

THE EFFECT OF TIME VARIATIONS IN ASSEMBLY LINE BALANCING: LESSONS LEARNED IN THE CLOTHING INDUSTRY IN SOUTH AFRICA

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ABSTRACT

South African clothing sector has undergone large-scale restructuring over the past 15 years. The global economy is pressurizing organisations to improve productivity of their business processes. Competition is forcing organisations to focus their energy on “core competencies.” Like many industries, the clothing industry is witnessing changes in technology, diversification of labour, managerial implications while competing on the global market. The South African clothing and textile industries have the potential to create jobs, but this potential has been steadily diminishing over the last decade. In this context, the clothing industry is regarded as a powerful engine for economic and employment growth. Nevertheless, the performance of the clothing industry, whether in terms of efficiency, working conditions or degree of social protection, is unstable. This paper aims to highlight some of the problems experienced by manufacturers’ through a semi-structured questionnaire and provide suggestions for improvement of the clothing industry through the application of line balancing as a means of productivity improvement. The research methodology employed in this paper is qualitative and exploratory in nature making use of applicable literature and appropriate case studies [10].

OPSOMMING

Die Suid-Afrikaanse klerasievervaardigings sektor het grootskaalse verandering ondergaan die afgelope 15 jaar. Die wereld ekonomie plaas verhoogde druk op organisasies om werker produktiwiteit te verhoog en werk prosesse te verbeter. Wedywerende organisasies moet hulle energie fokus op die organisaie se kern bevoegdhede. Die klerasievervaardigings sektor aanskou tans tegnologiese veranderinge, diversifikasie van arbeid, bestuurstyl veranderinge terwyl hulle terselfde tyd moet meding op wereld markte. Die sektor beskik oor die vermoee om grootskaalse werkskepping geleenthede te vestig. Ongelukkig het die werkskepping vermoee afgeneem gedurende die laaste dekade. Die sektor illustreer ‘n onstabiele groei en is as ‘n geheel oneffektief in werkwyse en produktiwiteit vergelykend teenoor direkte mededingers van ander lande. Die referaat sal poog deur gebruik te maak van lyn balanseering te die sektor mededingend te maak. Kwalitatiewe en ondersoekende navorsings metodologie is gebruik met die opstelling van die referaat.

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1. INTRODUCTION AND BACKGROUND

Line balancing is the distribution of work on the line in such a way that everyone gets the same amount of work in terms of time. With the clothing industry being labour intensive, machinists are pressurised for production output throughout the day. All workers should be productive during their working time and production should flow smoothly, thereby achieving planned targets. The objective is to accurately delegate workers to the various operations required to complete the product based on their skills and experience so as to achieve the highest level of productivity and delivery as per the planned targets. The standard minute value is generally used in the clothing industry as a predictor of sewing speed and production efficiency. The standard minute value that is derived through the application of work study methodology is generally assumed as a constant for line balancing. However, a lot of factors cause variations on operational time of the same task such as the fabrics and sub-materials, performance of the machinery, working environment and quality level of the product. With the aid of an illustrating example selected from a men's shirt manufacturing factory, the effect of time variations for assembly line balancing has been studied in this paper.

The SA clothing industry shed over 67 000 jobs in the past three years [4]. There is a possibility that more jobs may be shed in Durban (Kwa-Zulu Natal). The Alexander Report mentions that between July 2006 and May 2007 there was a drop of 5275 in employment figures [18]. The cut, make and trim (CMT) industries find it difficult to negotiate wage increases as production costs escalate beyond proportion. If the lay-off of workers continues in the clothing industry, it would increase the unemployment rate, thus impacting on the economy of South Africa [17].

The problems faced by clothing producers are summarised below:

- “Throughput time per unit: The time to complete one unit of production vs. the time to complete the order.
- Inventory between processes: used as buffer stock, machine breakdowns, line balancing. It may extend completion time.
- Critical paths: need to be arranged in parallel or in serial. This could affect the production process.
- Bottleneck operations: need identification for action.
- Plant utilisation: estimates effective use of resources.
- Minimum order size: affects the production process in terms of set-up costs and has a bearing on cost per unit.
- Change-over/setup: the loss of production when there is a style change.
- Rejects and repairs: evaluates capacity lost through repairs and costs lost through rejects” [1;11].

2. LITERATURE REVIEW

The multitude of competitive priorities has been the subject of considerable argument by manufacturers around the world. A universal set of priorities does not exist for all the firms in the global marketplace. Porter [19] formalized the concept of competitive priorities into four different types namely, price; flexibility; quality and dependability. Ward et al [24] identified five different dimensions namely price; quality; dependability; product flexibility; and volume flexibility.

Hill [14] argued that a firm should identify those criteria or priorities that win orders against the competition in the marketplace. His "order-winning" criteria included price, delivery, quality, product design and variety. Hill also considered that "qualifying" criteria (or performance criteria) were also important for an organisation.

Glock and Kunz [13] put forth a more detailed list by differentiating four different aspects namely, cost; quality; time; and flexibility.

In the South African clothing industry context, competitive strategies that require implementation as a matter of urgency from the researcher's perspective would be leadership that is people orientated with an insight into cultural diversity, financial management by understanding organisational costs, service delivery with quality management imperatives and last but not least, performance management initiatives [15].

The clothing supply chain continues to influence industrialisation throughout the developing countries [15]. Thus, consumer industries are struggling to maintain their share of the global market in terms of fashion design, production and distribution throughout the supply chain [8].

Stevenson [23] mentioned that an organisation can compete on three major issues namely:

- cost leadership - competing on the basis of price;
- differentiation - a unique product that is valued by customers; and
- focus - a niche market for its products developed on cost and differentiation strategy.

The use of technology in the clothing and textile industry is always a major factor in its competitive struggle. It is controlled by the established industries in Japan, Europe and the USA. However, technology is not the only way to achieve competitive advantage, but the understanding of systems methodology based on cost and productivity [16]. Information technology also plays a major role in processing information using real time technology, thus facilitating communication and feedback by the touch of a button. The information technology explosion is shaping business operations in all its contexts [12]. Although line balancing could be done manually, it would be advantageous to implement line balancing methodology using appropriate software.

The role of the supervisor is to ensure that the garment breakdown into the various operations is distributed as evenly as possible between workstations. The determination of the standard time value for each task is a critical component in the line balancing process which is obtained through the application of work study principles. However, this may be done using pre-determined motion time standards, which may oversee factors such as the property of the fabrics being used, performance of machinery, the effect of the environment and the quality level of the product may influence task times. There are numerous process improvement methodologies that could improve the status quo in the clothing industry. Qualitative results of the implementation of line balancing and its relative experiences at a South African clothing manufacturer are presented through a case history.

3. SURVEY EVIDENCE THROUGH CASE STUDY APPLICATION - (SELECTED VARIABLES FOR THE PURPOSE OF THIS STUDY)

3.1 DESCRIPTION OF THE INDUSTRY

The clothing industry is dispersed throughout South Africa, but is condensed in the provinces of KwaZulu-Natal and the Western Cape. In Kwa-Zulu Natal, the clothing and textile facilities are found in and around the Durban Metropolitan area with pockets in the north and south coasts, Newcastle, Ladysmith, and Qwa-Qwa. In the Durban metropolitan region (only) there are about 300 organisations employing over 15000 workers. The major part of the South African clothing industry is dominated by small and average sized organisations, i.e. those employing less than 200 employees which make up the majority of CMT manufacturers.

According to the National Bargaining Council statistics, it is estimated that there is approximately 827 formal (registered) clothing companies in South Africa. The clothing and textile industry in South Africa is predominantly South African owned. There are a substantial number of foreign-owned organisations which are located in non-metropolitan areas. The majority of CMT manufacturers, as well as micro-manufacturers receive their customer orders from the larger independent organisations.

Many industrialists from Chinese origin established clothing and textile operations in areas such as Hammarsdale, Mooi-river, Ladysmith, Isithebe and Newcastle. Clothing manufacturers appear to be medium-sized and focused on exclusive outer-wear for the middle to upper-end of the market. These manufacturers sometimes outsource their production to CMT (cut, make, trim) operations. The investigation focused on a limited number of “larger” organisations as these organisations restructured their facilities totally.

3.2 CLOSURES OF CLOTHING ORGANISATIONS

Clothing and textile organisations in South Africa that are unable to cope with the changes in industry sought closure as a resolution. According to the Inggs [15] approximately thirty clothing and textiles companies closed since July 2002. Many of these organisations sought legal advice on the process of liquidation. Closures are wide ranging, from textile manufacturers that produce standardised products to clothing manufacturers who focus on the fashion trends of the industry. Chinese imports proved to be an intimidating force for the entire clothing value chain.

3.3 PARTIAL CLOSURES OF ORGANISATIONS

Organisations that are involved with standard products found the competition stifling. These organisations (especially textiles) are pressured to shut certain parts of the operations only. A very good example is Coats South Africa that closed its spinning and twisting departments. It imports yarn ready for the dyeing process from sister companies around the world. Such organisations streamlined the production process to focus on specialised products [2].

Organisations that focused on niche markets managed to become highly profitable. The National party supported a textile manufacturer in the production of parachute fabric manufacture and material for bullet-proof vests and airbags. Other organisations that maintain their competitive edge are those that supply the paper/pulp industry and the mining industry.

3.4 SOUTH AFRICAN ORGANISATIONS FOREIGN TAKE-OVER

Trade liberalisation prompted organisations to focus on its competitive abilities. In this regard an investment in the latest technology and human assets is required. Foreign investment is imperative to bolster the industry in its pursuit of becoming competitive. The latest example is Edcon, which was taken over by the Anglo-American group in April 2007. Approximately 30 percent of the clothing and textile firms in SA are under foreign ownership as organisations strained under competitive pressure [7].

3.5 RELOCATIONS OF SOUTH AFRICAN ORGANISATIONS

Many clothing and textile firms, South African clothing industries (SACI) as an example, relocated to industrial districts such as Isithebe, Madadeni and Ladysmith. The organisations in urban areas are required to comply with the Bargaining Council regulations and unionised labour, thus escalating the cost of production. Rural areas constituted discretionary wage rates as determined by the employer and minimal union interference. The union has an important role to play in the South African clothing industry but stakeholders need to apply themselves in a harmonious relationship.

Many clothing and textile manufacturers abandoned their South African operations to set up facilities in neighbouring countries such as Lesotho, Swaziland and Botswana. The Botswana government provides incentives for clothing and textile manufacturers to invest in the country. In addition to this, there is skilled labour at approximately half the price of SA. These manufacturers are allowed to import raw materials according to the AGOA agreement [2]

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The Botswana government provided incentives to draw organisations into the country. The major incentive is the payment of approximately 80% of the payroll costs for the first three years. Botswana provides excellent investment opportunities where the clothing industry could thrive. Taxes imposed on clothing manufacturers are much less than those imposed in SA. One textile manufacturer that set up its facilities in Botswana was Waverly Blankets, which relocated in June 2001.

3.6 PERFORMANCE OF THE INDUSTRY

The clothing industry in SA is performing in the region of 85% labour efficiency. Capital expenditure on new assets averaged approximately 1.4% of sales (Robbins, 2004). With clothing manufacture being labour intensive it is important to advance through the investment in capital requirement and technological innovations to overcome the competitive nature of the industry. Exports decreased, while imports increased. Labour efficiency of the SA clothing operators is approximately on par with the United Kingdom, European Union and the United States but it is the application of technology, working culture and productivity levels that are a matter of concern [3].

3.7 PERFORMANCE MANAGEMENT

Management of all organisations claimed that they had the skills that would improve their production levels. An amazing fact is that 100% of the organisations sampled did not measure their productivity levels, as they focus on labour efficiency. "We do not need training and development," was mentioned by (5%) of the sampled organisations' management. The fundamental aspects of work-study, production management and quality management are not implemented by CMT manufacturers. Thus, it can be presumed that output performance could be improved by approximately 30% by CMT manufacturers.

3.8 GARMENT COST BREAKDOWN

CMT manufacturers did not break down costs of the garment from a manufacturing and financial perspective. Garment costing provides information such as labour cost, the number of machinists required, line balancing requirements and production output. With a structured costing system and the estimation of production costs, the organisation would be able to determine delivery times, output performance and profitability of the organisation.

3.9 PLANT HISTORY AND CONTEXT

A qualitative approach using a case study is used in the implementation of line balancing methodology. This production facility manufactures men's and ladies fashion wear and operates in a small town in Kwa-Zulu Natal. Currently, approximately 300 people work in the plant. The factory opened in 1970 and did not implement modern technology due to financial constraints. The facility had 16 supervisors and a plant manager.

The plant manager agreed to perform a pilot project on line balancing to determine its effectiveness. The sewing department used to the bundle system of manufacture. Work is passed to sewing machines in bundles of cut pieces. The number of cut parts in the bundle may vary according to weight or the complexity of operations required, but the principle remains the same: the operator unties the bundles, sews the cut parts together, re-ties the bundle, processes the work ticket and places the bundle into a bin or on a transporter system (a U shaped manual conveyor). The bundle then goes to another machinist who repeats a similar sequence; a bundle may be tied and untied several times before it completes its lengthy journey. Units move from operator to operator for completion of the respective operation. The bundle production system is a prominent production system used in the clothing industry. Manufacturers use it as a "buffer feeder" and fail to implement process improvement techniques to enhance production flow. Bundles of work-in-progress are found at workstations and sub-assemblies[5;22].

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The plant followed conventional management practices before the 1980's but started changing as new management came on board. There was very little interaction among employees and management and there was an autocratic style of management.

Before the year 2000 the production facility was accustomed to lot sizes of between 2000 and 10000 units per order. Currently, there are lot sizes of approximately 100 units per order. The garments were not as complex in construction as the ones received currently. The factory was "flooded" with high lots of work-in-process throughout the plant. Employees who were loyal and employed for the last 30 years said that the environment in which they worked was hostile and they did the same operation for several years. It is important to note that there was no process improvement methodologies implemented at this organisation.

4. IMPLEMENTATION OF LINE BALANCING

4.1 LEADERSHIP QUALITIES

The workforce of the majority of the organisations sampled complained that management did not treat them as "assets" of the organisation. They claimed that they are often treated poorly and management would not consider their views on issues. Labour relations are considered "sub-standard" as management regard workers as another "input" for production. Workers mentioned that all management is concerned about is production, and didn't care how it is achieved. The portrayal of an authoritative management style is common in the clothing industry due to its labour intensity. But the ability to improve the morale through the philosophy of total management could have a positive impact on the output performance of the industry[6].

Organisations are positive about their future in the industry and adopted an attitude of "survival of the fittest." Managers are reluctant to believe that the implementation of process improvement methodologies within the production environment would enhance productivity levels [9].

Organisations realised the benefits of work-study principles, 45% complained that they did not have the capacity to apply the process improvement principles. Finally, the implementation of innovative practices with regards to production techniques, design and development of production, manufacturing processes, supply chain management and labour relations should enable clothing manufacturers to maintain and grow within the industry. The multitude and magnitude of challenges facing the SA clothing and textile industry are clear from the information presented.

4.2 PREPLANNING FOR LINE BALANCING

Line balancing is the distribution of work on the line in such a way that all machinists obtain an equal amount of work in terms of time value. All workers should be productive during the day and production should flow smoothly, thereby achieving planned targets. The objective is to accurately delegate workers to the various operations required to complete the product based on their operational skills and to maximise productivity and delivery as per the planned targets.

One of the major oversights on the part of management is that they do not indicate the link between labour costing, order scheduling, line balancing and control to the line staff. Line balancing has 2 stages:

- Pre-planning
- Control

Both stages are inter-complementary and extremely important.

Pre-Planning: Planning includes theoretical calculations & assumptions and is generally guided by past practical experience (and in most cases reliant on the memory of the

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supervisor). It takes into account operation complexities, machinery and productivity constraints.

Historically the method of allocating workers and operations was based purely on a 1 machinist to 1 operation basis. When bottlenecks were experienced, additional labour was allocated to minimise the constraint. Although this achieved the desired effect, labour utilisation was sacrificed. Thus, the productivity of the line was poor, and with lack of measurement practices, there was no factual information to address the situation. Supervisors used under-balanced workers for the preparation of the next order which was not required and thus over-stocked work in progress. The resultant effect was the production of products under stressful conditions for the workforce.

In order to address this situation, an operation bulletin was drawn up during the garment costing stage using pre-determined motion time studies such as GSD (general sewing data) or synthesis, indicating the sequence of operations, necessary machinery and equipment. Just before production could commence the operator allocation bulletin was handed to the supervisor for the allocation of operations. Follow-up procedures were adopted to verify the operation bulletin using work-study principles. Discrepancies were ratified and kept on record for future consultation. The follow-up is often related to forceful methods of target achievement and often unfair to workers allocated to critical operations. This causes discontentment among the workforce and leads to high labour absenteeism and labour turnover, with necessary skills being lost.

Where standard minute values are available, the balancing of the line becomes simple and can be completed via a simple spreadsheet exercise on a computer. This method is used by the proactive individuals who realise that one has to drive the balance rather than let it drive the individual.

Accurate worker to operation ratios were established based on time value expressed as SMV (standard time value). The results reflected that some workers were required for a full day while others were required for only a portion of the day to complete the tasks required. This entails the reliance on the number of different skills possessed by every worker and the ability of the supervisor to optimize the use of these skills which usually manifests itself in the "control" function of line balancing.

4.3. MONITORING AND CONTROLLING THE LINE

Control initially begins with the initial line set up and daily monitoring of operator efficiencies. It includes a thorough knowledge of worker skills and levels of efficiency and can be made available via an updated skills matrix. With a proper understanding of worker skills it is possible to make reliable decisions about operation combinations that would minimize equipment and labour resource requirements.

Thorough planning enhances the control function. A skilled supervisor has to have the knowledge of the appropriate levels of work-in-progress, an analysis of current machinery and its operational features, knowledge of replacement workers in the event of absenteeism or poor skills and full control on the quality of work to be produced. This is often the most difficult part of line balancing as it desires the knowledge, skills and experience of a person that is proficient in the clothing manufacturing industry.

Exploratory information has revealed that supervision is a major problem in the clothing industry. There is a lack of logical and common sense thinking and weakness in mathematical judgement. Supervisors rarely have the ability to foresee problems and are often reactionary, hence the term "fire-fighters." In most cases the supervisor is the supplier of work and the other term with which supervisors are called are "glorified service-hands." Observation skills, re-planning and adaptation skills are not used until the very last minute until the crisis arises.

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In the process of controlling the production of each operator by recording outputs, it is common to view operations as requiring one worker or half a worker or 1 and half worker. It is important for supervisors to think in terms of time, that is, if a worker is required on an operation for the full day then it is for 60 minutes every hour, and if only half a worker is required then the worker should only spends half an hour on the job to achieve the required target. This is where most supervisors fail at their line balancing activity. They do not actually control the halves, or less than halves. Management should be guiding supervisor to an extent in which they can pre-plan this information so that supervisory control can improve. This would most certainly lead to improved line balancing[3].

An exercise was undertaken to highlight line balancing on a lounge shirt sewing line. The line balance exercise was completed on a simple and regular style with consideration given to controlling periods of 10 minutes. Each operation was studied using stop watch time study methodology. A 34% increase in production was achieved with outputs per hour rising from 81 units per hour to 109 units per hour. The in-line and off-line efficiencies were accurate for the first time in 15 years of efficiency control. The manager, supervisor and worker morale improved the team spirit of the line.

4.4 THE EFFECT OF LINE BALANCING

The following is a before and after example to illustrate the effect of line balancing on a clothing production line. It is important to review the efficiency expectancy, operation output and total output differences for the same style using the same number of workers.

Table 1 - Worker allocation to each operation before balancing

VBCS April 28 2010

Line Balance Report

Order: 4713

ID	Operation	Machine	SMV	Theory Bal	Round Off	Output	Efficiency
1	Fit Cuff	3TOL	0.74	1.07	1	81	100%
2	Join Bands	3TOL	0.52	0.75	0.83	95	85.26%
3	Press Band	IRON	0.75	1.08	1.17	93	87.1%
4	Make Belt	3TOL	0.44	0.64	0.67	91	89.01%
5	Turn Belt	Belt Turner	0.43	0.62	0.67	93	87.1%
6	Close Belt	3TOL	0.32	0.46	0.5	93	87.1%
7	Press Belt	IRON	0.3	0.43	0.5	99	81.82%
8	Fit Label	SNLS	0.23	0.33	0.33	86	94.19%
9	Join Shoulders	Mock Safety	0.49	0.71	0.67	82	98.78%
10	Set Sleeves	5TOL	0.69	1	1	86	94.19%
11	Fit Pocket	5TOL	0.49	0.71	0.67	82	98.78%
12	Close Sides Long	5TOL	1.42	2.05	2	84	96.43%
13	Fit Full Band Long Gown	3TFL	1.24	1.79	1.83	88	92.05%
14	O/L Bottom	3TOL	0.34	0.49	0.5	88	92.05%
15	Hem Bottom	SNLS	0.55	0.8	0.83	90	90%
16	Bartack (9)	BARTACK	0.73	1.06	1	82	98.78%
Total SMV = 9.68		Number of Operators = 14		Line Balance Efficiency =			
Theoretical Output = 86		Practical Output = 81		94.19%			

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Table 2 - Worker allocation to each operation after balancing

VBCS
Line Balance Report

April 28 2010

Order: 4713

ID	Operation	Machine	SMV	Theory Bal	Round Off	Output	Efficiency
1	Fit Cuff	3TOL	0.74	1.07	1	81	134.57%
2	Join Bands	3TOL	0.52	0.75	1	115	94.78%
3	Press Band	IRON	0.75	1.08	1	80	136.25%
4	Make Belt	3TOL	0.44	0.64	1	136	80.15%
5	Turn Belt	Belt Turner	0.43	0.62	1	139	78.42%
6	Close Belt	3TOL	0.32	0.46	1	187	58.29%
7	Press Belt	IRON	0.3	0.43	1	199	54.77%
8	Fit Label	SNLS	0.23	0.33	1	260	41.92%
9	Join Shoulders	Mock Safety	0.49	0.71	1	122	89.34%
10	Set Sleeves	5TOL	0.69	1	1	86	126.74%
11	Fit Pocket	5TOL	0.49	0.71	1	122	89.34%
12	Close Sides Long	5TOL	1.42	2.05	2	84	129.76%
13	Fit Full Band Long Gown	3TFL	1.24	1.79	2	96	113.54%
14	O/L Bottom	3TOL	0.34	0.49	1	176	61.93%
15	Hem Bottom	SNLS	0.55	0.8	1	109	100%
16	Bartack (9)	BARTACK	0.73	1.06	1	82	132.93%
Total SMV = 9.68		Number of Operators = 14		Line Balance Efficiency = 126.74%			
Theoretical Output = 86		Practical Output = 109					

It is imperative to note that should an operation require an operator for a 15 minute period to complete an hour's production, as defined by the line balance, the operator needs to be allocated another task on the line. Therefore, resource utilisation improves, with the optimisation of productivity and efficiency. This would enable the industry to improve their competitive status, quality, price and delivery dates.

5. RESULTS AND DISCUSSION

5.1 MANAGEMENT COMMITMENT

Any change in the organisation stems from top management. Commitment from management drives the process of change and nothing can be achieved if management does not support the initiative. Once management gives their approval any change is possible, but employees need to understand and support the changes for it to be successful.

Management realised that in order to counteract the threat of imports they would try out the team-working concept although employees wished for "the good old days." They could not afford huge piles of inventory on the machine floor.

Employees were delighted that the plant manager supported the initiative and frequently visited to find out how they were performing. An employee of the team briefly summarized how he felt and mentioned that any project has to have the support of management and the acceptance from employees for it to be successful. The managing director of the organisation initiated the process of change as funding in terms of labour is involved. Support from management, especially in terms of funding is important for a project of this nature.

The planning, organising, leading and controlling of the project are important as it would benefit the organisation over a period of time. The clothing industry is in need of radical change that would be able to counteract the competition faced. Employees were thankful that they had commitment and the necessary expertise from the management team.

5.2 EDUCATION AND TRAINING

A number of training sessions were held with the team of employees to provide orientation with the objectives of the project. Employees held discussions regarding their concerns so that everybody understood their role in the project. The researcher explained that it was

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important for employees to understand the basic principles under which businesses operate, and that the industry was under threat due to globalisation. It was explained that the objectives of the project was to improve their competitive position so that they could maintain their households.

The organisation invested in training and development of employees on an ongoing basis. It was mentioned that training of employees in the latest developments would enhance employee skills and workers would embrace changes in future. Another employee's experiences was that people would be willing to change if they knew what the change was all about and how it would impact on their work. Mention was made that employee involvement from the very outset would clear any negativity that may be spread through the grapevine within the organisation. It was said that management discussions behind closed doors regarding changes are unhealthy for an organisation. Open communication and the building of trust among the people are extremely important.

An employee mentioned that learning can only take place by change in attitude and behaviour. She mentioned that training makes employees aware of the current occurrences, what employees should expect and the manner in which barriers could be reduced. This is a great motivator for the workforce.

Employees were enlightened on the benefits of team-work and line balancing and how it could change the entire organisation. An employee mentioned that training made them understand the current status in the clothing industry and how they could rise above the competition. It was mentioned that they are setting an example for the industry to follow and they could be the best manufacturer in the clothing industry. The advantages they experienced created team-spirit and they found that they were responsible for the making this project a success.

Another employee mentioned that the concept would be ineffective and that government intervention was the only way that the industry could be saved. The researcher interacted with the individual and convinced him of the way forward.

The employee admitted that he was sceptical and did not want change, but since there was communication with management and training of workers, he would "go with the flow." The comments suggest that a project such as this needs education, training, communication and management support.

Open communication is important in a project. The sharing of information between management and employees enhances the success of the project. It was mentioned that the dissemination of too much information and the interpretation of the information could cause problems within the work environment. The "grapevine" misinterprets information and employees become despondent. It was mentioned that 15 years ago operators were not allowed to speak and at present communication is encouraged in team-work.

An employee mentioned that this was quite a change for "them." It was mentioned that approximately 15 years ago the floor manager had an elevated office at a centralised point on the machine floor where there was a clear view of all employees. Supervisors were called into the manager's office on a regular basis and screamed at while the operators observed his ruthless behaviour. "Management by walk about" (MBWA) has become a prominent feature in the clothing industry. It was mentioned that the manager should be a part of the team on the production floor, know the employees by name and understand the problems experienced. Much could be achieved if team-work is implemented throughout the organisation and all employees strive to achieve the mission and vision of the organisation. Human assets need to be appreciated to enhance their motivational level. Working together could "change a mountain into a molehill," mentioned an employee [22].

It was mentioned that employees were often ignored and management made all the decisions. Issues such as product quality, customer expectations, productivity were never

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disclosed to employees. A motivated workforce can achieve labour efficiency without the pressure from management. It was explained that communication among the employees and management improved quality of production and an empowered employee could definitely add value to the organisation, no matter what problems were faced.

It was mentioned that customer focus and expectations, together with quality and on time delivery is an organisational problem, and not only the responsibility of the floor manager's. The team effort created a change in the working climate with information sharing that enables employees to better understand the operational aspects of an organisation.

The implementation process outcome indicates that active employee participation with knowledge sharing could improve the performance of the organisation. Sharing information about the costs that go into production and the financial position of the organisation makes employees understand the importance of "right the first time, every time." With work-study officers involved in the process, all work measurement and method study evaluations were done with the team that shared ideas on methods and ergonomics. With the adoption of transparency in all activities employees understood their situation and that of the organisation [20].

6. RECOMMENDATION AND CONCLUSION

The nature of assembly line balance in the clothing industry is stochastic because of the existence of task time variations. The use of the fifteen minute break intervals for a machinist enables the smoothing of tasks which is appropriate for measuring the effectiveness of assembly line balance in the clothing industry. Based on the real production data collected from a men's shirt manufacturing factory, the example illustrated in this study clearly showed that the tasks can be categorised in 15 minute intervals. This implies that should an operator complete the required target, the operator needs to be moved to another workstation so that line balance could continue. The time variance should be taken into consideration for improving effectiveness of line balancing. Operators should be moved between workstations to improve the line balancing efficiency[21].

This paper contributes to the existing body of knowledge in clothing manufacture and competitive strategy in two ways. First, it presents the relationship between competitive priorities and its impact within the clothing industry by using work study methodology. Secondly, this study provides empirical evidence on some natural rules of how strategic elements can be applied through management commitment and draws attention to the fundamental strategic issues that are often overlooked in the development of an appropriate manufacturing system for clothing manufacture.

The benefits of the findings in this study lie in their potential applicability to extending the operations of clothing manufacture beyond the system boundaries. This is important nowadays to reaffirm that the clothing industry in South Africa has the potential to survive under a strenuous climate. Managers should understand the importance of implementing competitive priorities and positioning strategies with their manufacturing systems [1].

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