept – Classics of Organisations theory*: Thomas Learning.

KORSTEN, A.D. 2002. Developing a Training plan to ensure employees keep up with the dynamics of facility management. *Journal of Facilities Management*, 1(4):365.

KRESSLER, H. 2003. *Motivate and Reward: performance appraisal and incentive systems for business success.* New York: Palgrave Macmillan.

KVALE, S. (1996). *Interviews: An introduction to qualitative research interviewing*. Thousand oaks. C.A.: Sage.

LEEDY, P.D. & ORMROD, J.E. 2001. *Practical Research Planning and Designing*. New Jersey: Merrill-Prentice Hall.

LIN, M. 2008. The single row machine layout problems in apparel manufacturing by hierarchical order-based genetic algorithm. *International Journal of Clothing Science and Technology*, 21(1):31.

LIN, S., MOORE, M., KINCADE, D.H. & AVERY, C. 2002 Dimensions of apparel manufacturing strategy and production management. *International Journal of Clothing Science and Technology*, 14(1):46.

LIN, S.H., KINCADE, D.H. & WARFIELD, C. 1994. Productivity and production in the apparel industry. *Bobbin*, 25(5):20.

LINCOLN, Y.S. & GUBA, E.G. 1985. *Naturalistic inquiry*. Newbury park, CA: Sage publications.

LOKER, S. 2002. People and technology management in flexible manufacturing: An apparel industry case study. *Clothing and Textile Research Journal,* 20(1):26.

MAREE, K. 2007. *First steps in Research.* Pretoria: Van Schaik Publishers.

MARSHALL, A. & ROSSMAN, G.B. 2006. *Designing Qualitative Research*. London: Sage Publications.

MATSUMARU, R., KIJIMA, K., NAKANO, B. & TAKAHASI, S. 2003. An analysis of an incentive problem considering non-monetary utility. *Kybernetes*, 32(4):511.

MCLEOD, W.T. 1984. *The Collins Thesaurus.* London: Guild Publishing.

MEYERS, F.E. 1993. *Plant Layout and Material Handling*. New Jersey: Prentice- Hall Regents.

MILES, M.B. & HUBERMAN, A.M. 1994. Qualitative data analysis. 2nd edition. Thousand Oaks: Sage.

MOODLEY, S., MORRIS, M. & BARNES J. 2001. *Unlocking Value in the "New Economy": The Implications of the B2B E-Commerce for South-African Apparel and Automotive Component Firms.* Thesis. University of Natal. Durban.

MORRIS, M., BARNES, J. & DUNNE, N.1997. *Globalisation and the restructuring of Durban's industry*. Working paper No.18. Waar?

MORROW, T. 2001. Training and development in the Northern Ireland clothing industry. *Journal of European Industrial Training*, 25(2/3/4):80.

MOUTON, J. 1998. *Understanding social research.* Pretoria: Van Schaik.

NEMETH, C.P. 2004. *Human Factors Methods for Design: Making Systems Human-Centered*. London: CRC Press.

NORDAS, H.K. 1996. South African manufacturing industries catching up or falling behind? *The Journal of Development Studies,* 32(5):715.

OLIVER, B.A., KINCADE, D.H. & ALBRECHT, D. 1994. Comparison of apparel production systems. *Clothing and Textile Research Journal,* 12:45.

PATRICK HUE, C.L., FRENCY, H.G. & CHAN K, C.C. 2000. A study of the roll planning of fabric spreading using genetic algorithms. *International Journal of Clothing Science and Technology*, 12(1):50.

PATTON, M.Q. 2002. *Qualitative research and evaluation methods*. 3rd ed. Thousand Oaks, CA: Sage.

PRAGMA AFRICA [WWW document – 27/04/2005]. URL http://www.pragmaworld.net/about/pragma-africa.php

PRIDE, W.M. & FERREL, O.C. 1993. *Marketing*. London Penguin books.

Race, gender, and anticommunism in the International Labor Movement: The Pan-African connections of Maida Springer. *Journal of Woman's History*, 11(2):35.

REEVE, R.C. 1994. Investing in training. *World class design to manufacture*, 1(1):30.

ROGALE, D.R., DRAGCEVIC, Z. & HURAS, A. 2001. The impact of auxiliary devices on sewing machines upon processing parameters of sewing operations. *International Journal of Clothing Science and Technology*, 13(3/4):251.

ROTH, W.F. 1992. *A systems approach to quality improvement*. New York: Preager Publishers.

ROWAN, M.P. & WRIGHT, P.C. 1994. Ergonomics is good for business. *Work Study*, 43(8):9.

RUBEN , A & BABBIE, E. 2005. Research methods for social work. 5th ed. Australia. Thomason books/Cole.

SALINGER, B.L., BHORAT, H., FLAHERTY, D.P. & KESWELL, M. 1999. *Promoting the Competitiveness of Textiles and Clothing Manufacture in South Africa.* Research Report. Office of Sustainable Development. Washington.

SCHURINK, W., FOUCHE, C.B. & DE VOS, A.S. 2011. Qualitative data analysis and interpretation. In *Research at grass roots. For the social sciences and human service professions*. Edited by A.S. De Vos, H. Strydom, C.B. Fouche & C.S.L. Delport, 4th ed. Pretoria. Van Scaik. p. 341-375.

SCHWANDT, T.A. 2007. The dictionary of qualitative research, 3rd ed. Thousand Oaks. CA: SAGE.

SOLINGER, J. 1980. *Apparel manufacturing handbook: analysis, principles and practice.* New York: Litton Educational.

SPEARS, M.C. & GREGOIRE, M.B. 2004. *Foodservice organizations: a managerial and systems approach*. 5th ed. New York: Pearson.

SPEARS, M.C. & PARKER, D.F. 2002. A profit analysis of the impact of training on performance appraisal satisfaction. *American Business Review,* 20(2):12.

SPEARS, M.C. & VADEN, A.G. 1985. *Foodservice organizations: a managerial and systems approach*. New York: McMillan.

SPROLES, G.B. & BURNS, L.D. 1994. *Changing appearances. Understanding dress in contemporary society.* New York: Fairchild.

Statement by COSATU and SACTAWU. [WWW document – 15/1/2005]. URL http://www.nedlac.org.za/docs/pr/2003/pr0807a.html

STYLIOS, G. & SOTOMI, J.O. 1996. Thinking sewing machines for intelligent garment manufacture. *International Journal of Clothing and Technology*, 8(1/2).

TAI, W. 2006. Effects of training framing, general self-efficacy and training motivation on trainees' training effectiveness. *Personal Review*, 35(1):53.

TRUETT, J. & TRUETT, D.B. 2008. *The South African textile industry: Challenges and opportunities.* The University of Texas at San Antonio, College of Business.

TUNCEL, S., GENAIDY A., SHELL, R., SALEM, S., KARWOWSKI, W., DARWISH, M. *et al*. 2008. Research to practice: effectiveness of controlled workplace interventions to reduce musculoskeletal disorders in the manufacturing environment – critical appraisal and meta-analysis. *Human Factors and Ergonomics in Manufacturing*, 18(2):93.

VAN DER BIJ, H. & VAN EKERT, J.H.W. 1999. Interaction between production control and quality control. *International Journal of Operations & Production management,* 19(7):674.

VARUKOLU, V. & PARK-POAPS, H. 2009. Technology Adoption by Apparel Manufacturers in Tirupur town, India. *Journal of Fashion Marketing and Management,* 13(2):203.

VISSER, K. 1998. *The export and growth potential of small and medium-sized enterprises in the clothing industry*. Centre of African Studies. University of Edinburgh.

VLOK, E. 2006. The textile and clothing Industry in South Africa. http://library.fes.de/pdf-files/iez/03796/16suedafrika.pdf. In Jauch, H. & Rudolph, T. *The future of the textile and clothing industry in Sub-Saharan Africa.* Bonn: Friedric-Ebert-Stiftung.

WADUD, I.K.M & NAIR, M. 2003. Impact of liberalisation on the competitiveness of the Australian clothing industry. *International Journal of Management,* 20(3):325.

WATKINS, J.A. 2000. *A Structured Systems Approach to Model Conceptualisation: An Executive Management Perspective*. Unpublished doctoral thesis. University of Pretoria. Pretoria.

WICKHAM, P.A. 2004. *Strategic entrepreneurship*. London: Prentice-Hall.

WOODFORD, K. & MAES, J.D. 2002. Employee Performance Evaluations: Administering and Writing them correctly in the multi-national setting. *Equal Opportunities International*, 21(4):1.

YEH, C. 2000. A customer-focused Planning Approach to Make to-order Production. *Industrial Management & Data Systems,* 100(4):184.

YIN, R.K. 2003. *Case Study Research, Design and methodology*. London: Sage Publications.

ADDENDUM A

DATA ANALYSIS

OBJECTIVE		DATA	
Human resources			CONCLUSIONS
• Performance appraisal			
TRAINING • Type	A	Q: Training? Can you tell me more about the training that you provide to workers? A: When they employ new people they ask them what they can do. Most of the people start off with straight stitching, and from there the line managers take over and tell them what to do. Then she is basically trained in this way.	-Mainly in the line training new recruitments. -Do not have much time to spend with training -
	C	Q: When new people come in do you train them? Are there regularly new people coming in or is it only old workers that you train? A: Look, you know what, we are talking about 150 people working here. When we get busy we only try to re-employ the people that are already experienced. At least, that's how we work. So what we do, we give them an easy job to start, and after a few months, if they can handle the machine, we put them in a proper job, you know.	- Teach basics to sewing machine operators but do not explain further – for example problem management early fault detection New sewing machine operators are trained in line - -
	D	Q: Neteni, how did you learn how to sew? A: When I came here no one trained us. Q: Okay, so who trained you to sew a jacket? I learned from school. All training that I have received here was on the job training. While I was working they have trained me. Q: Tell me, if you receive training, is it enough? Do you want more training in the factory? They teach us well, but there are certain things that they can teach us that we do not know about, like in the production, how can we get the quality better for example, because then we can do our job better. Q: Please tell me, when you came here, did you start to work as a supervisor? A: No I started working on the machine, and then they send me on a course to become a supervisor. I had worked only two years in the factory and then they sent me on a course.	Supervisors were sent on a course -Supervisors in the same job for 16 years thus received formal training 16 years ago. Supervisors do not start off as supervisor; they work their way up to become supervisors. -Want to establish training school, currently no funds -Line managers do most of the training – in line training.
	F	Q: Who teach the people? A: I teach them, it's my job, it's my job to teach them, get production, make sure that the machines are alright. Q: And do think, if they get better training they will be more …? A: Skilled, more skilled. We are currently trying to teach them in the line, because we have not got any other space to train them; we are fighting for space at the moment. But in the clothing industry it is tough out there. We are fighting and we are surviving. Q: Do you pay a skills development levy (SDL) to the government? Because I know they can also do training programmes for you. A: Ja, that is what I know my boss is currently fighting for. I want to get a training school up and running together with the government, and for the training school we need to have space. So I think that will be good. At the moment he is busy with it. And my problem is not always training the people, because I train them myself. Like when I get a style I must know exactly what to do, and every step of the trousers, that's my responsibility. A: I teach them, it's my job, it's my job to teach them, get production, make sure that the machines are alright.	
• Frequency	A	Q: Do they teach they as time goes by? A: Yes.	
	B	Q: Tell me, when you get new people in the cutting room, do you train them or how do they learn how to cut? A: I will train them, but up until this point in time we never got somebody new. Since I got here the same people have been working here.	Trained as a training need occurs, do not have fixed training schedule.
• Employees Knowledge	B	2 Q: And the people that work in the cutting room, do they know what to check for? To make sure everything runs smoothly? A: People are used to do things for 10 – 15 years, and when you come up with new techniques they do not always want to implement the new ideas. If they teach	Knowledge basic, but no in-depth knowledge, for example, how to sew a garment. Need – to train more intensely – e.g. how to fix a

OBJECTIVE		DATA	
Human resources			CONCLUSIONS
		us what is the right way and the wrong way, it will help us not to make mistakes in the future.	problem.
	C	Q: How do they know that? Do you explain it to them? A: Well, we got a constitution here in the factory, so when we employ somebody new, we tell them what they are supposed to do and not supposed to do.	Employees are told what to do when they are employed
	D	Q: Do you think you can get better training, and how can they train you better? A: They can teach us, like for example, the lining, the lining must fit in the jacket, and then it does not always fit well, we just make it fit as we know well, but they must teach us how to properly fit the lining. Q: And you, (different person), what can you add regarding training? A: If they teach us what is the right way and the wrong way, it will help us not to make mistakes in the production, like for example, if the marker is wrong we cut the cloth from the marker, but we do not know that the marker is wrong, so if they teach us a little more about the marker, we will not make the mistake to cut in the first place. Because you know what happens in this factory, nè, like for example, they make a mistake in the computer room, so if they make a mistake there, the whole factory goes wrong, and then they tell us to make a plan, but how can we make a plan if we do not know enough?	
	E	Q: Are you now having more comebacks from the customers since there is nobody to do a quality check in the cutting room? A: Previously we had a white lady doing that job, now the customer sends it back, and they blame us, but we do not really know what to do. Yes we do. We got the big board there by the tea room. They know what they are supposed to do and what they can do, you know. They know for example they can not go and cut an electrical wire.	
	F	Q: Are you open on Friday next week? Because I want to work with them. A: You know what? These people are very difficult to work with, but once they trust you, you can work with them. They are used to one operation, but some of them are very multi-skilled. They do various operations on trousers. Some of them know skirts. Q: And also if they are multi- skilled, do they have a more holistic view of what is going on? A: I tell you, I can take one of them out, and they will not know how to sew a pair of trousers completely. They only know the job that they are supposed to do. But tell them to sew a pair of trousers, and they can't. Q: And don't you think, if they are multi-skilled, when they make a mistake in their own operation, they will know what is the influence at the end of the line? A: That's it. If they make a mistake they must know what's the consequence at the end. Now you get that they do only one operation and they still make mistakes from the operation when they sew it – operations that they are doing, they have been doing for 10-15 years – but they still make mistakes. So you got to check them and watch them as to what they are doing. That's why I am trying to multi-skill them, that's why even when I leave here one day they must be able to work on every machine. That is why I am trying to get them in a multi-skilled factory, you must try and multi-skill your people. Because when one person is absent they must be able to shift and change around. Q: And also, if they are multi-skilled, they have a more holistic view of what is going on. A: I tell you, I can take one of them out they will not know how to sew a pair of trousers completely. They only know the job that they are supposed to do. But tell them to sew a pair of trousers, and they can't. Q: And don't you think, if they are multi-skilled, when they make a mistake in their own operation, they will know what is	People must be trained to be multi-skilled, because they do not have a holistic view of the work. People need to be checked – overcome this with more intensive (and holistic) training. Space is a limitation for training – according to management. People have 10-15 years; they do not always want to implement their own ideas.

OBJECTIVE		DATA	
Human resources			CONCLUSIONS
		the influence at the end of the line? A: That's it. If they make a mistake they must know what's the consequence at the end. Now you get that they do only one operation and they still make mistakes from the operation when they sew it – operations that they are doing, they have been doing for 10-15 years – but they still make mistakes. So you got to check them and watch them as to what they are doing. That's why I am trying to multi-skill them, that's why even when I leave here one day they must be able to work on every machine. Q: And do you think, if they get better training they will be more … A: Skilled, more skilled. We are currently trying to teach them in the line, because we have not got any other space to train them; we are fighting for space at the moment. But in the clothing industry it is tough out there. We are fighting and we are surviving. Q: Do you pay a skills development levy (SDL) to the government? Because I know they can also do training programmes for you. A: Ja, that is what I know my boss is currently fighting for. I want to get a training school up and running together with the government, and for the training school we need to have space. So I think that will be good. At the moment he is busy with it. And my problem is not always training the people, because I train them myself. Like when I get a style I must know exactly what to do, and every step of the trousers, that's my responsibility. I can sew on every machine. I can cut for you…	
Overview on training		*Respondents A + B not really participating in training discussion because do not have much experience in training people.* *Supervisor sees the need for more holistic training. Respondents C + F are closely involved in training.* *Line managers more involved than supervisors. Management does not see the need for holistic training, but employees do. Management regards funds, space and time as limitations in respect of training.* *One answer to training problems will be to introduce a training consultant to introduce training workshops, and in-house training. This will take the load off the production managers*.	
MOTIVATION • Incentives	A	Q: What can you tell me about motivation, and how management motivates the workers to work harder? A: What we sometimes do to get an order finished, we buy the workers a coke basically out of our pockets. Otherwise they just get their normal payment, and we just have to push them as hard as we can.	One incentive that has been used is to buy coke.
	B	Q: And is it going to happen or not? A: I think it is going to happen, because people like this are motivated more when money is involved.	
	C	Q: So is money not a motivating tool? A: The money is always a factor you know, because we work on a bonus system: the more they produce, the more they get. For that you have got to have everybody present, because for that it does not help to have twenty people absent. And now you set up the lines with less people. Q: So does absent people also get bonus? A: No, because the next day another twenty people are absent and then we can't make the target, and then they lose. That's why the bonus system does not really work.	Money is an option but it does not always work because of logistic problems (everybody needs to be present at work).
	F		Negotiating for production bonus, between management and head office. Production bonus according to management will improve production.
• Motivation system	A		There are currently no formal motivation system in place.

ADDENDUM B

STATISTICS

P01
C Prinsloo - Frekwensies vir kontrole   14:26 Thursday, June 19, 2008 10

The FREQ Procedure

V1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	40	38.83	40	38.83
2	34	33.01	74	71.84
3	29	28.16	103	100.00

V2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	92	89.32	92	89.32
2	11	10.68	103	100.00

V3	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	88	89.80	88	89.80
2	8	8.16	96	97.96
3	2	2.04	98	100.00

Frequency Missing = 5

V4	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	42	45.16	42	45.16
2	51	54.84	93	100.00

Frequency Missing = 10

V5	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	18	19.35	18	19.35
2	75	80.65	93	100.00

Frequency Missing = 10

V6	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	30	32.26	30	32.26
2	63	67.74	93	100.00

Frequency Missing = 10

C Prinsloo - Frekwensies vir kontrole

The FREQ Procedure

V7	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	11	12.94	11	12.94
2	74	87.06	85	100.00

Frequency Missing = 18

V8	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	69	66.99	69	66.99
2	34	33.01	103	100.00

V9_1	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	31	60.78	31	60.78
2	1	1.96	32	62.75
3	3	5.88	35	68.63
4	2	3.92	37	72.55
7	1	1.96	38	74.51
8	2	3.92	40	78.43
9	1	1.96	41	80.39
10	3	5.88	44	86.27
11	1	1.96	45	88.24
12	1	1.96	46	90.20
13	1	1.96	47	92.16
14	3	5.88	50	98.04
15	1	1.96	51	100.00

Frequency Missing = 52

V9_2	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	1	20.00	1	20.00
2	1	20.00	2	40.00
5	2	40.00	4	80.00
8	1	20.00	5	100.00

Frequency Missing = 98

ADDENDUM C

QUESTIONNAIRE

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

RESPONDENT NUMBER	

Answer the following questions by drawing an x in the appropriate box, or writing an answer on the open line. Please answer all the questions and click every box.

SECTION A – TO BE ANSWERED BY EVERYBODY

1) What is your job in the factory? V1

(Mark only one box)

Machinist – (Jacket Line)	1
Machinist – (Trouser Line)	2
Quality Controller	3
Dispatch	4
Material Cutter	5
Supervisor	6
Other (Specify)	7

2) Do you know what you must do in your job? V2
(Mark only one box)

Always	1
Sometimes	2
Never	3

3) Who checks your work?
Mark only (YES) or (NO), **and mark every answer**

Line supervisors	YES	NO	V3
Department managers	YES	NO	V4
Quality controller	YES	NO	V5

Co-workers	YES	NO	V6
Nobody	YES	NO	V7

4) Are you happy in your job? V8

Yes	1
No	2

5) If not, what can management do to make you a happy worker? V9

6) How do you get rewarded for doing more than your workload?
Mark the (YES) block if you receive the reward or the (NO) block if you do not receive the reward, **and mark every answer**.

Day off	YES	NO	V10
Receive a cool drink or something to eat	YES	NO	V11
Longer lunch or tea breaks	YES	NO	V12
Get promoted to a better job in the factory	YES	NO	V13
Bonus on your salary	YES	NO	V14
Increase	YES	NO	V15
Other – Specify	YES	NO	V16

7) When do/did you receive training?
Mark only (YES) or (NO), **and mark every answer**.

When I started working here	YES	NO	V17
When I have to work on a different machine	YES	NO	V18
When you have to sew something new than what you are used to	YES	NO	V19
Once a month	YES	NO	V20
Once a year	YES	NO	V21

8) What form of training do you feel you need at this stage? V22

SECTION B

ONLY SEWING MACHINE OPERATORS TO ANSWER THIS SECTION

9) Which of the following can management do to help you not to get tired when working? Mark the (YES) block if you agree, or the (NO) block if you don't think it is necessary. **(Mark every answer)**

Give you a higher chair to sit on	YES	NO	V23
Give you a lower chair to sit on	YES	NO	V24
More breaks e.g. lunch or tea breaks	YES	NO	V25
Change to standing to stretch your legs if you sit a lot	YES	NO	V26
More fresh air	YES	NO	V27
Bring material bundles closer to your machine	YES	NO	V28
Less noise in the factory	YES	NO	V29
Cool down the factory in summer	YES	NO	V30
Warm the factory in winter	YES	NO	V31
Better lighting	YES	NO	V32
Check the vibration on the machines	YES	NO	V33
Better safety, e.g. dust mask for fluffy materials	YES	NO	V34

10) Any other suggestions on how management can better your workplace.

V35 ☐

11) Is the current flow of work fast and effective in the factory? V36 ☐

Yes	1
No	2

12) Which of the following problems do you experience? Mark the (YES) block if you experience the problem and the (NO) block if you do not experience the problem. **(Mark every answer)**

There is not enough work in the factory	YES	NO	V37
Some sewing operators stitch too slow	YES	NO	V38
Here are not enough machines for the work	YES	NO	V39
The cutting room does not cut fast enough; I wait for work from the cutting room	YES	NO	V40
I always have an overload of work	YES	NO	V41
The machine layout is wrong, work does not go through the line fast enough	YES	NO	V42
Machines often break	YES	NO	V43

I do not know how to operate my machine	YES	NO	V44
Some materials are difficult to sew	YES	NO	V45
Running out of material/yarn/buttons etc.	YES	NO	V46
Quality checks are done too late	YES	NO	V47
I often unpick work because of bad sewing	YES	NO	V48
I often unpick work because of bad material	YES	NO	V49
I often unpick work because of bad cutting	YES	NO	V50
I often unpick work because of bad quality checks	YES	NO	V51
I do not always know how to prevent my mistakes	YES	NO	V52
I do not always know how to correct my mistakes	YES	NO	V53
I cannot always give new suggestions to management	YES	NO	V54
I cannot always communicate my problems to management	YES	NO	V55
I do not know what is expected of me in a day's work	YES	NO	V56
My sewing machine is too fast	YES	NO	V57
My sewing machine is too slow	YES	NO	V58
I do not know which pattern pieces to group together	YES	NO	V59
I do not understand what management tells me to do	YES	NO	V60

13) Anything else? V61

14) When is the work checked in the factory?
Only answer (YES) or (NO), **and mark every answer**.

After every stitching step	YES	NO	V62
After a each piece of the garment is finished e.g. waistband	YES	NO	V63
After every 3-4 steps	YES	NO	V64
After the garment is finished	YES	NO	V65

SECTION C

ONLY CUTTONG ROOM OPERATORS TO ANSWER THIS SECTION

15) Which of the following can management do to help you not to get tired when working? Mark the (YES) block if you agree, or the (NO) block if you don't think it is necessary. **(Mark every answer)**

Give more breaks	YES	NO	V25
Change to sitting when standing for a long time	YES	NO	V26
More fresh air	YES	NO	V27
Raise the cutting table	YES	NO	V28
Lower the cutting table	YES	NO	V29
Less noise in the factory	YES	NO	V30
Cutting blade too heavy to handle	YES	NO	
Cool down the factory in summer	YES	NO	V31
Warm the factory in winter	YES	NO	V32
Better lighting	YES	NO	V33
Check the vibration on the machines	YES	NO	V34
Better safety, e.g. dust mask for fluffy materials	YES	NO	V35

16) Which of the following problems do you experience? Mark the (YES) block if you experience the problems and the (NO) block if you do not experience these problems **(Mark every answer)**

There is not enough work coming from the marker room	YES	NO	V52
Here are not enough cutting tables and cutting knives	YES	NO	V54
The material cuts difficult	YES	NO	V55
I always have an overload of work	YES	NO	V56
The markers are wrong most of the time	YES	NO	V57
The cutting blade often breaks	YES	NO	V58
Bad material quality makes me cut slower	YES	NO	V59
Material is full of flaws	YES	NO	V60
Material have bad colour shading, this makes me cut slower	YES	NO	V61
I often re-cut because of bad cutting	YES	NO	V62
I often re-cut because of a bad marker	YES	NO	V63
I often re-cut because people sewed badly	YES	NO	V64
I often re-cut because of bad quality material	YES	NO	V65
I do not always know how to prevent my mistakes	YES	NO	V67
I do not always know how to correct my mistakes	YES	NO	V68
I cannot always give new suggestions to management	YES	NO	V71
I cannot always communicate my problems to management	YES	NO	V72
I do not know what is expected of me in a day's work	YES	NO	V73
I do not understand what management tells me to do	YES	NO	V76