P-3582

IMPROVING PRODUCTIVITY BY REDUCING INEFFECTIVE TIME IN APPAREL PRODUCTION

A PROJECT REPORT

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in partial fulfillment for the award of the Degree

of

BACHELOR OF TECHNOLOGY

in

TEXTILE TECHNOLOGY (FASHION TECHNOLOGY)

KUMARAGURU COLLEGE OF TECHNOLOGY

(An Autonomous Institution affiliated to Anna University of Technology, Coimbatore)

APRIL2011

KUMARAGURU COLLEGE OF TECHNOLOGY

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BONAFIDE CERTIFICATE

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21.4

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ACKNOWLEGDEMENT

We the students of this project humbly honor "**THE ALMIGHTY**" for the blessings and the doings.

We are highly elated in manifesting our deep sense of gratitude to our beloved co-chairman **Dr.B.K.Krisnaraj Vanavarayar**, respected Director **Dr. J.Shanmugam** and our respected principal **Dr. S .Ramachandran** for providing us the wonderful opportunity to carry out this project.

We take this opportunity in expressing our profound thanks to **Dr. J .Srinivasan** Professor and Head of Department of Fashion Technology whose constant encouragement was instrumental in completing this project work.

We owe immensely to **DR.R.Shanthi** ,Assistant professor, Project Guide for her wonderful guidance, enthusiasm and invaluable help rendered throughout the project.

Our sincere thanks and profound gratitude to **Prof. C.S. Senthil Kumar**, for his support during this project.

We are obliged to extend our sincere thanks and gratitude to **STANFAB APPARELS**, Chennai and **CLIFTON EXPORTS** ,Tirpur for completing the project work successfully.

We also wish to thank our **Parents** for their constant encouragement, help rendered and also making all the facilities necessary to carry out the project.

ABSTRACT

The apparel industry is truly global in nature. Apparel manufacturing being labor intensive has been migrating from the high wage developed world to developing countries. However, the developing countries will need to have efficient manufacturing operations if they are to retain their competitiveness in the apparel industry.

Improving productivity is one of the major challenges that apparel industries are facing. Working on this basis, it is found that there are several ways to improve productivity and one such effective way is by reducing ineffective time. Thereby studies were conducted in two companies, one is Stanfab Chennai, and the other one is Clifton Tirupur. Both the companies selected were medium scale industries. Since the large scale industries seem to cope up with the upcoming technologies and improved productivity, medium scale industries made a natural choice of study. The factors leading to the ineffective time were identified, analyzed and changes were brought to the notice of the management of the industry selected. These changes were also implemented and proved to be economical as well. Hence this work would serve as a guideline to many apparel industries which have to sustain stiff competition in global market

INTRODUCTION

1.INTRODUCTION

The Indian apparel industry has a vast existence in the economic life of the country. It plays a critical role in the economic development of the country with its contribution to industrial output, export earnings of the country and the generation of employment. The Indian apparel industry has seen remarkable changes in the past few years and it is also one of the India's largest foreign exchange earners.[1]

As the apparel manufacturing industry has become more labour intensive and requires less capital investment, its concentration is shifting more towards the developing countries and even constituting large amount of their exports. This can be analyzed by the fact that the apparel production in industrialized countries decreased between 1980 and 1996, where as the production increased in developing countries during the same period. Similar trend was seen in exports, the apparel exports of developing countries increased six times between 1980 and 1997, and that of developed economies rose by 150%.

The global apparel industry's total revenue in 2009 was US $ 1, 252.8 billion, which was approximately 68% of the overall industry value. Asia Pacific constitutes the largest amount of production and trade in the apparel industry worldwide. The percentage share of different regions of the world in the total trade revenue in the year 2009 was

THE TABLE SHOWS THE PERCENTAGE SHARE OF TRADE REVENUE IN DIFFERENT REGIONS

Region	% Share
Asia Pacific	35.40%
Europe	29.40%
USA	22.30%

Rest of the world	12.90%

table no: 1

China had captured 65% of the global market share towards the end of 2009 in total apparel exports. The other major apparel exporting nations include USA, Germany, Hong Kong, Italy, Malaysia, Pakistan, Thailand and India. Some of the apparel trade statistics are presented below:

THE TABLE SHOWS THE APPAREL TRADE STATISTICS AMONG MAJOR NATIONS

Country	**US $ Billion**
China	8,260.921
Hong Kong	1,723.210
Italy	1,353.586
Malaysia	1,255.069
Germany	669.130
Pakistan	618.830
Thailand	597.758
USA	595.171
India	522.463

table no: 2

The Apparel Industry is growing at a very high rate but still there are some barriers, which are hindering the growth of this industry. Some of them are:

Though the demand for garments is increasing day by day but the production rate has still not been able to match with the ever rising demand. More production facilities are needed to meet the demand.Most of the raw material needed for apparel manufacturing is available in the developing or under developed countries and these countries do not have enough resources and manpower to explore them. These countries also do not have finance to set up factories for clothing and garment production.

The importers of developed economies are facing very stiff competition as countries like China are producing good quality products in low prices due to availability of very cheap labour. Some trade laws still are very much in favor of developed countries and they need to be reviewed, to facilitate imports from the developing countries.As apparel industry is fashion driven, and fashion keeps changing, the firms have to cope with the changing apparel industry trends and still complete orders in time. Thus they usually have to work under pressure.[2]

The global apparel manufacturing industry is expected to grow more than ever in times to come. According to an estimate, the global apparel industry will reach a value of US $ 1,781.7 billion by the end of 2012. The apparel manufacturers are now adopting new techniques to increase their trade. New business models and competitive strategies are used to enhance profits and growth. The consumer is more aware and more demanding with the development of media like television and Internet. They have more choices in quality, price and design. This is the reason why apparel chains all over the world are focusing more on improving the quality of the product and offering in varied range of fashion designs. Apparel manufacturers are developing methods to keep up with the pace of change like offering on wholesale prices to survive in the global competition.[3]

According to statistics of Apparel Export Promotion Council (AEPC) of India, the country's apparel exports registered a year-on-year growth of 1.5% to US$728 million in October 2010.

The cumulative exports during April to October amounted to US$5.7 billion, about 6% lower compared with the same period last year, despite a positive growth since August.

Technology has revolutionized the manufacturing process, virtually in all the industries. Apparel industry is no exception for this global phenomenon. Major apparel producing nations are attempting to use modern technology for improving productivity and quality to retain their competitive edge.

Through work study, the apparel industries gain overall improvement in productivity, higher customer satisfaction, higher foreign returns and reduced shipment delays, labor turnover. Thus the company is benefitted.

In the present business scenario, to survive in the market and to be profitable, the goal of any manufacturing system is to produce the highest quality products in the shortest lead time possible at the lowest cost. Fulfilling the buyer's expectations in quality and productivity is crucial in future. In this juncture, industrial engineering department, place a critical role in measuring productivity and methods of improving work procedure for operator and shop floor level persons. With this background this study was undertaken with the following:

- It helps in reducing ineffective time.
- It helps in the elimination of wasteful efforts, useless material handling, etc.
- It helps in the optimum use of plant, equipment, manpower and material.
- It helps in developing economical and efficient work methods.
- It helps in improving overall productivity.

REVIEW OF LITERATURE

2.REVIEW OF LITERATURE

The review of literature undertaken for this study is reviewed under the following heads

2.1 Work study

2.2. Method study

2.3 Work measurement

2.4 Strategy for productivity improvement

2.5 Ergonomics

2.1WORK STUDY

Work study, as its stands today, provides us with a scientific approach to investigate into all forms of work, with the view to increase productivity. Method study and work measurement are two topics that are covered in work study. Method study concerned with the reduction of the work content of a job or operation, while work measurement is mostly concerned with the reduction of the work content of a job or operation, while work measurement is mostly concerned with the investigation and reduction of ineffective time associated with it and with the establishment of time standards for the operation carried out in the improved fashion as determined by method study .

Work study is the generic term for those techniques , particularly method study and work measurement , which are used in the examination of human work in all its context and which leads systematically to the investigation of all the factors which affect the efficiency and economy of the situation being reviewed , in order to effect improvement, method study is the systematic recording and critical examination of existing and proposed ways of doing work , as the means of developing and applying easier and more effective methods and reducing cost . Work measurement is the application of techniques and design to establish the time for the qualified worker to carry out the specified job at defined level of performance conducting time study will contribute better for improvement of productivity in apparel enterprise.

THE FIGURE SHOWS WORK STUDY AND ITS SCIENTIFIC APPROACH TO ALL FORMS OF WORK

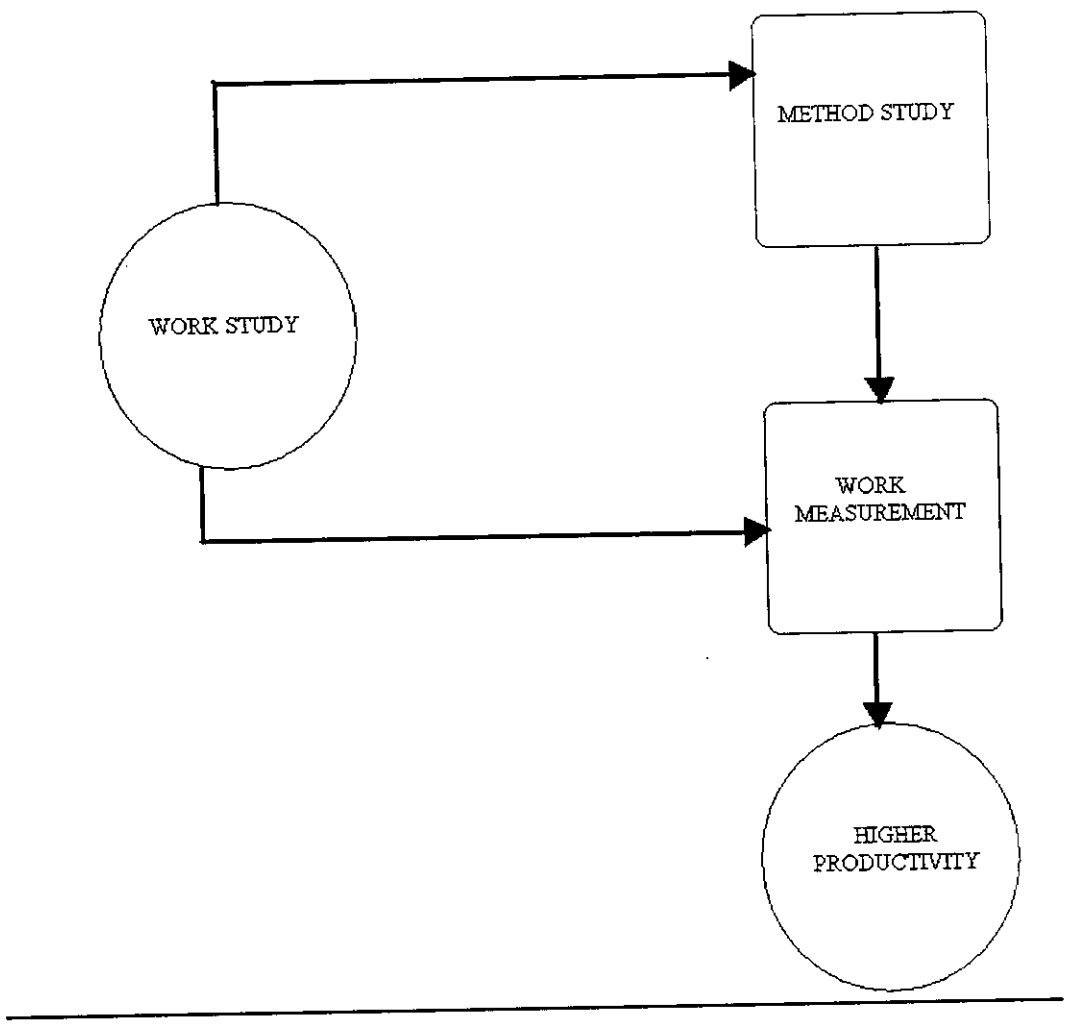


figure no: 1

2.2 METHOD STUDY

Method study is the systematic recording and critical examination of existing and proposed ways of doing work, as a means of developing and applying easier and more effective methods and reducing costs.

OBJECTIVES OF METHOD STUDY:

- Improvement of processes and procedures.
- Improvement in the design of plant and equipment
- Improvement of plant layout.
- Improvement in the use of men, materials and machines.
- Efficient material handling.
- Improvement in the flow of production and processes.
- Economy in human effort and the reduction of unnecessary fatigue.
- Method standardization.
- Improvement in safety standards.
- Development of a better physical working environment.

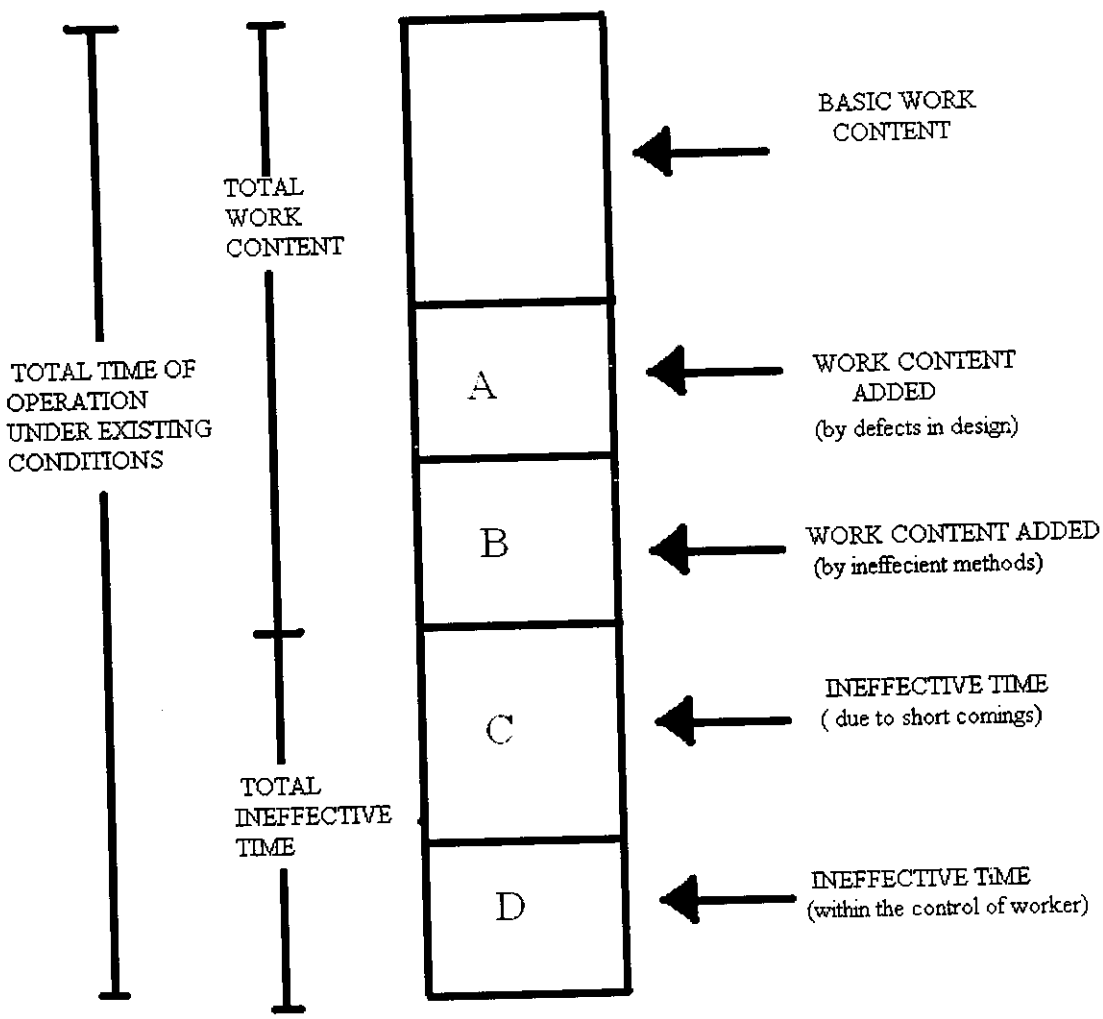
2.3 WORK MEASURMENT

Work measurement is the application of techniques designed to establish the time for a qualified worker to carry out a specific job at a defined level of performance.

PURPOSE OF WORK MEASUREMENT:

- To evaluate worker's performance
- To plan work-face needs
- To determine available capacity
- To determine price or cost of a product
- To compare work methods
- To facilitate operations scheduling
- To establish wage incentive schemes

THE FIGURE SHOWS THE MANUFACTURING TIME



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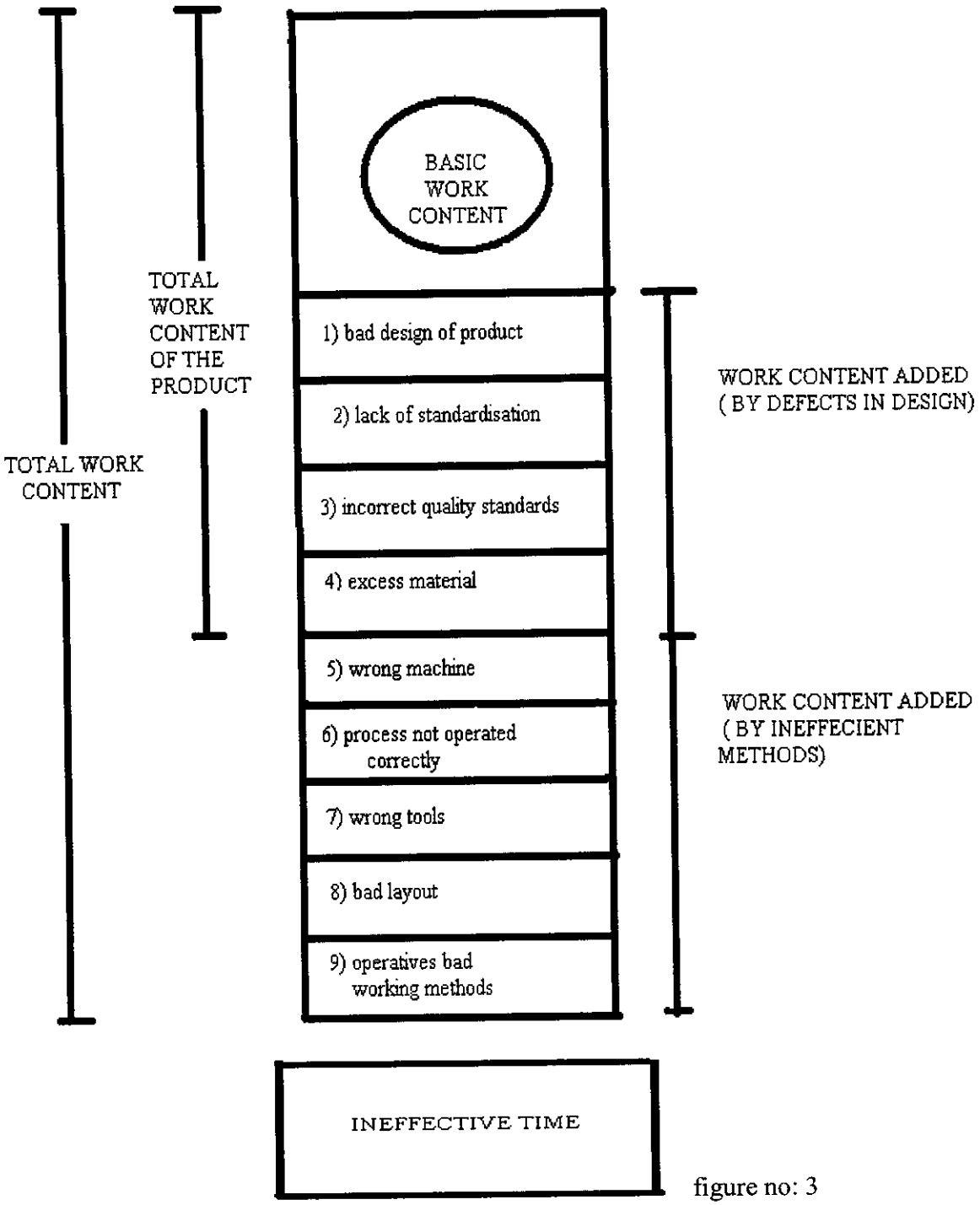
THE FIGURE SHOWS THE WORK CONTENT DUE TO THE PRODUCT AND PROCESS

WORK CONTENT DUE TO THE PRODUCT AND PROCESS



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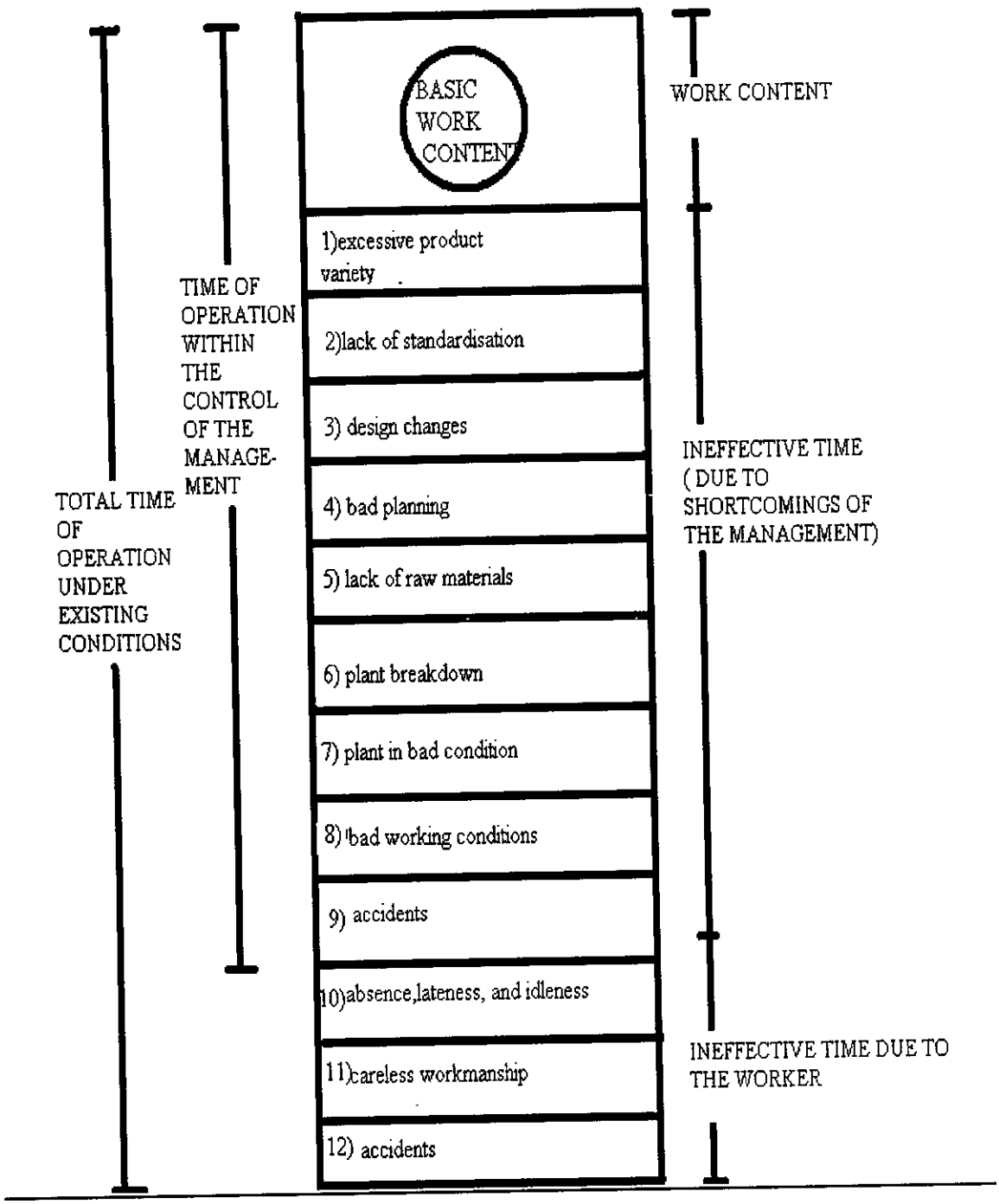
THE FIGURE SHOWS INEFFECTIVE TIME DUE TO MANAGEMENT AND WORKERS



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THE FIGURE SHOWS MANAGEMENT TECHNIQUE FOR REDUCING EXCESS WORK CONTENT

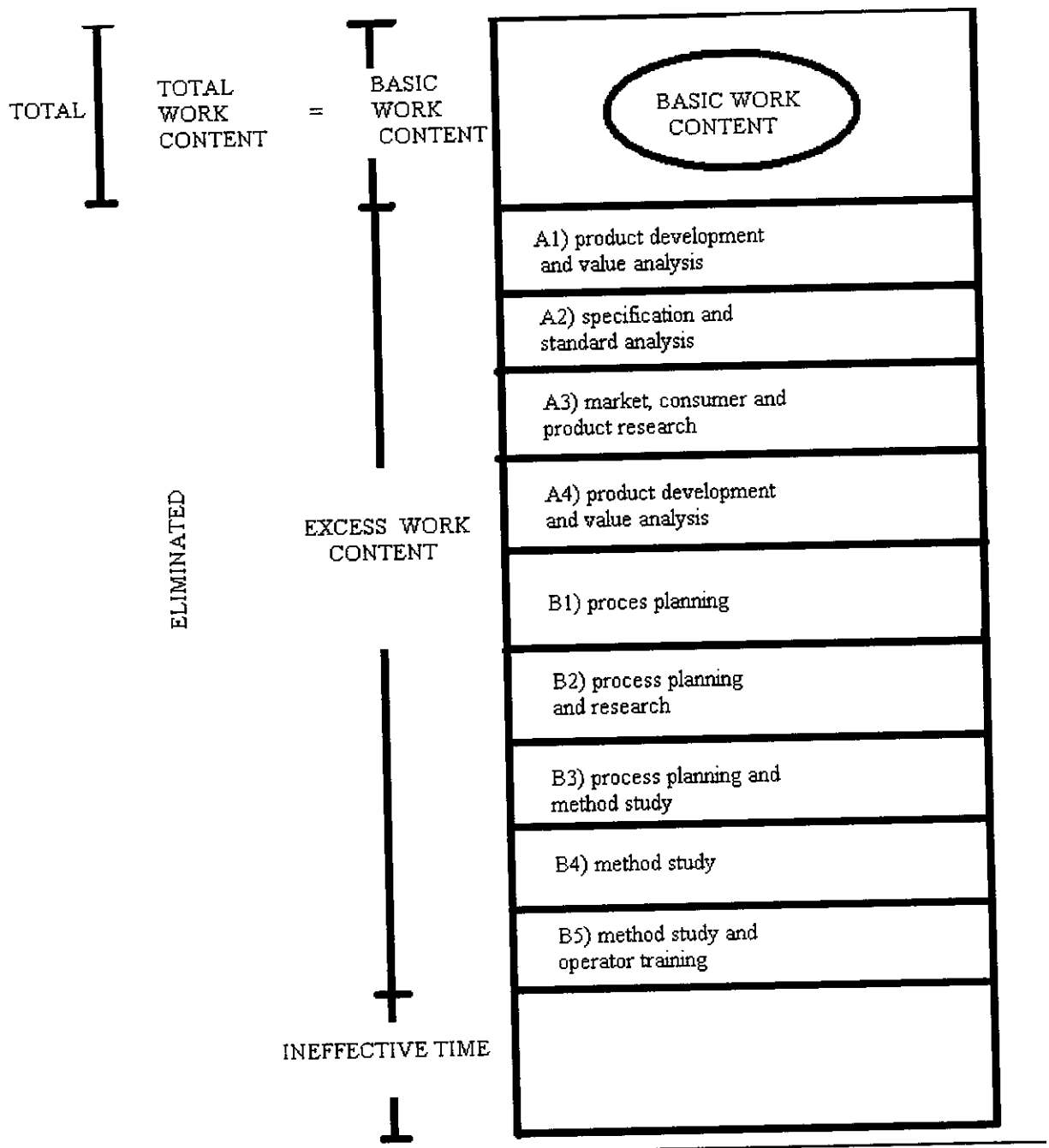


figure no: 5

In the process of setting standards it may be necessary to use work measurement .

- To compare the efficiency of alternative methods.
- To balance the work of members in team.
- To determine, in association with worker and machine multiple activity chart.
- To provide the basis for production planning and control for the choice of a better layout and for process planning and for establishing just in time inventory control systems.
- To provide information that can enable estimates made for tenders, selling prices and delivery dates.
- To set standards of machine utilization and labour performance which can be used as the basis for incentive schemes.
- To provide information for labour cost control and to enable standard cost to be fixed and maintained.[5

2.4STRATEGIES FOR PRODUCTIVITY IMPROVEMENT

The following are the strategies for productivity improvement

2.4.1 Proposed Productivity measurement system

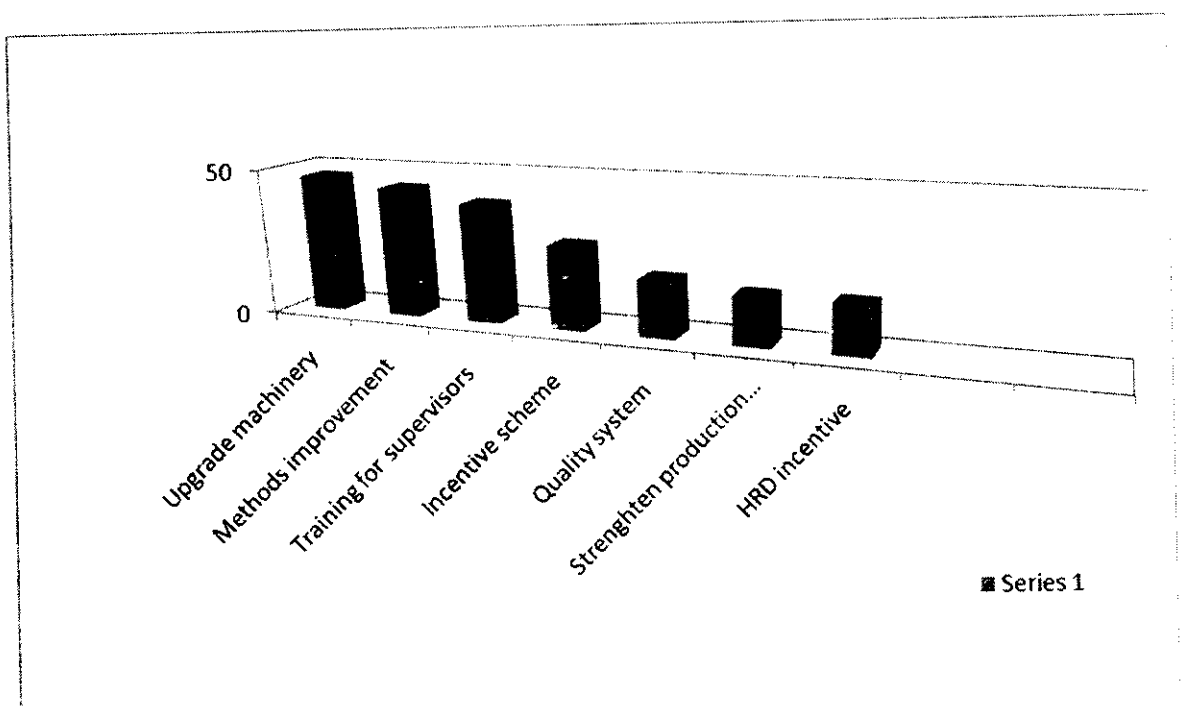
2.4.2 Strengthen quality system

The following are the suggestions in the order of the popularity.

- Machinery up gradation
- Methods improvement
- Training for supervisors and managers
- Incentive scheme for operators
- Quality system implementation
- Strengthen production planning and control
- HRD initiatives

- Use of work aids and attachments
- Research and development
- Use of better quality fabric
- Improvement in cutting quality
- Productivity monitoring

THE CHART SHOWS THE ORDER OF POPULARITY



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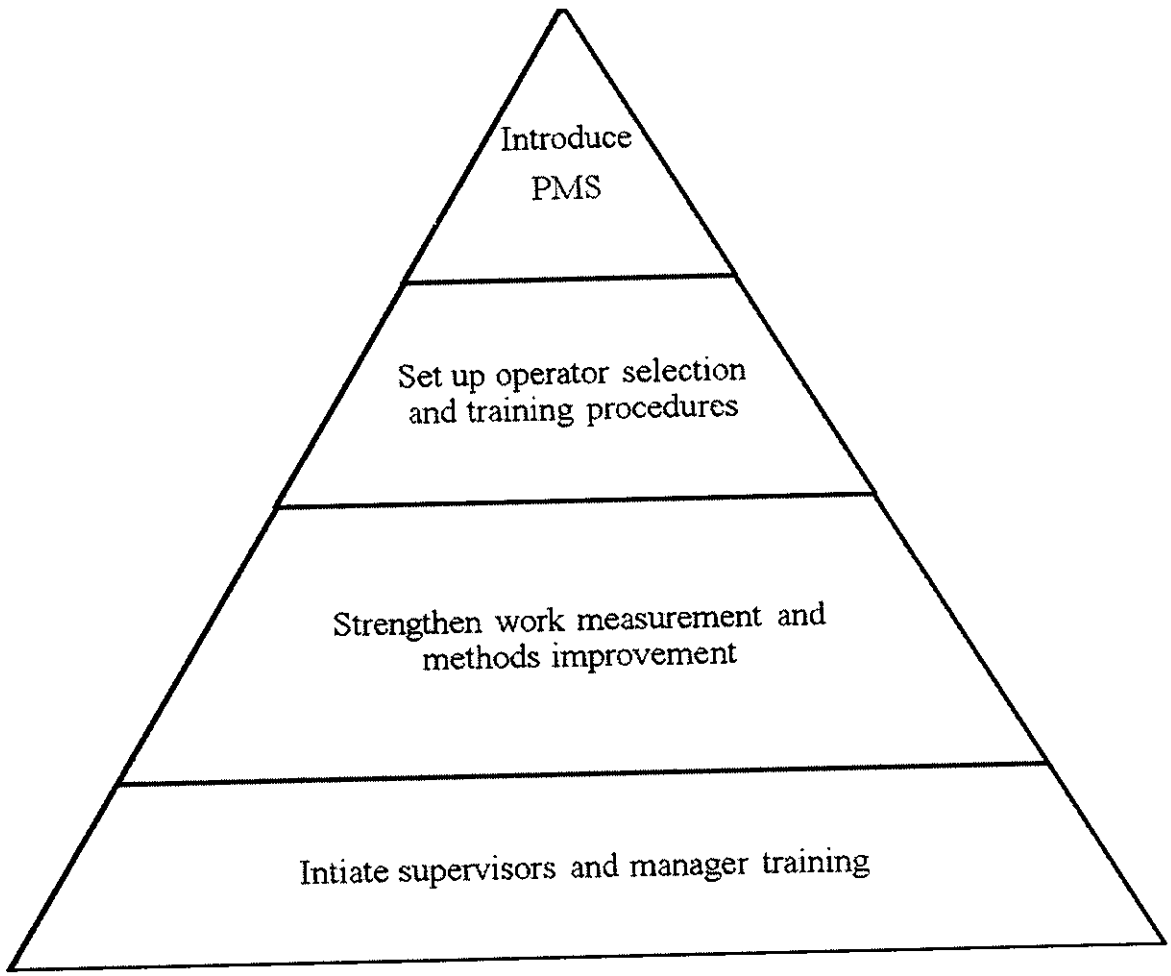
STRATEGY FOR PRODUCTIVITY IMPROVEMENT

The recommended strategy for an average apparel manufacturer is given as follows.



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THE APPROACH

A problem in the apparel industry can be solved by analyzing the following research concepts.

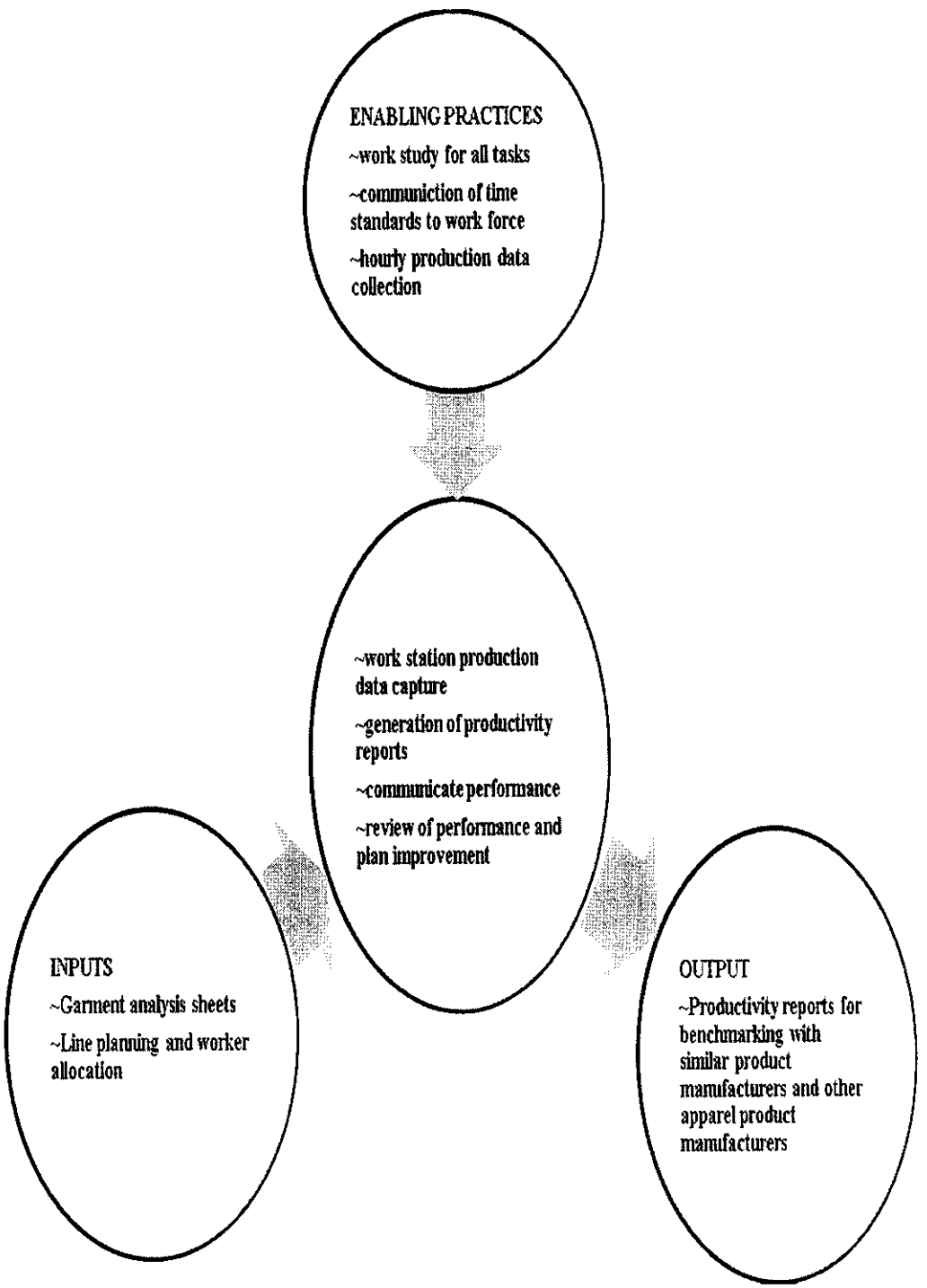
- Introduction
- Organization profile and philosophy
- Operation identification

- Problem identification
- Objective
- Problem solving approach
- Solution
- Conclusion

2.4.1 PROPOSED PRODUCTIVITY MEASUREMENT SYSTEM (PMS)

Proposed system is aimed at capturing production data from various work stations at a predetermined frequency. Trained personnel should process and analyse the data to generate productivity reports for specific operation, machine, operator, section, production line and the total production floor.The system should generate productivity reports in physical productivity terms, as well as percent efficiency, as compared to the standard performance. Immediately upon the generation of productivity performance reports the results should be shared with various stock holders. The next important aspect has to be the mechanism for productivity performance review of the plant. This process will involve analysis of reasons for productivity gap and suggest specific measures to be taken to bring in improvement.

THE FIGURE SHOWS THE PROPOSED PMS



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SUGGESTED PRODUCTIVITY MEASURMENT SYSTEM FOR APPAREL INDUSTRY

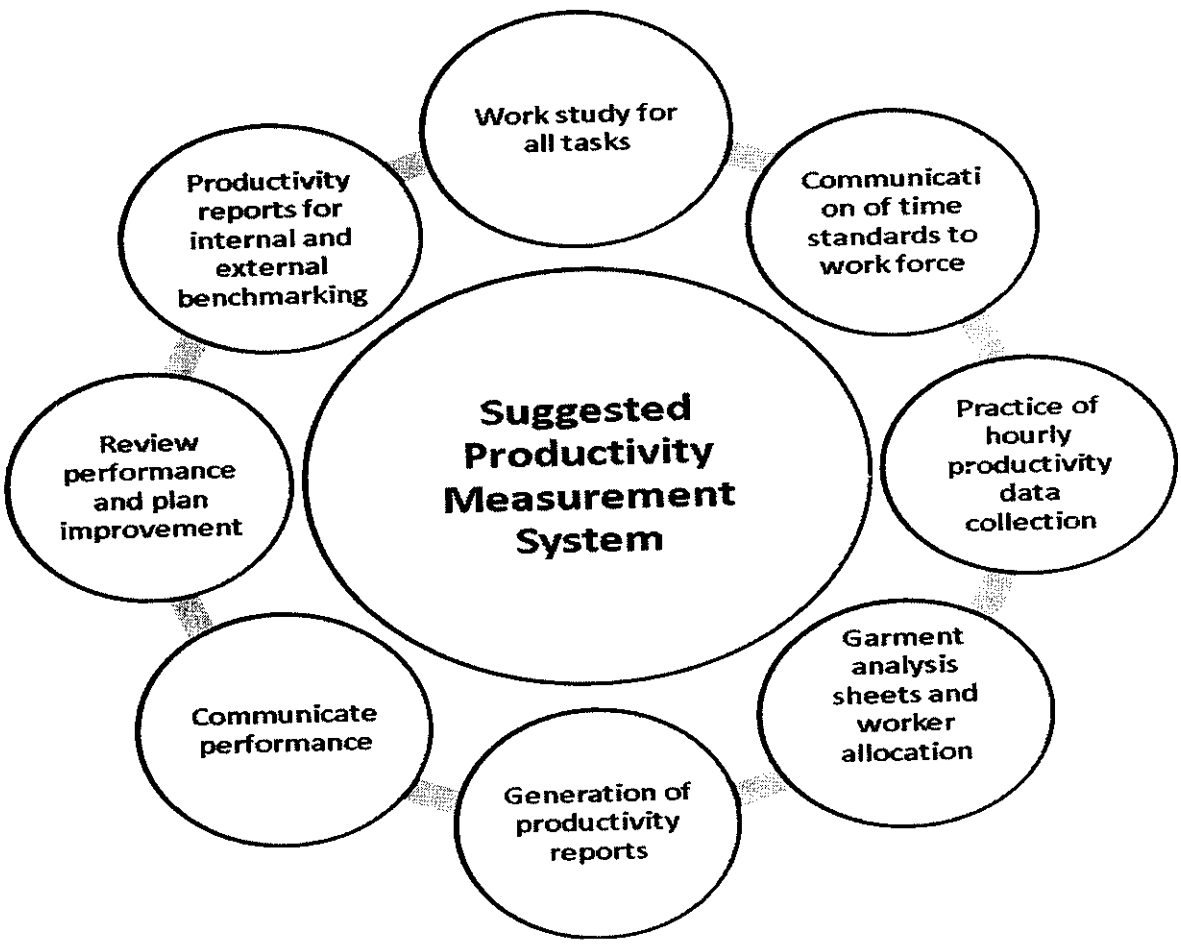


figure no: 8

2.4.2 STRENGHTHEN QUALITY SYSTEM

There is an urgent need to strengthen the existing quality system in the apparel manufacturing organizations . The focus of efforts of the quality function tends to be on defect detection prior to the dispatch of shipment to the customer rather than defect prevention. Managers tend to overlook quality defects in the merchandise in order to meet the delivery

schedules. It is also observed that only in rare cases , the quality performance of the factory is analyzed in terms of success/failure , rate of shipments , defect rate trends , frequency of defect type in total defects , cause of the defects and remedial actions taken to prevent the defects

It is important that apparel manufacturers understand the true cost of ignoring quality . If the factory could use the large work force employed to inspect and repair the garments for actually producing the right quality garments in the first place itself , the productivity can be improved substantially. Systems approach to the quality can help in a big way to assure "right first time" quality in the merchandise. The framework provided by ISO 9000 could be useful in this direction .The major advantage of ISO 9000 is that it integrates the entire organization towards achieving customer satisfaction. Most of the apparel manufacturers are blissfully unaware of the amount of the money going down the drain due to poor quality. This could be as high as 25% of the total operating cost.

If an apparel manufacturer specializes in basic or staple apparel products, managing quality becomes easier , compared to high fashion products with small order quantity. As the product keeps changing very fast in fashion business, the firms have to adopt a "process oriented approac h" to the quality than product specific approach

The Process Chain

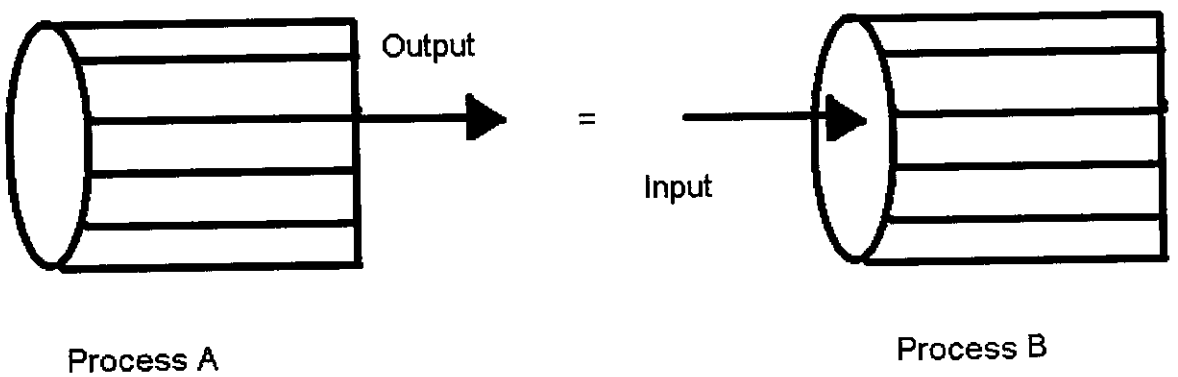


figure no: 9

The model represented stress on five elements needed for a work team to be process capable , namely motivated work force , know – how , skills , training and plant and machineries . Unless these 5 elements are present , the process capability cannot be achieved . It is the responsibility of the management to understand the principles governing process and to ensure that all the work groups responsible for various processes are capable.

THREE PRINCIPLES OF STRENGTHENING QUALITY SYSTEM

- Output of previous process becomes input to the next process.
- No standard input to be given to any process.
- No process shall allow sub standard output to come out.

SYMPTOMS OF ORGANISATION WHERE QUALITY CANNOT FLOURISH

- Do not have a clear quality policy
- The management does not demonstrate commitment to quality.
- Employees of this organization are well aware of the"chalta hai" (cutting corners) approach of the management.
- To the extent possible they would like to blame others for the quality problem.
- Believe that quality starts with inspection and ends with inspection.
- Mainly quantity not quality, driven targets for the departments.
- Departmental goals may not be synergise with the organizational goal .
- Have no idea about cost of quality.

STRATEGIC TECHNOLOGY UPGRADATION

Though the importance and vital role played by technology cannot be undermined, 'strategic technology up gradation' has been kept for the second phase of the productivity improvement strategy. This has been done due to the fact that the productivity paradigm in most factories is lower than what is possible. Unless you break this, there is a danger of additional investments in new technology.

Following steps , developed using the framework provided by AAMA report , shall be useful to companies to draw up a technology up gradation plan:

- Identification of bottleneck operation and these areas need to be given preference in the up gradation plan.
- The factory depends heavily on standard single needle lock stitch machine. This tends to lower the productivity and need for highly skilled operator. It is important to strike a right balance between specialized machineries and standard machineries.

- Review the modern technology solutions available in the market. Many progressive apparel manufacturers tie up with technology developers to do collaborative developments.
- Drawing up a holistic medium term up gradation plan is desirable than taking a piece meal decision.
- Once the up gradation implementation starts it is important to carry out the periodic review. The results of the review process of the technology absorption may provide certain inputs for the fine tuning, the overall up gradation plan .

STRENGTHEN PRODUCTION PLANNING,SCHEDULING AND CONTROLLING

The workers have to shoulder the blame of low productivity beyond their control , large amount of time is unutilized due to loop holes in planning and scheduling. Phase 2 of the productivity improvements strategy posses a management team equipped with better technical and man management skills, trained operators, can now concentrate on strengthening production planning and scheduling.

INCENTIVE SCHEME

The productivity gains will not be sustainable if the workers and the staffs do not reap the benefits. As the factories are likely to have already gained substantially through implementation of the recommendations, it's the right time to draw an incentive plan for the work force to encourage them for higher performance. The principle governing the payment system should be "fair day's pay for fair day's work".

An incentive based payment system should be able to address the following points:

- The system should not only motivate workers but also to provide better quality.
- The system must be transparent and easy to understand.
- It should not be complex to operate.

- It should be aimed at overall productivity improvement.

TYPES OF INCENTIVES

1.STRAIGHT INCENTIVES

It is plan commonly used in sewing room installation.

- Commonly expressed as SAH, SAM.
- Easy to operate.

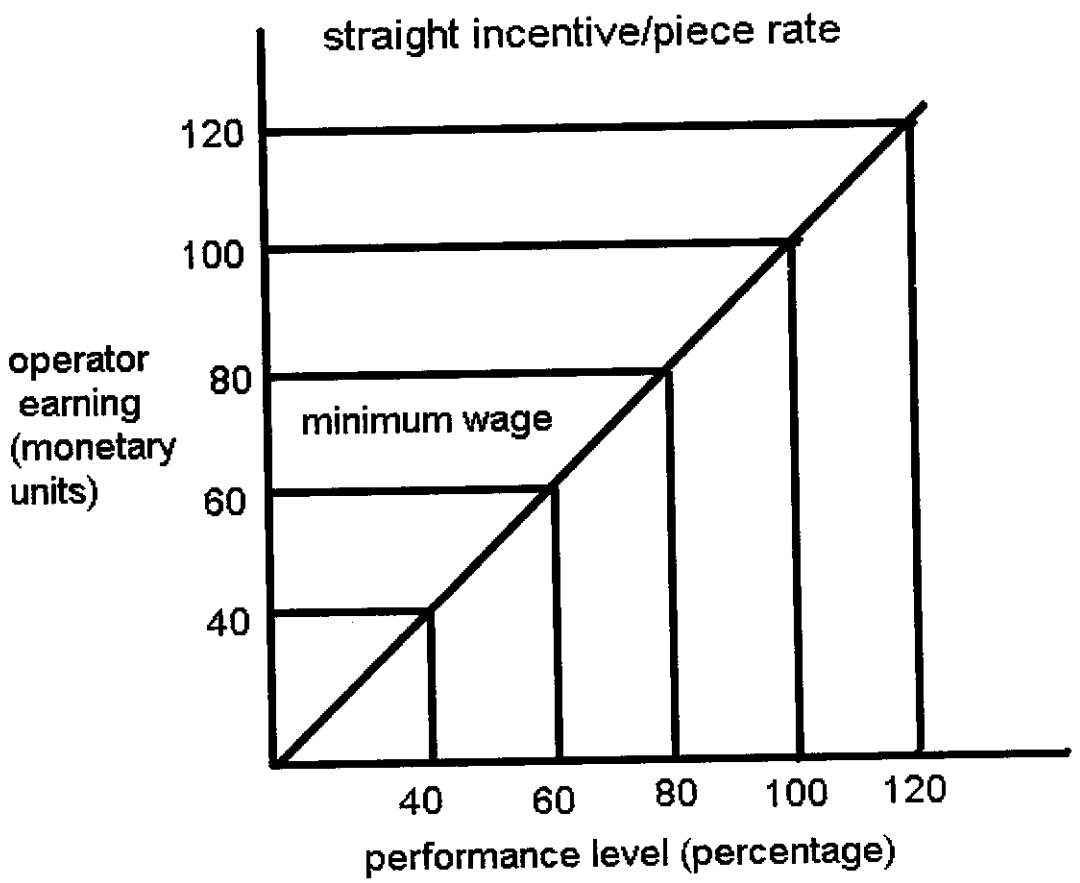


figure no: 10

2.SPLIT INCENTIVES

- It is used for new or non repetitive operations where the sewing operator needs a cushion to make standards.
- The operators are paid a fixed percentage of coupon dollars earned and, a fixed percentage of the base.

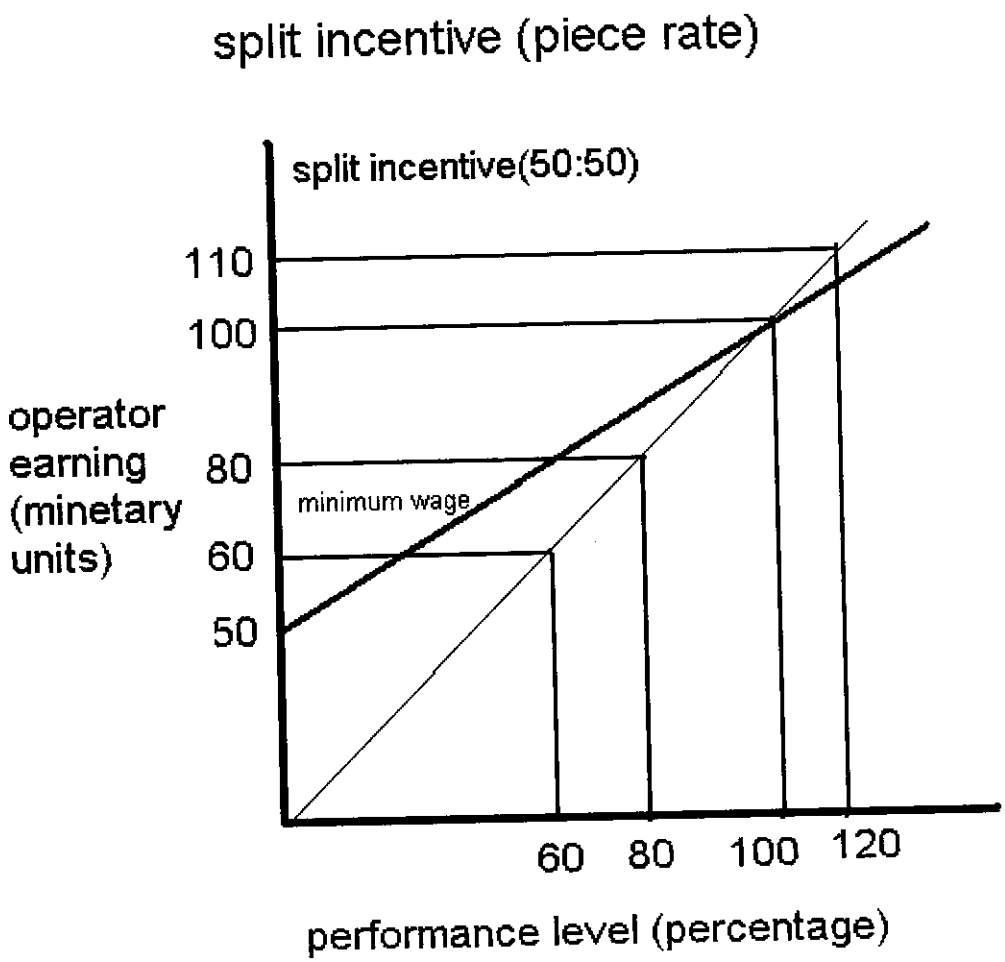


figure no: 11

3. TRANSFER INCENTIVE PLAN

- This plan can be used when ever an operator is transferred from the regular operation to another piece work operation.

4.GROUP INCENTIVES

- Used when it is difficult to establish individual contributions to overall production.
- This plan is not commonly used in sewing room but can also have an application in the cutting room.

THE TABLE SHOWS THE INFORMATION SYSTEM FOR PRODUCTIVITY IMPROVEMENT

Critical success factors	Prime measures
Technology deployment and exploitation	• Technology index • Upgradation needs • Estimated vs actual productivity
Quality system	• Repair and rejection level • Cost of quality
Technical capability of the work force	• Skill matrix(labour) • Supervisory skill index

table no: 3

2.5 ERGONOMICS IN THE APPAREL INDUSTRY

Ergonomics is the study of the relationship between a person and their work environment. The objective is to adapt the workplace for the worker in order to decrease the risk of injury and improve the link between the worker and their environment.

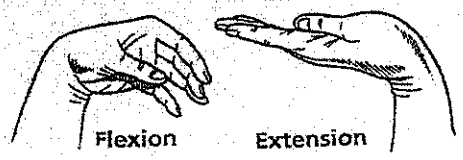
Awkward body postures are a major ergonomic concern in the garment industry. Awkward postures take the body away from a comfortable position, which reduces efficiency and increases the use of energy. Another major concern are static postures. Static means to hold in place, so these are postures where the body is held in one position for a long period of time. An example is when you work with your arms above shoulder height for long periods of time. These types of postures require constant muscle use for the time the body is held in the position. This reduces rest and recovery time, which leads to muscle tiredness. The following are recommendations which will help to reduce the risk of injury due to the above concerns.

For seated and standing work, the height of the workstation should allow workers to function with elbows at 90 degrees. If the workstation is too low, the worker is forced to bend at the waist to reach the work being done. This puts stress on the lower back. If the station is too high, the worker is forced to lift their shoulders or move their elbows away from the body to reach their work. This puts increased stress on the shoulders which may lead to injury.

During seated work, if a good back support is not present or used, static postures occur which results in constant use of the back muscles. It is important to adjust the workstation in order to allow the worker to use the backrest. It is also important to adjust the worker's chair to allow duties to be performed with their bodies in comfortable positions. The workstation and chair should be positioned so that the worker's knees, hips, and elbows are at 90 degrees, which will reduce stress on the body. There should also be enough room to allow the worker to change their sitting position throughout the day.

Static postures can also occur during standing work. If the worker stands in one position for long periods of time, muscles of the back and legs will be constantly activated. This can lead to increased fatigue, and decreased blood circulation to the legs. During the day, workers should try to walk around to allow their blood to flow. As well, workers should try and sit for short periods of time while working to give their leg and back muscles a rest.

Awkward wrist postures are one of the major causes of cumulative trauma disorders (CTD) such as carpal tunnel syndrome (CTS), tendinitis, and muscle strains. Awkward wrist postures are those which take the wrist away from the neutral position. Neutral position is when the hand is in line with the forearm. The workstation should be adjusted and the worker educated on awkward wrist postures, their harmful effects, and the signs and symptoms of CTD.



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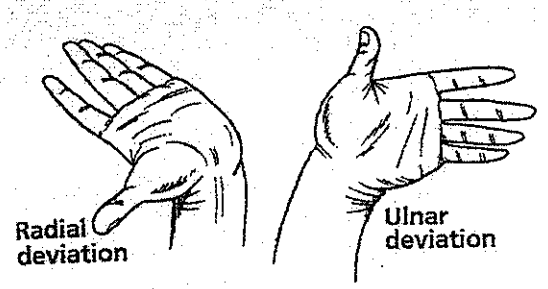

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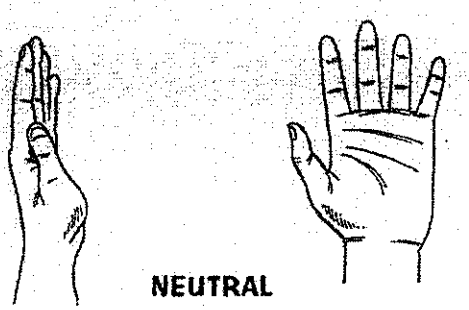

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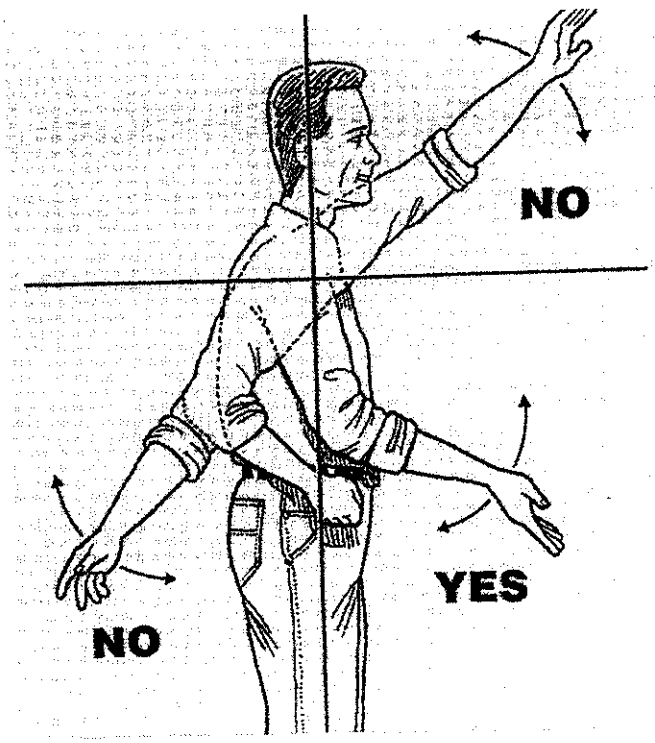


Workers should not constantly work with their arms above shoulder level. Work above the shoulders increases the use of the shoulder muscles. With this constant use, the muscles do not have time to rest and thus tire more rapidly. The majority of work should be done between knuckle height and shoulder level.

Workers should try not to twist their upper body when placing objects besides them. By keeping their feet in place and only moving their upper body, workers are putting large stresses on their backs, which may lead to injuries. Workers should move their feet, instead of twisting at the waist, in order to face the area where the object is going to be placed. If the worker is sitting, they should try to swivel in their chair, instead of twisting their upper body.[6]

INJURIES AND ILLNESS AMONG TEXTILE AND APPAREL WORKERS

- 70% of Sewing Machine Operators Using Foot Controls, Report Back Pain.
- 35% Report Persistent Low Back Pain.
- 25% Have Suffered a Compensable Cumulative Trauma Disorder (CTD).

- 81% of CTDs Were to the Wrist.
- 14% of CTDs to the Elbow.
- 5% of CTDs to the Shoulder.
- 49% of Workers Experience Pain in the Neck.
- Absenteeism Increases as Working Conditions Worsen.
- Loss of Workers Due to Injuries or Turnover is Associated With Working Conditions.

LIGHTING

- 36% of Operators Feel Lighting is Inadequate.
- Surveys Found Light Levels at Less Than 60% of Recommended Levels.
- Operators Lean Forward to See Their Work.

SEATING

- Straight Backed Wooden or Metal Chairs are Typical in the Industry.
- Chairs Often Lack Cushioning.
- Chairs Often Lack Adjustable Back Rests.
- Chairs Often Lack Height Adjustability. Thereby Improved Seating is Readily Available.[7]

METHODOLOGY

3.METHODOLOGY

The methodology of this study comprised of the following steps

3.1 Selection of industry

3.2 Process flow

3.3 Evaluation

3.1 SELECTION OF INDUSTRY

The apparel industry is infested with idle time, delay, excess production, machine break down, etc. and so this project was chosen as to reduce the ineffective time and to increase productivity using various simple improved methods.

Woven and knit form an integral part of apparel production and so the following industries have been selected on the basis of random sampling.

3.1.1 Stanfab Apparels(Woven), Chennai

3.1.2 Clifton Clothing(Knitwear), Tirupur

3.1.1 STANFAB APPARELS

This industry which is situated in Mohappair industrial estate, Chennai caters to all segments: kids wear, menswear and women's wear.Some of its clients are Acanthe, Billabong, British khaki, Catimini, Cedarwood state, Ethelaustin, Forus, Jules, Replay & sons, Sir Oliver.

3.1.2 CLIFTON CLOTHING

This industry which is situated in Tirupur caters to all segments: kids wear, menswear, women's wear. This industry was chosen because it is located in the knitwear hub, Tirupur. Some of its clients are Teen scene, Playboy, Just 4 girls, Long night, OPUS.

3.2 PROCESS FLOW

A set of process steps and order for performing the process steps to produce a desired result.[14] The following is the process flow of this project.

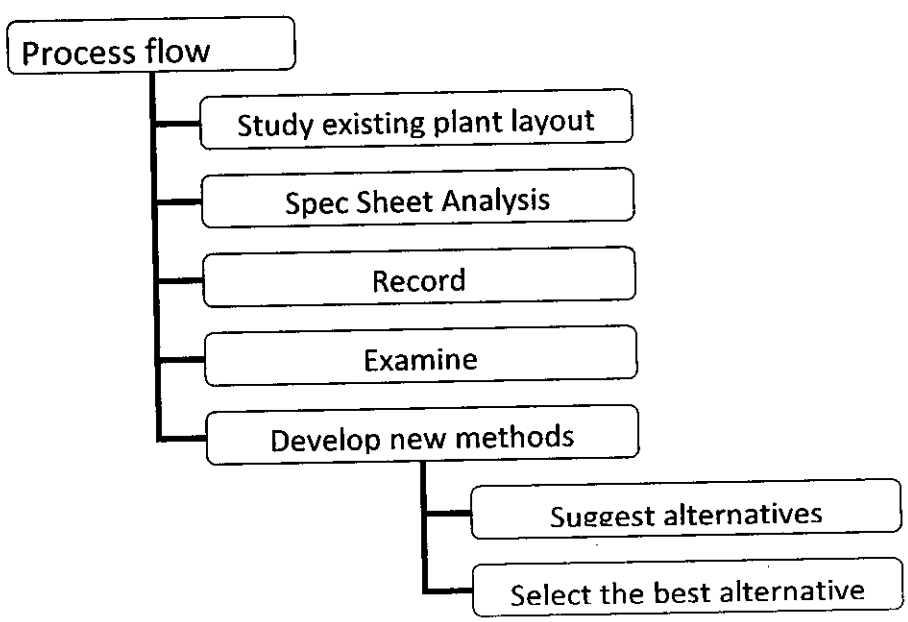


figure no:12

3.2.1STUDY THE EXISTING PLANT LAYOUT

Plant Layout is the physical arrangement of equipment and facilities within a Plant. The **Plant Layout** can be indicated on a floor plan showing the distances between different features

of the plant. Optimizing the Layout of a Plant can improve productivity, safety and quality of Products. Unnecessary efforts of materials handling can be avoided when the Plant Layout is optimized. This is valid for:

- Distances Material has to move
- Distances Equipment has to move
- Distances Operators have to move
- Types of Handling Equipment needed
- Energy required to move items against resistance (i.e. gravity) [8]

3.2.2SPEC SHEET ANALYSIS:

Specification sheets provide important details to ensure the correct execution of your patterns into finished garments. Spec sheets help to produce accurate samples, which improves turnaround time and simplifies communication during all stages of manufacturing and quality control.Spec sheets include detailed technical diagrams, construction notes, finished garment measurements, fabric yields and material and trim details. All specs are in Excel spreadsheet format and can be easily transferred through e-mail.[9] This guides in the step by step construction of the garment and helps in analysis of the flow process.

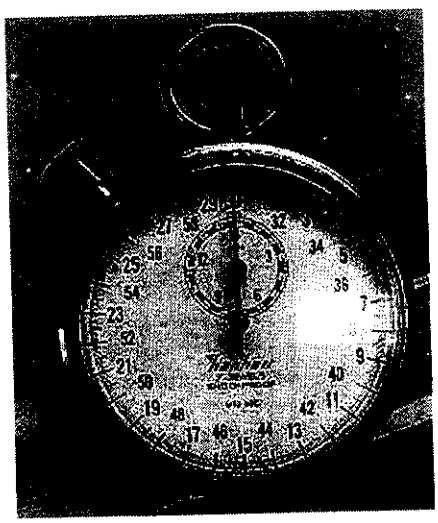
3.2.3RECORD

The next step after selecting the work to be studied is to record all the facts relating to the existing method. This provides both the critical examination and the development of improved methods. It is therefore essential that the record be clear and concise. Recording helps to develop the quickest and the best method y having an improved sequence of doing the work, omitting the redundant elements, selecting more appropriate person and more suitable place for doing the work. The most accurate way of recording is by the use of techniques or tools which helps in recording detailed information in a standard form [10].

The following are the tools used

ANALYZE PRODUCTIVITY FOR EXISTING METHOD

The productivity in each department was carefully recorded by direct observation and the time being recorded using a stop watch. A **stopwatch** is a handheld timepiece designed to measure the amount of time elapsed from a particular time when activated to when the piece is deactivated. A large digital version of a stopwatch designed for viewing at a distance, as in a sports stadium, is called a **stop clock**.



A typical mechanical analog stopwatch. [11]

The timing functions are traditionally controlled by two buttons on the case. Pressing the top button starts the timer running, and pressing the button a second time stops it, leaving the elapsed time displayed. A press of the second button then resets the stopwatch to zero. The second button is also used to record *split times* or *lap times*. When the split time button is pressed while the watch is running, the display freezes, allowing the elapsed time to that point to be read, but the watch mechanism continues running to record total elapsed time. Pressing the split button a second time allows the watch to resume display of total time.

Following is the procedure for a direct time study:[12]

1. Define and document the standard method.

2. Divide the task into work elements.Steps 1 and 2 these two steps are primary steps conducted prior to actual timing. They familiarize the analyst with the task and allow the analyst to attempt to improve the work procedure before defining the standard time.
3. Time the work elements to obtain the observed time for the task.
4. Evaluate the worker's pace relative to standard performance (performance rating), to determine the normal time.Note that steps 3 and 4 are accomplished simultaneously. During these steps, several different work cycles are timed, and
5. each cycle performance is rated independently. Finally, the values collected at these steps are averaged to get the normalized time.
6. Apply an allowance to the normal time to compute the standard time. The allowance factors that are needed in the work are then added to compute the standard time for the task

ALLOWANCE USED [13]

DETERMINING ALLOWANCE

The normal time for an operation does not contain any allowances. It is merely the time that a qualified operator would need to perform the job if he/she worked at a normal tempo. However, it is not expected that a person will work all day without some interruptions. The operator may take time out for personal needs, for rest, and for reasons beyond his or her control. Allowances for such interruptions to production may be classified as follows:

(1) Personal allowance,

(2) Fatigue allowance,

(3) Delay allowance.

PERSONAL ALLOWANCES

Every worker must be allowed time for personal needs. The amount of this allowance can be determined by making all-day time studies or work sampling studies of various classes of work. For light work, where the operator works 8 hours per day without organized rest periods, 2 to 5 percent (10 to 24 minutes) per day is about all that the average worker will use for personal time.

FATIGUE ALLOWANCE

In the modern well-managed plant so many steps have been taken to eliminate fatigue. In fact, fatigue is of such little consequence in some kinds of work that no allowance is required at all. There are many reasons for this. The length of the working day and the length of the working week have been shortened; machinery, mechanical handling

Equipment, tools, and fixtures have been improved so that the day's work is more easily done and the employee works in greater physical comfort than formerly. There are, of course, some kinds of work that still involve heavy physical exertion and are performed under adverse conditions of heat and humidity, and therefore require rest for the operator. Fatigue results from a large number of causes, some of which are mental as well as physical. There is no fully satisfactory way of measuring fatigue. Physiological measurements are the most objective means of determining the time and duration of periods of work and rest during the day.

DELAY ALLOWANCE

Delays may be avoidable or unavoidable. Intentional delays will not be considered in determining the time standard.Unavoidable delays do occur from time to time, caused by the machine, the operator, or some outside force.

It is expected that machine and equipment will be kept in good repair. When there is a **breakdown** or when repairs are necessary, the operator is usually taken off the job and

such delays **do not enter into the time standard**. In such cases the operator is usually paid for waiting time at the hourly base rate.

Standard Time = Normal time +(Normal time x Allowance in %)

Standard Time = Normal time x [(100 + Allowance in %)/100]

IMPROVED EQUATION

Standard Time = Normal time x [(100)/(100 – Allowances in %)]

BENEFITS INCLUDE

- Quicker response times (reduced lead times) to meet changing market and customer needs
- Faster new product development
- Reduction in waste, therefore greater efficiency

The following are the departments in which time study was conducted.

Sampling, inspection, cutting, sewing, finishing, final inspection and packing

3.2.4 EXAMINE

The technique used in examining is the questioning technique.

The questioning technique is the means by which the critical examination is conducted, each activity being subjected in turn to a systematic and progressive series of questions. [15]

THE PRIMARY QUESTIONS

The question sequence used follows a well established pattern which examines:

- Purpose for which
- Place at which
- Sequence in which
- Person by which

} activities are undertaken

THE SECONDARY QUESTIONS

The secondary questions cover the second stage of the technique during which the answer to the primary questions are subjected to further query to determine whether possible alternatives are practicable and preferable as a means of improvement upon the existing method.[16] The prepared questionnaire is attached in annexure 1

3.2.5 DEVELOP

The disadvantages of the existing methods were carefully analyzed and better alternatives have been suggested, of which the best has been chosen. This has been done taking into consideration the cost and physical changes in the industry.

- Suggest the alternative
- Select the best alternative

3.3 EVALUATION

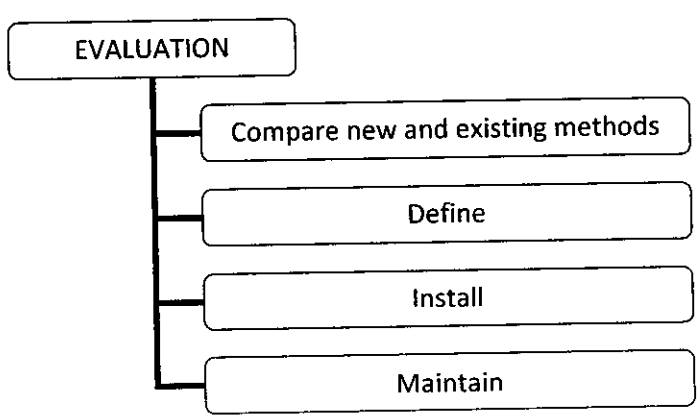


figure no: 13

3.3.1COMPARE

The efficiency of the existing and the new method was calculated. the formula used to calculate efficiency is as follows

Efficiency % = (existing time taken - proposed time taken /proposed time) x 100

Total working time = standard working time – total time wasted

Actual working time = total working time – total time waited

Prod time loss % = (standard working time – actual working time/standard working time) *100

Actual operation time = (net operation time * allowance ratio / 100) + net operation time

Daily output pieces = daily working time(sec) / actual operation time

The results were compared and represented graphically.

3.3.2DEFINE

Define the new method and their related time so that it can always be identified. The written standard practice outlines in simple terms the methods to be used by the operative. Three sorts of information are required

a) The tools and equipments to be used and the general operating conditions.
b) A description of the method. The amount of detail required will depend on the nature of the job and the probable volume of production.
c) A diagram of the workplace layout.

Over production = (order quantity * allowance percentage)/ 100

Total quantity to be produced = order quantity + over production

The descriptions and the diagrams are attached in annexure1.

3.3.3INSTALL

Install the new method as agreed standard practice with the time allotted. It can be divided into five stages mainly:

a) Gaining acceptance of the change by departmental supervision.
b) Gaining approval of the change by management.
c) Gaining acceptance of the change by workers.
d) Restrain the workers to operate the new method.
e) Maintaining the close contact with the progress of the job until satisfied that it is running as intended.

3.3.4MAINTAIN

It is important that, when a method is installed it should be maintained in its specified form and the worker should not be allowed to slip back into the old methods or introduce elements not allowed for unless there is very good reason for doing so. New personnel were appointed to supervise the process flow and to prevent any faults.

RESULTS AND DISCUSSIONS

4. RESULTS AND DISCUSSION

The results of the study are discussed under the following heads

4.1 Stanfab apparel

4.2 Clifton apparel

4.1 STANFAB APPAREL

The following are the departments under study

4.1.1 Inspection department

4.1.2 Cutting department

4.1.3 Sewing department

4.1.4 Final inspection department

4.1.1 INSPECTION DEPARTMENT

EXISTING METHOD

- 40 watts tube lights in a row are used to inspect the fabric .This proves cumbersome as the workers are sometimes found squinting and straining their eyes to find out a particular defect. Further tiny defects are sometimes left unobserved.
- Fabric roles and bundles are carried by an individual worker in their hands from the storage to the inspection tables. Thus frequent movement in the storage room adds on to the handling time.

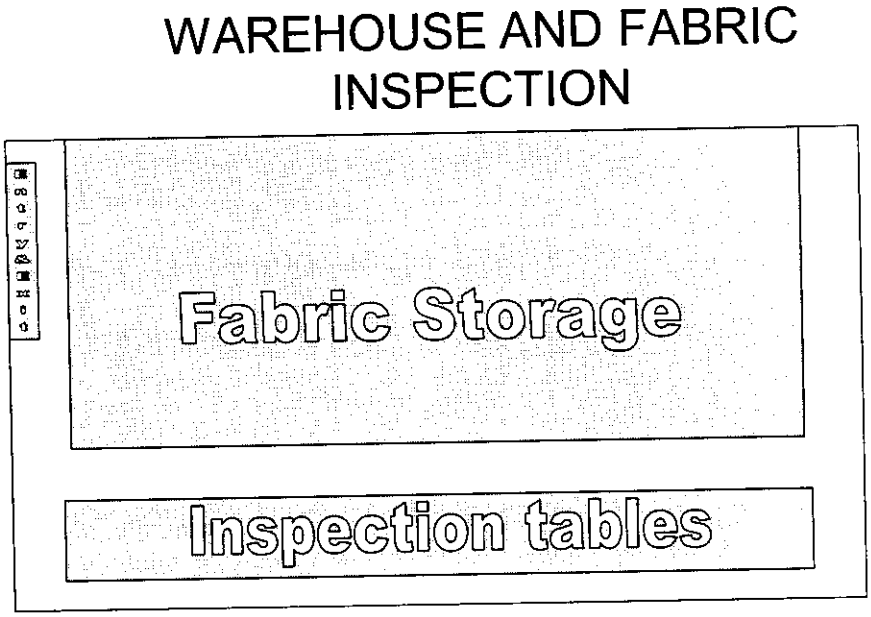


figure no: 14

IMPROVED METHODS

- Fabric is taken from the store room for checking. An inspection table is used for this purpose which has diagonal glass surface and lot of tube lights on its bottom, fabric roll is adjusted on one side of the table and a specific length of fabric is unrolled from the roll to pass over the machine and to reach on other side where observer is standing. After inspecting a particular length, fabric can be unrolled just by pulling the free end from roll. It is pulled with a smooth speed so that observer easily mark fault if there is any under the light of several tube lights.

- Trolleys are used so that more than 2 roles can be moved to the inspection table simultaneously thus saving the handling time.

Improved Layout

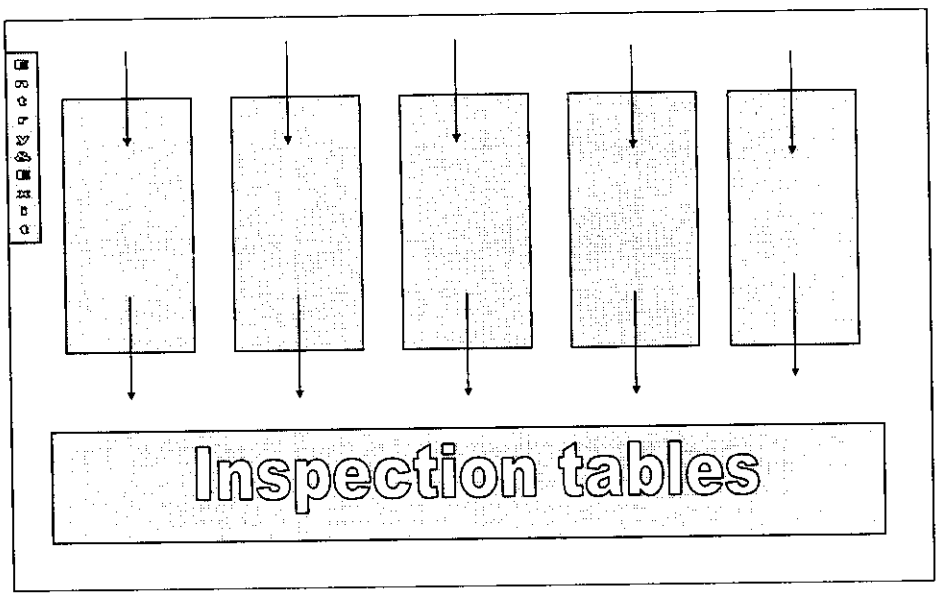


figure no: 15

THE TABLE SHOWS THE DIFFERENCE IN TIME IN THE INSPECTION DEPARTMENT BEFORE AND AFTER IMPLEMENNTATION

Sno	Number of workers	Number of defects	Length of fabric inspected	Time taken in exiting method (min)	Time taken in improved method
1	2	7	140 mts (53'')	6.08	5.00
2	2	4		5.00	4.65
3	2	6		5.08	4.95
4	2	5		6.05	5.00

5	2	6		5.03	4.32
6	2	5		5.30	5.02
7	2	5		5.12	5.01
8	2	6		6.14	5.01
9	2	7		5.52	5.08
10	2	4		6.00	5.05
11	2	5	31 mts (60'')	2.30	2.02
12	2	6		2.00	1.85
13	2	7		2.60	2.09
14	2	7		2.15	2.07
15	2	4		2.42	2.04
16	2	7		2.58	2.14
17	2	5		2.50	2.00
18	2	9		2.90	2.10
19	2	7		2.50	2.15
20	2	5		2.72	2.00

table no: 4

EXISTING METHOD

Average time taken to inspect = 3.99 min

Time for inspecting = 79.99min

Idle time of workers = 7 min

(During transportation)

Handling time = 12 min

Total time taken per day = 98.99 min

Total time taken per month in existing method =2999.4 min

IMPROVED METHOD

Average time taken to inspect = 3.47 min

Time for inspecting = 69.55 min

Handling time = 5.2 min

Total time taken per day = 74.75 min Total time

taken per month in improved method =2242.5 min

Total time saved per day =24.24 min

Percentage of time saved =time taken in existing method –time taken in new method*100

Time taken in existing method

= [(98.99 -74.75)/ 98.99]*100

= 24.48%

Thus the time saved in the inpecting per day is 24.48% approx.

THE CHART SHOWS THE DIFFERENCE BETWEEN EXISTING AND IMPROVED METHOD IN INSPECTION DEPARTMENT

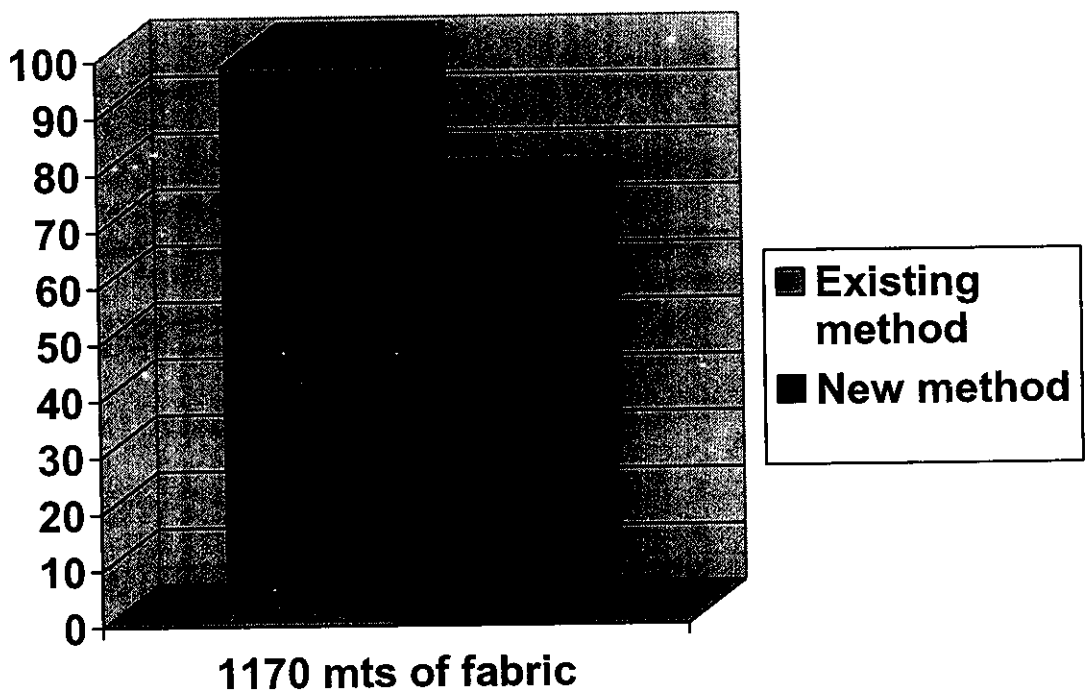


chart no: 2

4.1.2 CUTTING DEPARTMENT

EXISTING METHOD

The layout of this department was found to be inefficient. The flow of material was not coherent and this resulted in excess of handling and idle time. The fabric bundles were stored for an abnormal time and retracing of the material was present.

Cutting Department

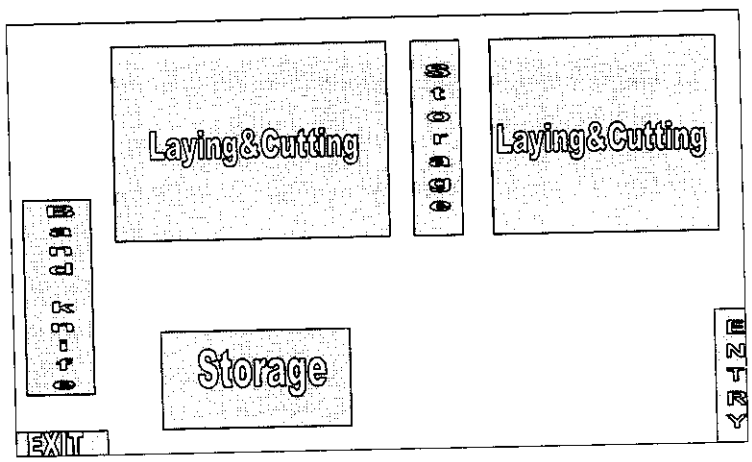


figure no: 16

IMPROVED METHOD

So, a new layout has been suggested and implemented. In the new layout, there is a common storage and this avoids retracing of materials. Also it increases the floor space thus enabling smooth movements for the workers. The time saved in the cutting per day is 2% approx.

Improved layout

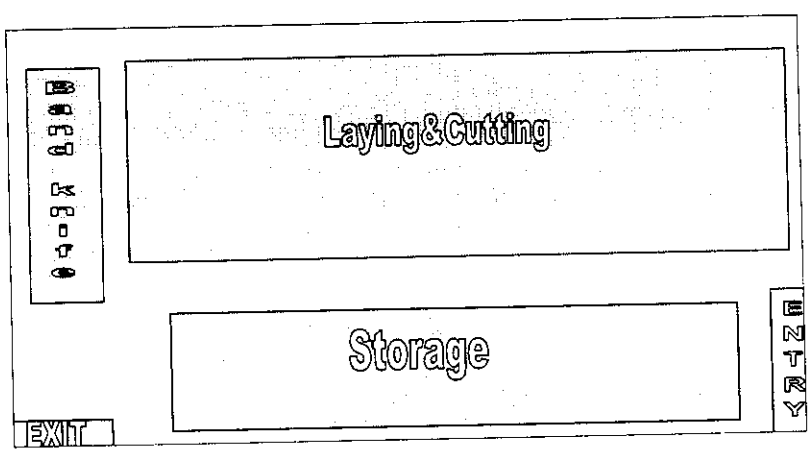


figure no: 17

S.No:	No: of workers	Time taken for spreading	Time taken for cutting	Handling time taken in existing method	Total time taken in old method	Handling time taken for new method	Total time taken in new method	Time difference
1	8	20	30	1.75	51.75	0.75	50.75	1
2	8	22	31	2	55	0.70	53.7	1.3
3	8	23	35	2	60	0.75	58.75	1.25
4	8	24	32	1.75	57.75	0.76	56.76	0.99
5	8	25	32	1.75	58.75	0.80	57.8	0.95
6	8	24	32	1.75	57.75	0.88	56.88	0.87
7	8	22	33	1.90	56.9	0.82	55.82	1.08
8	8	23	32	1.85	56.85	0.77	55.77	1.08
9	8	22	33	1.88	56.88	0.75	55.75	1.13
10	8	22	32	1.98	55.98	0.88	54.88	1.1
11	8	23	35	1.88	59.88	0.88	58.88	1
12	8	21	32	2	55	0.75	53.75	1.25
13	8	24	32	1.75	57.75	0.76	56.76	0.99
14	8	23	33	2	58	0.74	56.74	1.26
15	8	24	34	2.1	60.1	0.77	58.77	1.33
16	8	24	34	2.1	60.1	0.80	58.8	1.3
17	8	23	35	1.75	59.75	0.80	58.8	0.95
18	8	23	32	1.80	56.8	0.78	55.78	1.02
19	8	22	32	1.80	55.8	0.75	54.75	1.05

20	8	23	32	1.78	56.4	0.78	54.34	0.75

table no: 5

Marker length = 6mts

Number of bundles for blue fabric = 5 bundles

Number of bundles for pink fabric = 1 bundle

Total number of bundles for spreading = 6 bundles

EXISTING METHOD:

Average time taken for the old method = 57.3795 min

Time taken for 6 bundles = 344.277 min = 5hrs 45 min approx.

IMPROVED METHOD:

Average time taken for the new method = 56.282 min

Time taken for 6 bundles = 337.692 min =5hrs 38 min approx.

Time saved = 6.5 min

$$\text{Percentage of time saved} = \frac{\text{time taken in existing method} - \text{time taken in new method}}{\text{Time taken in existing method}} * 100$$

$$= [(344.277-337.692)/344.277]*100$$

$$= 1.91\ \%$$

Thus the time saved in the cutting per day is 2% approx.

THE CHART SHOWS THE DIFFERENCE IN CUTTING DEPARTMENT BEFORE AND AFTER IMPLEMENTATION

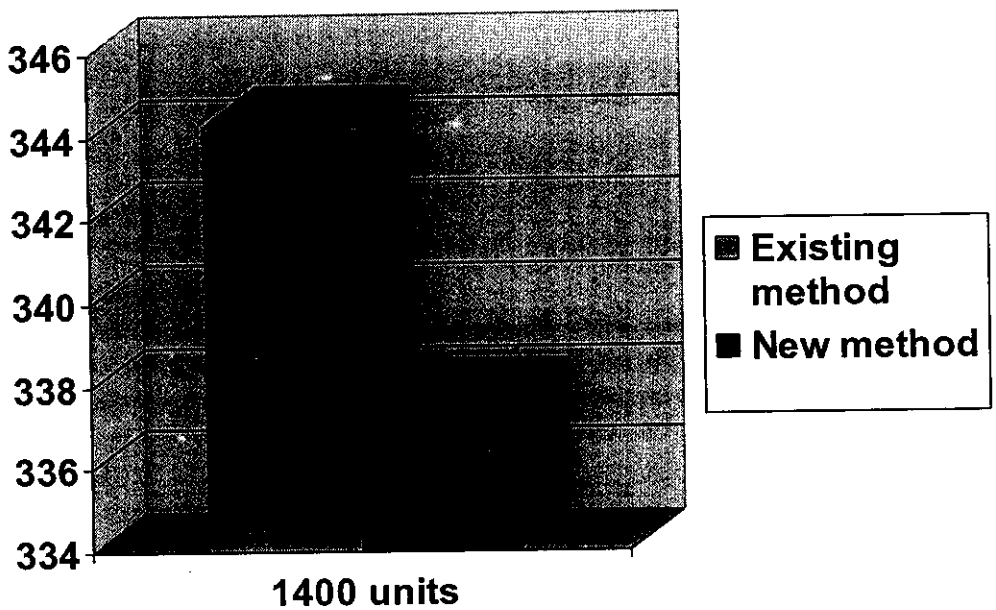


chart no: 3

4.1.3 SEWING DEPARTMENT

EXISTING METHOD

The layout of the sewing machines was studied and the recorded carefully. The time taken for each operation was recorded. This time includes the idle time, transfer of component time and allowances. On complete analysis of the sequence it was found that lot of time was wasted due to improper alignment of machinery and also there was a major retracing of material.

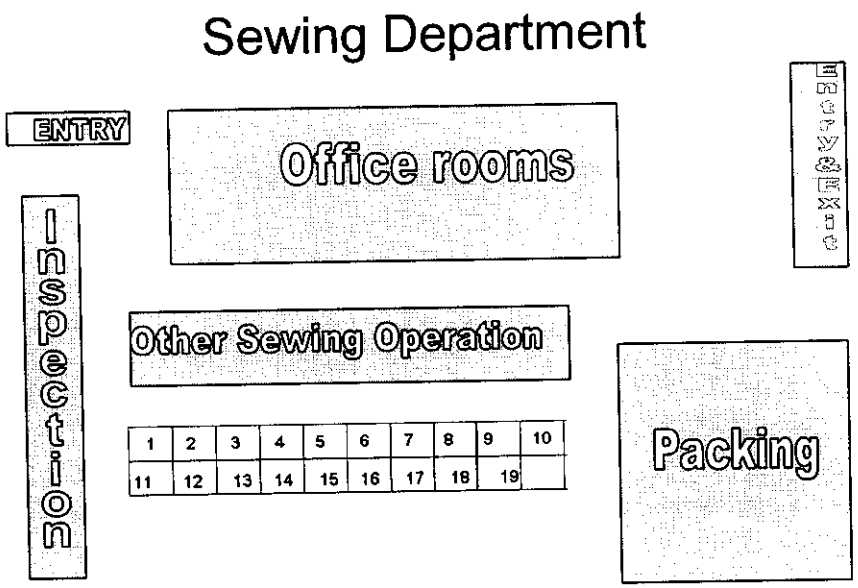


figure no: 18

IMPROVED METHOD

A new layout was suggested and implemented. In the new layout the machines have been arranged as per the flow process and the sides of the machines have been changed. This resulted in saving of time as there was no idle time.

Thus the production was increased by 37 garments per day.

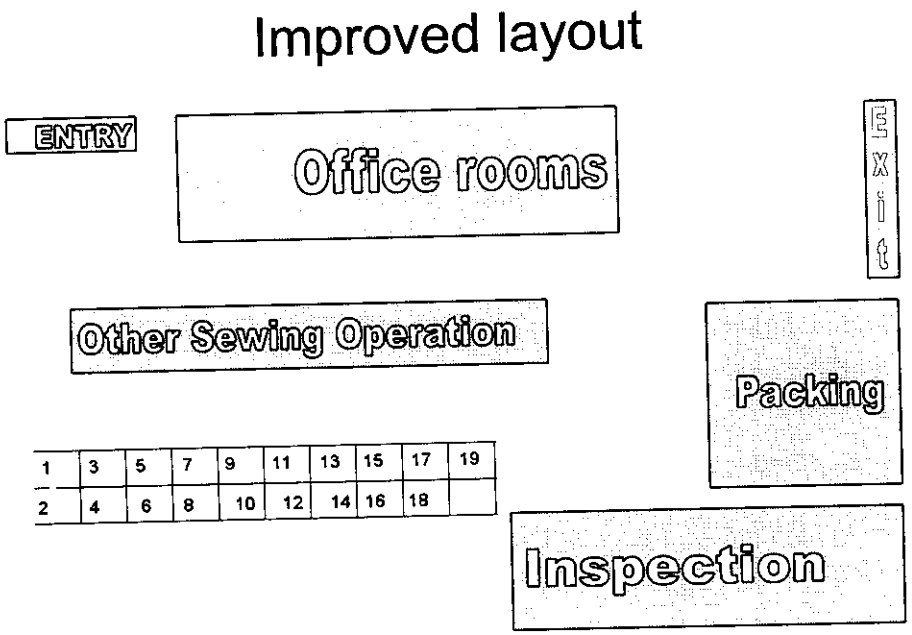


figure no: 19

THE TABLE SHOWS THE TIME TAKEN IN THE SEWING DEPARTMENT BEFORE AND AFTER IMPLEMENTATION

S. no	operation	No.of operators	No.of m/c used	m/c used	m/c speed (rpm)	Allowance ratio	Net operation time	Time taken initially (t) sec	Time take using improved methods (t1) sec
1	Back yoke panel attach	2	2	SNLS	3500	30	32.14	41.78	41.78
	Back yoke			SNL					

2	panel edge	2	2	S	3500	20	32.14	38.57	37.55
3	Shoulder attachment	1	2	SNLS	3500	30	32.14	41.78	40.76
4	Shoulder edge	2	2	SNLS	3500	15	32.14	36.96	36.94
5	Front yoke panel Attach	2	2	SNLS	3500	30	32.14	41.78	41.77
6	Back zip attach	1	1	SNLS	3500	30	31.93	41.50	40.49
7	Sleeve attach	1	3	SNLS	3500	30	31.93	41.50	40.49
8	Sleeve O/L	2	3	O/L	3000	20	31.93	38.32	37.31
9	Side attach	1	2	SNLS	3500	30	31.93	41.50	40.49

10	Side O/L	1	2	O/L	3000	30	31.93	41.50	40.49
11	Side label attach	1	2	SNLS	3500	30	32.14	41.78	40.77
12	Bottom hemming	2	2	SNLS	3500	15	32.14	36.96	35.95
13	Bottom label Attach	1	1	SNLS	3500	20	12.55	15.06	14.03
14	Main label locking	1	1	SNLS	3500	15	12.55	14.43	13.41

table no: 6

EXISTING METHOD

Time taken for completion of one garment = 12mins 5 sec

Hence the number of garments that can be produced

In a day = 1480 pc

IMPROVED METHOD

Time taken for completion of one garment = 11mins 7sec

Hence the number of garments that can be produced

In a day = 1517 pcs

Increase in production per day = 37 garments

THE CHART SHOWS THE DIFFERENCE IN SEWING DEPARTMENT BEFORE AND AFTER IMPLEMENTATION

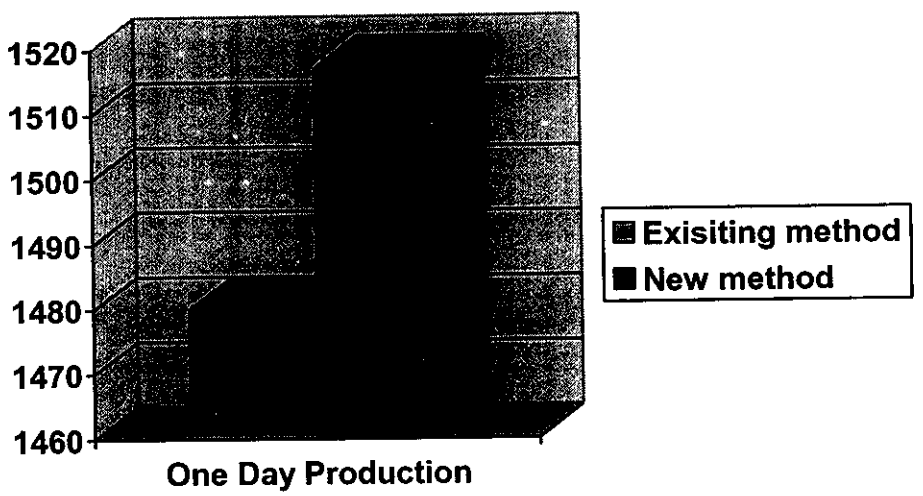
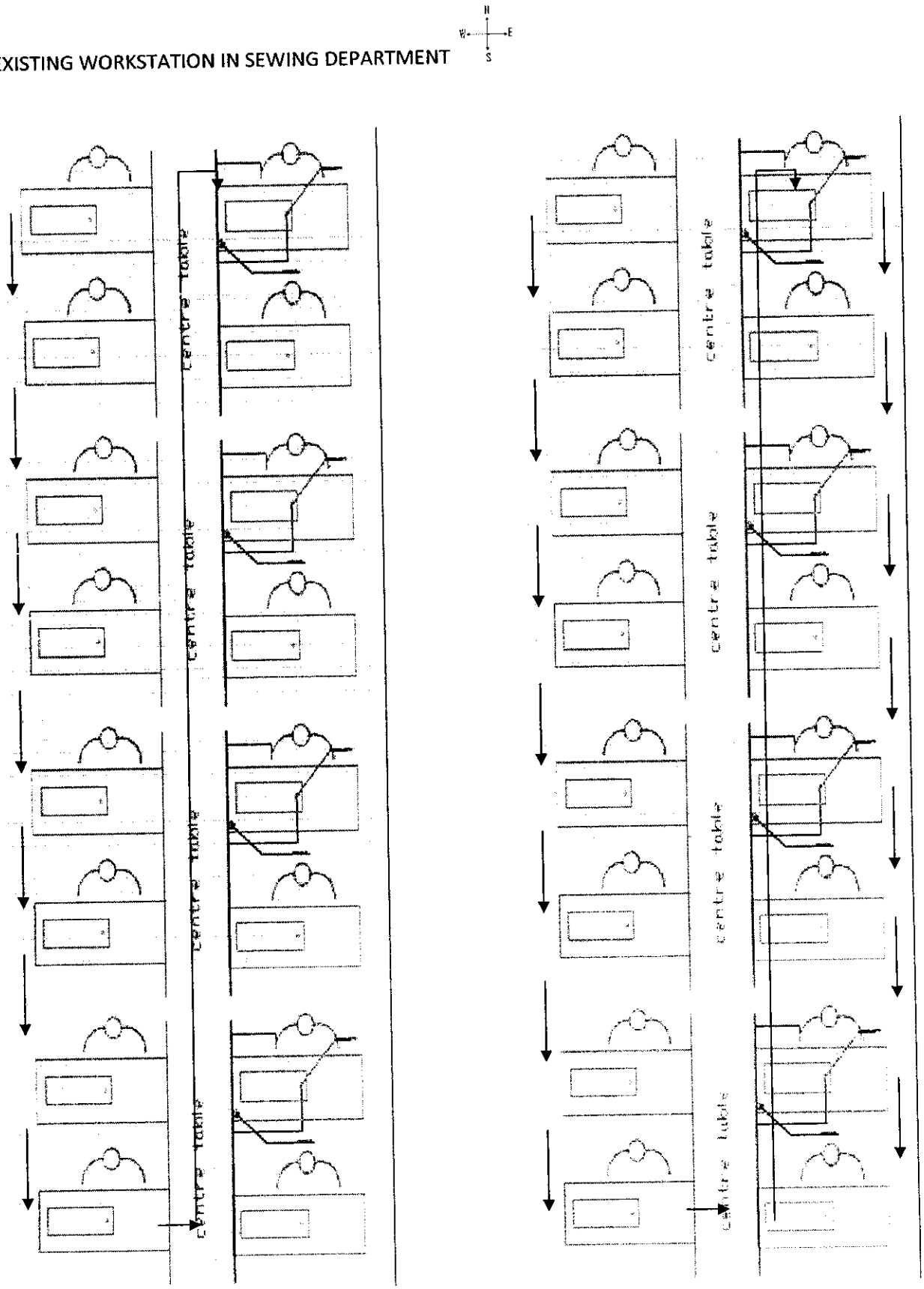
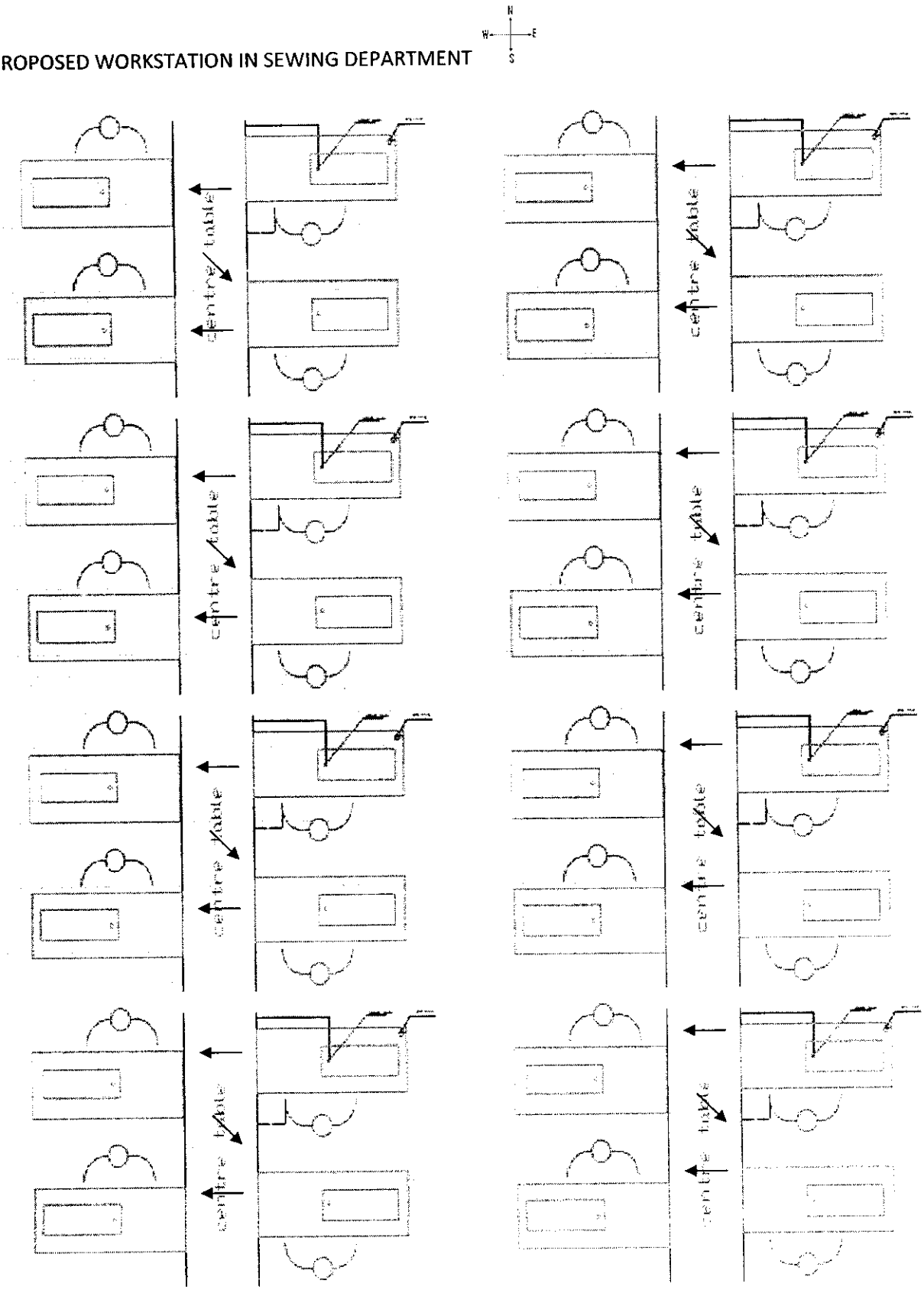


chart no: 4

EXISTING WORKSTATION IN SEWING DEPARTMENT



PROPOSED WORKSTATION IN SEWING DEPARTMENT



DIFFERENCE BETWEEN OBSERVED AND STANDARD TIME

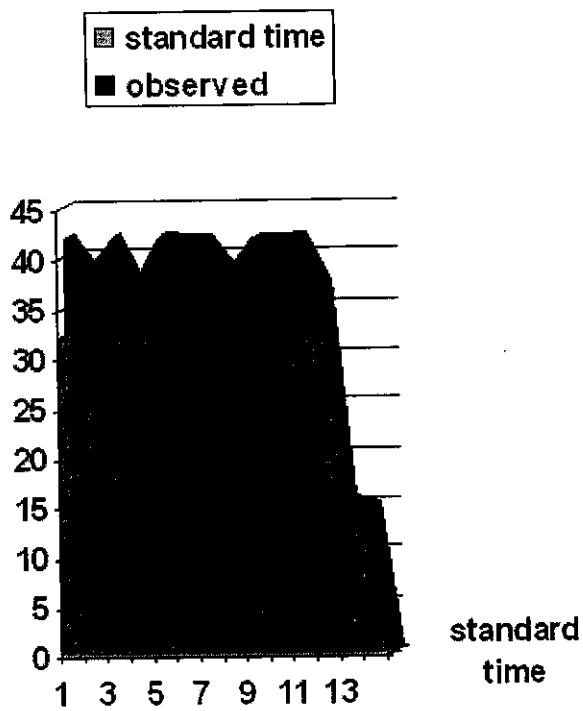


chart no: 5

4.1.4 FINAL INSPECTION DEPARTMENT

EXISTING METHOD

The finished garment is inspected in this department. The checker checks the garments by keeping it over the prototype sample. This is not very accurate and moreover it is very time consuming. It does not allow checking of elasticity, etc. This is a very erratic process.

IMPROVED METHOD

New and easier and accurate ways was created. On the inspecting table, lines were drawn **using whitener** to indicate chest, garment length, neck depth, sleeve length, armhole depth, and stretched length. This is very economical and also very accurate. It saves lot of time.

Time taken to inspect 1140 pieces was reduced by 29.4 %.

EXISTING METHOD

Time taken for inspecting one garment = 17 sec

Therefore time taken for inspecting 1400 garments = 396 min= 6hrs 36min

IMPROVED METHOD

Time taken for inspecting one garment = 12 sec

Therefore time taken for inspecting 1400 garments = 280 min= 4hrs 40min

Time saved per garment = 5 sec

Total time saved = 1hr 56min

$$\text{Percentage of time saved} = \frac{\text{time taken in existing method} - \text{time taken in new method}}{\text{Time taken in existing method}} * 100$$

$$= [(396-280)/396]*100$$

$$= 29.29\%$$

THE CHART SHOWS THE DIFFERENCE IN FINAL INSPECTION BEFORE AND AFTER IMPLEMENTATION

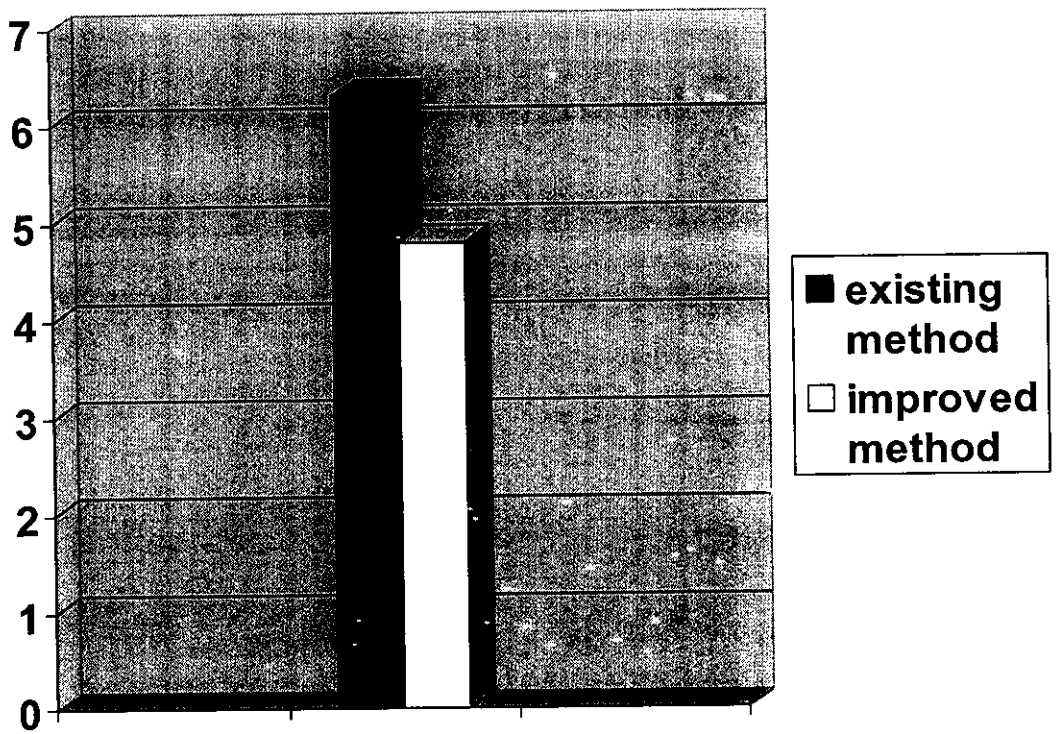


chart no: 6

OVERALL REDUCTION IN TIME

Process involved	Time taken for existing method	Time taken for improved method

• Fabric inspection • Cutting • sewing • Final inspection	98.99 min 344.27min 750 min 396 min	74.75 min 337.69 min 510 min 280 min
	1589.26 min **= 26 hours 20 mins**	**1202.44** **=20 hours 4 mins**

table no: 7

overall improvement in productivity

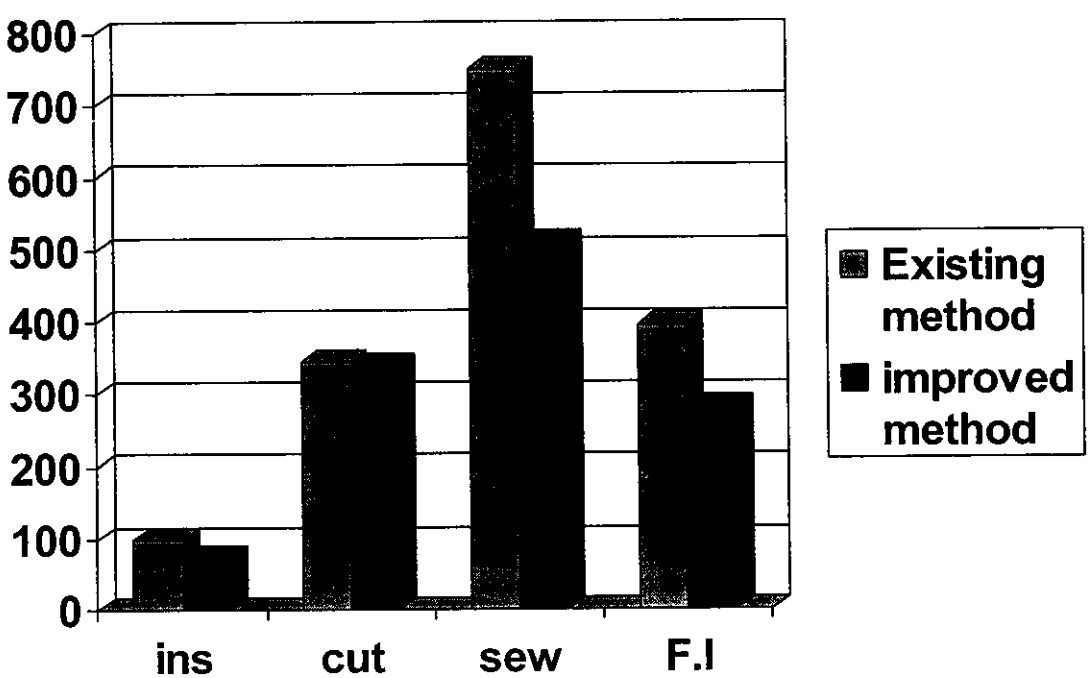


chart no: 7

4.2 CLIFTON APPAREL

The following are the departments under study

4.2.1 Sampling department

4.2.2 Sewing department

4.2.3 Plant layout

4.2.1 SAMPLING DEPARTMENT

FORMULAE

Over production = (order quantity * allowance percentage)/100 Total quantity to be produced = order quantity + over production

ORDER QUANTITY = 7500 PIECES

BEFORE IMPLEMENTATION	AFTER IMPLEMENTATION
Allowance % at present = 5% Over production = (7500 *5)/100 = 375 (extra) Total quantity produced at present = 7875 time taken = 10.5 days	Recommended allowance % = 3% Over production = (7500 * 3)/ 100 = 225 (extra) Total quantity produced at present = 7725 time taken = 10.3 days
	Reduction in over production = 150 pieces

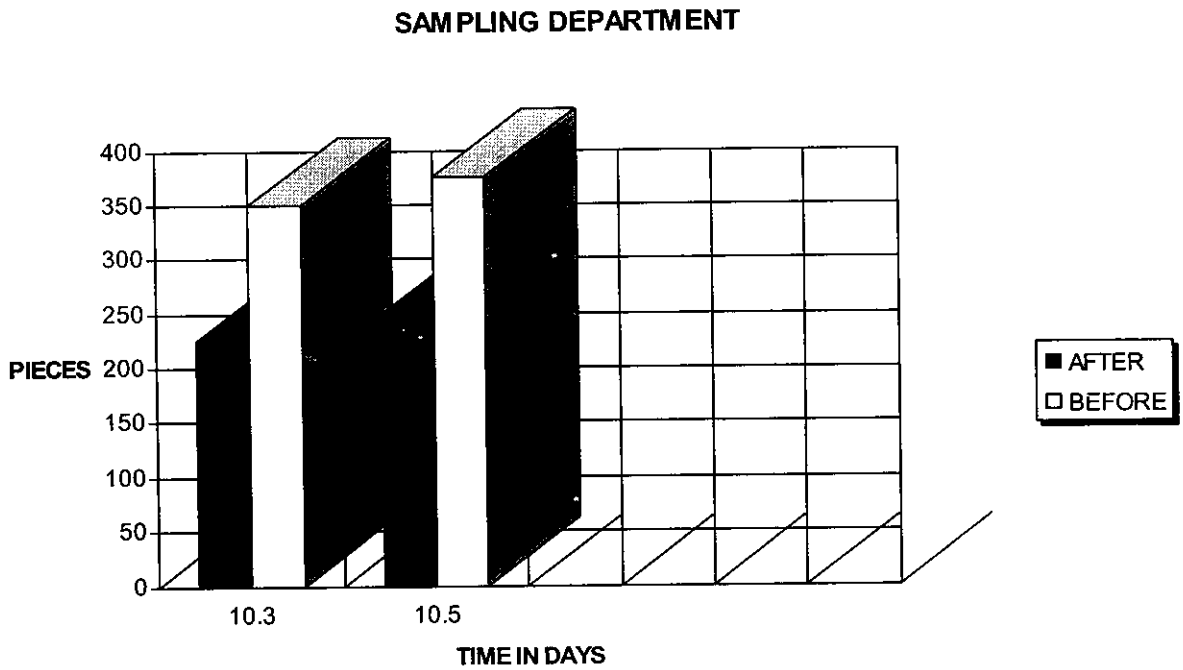


chart no: 8

SUGGESTIONS

EXISTING METHOD

- Manual method for fit sample
- Manual method : color approval by fabric swatches

IMPROVED METHOD

- Using dummies of standard size
- Using electronic shade cards

FABRIC INSPECTION DEPARTMENT

SUGGESTIONS

EXISTING METHOD

- Manual method- many problems occur due to improper and inconsistent checking.

IMPROVED METHOD

- Usage of fabric defect checking machine.
- inspection can be carried out during spreading.
- Lights under tables can be used for effective checking of defects.

SPREADING DEPARTMENT

SUGGESTIONS

EXISTING METHOD

- Manual spreading is done

IMPROVED METHOD

- Using Eastman expandable rollers
- Usage of clamps to hold the fabrics
- Using templates

4.2.2 SEWING DEPARTMENT

RED FLAG SYSTEM

Red flag system is a simple technique that reduces the wastage of working time in sewing department. It is very economical as it does not require much investment.

- It is noted that when a needle is broken , the worker has to go to the ground floor to get the needle, most of the time is wasted.
- So we suggested a red flag system . A red color flag is made and placed in a sewing room.

- If an operator has machine problem he has to place the red flag on top of the machine. So that it is visible from any corner of the room.
- So that for easy identification by the mechanic and thus the waiting time is saved.

EXISTING LAYOUT

In the sewing department the total number of machineries are equally divided and arranged on left and right side of the block. There are totally eight production lines, four on each side. The arrangement of machineries are not convenient of the sewing process. There are no side tables present and hence this increases the labour work of transferring the garment components which in turn reduces the efficiency of the working environment.

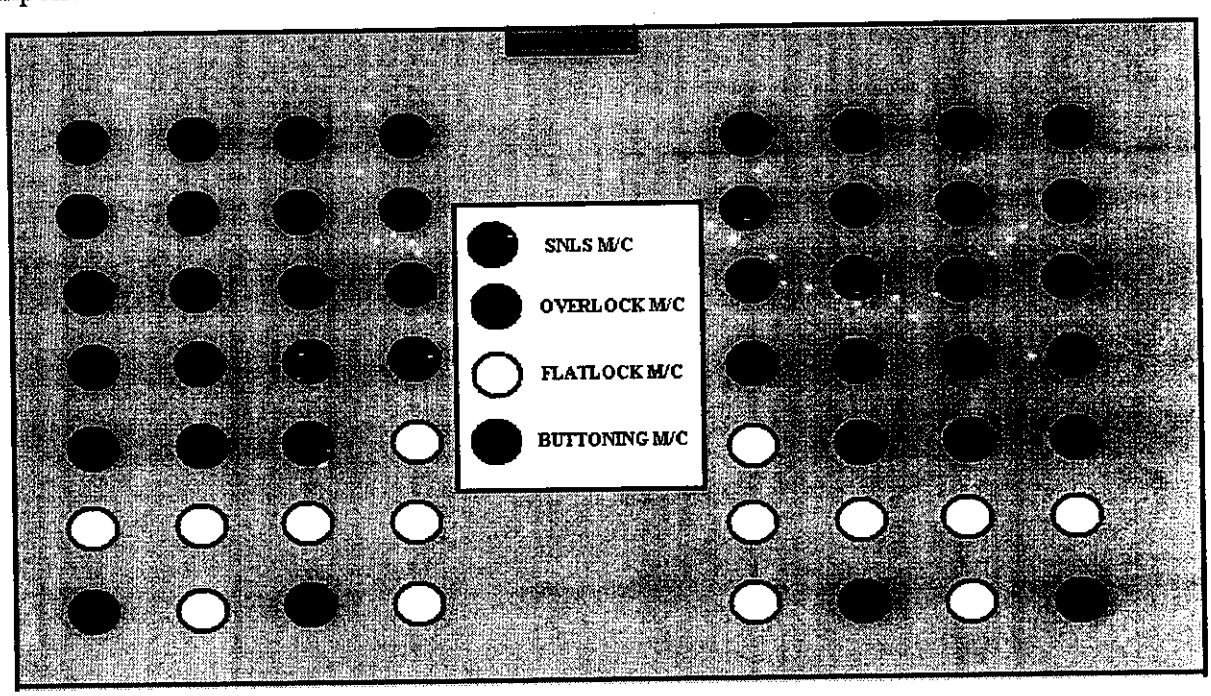


figure no: 20

IMPROVED LAYOUT

The arrangement of machineries is altered according to the current product (t-shirt). The eight production lines is reduced to six production lines with proper sequence of machinery arrangement. The side tables are introduced on the left hand side of the worker for convenient

passage of the garment components, this reduces the labors extra work . Thus the efficiency of the process is increased.

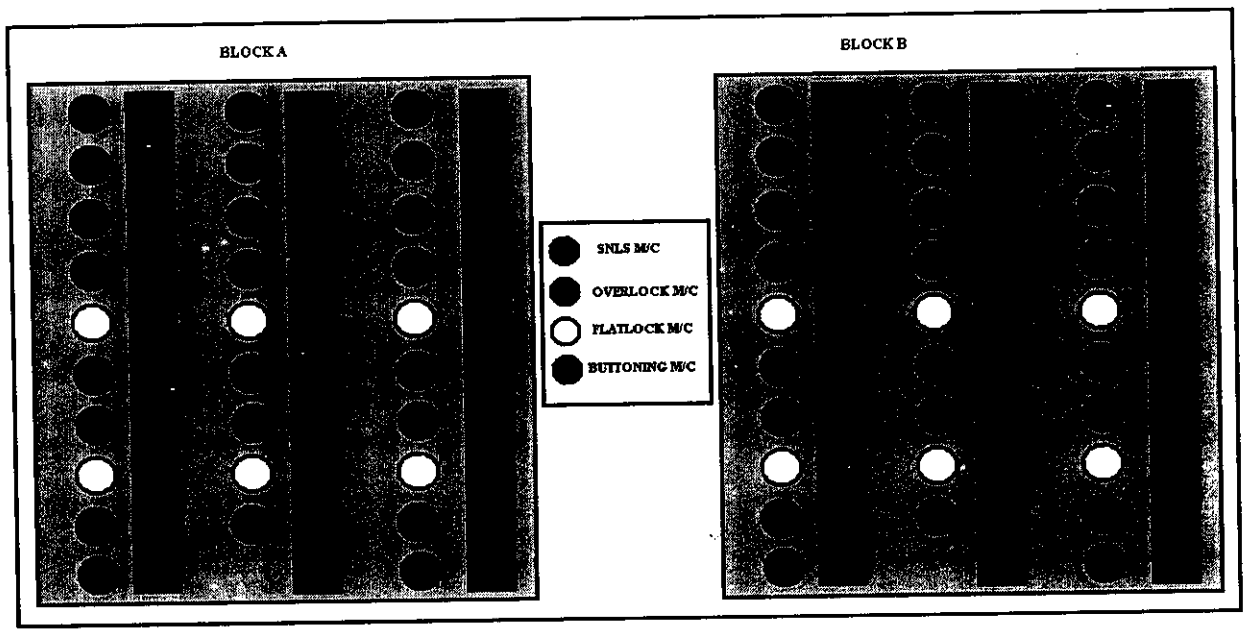


figure no: 21

FORMULAE

- Actual operation time = (net operation time * allowance ratio /100) + net operation time
- Daily output pieces = daily working time (sec)/ actual operation time

s.no	operations	Type of machines	Operation time	Net operation time	Allowance ratio	Actual operation time T (sec)	Daily output pieces per 8 hrs	Improv operati time T1 (sec)
1	Placket and front body attachment	single needle , lock stitch machine	43,44,45,43,46,47, 45,45,44,45,43,46 45,43,45,46,47,45 45,44,45	45	30	58.5	492	58.5

2	Placket open cut and turn over and folding both plackets	Hand operation	49,50,51,48,50,51, 52,50,50,49,50,49 51,50,49,51,50,50 51,50,50	50	20	60	480	56
3	Placket extra fabric trimming and cover-up stitching	double needle , over lock machine	30,31,29,32,30,30, 30,31,30,31,30,29 28,30,30,30,31,30 29,30,30	30	30	39	738	35
4	Pocket preparation	Electric steam ironing	34,35,35,33,35,36, 35,35,36,34,35,37, 36,35,35,34,35,33, 34,35,35	35	15	40.25	716	35
5	Pocket attachment	single needle , lock stitch machine	50,49,48,51,52,50, 50,51,50,50,51,49 51,52,50,50,49,50 49,50,50	50	30	65	443	60
6	Join shoulder	double needle , overlock machine	32,31,30,32,32,30, 33,32,32,34,33,32, 31,32,32,33,32,33 30,32,32	32	30	41.6	692	41.6
7	Cover on shoulder seam	Double needle flat lock machine with top cover , thread trimmer	28,29,27,28,28,29, 30,28,29,28,28,29 30,27,28,28,27,27, 28,28,28	28	30	36.4	791	36.4

8	Sleeve hem finish	Single needle lock stitch	25,24,26,25,24,24, 25,26,24,23,26,25 25,25,25,24,25,25 24,24,25	25	30	32.5	886	30.5
9	Sleeve attachment to the bodice	double needle overlock machine	35,34,36,34,34,34 35,36,35,35,35,34 35,34,35,36,35,34 35,35,35	35	30	45.5	633	44
10	Side seam attachment	Double needle overlock machine	30,30,29,28,31,32 30,30,29,30,30,29 29,31,30,30,30,30 29,30,31	30	30	39	738	38
11	Bottom hem finish	double needle flat lock machine	28,29,27,28,28,29, 30,28,29,28,28,29 30,27,28,28,27,27, 28,28,28	28	30	36.4	791	34
12	Side slit finishing	Single needle lock stitch	32,31,30,32,32,30, 33,32,32,34,33,32, 31,32,32,33,32,33 30,32,32	32	30	41.6	692	39
13	Collar band preparation	Single needle lock stitch	50,49,48,51,52,50, 50,51,50,50,51,49 51,52,50,50,49,50 49,50,50	50	20	60	480	58

14	Collar attachment	Single needle lock stitch machine	43,44,45,43,46,47, 45,45,44,45,43,46 45,43,45,46,47,45 45,44,45	45	30	58.5	492	57
15	Button attachment	Button machine	25,24,26,25,24,24, 25,26,24,23,26,25 25,25,25,24,25,25 24,24,25	25	30	32.5	886	29
	total					686.75		652

table no: 8

BEFORE IMPLEMENTATION	AFTER IMPLEMENTATION
Time taken to complete 1 garment = 11.5 min (686.7 sec) Time taken to complete 7875 garment = 10.5 days	Time taken to complete 1 garment = 10.8 min (652 sec) time taken to complete 7725 garments = 9.7 days

THE CHART SHOWS THE DIFFERENCE IN SEWING DEPARTMENT BEFORE AND AFTER IMPLEMENTATION

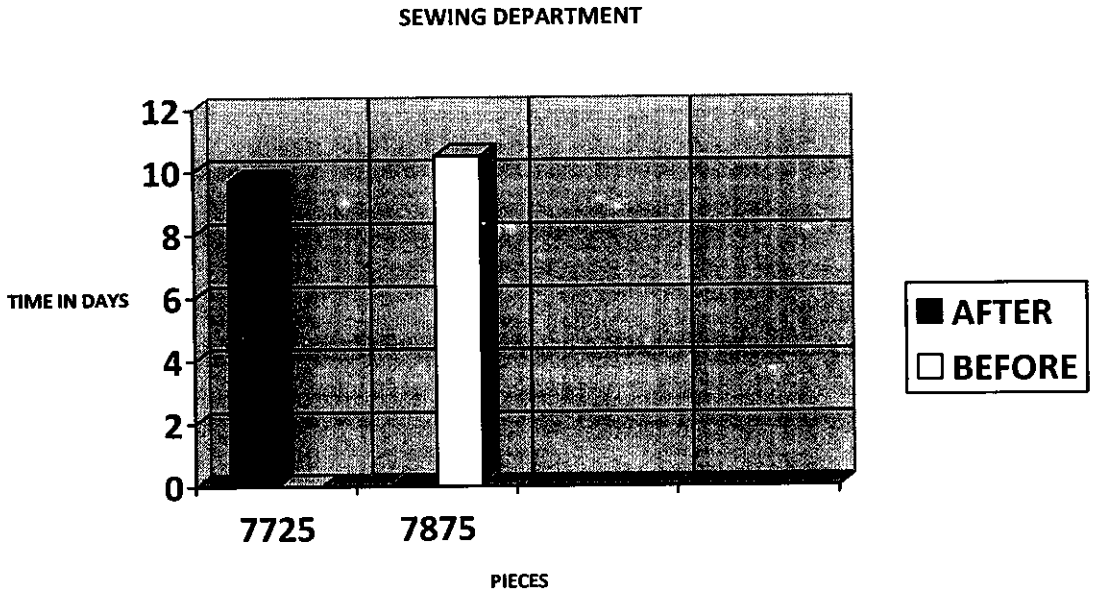


chart no: 9

4.2.3PLANT LAYOUT

The following factors should be taken into consideration while planning a layout:

- Minimization of manufacturing cost.
- Feeding the materials and parts at highest possible speed and in one direction without any backtracking or overlapping flow of products.
- Minimization of work transfer among the process from acceptance of raw materials till delivery of finished product with properly defined spaces for each process.
- Provision of future expansion plans,

The layout planning should be done based on factory site selection and arrangement of building and machines.

COLOR CARD SYSTEM

This system reduces the extra traveling and waiting time due to the confusion in transferring components from one area to another. In this system, different color cards are assigned to different departments. For example purple color card is assigned to cutting department, so the person carrying the fabric from spreading department brings it to the cutting department based on the color assigned.

EXISTING LAYOUT

Clifton clothing exports has two blocks namely A and B for garmenting. In block A there is fabric storage area where the fabrics required for garmenting is stored along with the necessary accessories required for the same. From the fabric storage department the fabric bundles are taken for spreading. The spreading area has two large spreading tables where the spreading activity is being carried on. After the lays are being spread the required patterns are marked on the lays then they are cut using the straight knife machine and then it is transferred to the cutting area. The cutting area has two band knife cutting machines for accurate cutting of the garment components for sewing. The cut components are bundled together and it is taken to block B for sewing operation.

The sewing area has a variety of machineries for garmenting. Total number of machineries in the sewing department are 62 . After the garment is sewn it is then taken to the inspection area where the garment is thoroughly inspected to meet the specification given by the buyer. The inspected garments are bundled and taken to block A for pressing and finishing operations. There are eight pressing tables with steam iron for effective pressing of garments. It is then transferred to the packing area where the garments are packed in poly bags or hangers or carton boxes as specified.

This layout has lot of disadvantages . they are listed below:

- It increases transportation of garment components.
- It increases production time.

- It increases the waiting time.
- It decreases the productivity.
- It decreases the efficiency.

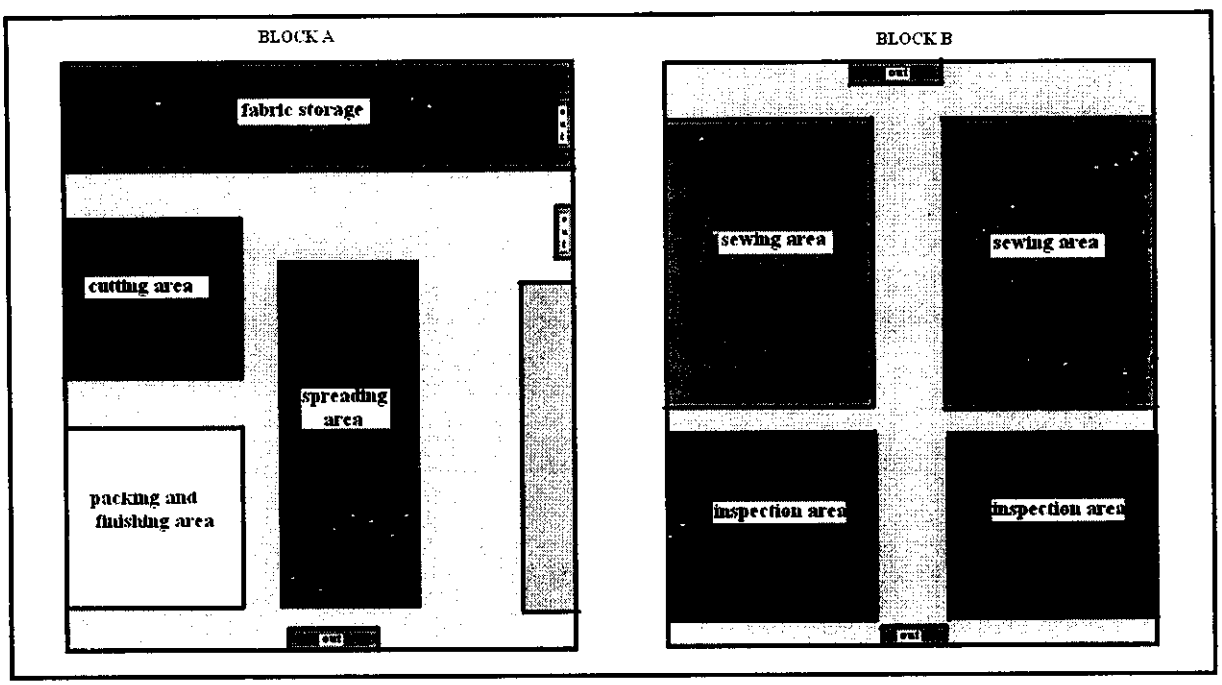


figure no: 22

IMPROVED LAYOUT

In order to eliminate the disadvantages in the existing layout, we have suggested an alternative plant layout. In this layout the block A and block B consists of a fabric storage area where the fabric bundles are stored. The two spreading table in the spreading area is segregated to block A and block B similarly the cutting tables. The machineries in the sewing area is equally divided and allocated to both the blocks. Similarly for inspection, pressing and packing. This layout has lot of advantages . they are listed below:

- It decreases transportation of garment components.
- It decreases production time.

- It decreases the waiting time.
- It increases the productivity.
- It increases the efficiency.

The order quantity is equally divided between both the departments and hence the overall efficiency is increased.

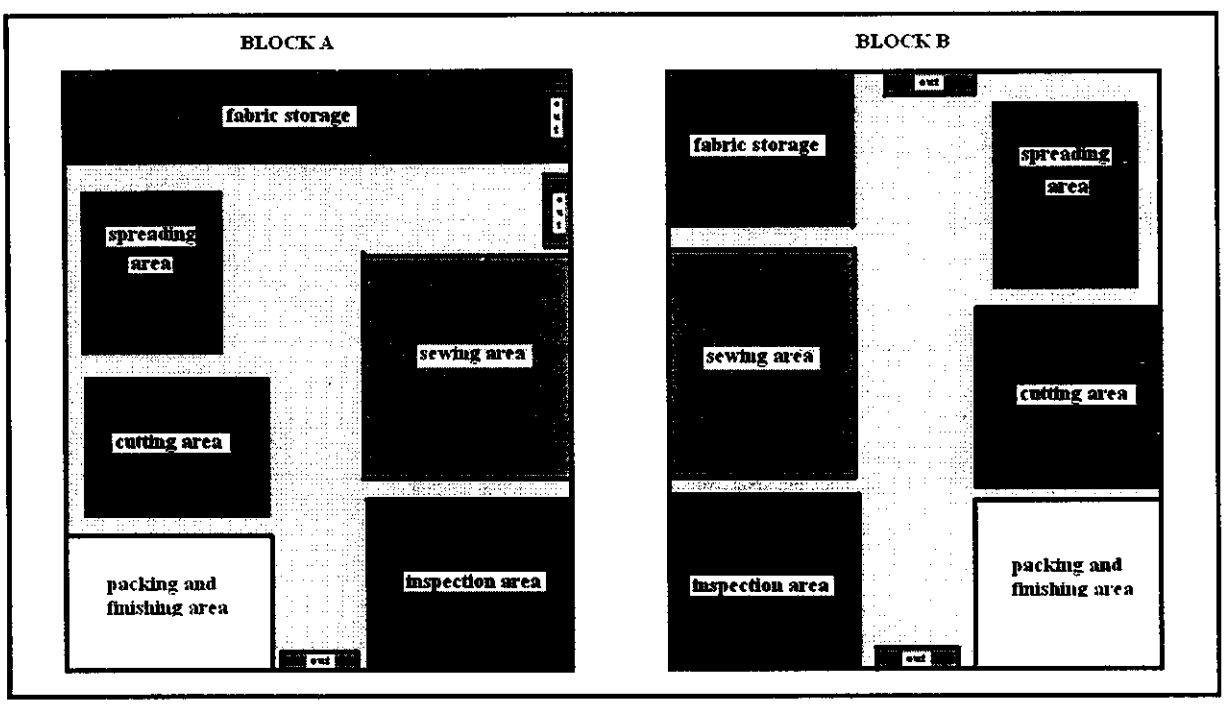


figure no: 23

FORMULAE

- Total working time= standard working time - total time wasted
- Actual working time = total working time - total time waited
- Productivity time loss % = (standard working time – actual working time)*100/standard working time

S.NO	BEFORE IMPLEMENTATION	AFTER IMPLEMENTATION

1	Standard working hours in a day = 480 min	Standard working hours in a day = 480 min
2	Standard working hours in 10 days=4800 min	Standard working hours in 10 days=4800 min
3	Total minutes wasted in a day = 57.6 min	total minutes wasted in a day = 57.6 min
4	Total minutes wasted in 10 days=576 min	Total minutes wasted in 10 days=576 min
5	Total working time in a day=422.4 min	Total working time in a day=422.4 min
6	Total working time in 10 days=4224 min	Total working time in 10 days=4224 min
7	Total minutes waited in a day= 62 min	Total minutes waited in a day= 13 min
8	Total minutes waited in 10 days=620 min	Total minutes waited in 10 days=130 min
9	Actual working time in a day=360.4 min	Actual working time in a day=409.4 min
10	Actual working time in 10 days=3604 min	Actual working time in 10 days=4094 min
11	Productivity time loss=25%	Productivity time loss=14.7%
		Increase in productivity time by 10.3%

PLANT LAYOUT

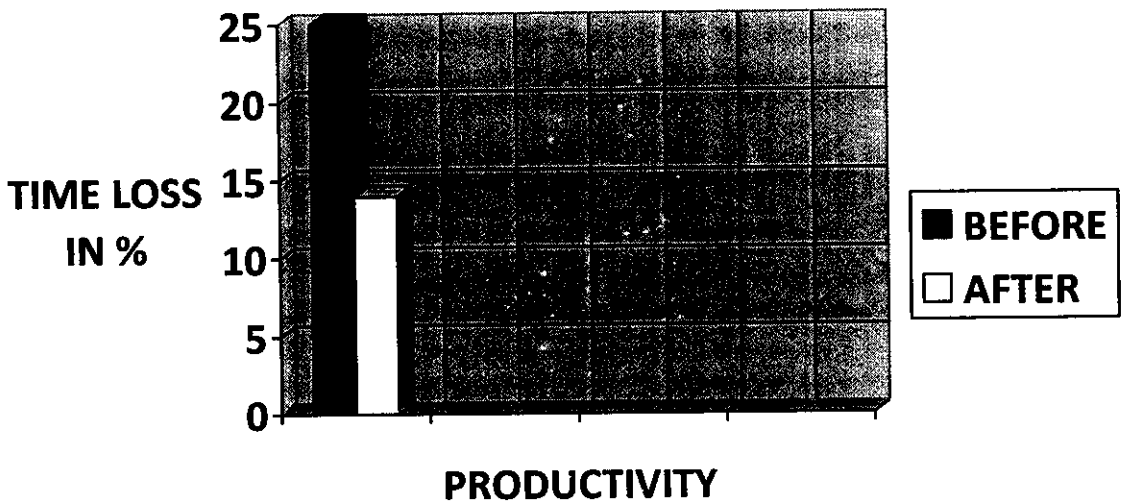


chart no: 10

DIFFERENCE BETWEEN OBSERVED TIME AND IMPROVED TIME

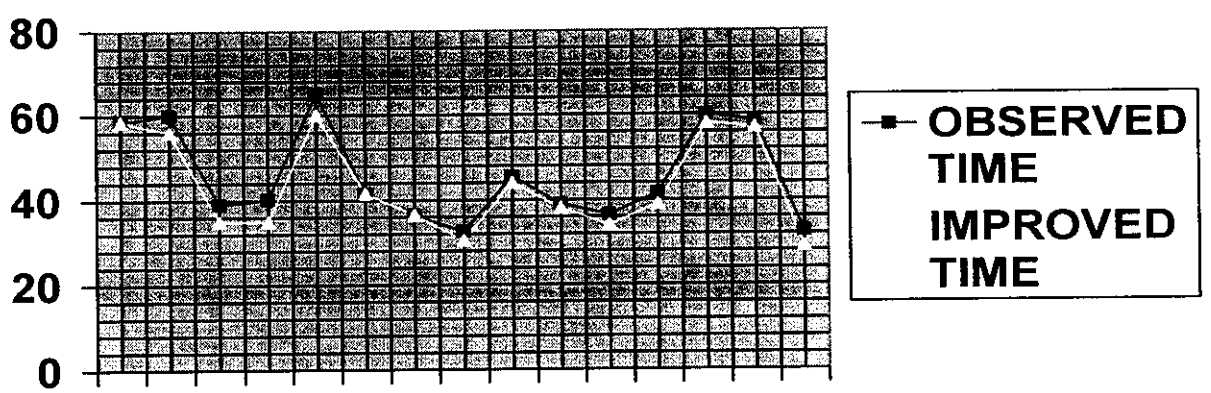


chart no: 11

FINAL INSPECTION DEPARTMENT

TRAFFIC LIGHT SYSTEM

- Instead of checking the defects at the final stage , it is essential that while sewing itself the operator is taught and trained properly.
- This system is a visual technique where three color card are given to the operator according to the performance.
- This is given by the quality controller to the operator during inline inspection .
- The red card is given to those who are identified by the quality control supervisor to produce one or more defective piece in the lot inspected.
- Yellow card is given to those who are identified by the quality control supervisor to produce two or more minor defects in the lot inspected.

Green card is given to those who are identified by the quality control supervisor to produce no reworks . There we can motivate the workers to produce good quality products .

OVERALL REDUCTION IN TIME:

Process involved	Time taken for existing method	Time taken for improved method
1.**sampling department**	**10.5 days**	**10.3 days**
2.sewing department	**10.3 days**	**9.7 days**
3.due to plant layout	**9.7 days**	**8.7 days**
	Productivity time loss=25%	**Productivity time loss=14.7%**

table no: 9

OVERALL IMPROVEMENT IN PRODUCTIVITY

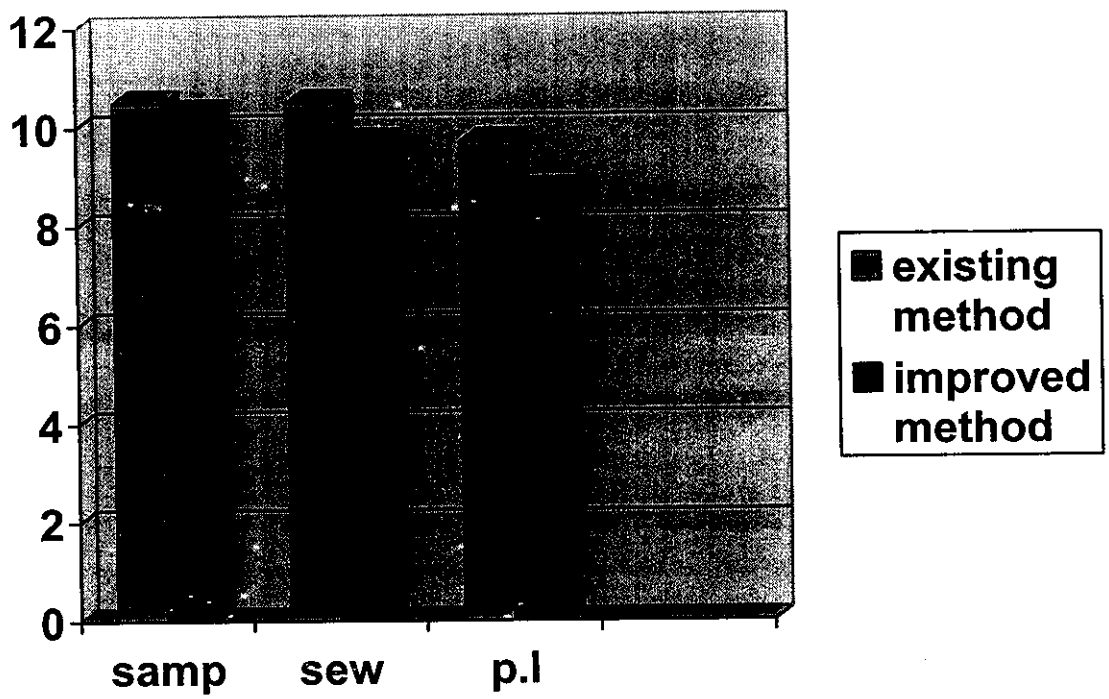


chart no : 11

SUMMARY AND CONCLUSION

5. SUMMARY AND CONCLUSION

The Indian apparel industry has a vast existence in the economic life of the country. It plays a critical role in the economic development of the country with its contribution to industrial output, export earnings of the country and the generation of employment. In the present business scenario, to survive in the market and to be profitable, the goal of any manufacturing system is to produce the highest quality products in the shortest lead time possible at the lowest cost. Fulfilling the buyer's expectations in quality and productivity is crucial in future. In this juncture, industrial engineering department, place a critical role in measuring productivity and methods of improving work procedure for operator and shop floor level persons.

With this background this study was undertaken with the following objectives:

- It helps in reducing ineffective time.
- It helps in the elimination of wasteful efforts, useless material handling, etc.
- It helps in the optimum use of plant, equipment, manpower and material.
- It helps in developing economical and efficient work methods.
- It helps in improving overall productivity.

The methodology of this study comprised of the following steps:

- **Selection of industry:**

  Stanfab Apparels (woven) and Clifton Apparels (knitted) are chosen for the study so, that the overall view of the apparel industry is analyzed.

- **Process flow:**

  The study is conducted in the following sequence . The existing plant layout is **studied**, the product is selected and the **specification sheet** for the same is analyzed, the facts related to the existing method **is recorded**, the questioning techniques is used for **examining, new method** is developed overcoming the

disadvantages in the existing method. The efficiency of existing and new method is calculated and **compared**.

- **Evaluation:**

  Evaluation consists of three steps. **Define** the new method and their related time. **Install** the new method and **maintained** in its specified form.

Thus by conducting the study the following results are obtained:

- Reduced ineffective time.
- Elimination of wasteful efforts, useless material handling, etc.
- Optimum use of plant, equipment, manpower and material.
- Economical and efficient work methods are developed.
- Overall productivity is increased.

LIMITATIONS OF THE STUDY

- The company is very secretive in giving out the details of the product and shipment details.
- They required a lot of explanation for implementing the new techniques.
- We felt little difficult in approaching the workers for conducting the time study.
- We were not allowed to take any samples from the industry.

RECOMMENDATIONS

- Improving productivity using lean manufacturing
- Improving garment manufacturing efficiency through GSD

6.APPENDIX

6.1 company profile

6.2 specification sheets

6.3 tables and formulae used

6.1.COMPANY PROFILE

Company	: **STANFAB APPARELS**
Address	: 14,east mogappair ind estate, anna nagar west extn, chennai – 600 037,
Phone no	: +91-44-26564102
Fax	: +91-44-26563860
E-mail	:stanfabapparels.com
Types of garments produced	:

men's woven casual readymade - top's,bottom and jackets.

ladies' woven casual readymade - top's,bottom and jackets.

children's woven casual readymade - top's,bottom and jackets

Departments available : pattern making and size grading, cutting, sewing, quality inspection , ironing , packing

Company : **CLIFTON APPARELS**

Address : 8/238, uppilipalayam arulpuram

p.o. palladam road

tirupur 641 605

Phone no : 914214312103, 4312121

Fax :91 421 2214075

E-mail :naveen@cliftonexport.com

Types of garments produced :

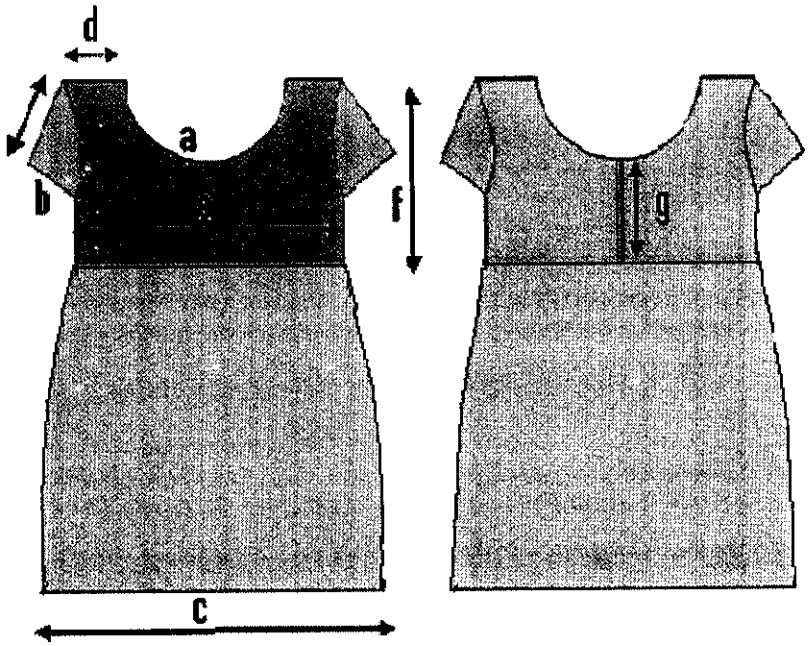
men's knitted casual readymade - top's,bottom and jackets.

ladies' knitted casual readymade - top's,bottom and jackets.

children's knitted casual readymade - top's,bottom and jackets

Departments available : pattern making and size grading, cutting , sewing, Quality inspection, ironing , packing.

6.2 SPECIFICATION SHEET OF STANFAB APPARELS



MEASUREMENT CHART

measurements	small	medium	large
Body length	16	17	18
Chest (e)	9 1/2	10	10
Waist	8 1/2	9	9
Shoulder width (d)	4 1/4	4 1/2	4 3/4
Armhole straight	4	4 1/8	4 1/4
back neck width	5 1/4	5 1/4	5 1/2

Front neck drop (a)	2	2	2 1/4
Cap sleeve length from CB	5	5 1/2	6
Cap sleeve opening (b)	2 7/8	3	3 1/8
shoulder	7	7 1/2	8
Yoke length (f)	5	5 1/2	6
Bottom circumference	24	24 1/2	25
Zipper lenght	5	5 1/2	6

6.3 TABLES AND FORMULAE USED

6.3.1 TABLES USED

TIME TAKEN IN THE INSPECTION DEPARTMENT

Sno	Number of workers	Number of defects	Length of fabric inspected	Time taken in exiting method (min)	Time taken in improved method
1					
2					

TIME TAKEN IN THE SEWING DEPARTMNET

s.no	operations	Type of machines	Operation time	Net operation time	Allowance ratio	Actual operation time T (sec)	Daily output pieces per 8 hrs	Improv operatic time T1 (sec)
1								
2								

COMPARSION TABLE

BEFORE IMPLEMENTATION	AFTER IMPLEMENTATION

6.3.2 FORMULAE USED

- Total working time= standard working time - total time wasted
- Actual working time = total working time - total time waited
- Productivity time loss % = (standard working time – actual working time)*100/standard working time
- Actual operation time = (net operation time * allowance ratio /100) + net operation time
- Daily output pieces = daily working time (sec)/ actual operation time
- Over production = (order quantity * allowance percentage)/100
- Total quantity to be produced = order quantity + over production

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Stanfab
APPARELS PRIVATE LIMITED
(Govt. Regd. Export House)

Asst. **Prof.Dr.R.Shanthi**
Department of Fashion Technology,
Kumaraguru College of Technology,
COIMBATORE-641 006.

Dated: 14/01/2011

CERTIFICATE OF COMPLETION

This is to certify that **Ms.V.Rudhra (O7BFT29)** student of B.Tech. Fashion Technology studying in **KUMARAGURU COLLEGE OF TECHNOLOGY – COIMBATORE**, has undergone In-plant training in our company from **05/01/2011 to 14/01/2011** and she has successfully completed the same.

She was found to be responsible, dedicated to work during her training tenure.

We wish her all the success endeavors.

For STANFAB APPARELS PRIVATE LIMITED

Authorised Signatory.

No.14, East Mogappair Industrial Estate, Anna Nagar West Extn., Mogappair, Chennai - 600 037. India.
Tel : +91-44-2656 4102 - 5 Lines Fax : +91-44-2656 3860 E-mail : info@stanfabapparels.com www.stanfabapparels.com

Stanfab
APPARELS PRIVATE LIMITED
(Govt. Regd. Export House)

To

Asst. **Prof.Dr.R.Shanthi** **Dated: 14/01/2011**
Department of Fashion Technology,
Kumaraguru College of Technology,
COIMBATORE-641 006.

CERTIFICATE OF COMPLETION

This is to certify that **Ms.Asha Kurian (O7BFT03)** student of B.Tech. Fashion Technology studying in **KUMARAGURU COLLEGE OF TECHNOLOGY – COIMBATORE**, has undergone In-plant training in our company from **05/01/2011 to 14/01/2011** and she has successfully completed the same.

She was found to be responsible, dedicated to work during her training tenure.

We wish her all the success endeavors.

For STANFAB APPARELS PRIVATE LIMITED

Authorised Signatory.

No.14, East Mogappair Industrial Estate, Anna Nagar West Extn., Mogappair, Chennai - 600 037. India.
Tel : +91-44-2656 4102 - 5 Lines Fax : +91-44-2656 3860 E-mail : info@stanfabapparels.com www.stanfabapparels.com

Clifton Export

8 / 328 , Uppilipalayam, Arulpuram P.O., Palladam Road, Tirupur - 641 605. INDIA
Phone : 0421 - 2210995, 2214995, Fax : 0421 - 2214075, e.mail : naveen@cliftonexport.com

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Ms. Shanthi.S , Ms.Suganya.P** and **Ms. Yamini Shekhar** of final year B.Tech-textile technology(fashion technology) of Kumaraguru college of technology has completed a project work titled "**Reducing inefficient time and improving productivity in apparel industry by work measurment**" in our industry in tirupur during the period from 3-1-2011 to 20-1-2011 .They were very sincere in their approach and the observation made by them during their course of project was useful to us .

We wish them all the best in their career