EVALUATION OF RESOURCE USAGE AND THROUGHPUT PROCESSES IN A CLOTHING PRODUCTION SYSTEM

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OPSOMMING

Hierdie artikel fokus op die Suid-Afrikaanse kledingproduksie industrie wat in die laaste dekade aansienlik gekrimp het. Die doel van die ondersoek was om die interaktiewe bydrae van die menslike- en fisiese hulpbronne en die deurvoerprosesse in terme van die werking van 'n geslekteerde Suid Afrikaanse kleding-produksie maatskappy te verken en te beskryf vanuit die werkers se perspektief. 'n Sis-teemteorie benadering is gebruik om 'n bespreking van die interaktiewe bydrae van die hulpbronne en deurvoerprossesse van die kledingprduksiesisteem te struktureer. 'n Kledingproduksie maatskappy in die Bronk-horstspruit area, Gauteng, is gekies as die eenheid van analise vir die gevallestudie. 'n Voorafgetoetste, gestruktureerede vraelys is deur 103 werkers (stiksters en uitknippers) ingevul. Beskrywende resultate is verkry, wat bruikbare bewyse verskaf het om die interverwantskappe van die fabriek se hulpbronne te bevestig en dui ook daarop dat die optimalisering van elke hulpbron 'n beteknisvolle bydrae sal maak tot 'n meer effektiewe uitset. Die verwaarlosing van menslike hulpbronne is hoofsaaklik verant-woordelik vir die werkers se onvermoë en magteloosheid om probleme te hanteer. Die kwaliteitsbeheer en fisiesie hulpbronne het ook nie aan die verwagte standaarde van 'n mededingende maatskappy voldoen nie. Spesifieke probleme is in die studie aangespreek en aanbevelings is gemaak om hierdie hindernisse te oorkom.

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INTRODUCTION AND AIM OF THE STUDY

In a developing country such as South Africa, textile and clothing production is considered a crucial sector for the country's national economy, due to its high labour intensity and substantial generation of employment (Truett & Truett, 2008:1; Van der Westhuizen, 2006:2-4). Despite a trying economic climate, the clothing retail industry grew by 4,6% in 2011 to reach a value of $8,206.2 million, with a projected growth value of $10,053.7 million by 2016 (Market Line, 2012). This warrants efforts to enhance the South African clothing production scene. Textile production accounts for 14,7% of employment in the manufacturing sector in South Africa, with clothing manufacturing accounting for 10% of this figure. These two industries further contributed 8,1% of the manufacturing sector's salaries and wages during 2007 (Truett & Truett, 2008:1). The clothing industry in South Africa has, however, had to deal with multiple challenges in recent years (Cant, 2005:3). Uncontrollable threats, such as the global economic slump, resulted in the closure of many clothing construction companies and extensive job losses, while an influx of cheaper imports became a major threat for the industry's survival. On a more controllable level, low productivity and lack of investment in new machinery and the latest technology exerted insurmountable pressure in terms of the outputs of clothing production systems in South Africa (Small Enterprise Development Agency (SEDA) 2008; Kaplinsky & Morris, 2008).

Survival of the clothing production sector in South Africa and other developing countries requires an adoption of global value chains to increase exports, for example, enhancing capacity of innovation management through an ability to integrate external and internal environments (Kaplinsky & Morris, 2008). In

order to become part of the global landscape, a clothing manufacturer has to become more competitive and should upgrade external and internal key performance indicators in accordance with international counterparts (Vlok, 2006). No company operates in isolation and every clothing production unit will have to develop a future perspective and position themselves in terms of their national- and global economies to survive (Kaplinsky & Morris, 2008). Inevitably operational productivity and overall plant performance will have to improve simultaneously (Truett & Truett, 2008:1). Although companies are not able to control external and environmental factors, it is possible to adjust and enhance internal factors within their companies to enhance their operation and productivity.

A major internal factor that prevents the South African clothing industry from expanding into global markets is the poor performance in terms of companies' outputs per employee (labour productivity) (Barnes, 2005:8). This negatively affects a company's total production outputs and it is not only detrimental for the company, it is also bad for the economy (Kaplinsky *et al*., 2001). Increased productivity requires intentional scrutiny and a revision of factors, such as human resources (Hinzelman & Smallwood, 2004:36); investment in capital; the availability and utilisation of technology (physical resources) (Bair & Gereffi, 2003); production and quality control, as well as a revision of management systems, to ensure that the production unit is or becomes globally competitive. Inevitably, changes to reduce running costs and to increase the outputs of factories necessitate sacrifices, and therefore the perspectives of both management and employees are vital to identify and address problem areas, and to ensure that amendments are supported by all role players (Guo *et al*., 2009).

Considering recent economic trends, a clothing production company should utilise its resources optimally. This study hence aimed to:

- explore the contribution of available resources of a selected South African clothing production company, specifically its *human-* (training and motivation), and *physical resources* (equipment, space and utilities), as well as its throughput processes (production planning and quality control) in terms of the company's operation and optimising productivity.
- identify shortcomings in day-to-day operations that may prevent it from performing optimally and competing in a global market in future. Recommendations could inspire other, similar companies to become more competitive in the existing cut-throat environment. Findings could also be useful for smaller start-up clothing production units in terms of their long-term contribution to the national economy.

THE CLOTHING PRODUCTION SYSTEM

The systems theory (Spears & Gregoire, 2007:24; Gregoire, 2013:2-5) provided a suitable theoretical framework to investigate a clothing production system in terms of interaction of various resources of the production unit (system), and how they may contribute interactively towards improving the effectiveness of the system. The resources of a clothing production system (human- and physical resources) represent the inputs of the system that are converted into outputs (Wickham, 2004:200). The work flow in a typical clothing production system depends on the utilisation of these resources, specifically how human resources (employees and their skills) transform inputs (materials and operational resources, including production plans and time frames) in terms of anticipated outputs (finished products). The conversion of resources into finished products involves planning and an identification of relevant processes needed for the construction of garments (Glock & Kunz, 1995:315).

A clothing production company can, however, also be regarded as a system that does not operate in isolation. Instead, it operates in constant interaction with its environment and is affected by external factors that are difficult and even impossible to control, for example, the economic climate, globalisation, competition and political changes (Gregoire, 2013:3). The production system is, however, also internally influenced by a collection of interrelated smaller sub-systems, with specific objectives within their areas of expertise and forming part of the transformation process. Transformation in this study includes production planning and mplementation to produce the final clothing products. This can also be described as a people-machine system, where people use resources that include various machines to achieve desired objectives. Typical procedures that form part of the transformation process are the spreading and cutting of the fabric, construction of sample garments, subcontracting

of decorative details on selected pattern pieces, sewing together of pattern pieces, wet processes (if applicable), pressing, and the final finishing off of garments (Brown & Rice, 2001:89). All these processes may form independent sub-systems within the larger production system, which eventually interactively contribute and form part of the larger system (production unit). For the purpose of this study only the sewing and cutting sub-systems in the production process were investigated. Transformation within a particular system hence refers to the collective conversion of inputs into outputs, and that involves the contribution of various subsystems, as explained previously, to achieve the outputs that determine the success or failure of the system (Spears & Gregoire, 2007:2, 3).

Outputs, in the context of this investigation, refer to the finished garments resulting from the transformation process. The inputs into the system are therefore transformed into the desired outputs, for example, good quality clothing manufactured according to specific specifications (Gregoire, 2013:7). Apart from the actual constructed garments, other important outcomes are also inherently part of the outputs of the system and are inevitably linked to initial objectives of the production system, for example, producing high quality products, in the desired quantities in accordance with the order from the client, to the extent that it would evoke client and employee satisfaction and ensure financial accountability. 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, 2007:8). In order to operate effectively, a system has to involve certain measures of control and feedback. Control involves standards for evaluating the system and opportunity for managerial control. Feedback specifically provides opportunity to maintain or continually improve the effectiveness of the system (Spears & Gregoire, 2007:9, 10), for example, using the feedback from sewing machine operators to improve processes.

Figure 1 presents the conceptual framework for the study, which indicates how relevant concepts were integrated for discussion within a systems framework.

CONVERSION OF RESOURCES IN TERMS OF PRODUCTION IN A CLOTHING PRODUCTION SYSTEM

Inputs

Inputs include human and physical resources and demands as depicted in Figure 1.

Resources A variety of human and physical resources are relevant to the production outcome of a clothing production system. Resources have certain characteristics in common: they are *consumed* and/or *converted* in terms of anticipated outcomes. The value of a resource is determined by the way in which it is utilised. A company can gain a competitive advantage through the innovative utilisation of resources to increase its value (Wickham, 2004:202).

Human resources Human resources refer to the people that are involved in the system, for example, sewing machine operators and their contribution towards the outcome of the production system, which is made in many ways, for example, their efforts, knowledge, skills and insight, as well as their productive labour, technical expertise, functional-, organisational- or communication- and leadership skills (Wickham, 2004:200). Human resources, such as training and motivation, per se are very intricate and should be managed carefully to optimise their contribution towards a production line's outputs. Clothing production remains one of the most labour-intensive and complex of all production operations (Vlok, 2006:3), despite the introduction of technology that has improved certain clothing manufacturing processes and has lowered its dependency on labour (Berge, 2008). Because of the labour intensity of clothing manufacturing (it contributes up to 50% of the final garment cost), the educational- and skills levels of workers are vital to the performance of any manufacturing company (Salinger *et al*., 1999:10). Clothing producers inevitably then divert to locations where lower wages can be paid to reduce production costs (Lin *et al*., 2002), although such a step necessitates investment in skill-based training (Barnes, 2005). Training is mostly costly and the effect of training on productivity is not immediately tangible, since skills and knowledge gained in training are not necessarily applied immediately upon completion of training (Berge, 2008). Extant research, however, confirms that companies investing in operator training have

indeed experienced an increase in production outputs, because operators are cognisant of what is expected to be globally competitive (Bheda *et al*., 2003). Although the extremely labour-intensive workings and technological improvement in clothing manufacturing have lowered its dependency on labour, mass production techniques still require a large labour force. Also, companies are not necessarily able to afford the latest technology, especially in trying economic times.

Additional measures are therefore required to optimise human resources, for example, to boost employees' motivation (Berge, 2008). That could be done by instigating feelings of accomplishment, stimulating a desire to learn and creating opportunity for recognition by peers or management (Glock & Kunz, 1995:359). Other factors that motivate workers are recognition of responsibility and self-respect, praise, fair allocation of rewards, promotion, feedback on performance, as well as financial incentives such as bonuses and salary increases (Hinzelman & Smallwood, 2004:38). Lack of motivation negatively affects employees' work speed, contributes to absence from work and an undesirable quit rate. Employers therefore need to identify rewards that would increase workers' motivation and productivity (Kressler, 2003:132; Hong *et al*., 1995). Financial benefits are generally the most appreciated and influential incentives (Hong *et al*., 1995), but the aim of all such reward

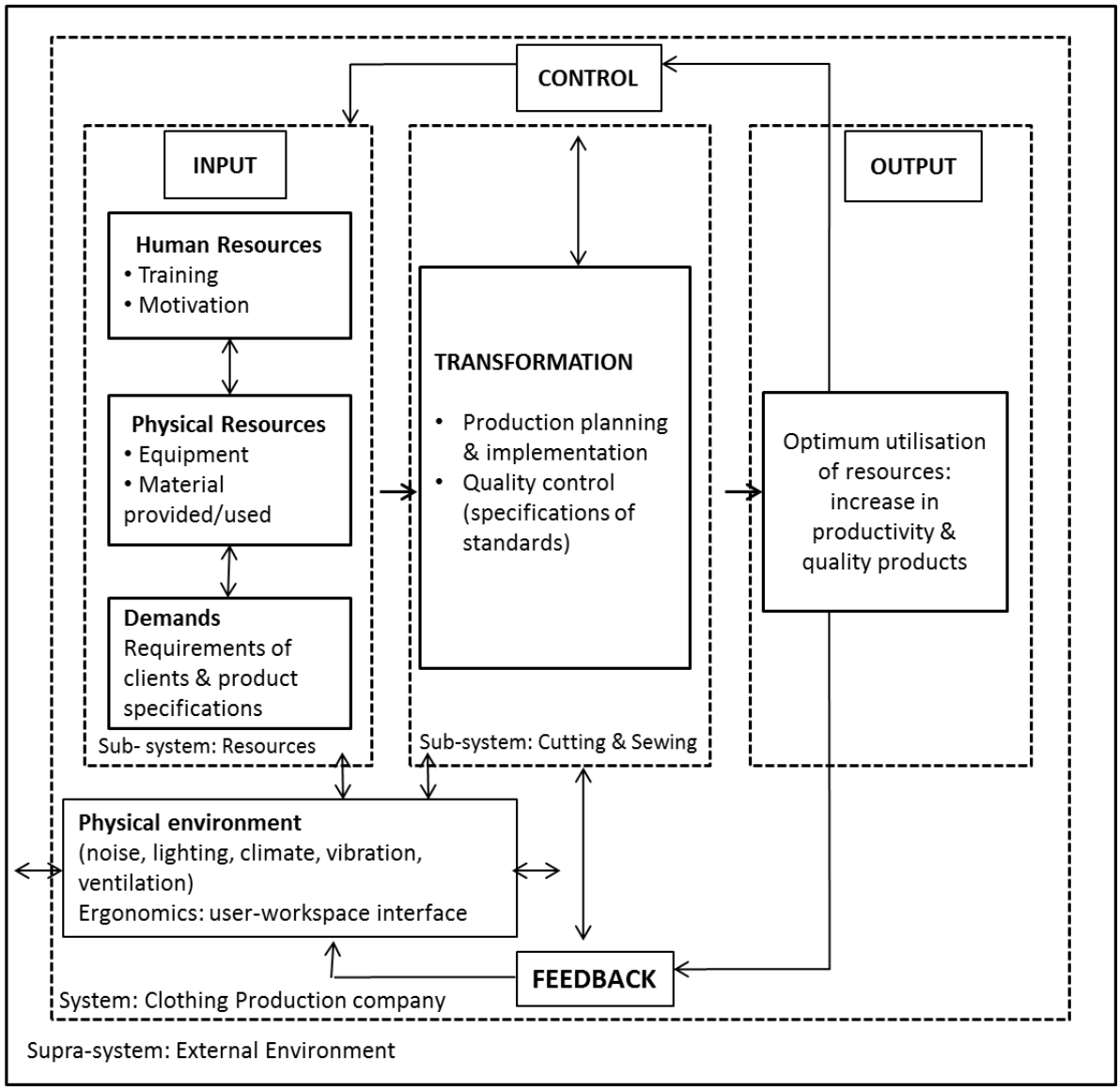

FIGURE 1: CONCEPTUAL FRAMEWORK

strategies should be to optimise employees' contribution to the company. In the clothing sector evaluation mostly occurs on an informal basis and companies mostly depend on line managers' feedback to determine incentives (Morrow, 2001).

Physical resources Physical resources of a clothing production system refer to the technology and materials that are used in the production systems (Spears & Gregoire, 2007:7). These components are interdependent, because they are important individually, but also mutually influence the outputs of a system (Boss *et al*., 1993:330). The use of appropriate technology can improve productivity and lower associated production costs (Lin *et al*., 1994), which is commendable because labour costs of clothing manufacturing are particularly high. By not investing in capital equipment that is globally comparable, companies suffer a major disadvantage (Vlok, 2006:18). A flexible clothing production system uses technology that is controlled by a skilled and flexible workforce and in so doing they can produce different products in a short period of time. Better technology may for instance include different computer software ranges that enable more efficient work processes (Loker, 2002). It is recommended that clothing manufacturers draw up a strategic plan, reflected in their budget, to allow an upgrading of their technology continually. Such an investment improves quality through greater consistency, reduces worker fatigue, as well as workplace injury, which will increase productivity, improve worker morale and lower workers' compensation costs (Dillard & Schwager, 1997). Admittedly, investment in technology is an expensive exercise, but every investment can also result in substantial productivity gain. Better technology has to be accompanied with hands-on training and formal education of the labour force to have the desired outcome (Nordas, 1996).

Demands Any production unit operates within the parameters of what a specific client requires, inclusive of product- and quality specifications and time lines. In order to meet these demands, specific resources are required, and the skills of the operators of the production unit have to match the demands (Bheda *et al*., 2003). Ultimately, the success of the company depends on its ability to satisfy clients, because that would encourage new orders and growth of the company (Loker, 2002; Wickham, 2004:200; Germanova-Krasteva & Petrov, 2008).

Transformation

Transformation in terms of a clothing production system involves actions and activities used in changing the input into output (Gregoire, 2013:2). It comprises a flow of goods or parts through a system that requires a logic layout of machinery and skilled workers to operate the machinery and ensure the flow of goods (Lin *et al*., 2002). Properly planned machine layout shortens the moving distance of materials between machines, which reduces time and costs. Material handling concerns the efficient flow of goods during the transformation process. Costs implied during material handling contribute as much as 30% of the labour cost, due to through-put time and the inflexibility of a clothing production system. Costs can, however, be reduced if subsequent processes are planned optimally, with the assistance of motion and time studies that would identify where and how time and workers could be reduced (Glock & Kunz, 1995:314; Meyers, 1993:2). The complicated nature of clothing production requires various types of inputs that involve not only different types of machinery, but also workers with specific skills to handle the diverse bundles of sub-assembly units that are needed to produce different styles. Various sub-assembly processes may be involved to assemble the finished garment (Gunesoglu & Meric, 2006). Sub-assembly processes may even be on different premises, for example, the embroidery and assembly of bodices that can be done by another company. Depending on the specification of the product, sub-stations or different production lines need to be planned with definite action sequencing (cutting and sewing), implemented (performance of specific tasks) and set up with quality check points. The execution of these tasks is influenced by the properties of the fabric, specifications of products, type of production line, as well as human factors (Gunesoglu & Meric, 2006:147).

Production Planning Production planning is an integrative process of coordinating production related resources with the demand of finished goods (Glock & Kunz, 1995:342). It is crucial in terms of productivity because large inventory quantities, long lead times and high levels of work-in-progress have a negative impact on outputs (Bowers & Agarwal, 1993). Production planning needs to be done in conjunction with capacity planning to match the maximum possible workload with what a specific production unit can handle within a given period of time under ideal circumstances (De Beer *et*

al., 1997:67). Two types of capacity planning are applicable. Effective capacity forms part of the design capacity and grants the possibility of interruptions, maintenance and exchanges, while actual capacity refers to the actual output per unit per day (Kroon, 1998:135). Effective capacity planning will eventually provide a higher profit and more realistic outcome. Any apparel manufacturer should also implement a productivity measuring system in the form of a work study to measure, compare and communicate the performance of workers and sub systems (Bheda *et al*., 2003). Work measurement techniques, such as time studies and work samples, may be used to forecast the work rate for a specific style that is produced at any given time, keeping in mind time allowance for personal needs, fatigue and unavoidable delays. As much as 23.2% of the time of a clothing production unit could be spent on personal and unavoidable issues (Gunesoglu & Meric, 2006). Work studies are useful to identify and reduce avoidable interruptions and to increase productivity. Fabric planning is another fundamental part of production planning, because it comprises 30-40% of the selling price of a garment and contributes to considerable waste, which may be unavoidable at times, for example, due to fabric flaws. Avoidable losses should, however, be reduced, for example, marker loss due to gaps between pattern piece layouts. Modern technology, such as computerised planning systems that use genetic algorithms to reduce waste can be used to optimise roll planning (Hui Patrick *et al.*, 2000).

Quality control Quality encompasses a combination of intrinsic product characteristics and extrinsic quality cues that would satisfy a specific consumer market. A formulated quality policy and the outlines for implementation of such quality policies are basic requirements for a clothing production company (Dahlgaard *et al.,* 1998). Inevitably the outputs of a clothing production system should meet certain minimum quality specifications regarding designers' specifications, aesthetics, durability and utility (Germanova-Krasteva & Petrov, 2008). Quality is even more important in terms of entering the export market (Glock & Kunz, 1995:228), therefore quality should be reflected in the entire clothing production process (Solinger, 1980:503) to eliminate rejects and to substantially reduce repair levels. Quality control can be done by comparing products with other similar products, or by comparing product characteristics to the company's standards and specifications (Glock & Kunz, 1995:228). Management and sewing machine operators should be familiar with such quality standards. Companies are therefore required to state policies on quality clearly and should provide outlines for implementation. The extent to which management participates in quality activities is a measure of the company's commitment to implement quality procedures. Top management should encourage and sustain on-going, on-the-job education and training to encourage a culture of teamwork and to enforce co-operation. Lastly, the use of applicable tools and methods is needed to ensure good quality (Dahlgaard *et al*., 1998).

Outputs of a production system

The outputs of a clothing production system refer to completed items that represent the number of units produced, compliance to high quality standards, as well as the resources used, wasted or generated (Gregoire, 2013:7). The number of workers involved in the process and the time taken to complete an order (Lin *et al*., 1994) can be used as an indication of productivity (Bheda *et al*., 2003).

Physical environment

The physical environment in which workers operate has a major influence on their performance, specifically how the ergonomic aspects of the environment are attended to. Ergonomics refer to the interaction between workers and their work environment and address all the conditions that may influence workers' performance (Glock & Kunz, 1995:332), including human factors such as ability to use machinery without strain or stress, and ability to implement systems relating to various aspects of the user's physical, environmental and cognitive capacities (Ahasan & Imbeau, 2003). Ergonomic principles in essence involve three primary goals, namely, to set parameters to protect human health and safety; to improve productivity; and to enhance operator satisfaction. Ultimately, the application of ergonomic principles is useful to identify stressors that may place strain on the body; to recommend measures to reduce problems; and to enhance operator satisfaction (Helander, 2006:15), which requires a proper matching of workers with technology, productive methods, tools, equipment and their environment. Due to the interdependency of these factors, neglect of any one factor, for example, using tools that are not suitable or working in a poorly designed environment, could affect productivity (Galer, 1987:19). Mostly, ergonomic aspects are

neglected due to ignorance, for example, not realising how poor lighting affects workers' performance, or neglect, for example, not maintaining equipment properly.

The interaction between user and machine or equipment always occurs in a given workspace (production system) or environment (physical environment). The physical environment that includes aspects such as noise, ventilation and climate, not only has an impact on the use of space and planning of facilities, but also on workers' interaction with their equipment and workspace in the clothing production company (Galer, 1987:19-20; Gregoire, 2013: 6). Due to the openness of systems, ergonomic principles are relevant in terms of the inputs of the system, i.e. proper planning of the work space and environment, as well as the transformation process that reflects the conditions under which the work is done and where resources are transformed into outputs.

RESEARCH DESIGN AND METHODOLOGY

A case study permitted a flexible approach in terms of understanding the phenomena in its specific context (Maree, 2007:5), while it enabled an investigation into the organisational practices and the complex interaction of various systems of a clothing production company as an example of similar companies (Dubé & Paré, 2003). A clothing production company situated in Bronkhorstspruit, Gauteng, was selected because it was accessible and seemed to be a typical South African clothing manufacturing company that complied with the labour laws of the country. It employs a workforce of between 200 and 300 workers and mainly manufactures school uniforms and suits. The company has a design room, cutting room and uses the bundle system for production and was accordingly classified as a mass production company. At the time of the study the management and records of the company confirmed that resources of the company were not utilised optimally and that productivity could be improved. The study was exploratory and descriptive in nature and was meant to instigate follow-up research that could be expanded to involve other types of clothing manufacturers, as well as entrepreneurs. The study was introduced to management during phase one, which took the form of personal interviews and focus group discussions, where managers were given opportunity to assist with the formulation of questions and the inclusion of concepts in a structured questionnaire, which workers could easily interpret and associate with. The first draft of the questionnaire was based on a thorough literature review. This was adapted after the interviews with the managers and line-managers. The final questionnaire was used to collect data during phase two, i.e. the survey, which involved the workers in the production lines, i.e. the cutting- and sewing lines in the factory.

Sample

Phase one involved interviews with three managers as well as focus group discussions with six line managers. The two management levels were interviewed separately to prevent intimidation and to encourage lively discussion.

Phase two involved 103 of the 250 workers in the factory: 75 sewing machine- and 28 cutting room operators. All the cutting room operators were included because they were in the minority, while sewing machine operators were randomly chosen. All the respondents were Black, female, full-time appointed employees between the age of 18 and 60 years, with at least six months' experience in the factory.

Data collection

Phase one of the data collection procedure was qualitative in nature and merely aimed to finalise the wording and concepts relevant to the utilisation of resources in a clothing manufacturing company, after an initial attempt to compile the questionnaire in accordance with existing literature. Face-to-face interviews with three members of management and two focus group discussions with six line supervisors were held. In both instances informal conversations about specific topics included in the questionnaire were used to encourage spontaneous and lively discussion (Babbie & Mouton, 2001:289). Recordings were made with the consent of the participants to encourage a flow of conversation without interruptions. Finalisation of the questionnaire involved a clarification of language and terminology to ensure that workers would understand it and interpret questions correctly.

Phase two involved a pre-test of the self-administered questionnaire that already included the terminology and content as recommended during phase one. However, respondents were not familiar with the procedure of completing the scales in the questionnaires and still struggled to answer the questions. The items therefore required further

TABLE 1: THE TRAINING OF EMPLOYEES

ITEMS	YES		NO	
	FREQUENCY	%	FREQUENCY	%
Training received (n=103)				
1. When I started working here	65	63,7	37	36,3
2. When I have to work on a different machine	57	55,3	46	44.7
3. When you have to sew something new, different to what you are used to	53	52,5	48	47,5
4. Once a month	24	23,5	78	76,5
5. Once a year	18	18,0	82	82,0
Production problems related to training (n=75)				
6. Some sewing machine operators stitch too slow	56	75,7	18	24,3
7. I do not always know how to correct my mistakes	45	60,8	29	39,2
8. I do not always know how to prevent my mistakes	19	26,1	54	73,9
9. I do not know which pattern pieces to group together	14	18,9	61	81,1
10. I do not know how to operate my machine	8	10,8	67	89,2
Cutting problems related to training (n=28)				
11. I do not always know how to correct my mistakes	14	53,8	12	46,2
12. I do not know what is expected of me in a day's work	14	50,0	14	50,0
13. I do not always know how to prevent my mistakes	14	50,0	14	50,0

simplification and had to be shortened in accordance with the linguistic ability of the workers. It was critical not to compromise content. Unnecessary questions were deleted, for example, questions about new technology that seemed irrelevant. The final questionnaire, which was formulated in simple English, included 98 closed-ended items with a bi-nominal Yes/No measurement (Delport & Roestenburg, 2011:178, 198). The items addressed training, motivation, equipment and material-related problems, production planning, ergonomic and quality control aspects. This article only reports on items that were relevant to the objectives formulated for this study. Fieldworkers, who were able to speak the same language as the respondents, as well as English, assisted the researcher with data collection. One hundred and three questionnaires were completed. Due to the nature of the questions, data analysis mainly involved descriptive analysis (Leedy & Ormrod, 2001:196).

RESULTS

Results are organised in terms of the resources and throughput processes that were investigated and are presented in table format to disclose the content of the questions.

Human resources

The training and motivation of workers were investigated as the relevant human resources that were used in the cutting and sewing subsystems of the clothing production system.

Training Training of employees was investigated through thirteen questions enquiring when training was received, and whether sewing and cutting problems could be related to training or a lack of training. Findings are presented in Table 1, in descending order for affirmative responses.

The majority of respondents (63,7%) were trained when appointed and also received training when they had to work on a different machine (55,3%), or had to use a new process (52,4%). More than 70% indicated that regular training did not exist, not even once per year. Training of employees was therefore not a scheduled activity that workers could partake in regularly to improve their skills. A pertinent problem that came to the fore in the production system was that 75% of respondents indicated that some sewing machine operators stitched too slowly. The majority also indicated that they knew how to assemble pattern pieces, how to operate their machines, and how to prevent mistakes, but that they were unable to correct their mistakes (60,8%). This signals a need for additional training, whereby machinists could be taught to take immediate corrective action to prevent a waste of items due to uncorrected mistakes. Respondents' answers pertaining to cutting-related training evoked indisputable concern. Half of the cutting room operators (50%) did not know how to prevent mistakes

that occurred with cutting operations, or how to fix them. Neither did they know what was expected of them in a day's work. Mistakes of this kind could have serious financial consequences. Training in this sub-system of the production process therefore seemed to be a priority.

Motivation Motivation of employees was investigated through six questions enquiring about forms of motivation that existed in the clothing production system to encourage employees to improve their productivity. Responses are summarised in Table 2.

The incentive most often received by workers for good performance, was an increase in salary (31%), and followed by a bonus of 21,5% of their salaries, both reflecting monetary incentives. Incentives such as having a day off (19,8%), receiving a cool drink or something to eat (16,7%), or having longer tea breaks (16,5%) did not compare favourably with monetary incentives, but may contribute to a positive attitude amongst workers. For employees with low educational levels, as is the case here, physical and security measures are more important than using social and self-actualisation methods to motivate them. Workers with minimal education may value incentive payouts and a free lunch (Hong *et al.*, 1995). Responses in Table 2 show that an allocation of incentives for commendable or outstanding performance seems the exception rather than the rule. That could reflect neglect by management, or it could reflect poor performance that does not warrant rewards. Particularly concerning was the indication that only a few workers got promoted to better positions in the factory due to good performance. According to management, supervisors' positions were limited because supervisors filled their positions for long periods before resigning. A lack of a future perspective could therefore be particularly disheartening for those who had higher aspirations in the factory. Reasons why incentives were rarely presented should also be investigated further. Ideally, conditions under which incentives could be earned, as well as the willingness of the employer to allocate incentives, should be clearly communicated to encourage optimal performance. Achievement motivation and skills training could also be used to identify worthy candidates for these awards.

Physical resources

In this study, physical resources were interpreted as all the equipment and materials required in the cutting and sewing sub-systems of the production line to handle the work load.

Equipment and material related problems Equipment- and material-related problems in the sewing- and cutting rooms were investigated through seven questions that covered aspects regarding the condition and availability of basic technology required to perform their duties.

The biggest obstacle experienced in both departments related to frequent breakage of equipment. Complaints about the breakage of machines (60,8%) and cutting blades (60,7%) indicate that tools may need to be checked or replaced more frequently. Furthermore, the workers apparently did not have enough equipment to deal with their work load. Long lead times before broken machines could be fixed resulted in not enough machines to work on, and sewing operators being idle. Deficient equipment can have a negative effect on workers' morale, since no department can perform optimally to produce the outputs that they are potentially capable of. These problems reflect negatively on management. Some materials used in productions were considered too difficult to sew by 77% of respondents. This may be due to a lack of skill and subsequently a need for training, faulty equipment or the quality of the material itself. Running out of yarn and/or material may be due to re-cutting or poor production planning.

Problems encountered with physical resources were mostly related to poor management, specifically a lack of attention to the condition of tools and equipment; inadequate stock in terms of what was required to prevent delays during the construction processes; as well as lack of training that would ensure that workers are skilled to perform the tasks they are trusted with.

Transformation

According to Figure 1, transformation includes production planning and quality control.

Production planning Problems relating to production planning were distinguished in terms of those encountered *during sewing operations* and problems encountered *in the cutting room*. According to summarised findings in Table 4, the majority of employees indicated that sewing

TABLE 2: MOTIVATION OF EMPLOYEES

TYPE OF INCENTIVE FOR GOOD PERFORMANCE (N=103)	YES		NO	
	FREQUENCY	%	FREQUENCY	%
1. Salary increase	31	31,0	69	69,0
2. Bonus on your salary	22	21,6	80	78,4
3. Day off	20	19,8	81	80,2
4. Receive a cool drink or something to eat	17	16,7	85	83,3
5. Longer lunch or tea breaks	17	16,5	86	83,5
6. Get promoted to a better job in the factory	13	12,7	89	87,3

TABLE 3: EQUIPMENT AND MATERIAL-RELATED PROBLEMS IN THE SEWING AND CUTTING SUB-SYSTEMS

ITEMS	YES		NO	
	FREQUENCY	%	FREQUENCY	%
Equipment related problems in the sewing department (n=75)				
1. Machines often break	45	60,8	29	39,2
2. Here are not enough machines for the work	31	41,3	44	58,7
3. My sewing machine is too slow	8	10,7	67	89,3
Equipment-related problems in the cutting room (n=28)				
4. The cutting blade often breaks	17	60,7	11	39,3
5. Here are not enough cutting tables and cutting blades	15	55,6	12	44,4
Material provided/used (n=75)				
6. Some materials are difficult to sew	58	77,3	17	22,7
7. Running out of material, yarn, buttons etc.	42	58,3	30	41,6

operations were delayed by slow flow from the cutting room. Frequent re-cutting, due to poor markers, seemed to be the most prevalent problem. This undeniably has serious financial implications, while negatively affecting outputs and productivity. Lack of training, that was mentioned earlier, could be the cause. Respondents seemed divided (Yes/No responses varied between 45% and 55%) about the appropriate layout of the sewing production system; whether there was enough work to keep them busy; and whether machines were adequate. It became clear that not all the workers were optimally involved. Problems in the cutting room were similar: wrong markers (46%) and poor flow from the design room (44%) were mentioned as primary obstacles. 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 in the cutting room. Because all problems in the production process have financial consequences for the company, the underlying causes for workers' negative responses concerning both areas of production planning warrant further investigation. The implementation of suitable solutions would contribute to an optimisation of human resources, improved production planning and prevention of obstacles that delay production processes.

Quality control Problems experienced by sewing machine operators, due to no or poor quality control in the production system, are summarised in Table 5 in terms of four categories, namely: person responsible for quality checks; problems related to poor quality checks; quality problems related to the cutting room; and quality check points. Almost 90% of the sample indicated that line supervisors were responsible for quality checks. The fact that only about 20% indicated that a quality controller was responsible for the task suggests that the role was not clearly specified. Most sewing machine operators indicated that they often had to unpick work because of bad sewing (65,7%), bad cutting (64,8%), low quality material (62,1%) or inadequate quality checks (59,7%). The fact that quality checks were only done after the completion of garments (83,7%) may increase quality-related problems experienced by sewing machine operators. Operators indicated that quality checks were done too late (56,9%).

The majority of cutting room operators had to re-cut garment sections because of bad cutting

TABLE 4: PRODUCTION PLANNING-RELATED PROBLEMS IN THE SEWING AND CUTTING SUB-SYSTEMS

ITEMS	YES		NO	
	FREQUENCY	%	FREQUENCY	%
Production problems experienced by sewing machine operators (n=75)				
1. The cutting room does not cut fast enough; I wait for work from the cutting room	45	60,0	30	40,0
2. The machine layout is wrong, work does not go through the line fast enough	41	54,7	34	45,3
3. I always have an overload of work	33	44,5	41	55,4
Production problems as experienced by the cutting room operators (n=28)				
4. I often re-cut because of bad markers	20	71,4	8	28,6
5. The markers are wrong most of the time	13	46,4	15	53,6
6. There is not enough work coming from the design room	12	44,4	15	55,6
7. I always have an overload of work	16	55,5	12	39,1

(78,5%) or bad sewing (75%). These affirmed that they often had to re-do or fix problems that resulted from previous steps in the production line. Cutting problems related to the quality of the material used were also evident. The majority of cutting room operators had to re-cut parts because the material was difficult to handle (70,3%), of low quality (60,7%), mismatched in terms of colour shading (53,5%) or was flawed (50%). The procurement of better quality material should be a priority for management. Apart from the financial consequences of lack of quality control, problems related to poor quality fabrics could have negative consequences for workers' motivation and performance. There were not sufficient check points to identify these problems early enough in the production process. Although 83% of respondents indicated that the quality of completed garments was checked, less than 40% indicated that there were intermediate check points. Insufficient quality control during the clothing production process implies that valuable resources are wasted on faulty components before the end product is investigated.

Physical environment

Ergonomics Respondents indicated multiple problems relating to neglect of the ergonomic principles related to the physical environment in the factory and the design of their workstations. The majority of respondents experienced problems with temperature control in the factory, which is unfortunate, as poor temperature control and insufficient ventilation contribute to exhaustion and poor work performance. This was also confirmed in workers' responses about motivation and the allocation of incentives. The need for better lighting (58,2%) and the reduction of noise levels (56%) were mentioned by more than half of the respondents. The type and suitability of furniture at working stations were also identified among problems that required attention. Not forgetting that ergonomic factors are crucial in terms of a worker's performance and ability to cope with long working hours, managers and factory owners should invest in the improvement of physical work spaces and all related elements in the factory to create conditions that are pleasant and conducive to optimal performance. None of the factors listed in the questionnaire was evaluated favourably.

DISCUSSIONS AND IMPLICATIONS

In order to survive, clothing production companies around the globe have no option other than to be cognisant of, and to adapt in accordance with challenges presented by a continually changing global market. The pressure of non-controllable external forces, such as the recent economic slump, has made it more important than ever for companies to optimise the use of their resources to maximise their outputs. In this project, a specific clothing production company's utilisation of its human and physical resource and throughput processes were investigated as an example of problems that may jeopardise the performance of similar companies wishing to become more competitive in a global market.

TABLE 5: QUALITY CONTROL

ITEMS	YES		NO	
	FREQUENCY	%	FREQUENCY	%
Who is responsible for quality checks				
1. Line supervisors	88	89,8	8	8,3
2. Department managers	42	45,2	51	54,8
3. Co-workers	30	32,3	63	67,7
4. Quality controller	18	19,4	75	80,6
5. Nobody	11	12,9	74	87,1
Problems related to poor quality checks (n=75)				
6. I often unpick work because of bad sewing (sewing machine operators)	48	65,8	25	34,2
7. I often unpick work because of bad cutting	48	64,9	26	35,1
8. I often unpick work because of bad quality material	46	62,2	28	37,8
9. I often unpick work because of bad quality checks	43	58,9	30	41,1
10. Quality checks are done too late	41	56,9	31	43,1
Quality problems related to the cutting room (n=28)				
11. I often re-cut because of bad cutting	22	78,6	6	21,4
12. I often re-cut because of bad sewing	21	75,0	7	25,0
13. The material cuts difficult	19	70,4	8	29,6
14. I often re-cut because of bad quality material	17	60,7	11	39,3
15. Material has bad colour shading; this makes me cut slower	15	53,6	13	46,4
16. Material is full of flaws	13	50,0	13	50,0
Existing quality check points (n=75)				
17. After the garment is finished	62	83,8	12	16,2
18. After a piece of the garment is finished, e.g. waistband	25	34,2	48	65,8
19. After every stitching step	18	24,3	56	75,7
20. After every 3-4 steps	15	20,5	58	79,5

Human resources

The clothing industry is labour-intensive (Vlok, 2006:3) and largely depends on the quality of its human resources. At the same time human resources is probably the most valuable resource of any clothing production company because it determines how other resources are utilised. The human resources (employees or workers) of a company are, however, also the most difficult of the resources to manage because it is the only resource that reacts when reacted upon (Gerber *et al*., 1998:3). Many uncontrollable personal factors are also involved in the actual performance of workers, for example workers' emotions, health issues and family problems. The quality of human resource management determines how other resources, for example, machines or materials, are utilised. Workers (human resources) can, for example, negate the frustration caused by machines that are outdated or that break down if they are trained to improvise to overcome such problems. Evidence gathered in this investigation indicated that, in this particular company, human resources were possibly neglected, based on limited evidence of continued training opportunities and limited evidence of awards of any kind for excellent performance. In the long run, this is demoralising and can contribute to lower than expected outputs of the factory as indicated in the first interview with management before the start of the project.

Training is vital to improve the productivity of workers, as well as the outputs of a clothing production company, despite the implications that training may pose in terms of space, time and production cost per unit (Bheda *et al*., 2003; Spears & Parker, 2002; Campbell, 1994). Findings of this study indicated a neglect of on-going training in the company, which negatively affected its entire production process. Mistakes related to incorrect cutting, incorrect procedures, inadequate utilisation of/and faulty equipment delayed the progress and outputs of the sewing and cutting departments. Workers were unable to cope with and correct problems that occurred during the cutting and construction processes. These were costly issues that jeopardised the outputs of the company but that

TABLE 6: ERGONOMIC PROBLEMS EXPERIENCED BY WORKERS

ITEMS	YES		NO	
	FREQUENCY	%	FREQUENCY	%
General ergonomic problems experienced by workers (N=103)				
1. Cool down the factory in summer	69	66,9	34	33,1
2. Warm the factory in winter	65	63,1	38	36,9
3. Change position of chair /table	65	63,1	38	36,9
4. Change position (to sitting when standing/to standing when sitting)	61	59,2	42	40,8
5. Better lighting	60	58,3	43	41,7
6. More fresh air	58	56,3	45	43,7
7. Less noise in the factory	58	56,3	45	43,7
8. More breaks	58	56,3	45	43,7
9. Check the vibration on the machines	53	51,4	50	48,6

could have been prevented with timely and relevant training (Berge, 2008; Korsten, 2002). Higher self-efficacy due to training will possibly increase workers' *self-motivation,* boost their willingness to learn (Tai, 2006) and enable a more realistic calculation of a factory's production outputs (Campbell, 1994).

Team-goal-based incentive systems are viable in the clothing production industry because co-workers in production lines will then motivate and encourage one another to increase performance (Hoffman & Rogelberg, 1998). A rotation of workers in various production lines can help to increase workers' self-worth and to keep them interested and motivated (Matsumaru *et al*., 2003). Although highly sought after, companies cannot necessarily afford to splurge on financial incentives (Hong *et al*., 1995). Employers should nevertheless investigate and apply realistic, affordable, yet tangible incentive systems.

Physical resources

Investment in recent technology and equipment with good ergonomic features is important to improve the productivity and quality of products produced by a clothing production company. In so doing, greater consistency could be achieved, worker fatigue could be reduced and worker morale could be boosted (Dillard & Schwager, 1997). Findings disclosed multiple problems with this company's physical resources. Time wasted on faulty equipment clearly affected the work flow of the production system throughout the factory, from the cutting room to the sewing department, which is typical of open systems that depend on one another. The lack of maintenance and misuse of equipment contributed to machine breakages and delays in production lines. Proper maintenance of production equipment has a great bearing on the quality and quantity of production (Duffuaa & Ben-Daya, 1994).

Plant layout, which has a fundamental influence on the outputs of a production line (Djassemi, 2007) due to main operations such cutting, stitching and pressing/finishing (Varukolu & Park-Poaps, 2009), was apparently not conducive to good work flow in this factory. This specific company was a 'Cut Make and Trim' company, which meant that they did not have control over the fabric that customers brought to the factory for production. However, delays caused by the shortage of crucial parts are preventable with better planning and stock control. Ultimately, a well-trained, properly organised production system should be able to cope with challenges of this kind (Ho & Ranky, 1995). Production planning and outputs can be advanced by using proper material handling equipment, the effective utilisation of human resources and improving system flexibility (Chan, 2002).

Planning and quality control

Production planning Due to the complex nature of the operation in a clothing production company, production planning requires the input of trained managers, as well as adequate communication with workers. Production planning acknowledges all available resources, for example, how human resources could be maximised in terms of time limitations, training requirements, available technology, materials and goals that have been set for production processes. It influences the transformation process and is meant to simplify the production process by distributing the work load sensibly to

increase the outputs. According to the findings of the study, almost fifty percent of workers indicated problems with the work flow in the factory. Some indicated that there was not enough work for all, while others were overloaded and struggled to cope, which indicates an inefficient allocation of workers. In addition, machines and tools were either inadequate or in poor condition. A factory that cannot afford to replace dated technology should at least maintain its existing equipment.

Quality control A quality control system encompasses every activity surrounding process specification and inspection, to ensure that the characteristics of the products produced by a company meet customers' expectations (Van der Bij & Van Ekert, 1999; Glock & Kunz, 1995:203). Unfortunately, in this study quality control was questionable. It was mostly absent or done too late, and workers were not aware whose responsibility it was to implement quality checks. This negatively affected the transformation process and subsequently the quality of the garments - all of which had time and financial implications for the company. Training could once again have solved workers' uncertainties and encouraged them to take responsibility and to act proactively (Van der Bij & Van Ekert, 1999).

Physical environment

The physical setting in which workers performed their tasks was not positively evaluated by the respondents. The application of *ergonomic principles* in the work place is supposed to ensure that workers are comfortable and well positioned at their workspace (Rowan & Wright, 1994). Instead, evidence of poor lighting, inadequate ventilation, poorly designed furniture and uncomfortable temperatures, which caused major discomfort, came to the fore in this production company. Incorrect working positions, due to tables that are not of a suitable height, cause emotional strain and exert physical strain on the musculoskeletal system of workers' bodies (Tuncel *et al*., 2008), which affects workers' performance negatively and will most likely contribute to absenteeism. Simple, short term solutions, which are offered in literature, were echoed by the workers, for example, more frequent breaks to reduce boredom and exhaustion (Rowan & Wright, 1994). Ideally, work stations should consist of convertible, adjustable furniture (Dillard & Schwager, 1997).

CONCLUSION

The problems that surfaced through this investigation provided valuable insight that could be used by other clothing production companies and entrepreneurs to ensure that their endeavours are profitable and have the potential to expand successfully. This study revealed the pertinence of every one of the resources investigated, as well as their interplay in terms of the production process of the company.

In terms of its human resources, lack of training probably explains the bulk of problems that were encountered and why workers did not operate optimally and proactively. Unpleasant working conditions and limited evidence of tangible incentives that could have motivated the workers to perform optimally, might have contributed to the workers' low productivity and the company's less than satisfactory performance. Failure of management to maintain and upgrade physical resources and to plan operations well, created a highly challenging working environment and conditions that were counterproductive. The absence of properly communicated quality control check points disregarded one of the most important requisites of a flourishing clothing production company. The use of resources needs to be planned and managed. If problems occur, the interactive contribution of resources could have superseded the unfortunate consequences of a mistake. For example, faulty machines would probably have been attended to sooner and handled better if workers were better trained. Additionally, lack of training in this scenario not only reflected negatively on the human resources of the company, it also influenced the optimisation of physical resources and deterred the flow of the production line during the transformation process. Similarly, lack of quality control resulted in a disorganised production system, major losses in all divisions of the production system and failure to comply with the envisaged quality standards and outputs of the company.

Although only explorative, the findings of this study justify more encompassing investigations and could provoke a dynamic discourse among role players in the clothing industry. As a labour intensive industry, clothing production companies can make a major contribution towards the well-being of lower educated people in South Africa. Every opportunity should therefore be used to improve the outputs and competitiveness of clothing production

companies that dare to enter or remain in the global battlefield.

LIMITATIONS AND FUTURE RESEARCH

This study was limited to a particular scenario. Future research could therefore focus on clothing production companies that differ in size, concerning number of workers and outputs, to enable a generalisation of findings and to enable a discussion of most advantageous scenarios. Future studies could also investigate so-called successful companies' utilisation of resources to gain a better understanding of the interactive effect of resources on companies' outputs and performance. Studies that focus on external environmental factors, such as the South African economic and political climate, globalisation and technological innovation, are also necessary to provide a holistic view of the interactive contribution and influences of all aspects influencing productivity. A longitudinal study that takes into consideration the effect of training on the performance of workers and their ability to adapt would be highly beneficial to confirm the value of training in any company. Finally, the data was collected from workers of one company in one specific area in South Africa. Future research is needed that include different populations from other clothing production clusters around South Africa. Moreover, future research is needed that applies the model relative to different types of clothing manufacturers as well.

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