Faculty of Engineering
Department of Textile Engineering

A Project on
"Competitive study on Manual and Automatic Fabric spreading and cutting process"

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This thesis submitted in partial fulfillment of the requirements for the degree of Bachelor of Science in Textile Engineering.

Advance In Apparel Manufacturing Technology

December 2019

Letter Of Approval

December 08, 2019
To
The Head
Department of Textile Engineering
Datta Para, Ashulia Savar, Dhaka.
Subject: Approval of Thesis Report of B.Sc. in Textile Engineering Program.

Dear Sir,
I am simply writing to tell you that this venture report titled as " Competitive study on between Manual and Automatic Fabric spreading and cutting process" has been set up by the under study bearing ID's 161-23-213 and 161-23-218 are finished for conclusive assessment. The entire report is readied dependent on the correct examination and interference through basic investigation of exact information with required assets. The understudy was straightforwardly associated with their venture exercises and the report become crucial to start of numerous important data for the pursuers.

Thusly it will profoundly be valued on the off chance that you mercifully acknowledge this task report and think about it for definite assessment.

Yours Sincerely

…...............................

Kazi Rezwan Hossain
Lecturer
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First and foremost, we would like to present our gratefulness to the Almighty **ALLAH** for granting us the ability to carry out our project work successfully.

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Declaration

We validate that this report is absolutely our very own work, aside from where we have given completely recorded references to crafted by others and that the materials contained in this report have not recently been submitted for evaluation in any proper course of study. In the event that we do anything, which is going to rupture the main announcement, the inspector/manager has the privilege to drop my report anytime of time.

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ABSTRACT

Spreading is the process of super imposing lengths of fabric on a spreading table, cutting table, or specially designed surface in preparation for the cutting process. Fabric loss resulting from the cutting and spreading processes is one of the key factors in determining the fabric utilization in apparel production. Amongst the three main productions process cutting, sewing, and finishing – in apparel manufacturing, a considerable amount of fabrics would be lost during the cutting and spreading process. Such loss can be prevented by following the appropriate production process. Fabric spreading is the immediate operation prior to cutting. So, the efficiency of cutting operation is largely dependent on fabric spreading. The purpose of the study is to know about the spreading and cutting methods that are followed currently in Meghna knit composite Limited, compare the different aspects of the methods which are required for defining the efficiency of the methods. In this project, the fabric spreading processes: both manual and automatic were observed. The aspects that are related to spreading process such as fabric wastage, spreading time, production cost and required manpower were analyzed. Same thing analyzed in case of cutting process. The data used in this project were collected directly from the factory premises. These data were analyzed and then comparison was done between two processes for conclusive results. It was found that in manually spreading time per ply is 46 second where it is only 36 sec required in case of automatic process. Total number of manpower required 10 person in manual process where it is only 6 person in automatic . But in automatic process 4.41% fabric is wastages happening which is higher than manual where it is only 3.53%. Duration of fabric lay cutting we found 41 minute required for cutting by manual method but it was required only 21 minutes in automatic method for cutting of same lay which save the almost half extra time of cutting duration. So experimental results shows the difference between the manual and automatic fabric spreading and cutting process in terms of the aspects mentioned above. The analyzed data proved to be different from the general phenomenon of fabric spreading and cutting. The findings of this project might be helpful for both the top management as well as the individuals related to the production floor of Meghna knit composite Ltd., by showing the current scenario of fabric cutting section in the factory and also in finding measures that can be taken for the development of spreading and cutting process.

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TABLE OF CONTENTS

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Chapter 5

Chapter 6

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LIST OF FIGURES

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LIST OF TABLES

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Chapter- 1
Introduction

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1.1 Introduction:

In apparel industry, it is difficult to determine the efficiency of a production unit in a specific time period due to complexity of processes, variety and large quantity of operators. As sewing department offers a wide range of optimization possibilities on production efficiency, most of studies are related with this department. On the other hand, studies about cutting department frequently focus on cut order planning optimization, cut scheduling problem and alternative formulations for layout problem. Moreover, no particular study is observed about spreading process in literature. But, the cutting room is one of the most important departments in the factory. An improvement of 2-3% in material utilization efficiency of cutting floor can make a huge difference to bottom line profitability.

Garment production involves three major operations which are: cutting, sewing, and finishing. Before performing the sewing and finishing operations, the main role of cutting process is to transform fabrics rolls into garments panels prepared for subsequent sewing operations. Spreading is the process of superimposing lengths of fabric on a spreading table, cutting table, or specially designed surface in preparation for the cutting process. Fabric loss resulting from the cutting and spreading processes is one of the key factors in determining the fabric utilization in apparel production. Amongst the three main production processes - cutting, sewing, and finishing – in apparel manufacturing, a considerable amount of fabrics would be lost during the cutting and spreading process and such loss cannot be recovered by subsequent production process. The percentages of various costs which add up to give the garment cost are as follows: raw material cost 50 %, direct labor cost 20%, indirect labor charges and factory overheads 30%. Fabric is the biggest cost driver of the garments industry, accounting to 50 to 80 percent of the garments cost, so even a small fabric saving can add a good amount to garments manufacturer pockets. The minimization of fabric wastage is crucial to the reduction of production costs.

In spreading, one cutting order may require several markers to achieve optimum material utilization as well as production efficiency. The actual process of spreading involves laying out fabric in the desired number of layers, and the fabric must be kept flat, smooth, and tension- free on the spreading surface. Such processes may be done manually or by spreading and cutting machines. A spread or lay may consist of a single ply or multiple plies of fabric that is the total amount of the fabric prepared for a single marker. The height of a lay or spread is limited by the vertical capacity of the spreading equipment, cutting method, fabric characteristics, and the size of the order to be cut. Another main consideration in the spreading is the spreading mode; that is the manner in which fabric plies are laid out for cutting. In some cases, fabric is laid out continuously as the spreader moves over the spreading table. Sometimes the fabric roll must be cut at each end of the spread and the new end is repositioned.

Here, this project is aimed to analyze the fabric spreading and cutting methods currently practiced in a garments factory, examine the different factors related to the productivity of these methods and to give an overall idea about how these methods can be developed for increasing the productivity.

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1.2 Objectives of this study:

- To know about the existing spreading and cutting processes in Meghna knit composite Ltd.
- To find out the different aspects (such as time, manpower, costs, fabric wastage etc.) of those processes that are related to the overall process efficiency.
- To analyze these aspects of the processes to find out the more productive spreading and cutting method.
- To find out the measures that can be recommended for increasing the spreading and cutting productivity thus reducing the overall production cost.

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Chapter- 2
Literature review

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2.1 Fabric Spreading:

Spreading is a preparatory operation for cutting. The main aim of the spreading process is to lay the several fabric plies essential for the production process to the marker length without any tension on the fabric. Fabric lay is done mainly for achieving two objects – for fabric saving and for time saving during cutting of fabric for each garment. The lay height depends on order size, fabric characteristic, capacity of the spreader, cutting method and equipment used. The preference of mode of spreading will influence the cost of spreading as well as finished garment quality. The composition of each spread, i.e. the number of plies of each colour is obtained from the cut order plan.

2.2 Objective of Fabric Spreading:

- To place the number of plies of fabric as to the exact length of the marker plan correctly aligned to length and width and without tension.
- To cut garments in bulk and the saving of fabric through the use of multi-garment marker plans; and
- The saving in cutting time per garment that results cutting many plies at the same time.

2.3 Requirements of Fabric Spreading:

i. Alignment of fabric ply:
Fabric spreading is done as per the length and width of a marker. It is strictly maintained so that each of the fabric plies is placed perfectly within the length and width of the marker in laying during the spreading of fabric. Otherwise the fabric of any ply which will be placed beyond the dimension of the length or width of the marker, will be cut defectively

ii. Correct ply tension:
In fabric spreading, all plies must be spread at uniform tension (as less as possible). Otherwise it creates various types of faults during cutting the fabric. During spreading it is to be taken care so that fabric spread is not done in loose condition, because if it happens, then fabric lay will be defective, fabric cutting will be inconvenient and patterns will also be defective.

iii. Fabric must be flat:
All plies must be spread in flat form during fabric spreading. Otherwise different types of faults such as crinkle and crease produced during fabric cutting.

iv. Elimination of fabric flaws or defects:
During fabric spreading, different types of fabric faults may be identified which must be avoided here by marking.

v. Correct ply direction and lay stability:
In fabric spreading time, all plies must be spread at the same direction (such as all faces up or all faces down or face to face) and from one end of the table.

vi. **Matching the checks and stripes:**
In case of stripe or check fabric spreading, stripe line or check line should be kept at uniform distance from one end of fabric to another.

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vii. Avoidance of fusion of plies during cutting:
In case of synthetic fabric spreading, anti fusion paper needed to be used between the plies to reduce the fusion between fabric and knives. Normally for every 30-40 plies needs one anti fusion paper.

2.4 Fabric lay:
Spreading means the smooth laying out of the fabric in superimposed layers of specified length and after spreading the shape of fabric plies is called fabric lay. During spreading the number of plies should not be more than three hundred.

The types of fabric lays can be done mainly in two methods.

a) Based on the construction of the lay.
b) Based on the direction of spreading of fabrics in lays.

a) **Based on the construction**: Based on the construction, fabric lays maybe of two types:

1. Straight lay.
2. Stepped lay.

- **Straight lay:** In straight lay each ply of fabric is spread according to marker length, i.e. all plies can have the same length. In that case one marker is used.

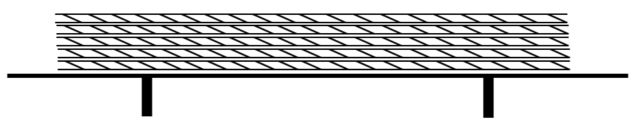

Figure 2.1: Straight lay

- **Stepped lay:** Ply of fabric lay is not spread according to marker length, i.e. when the plies are laid up in different lengths- a step can be formed. Different types of marker are essential for different steps. Its use is very much less because of fabric wastages and lay making if difficult as well.

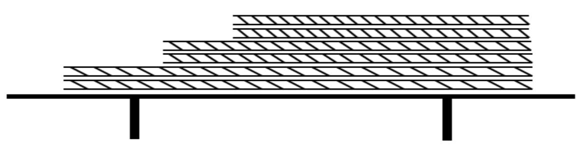

Figure 2.2: Stepped lay

b. According to the direction of spreading

- **One way spreading (Face to underside):** This method is used for open fabrics. The face can lie towards the top or bottom, but always in the same direction. If spreading machines are used, one way laying-up necessitates idle motion because the machine always begins its run at the same end of the table and must return to this position after every laying operation.

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- **Laying-up in pairs (Face to face):** This method is also used for open piece goods. The face side is always laid onto the previously spread face side so that- as in one way spreading- the machine returns running idle to the working position. The roll of fabric must be turned before the next piece is laid-up. When using spreading machines, these consequently require a device to turn the roll after the fabric has been cut off at the end.

- **Lap (Continuous, Zigzag) lying:** This method was also developed mainly for spreading open piece goods. Contrary to one way spreading and laying-up in pairs, the pieces are not cut off at the lay end but are clamped and then continuously laid in laps. This is the easiest and most popular way of spreading.

2.5 Methods of Spreading:

Two types of methods to makes lay by spreading fabrics.

a) Manual methods

b) Mechanical methods

a) Manual methods: The fabric is drawn from its package which, if it is a roll, may be supported on a frame, and carried along the table where the end is secured by weights or a clamp. The operator work back from the end, aligning the edges and ensuring that there is no tension and there are no wrinkles. The plies are normally cut with hand scissor or with a power circular knife mounted on a frame.

b) Mechanical methods: Semi-automatic spreading machine is working almost similar to Hand process with spreading track process because this methods working technique and working procedure are same but this process are working by electric motor. A roll of fabric are installed in the machine like Hand process with spreading track and this roll are spreading on spreading table automatically. The spreading machine are running on the spreading table by from one side too another side by electrical and mechanical power.

2.6 Methods of Marker Planning: There are two methods usually used for marker making in the apparel industry. They are

1. Manual method
2. Computerized method.

In garments industry, manual market making is the oldest, traditional and typically used method. In this processes pattern maker make the all pattern pieces manually and after that fabrics are spread on cutting table and set up all pattern pieces directly onto the marker paper. Then mark by chalk, pencil or pen.

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2.6 Flowchart of Automatic Fabric Spreading Process:

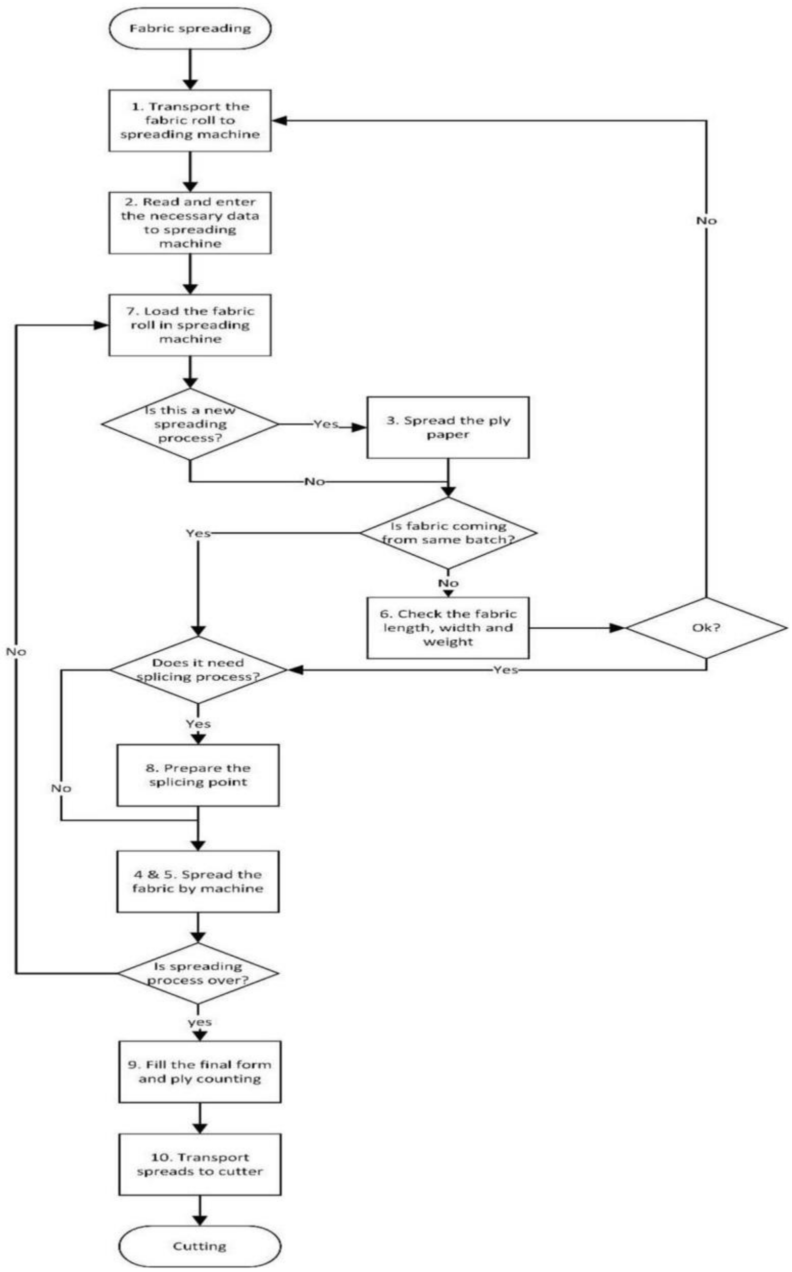

Figure 2.3: Workflow of automatic spreading process

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2.7 Cut Order Planning:

One of the vital operations that take place in the cutting section is known as cut order planning. It is the process that coordinates customer orders with all the variables of marker making, spreading, and cutting to minimize total production costs and meet customer demand for timely products. This could also be called 'lay plan', 'cut plan', etc. It is optimizing principally the cutting operation under certain constraints by following certain parameters. In short, cut order planning is nothing but deciding the arrangement or combination of markers and spread lays for a particular garment style order. This is a benchmark process to be done in every garment industry which has a huge impact on overall savings for the order. Cut order planning is the problem of planning the fabric cut for a set of apparel orders. Fabric loss in cutting room is mainly caused by two operations- marker making and fabric spreading.

- Marker planning is the placement of pattern pieces to meet the technical requirements and needs of the material economy.

- Marker production may include drawing of marker plan directly on the fabric, drawing it onto a marker paper by pen or automatic plotter, or, where the cutting method allows it, recording pattern piece information on the marker paper or on the fabric without actually drawing pattern lines on it. A CAD program is useful because it automatically calculates the yardage needed and indicates how many layers of fabric need to be spread in order to complete the desired number of products. Each fabric layer is called a "ply"

2.8 Methods of Marker Planning: There are two methods usually used for marker making in the apparel industry. They are

1. Manual method
2. Computerized method.

1. In garments industry, manual market making is the oldest, traditional and typically used method. In this processes pattern maker make the all pattern pieces manually and after that fabrics are spread on cutting table and set up all pattern pieces directly onto the marker paper. Then mark by chalk, pencil or pen.

2. Computerized method is the best and most popular method of marker making. Generally it gives higher efficiency. During this marker making method every specific style and part of the patterns are kept in the computer memory and grade rule is also mentioned. To do this marker making, computerized marker paper directly placed on fabric layer. Then the computer makes the marker by its programming techniques. Computer Aided Design (**CAD**) system are used to make marker. Comparison between manual and CAD marker making is huge.

Figure2.4: manual method

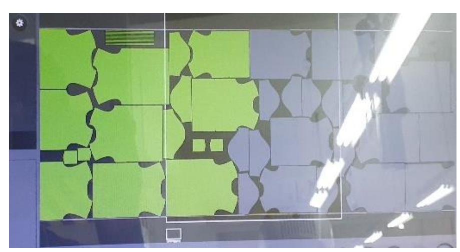

Figure2.5: Computerized method

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2.9 Points to be Considered before Marker Planning:

Following points should be considered before marker making (fig. 2.6):

a) During marker making it should be followed that fabric width must be higher than marker width (Bn).

b) Fabric length must be higher than marker length (Ls).

c) Marker width should be taken according to the fabric width and fabric spreading must be done by taking the guideline from the marker length.

d) When garment pattern pieces are laid down on the layer of fabric, in that time the grain line must be parallel to the line of warp in woven fabric and wales in knitted fabric. It should be noted here that, when pattern pieces are laid down across the layers, then the line is kept parallel to the weft for woven fabric and course in knitted fabric.

e) All the pattern pieces of a garment should be along the same direction when laid down on an asymmetric fabric.

f) During marker making, length of fabric cutting table should be considered.

g) Plan for garment production should also be considered during marker making.

h) During marker making, marker should be started with the large pattern pieces. Then fits the smaller pieces in the gap of larger pieces. In this way, fabric wastage is minimized and marker efficiency is also increased.

i) In the last step of marker making, all the patterns are shuffled in various directions to reduce the marker length. It also helps to increase the marker efficiency.

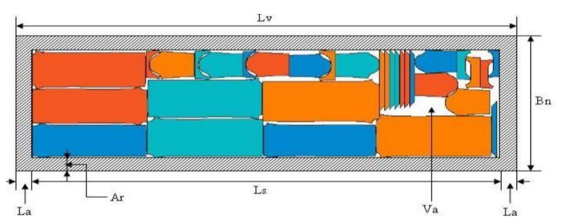

Figure 2.6: Details of a marker plan.

In figure 2.6, La = End allowances, i.e. allowances at the beginning and end of a layer
Lv = Lay length, i.e. marker length + end allowances;
Ar = Edge allowances, i.e. allowances at the fabric edge;
Va = Cutting loss, i.e. waste from within the lay plan;
Bn = Lay width, i.e. marker width + edge allowances;
Ls = Marker length.

2.10 Marker Types:

There are several marker types, where a few of those are cost effective. Several marker types can be drawn for a particular style and some of those give higher fabric utilization, but most optimum marker gives the best results in terms of all other factors. Varieties of these types of

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markers are used widely in the garment sector. This can be divided into two as single size marker and multi size marker.

I. Single size markers

This marker contains patterns for only one size of a garment. Normally these types of markers can be used for remnants fabric pieces.

II. Multi size markers

This contains two or more sizes of garment in one marker. These types of markers are commonly used in garment sector. These type of markers gain high marker efficiency than the single size markers.

All the above marker types can be divided again in to two categories, One-way marker and two-way (both ways) marker.

i. One-way marker All the parts of all sizes are drawn into one direction.

ii. Two-way marker – Normal mixed marker This is called normal marker as well, and this is the common marker in the garment sector when the fabric does not show defects such as shade variations, non-unique brush level and barre effect etc.

2.11 Quality Control Parameters in Cutting Section:

In cutting section quality is insured in two stages.

a) **Spreading quality control**: Following point are checked during spreading:

I. Table marking.
II. Ends
III. Tension
IV. Leaning
V. Counts
VI. Ply height
VII. Remnants
VIII. Fabric flaws
IX. Marker placing

b) After cutting quality control: After cutting, each block and bundles are checked on the following points:

I. Miss cut

II. Ragged cutting

III. Pattern checks

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IV. Matching Plies

V. Notches

2.12 Types of Fabric Loss in Cutting Room:

Mostly all the papers and research works are based on improving the marker efficiency. But very few work or research has been done to reduce the fabric losses outside the marker. For proper costing of a garment, and cost reduction, it is necessary to have good understanding of the fabric utilization and various fabric losses that occur during garment production. All the losses in cutting room are classified into three groups as marking loss, spreading loss and other indirect losses as discussed in the following sub- sections..

2.12.1 Marking loss:

Marker is the basic element in cutting process; it provides an accurate and essential indication for spreading and cutting. Without the marker, the required garment panels cannot be formed for the later stages of production. Not only is the marker the basic and vital element in production, but it also causes the largest portion of fabric wastage, which is known as marking loss or marker fallout. In practice, the value of marker efficiency is commonly used to indicate the effectiveness of a particular marker on fabric utilization. In actual operation, marker efficiency is governed by many factors and marking restrictions. Those factors are described as follows:

i. Fabric restrictions

Since the fabric properties such as the appearance, extensibility and shrinkage are different in warp wise and weft wise direction, each pattern block is designed with a predetermined grain line. In the process of marker planning, the placing of pattern blocks on the marker is restricted by their grain lines. It is impossible to place the pattern blocks in any directions on the marker even though such arrangement can provide better marker efficiency.

ii. The garment patterns

The shape of each garment panel, location and number of seams have a large influence on marker efficiency. The seams affect not only the number of pattern pieces, but also can determine the area that is used by each panel. Shifting of a seam for some parts can bring an extra space thus gained for placing one additional large part across the width of a marker. In addition to seam location, the number of seams directly affects the shape of the patterns, which can determine material uses. For example, in men’s shirts, the one-piece back can be transformed into two-pieces by adding an extra seam at the centre back in order to have more flexibility in marking.

iii. Marking skill

The variability of marking skill is well known. Depending on the marker maker himself, different marker makers will have their own skill, method, and experience for marking. Moreover, different talent and personality characteristics are other factors that influence the learning and marking

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ability of a person. Some of these characteristics included: mathematical ability and numerical reasoning; spatial visualization; the ability to integrate elements of patterns.

iv. Marker width

Marker width is one of the major constraints in marker making; it governs the flexibility for the marker maker to place pattern panels within the marking area. Actually, marker width is determined by fabric width and it cannot generate a marker wider than the fabric. As a result, fabric becomes the major constraint in marker planning.

v. Size combinations

Besides the number of sizes to be marked, size's combination is another factor that is closely related to marker efficiency. If the number of sizes to be put into a marker is fixed, a question may arise to what sizes of the garments should be chosen to mark on this marker. In general, there can often be 0.5% to 1% difference between the good and bad combinations

vi. Pattern engineering

It can be defined as pattern changes that do not affect the finished quality, appearance, fit, or salability of a garment. There are several techniques employed in pattern engineering. For example, shirttail reshaping, component reshaping etc. Pattern engineering could help to reduce the area that exists between the pattern panels, hence, to increase marker efficiency.

vii. Patterned fabric

The marking and cutting of patterned fabric become as the last manually-intensive practices in the cutting room. Placing pattern pieces accurately on the fabric imposes numerous problems on cutting room personnel, which despite many years of endeavor, automation has failed to solve. Selection of pattern repeat distances and modification of the location of the predominant stripe are two common ways to minimize waste for marking patterned fabric. There is a great potential for patterned fabric to reduce marker utilization and it is important that every aspect of manufacturing is scrutinized carefully.

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2.12.2 Spreading loss:

Spreading loss is the fabric loss outside the marker. The various fabric losses outside the marker can be broadly classified into different groups, namely ends of ply losses, ends of piece losses, edge losses, splicing losses and remnant losses, which are discussed as follows:

I. Ends of ply loss:

The flexibility, limpness and extensibility of fabrics along with the limitation of spreading machinery necessitate an allowance of some fabric at the end of each ply. These losses may be up to 2 cm at each end or 4 cm per ply. In case of some stable fabrics it may be less and for some unstable fabrics it may be more. The ends of ply loss is 1-2% of the total fabric usage. The higher the fabric length the lesser is the loss. If strong vigilance is not kept over the spreading machine setting and material handling, there is a tendency for the waste to become excessive. Standards should be established for this loss in the cutting room and it should be monitored properly by efficient supervisors.

ii. Ends of piece loss:

The most important loss comes because the fabric length is not exact multiple of the marker length. The spreader must either splice in the next piece, resulting in a loss of fabric from the end of the piece to the nearest splice point, or the part ply must be laid aside as a remnant and processed separately. The ends of piece loss varies from 0.5-1% of the total fabric usage. This loss is minimized if the average length of the pieces that are purchased is increased. This strategy has a number of other advantages, including the reduction in documentation, reduced levels of shade variation, and higher productivity in spreading. The ends of piece losses cannot be eliminated completely, but it can be controlled by establishing clear procedures for splicing and processing of the remnants.

iii. Edge loss:

In normal practice during marker planning, the width of the marker is kept a few centimeters less than the edge-to-edge width of the fabric. The marker is made according to the usable width of the fabric. The usable fabric width depends upon the quality of the selvedge, the consistency of fabric width, and also on the precision of edge control during spreading. Width variation in fabrics must be controlled alongside the edge allowances. Most companies experience great difficulties because of inconsistency of edge-to-edge fabric width in case of narrow width fabrics.

iv. Splicing loss:

Splicing is the process of overlapping the cut ends (the end of one length of fabric and the beginning of another) of two separate pieces of fabrics so that spreading can be continuous. Splicing is necessary as one roll of fabric is finished and a new roll is taken into use. Also during spreading there may be some objectionable fabric faults, which make the product unsalable or substandard. These faults are removed by cutting the lay at the fault point and incorporating splicing position into marker plans. During splicing the splicing line should be so selected that none of the pattern pieces contains the fault or is incomplete. A splicing allowance is made to ensure that only complete panels are cut. While certain development with automatic spreading can reduce this loss, splicing with manual spreading requires commitment and consistency on the part of spreader to minimize waste. The splicing losses may vary up to 5% of the total fabric usage.

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2.12.3 Other indirect losses:

i. Loss due marker planning

The job of marker planner is to determine the most efficient combination of style numbers, sizes, and colors for each marker to obtain the best of equipment and material usage. Loss on marker planning occurs when the most saving marker or the higher efficiency marker is not use for cutting. Obviously, the cost for choosing an unsuitable marker is the addition of the fabric losses. Although the company is suffering a loss due to the inappropriate marker, it may be forced to do so because of the need for quick response to customer requirements and production pressure.

ii. Ticket length loss

Woven fabrics and some knitted fabrics are sold by length. Each fabric piece is measured by the fabric supplier and a ticket is attached to each piece indicating the length for which the customer is invoiced. In many cases the gross length and the net length are marked in the ticket. The gross length is the distance between the ends of the fabric and the net length is the length for which the consumer is paying. When there are errors in the measurement of these lengths they are unlikely to be in favor of the purchaser. When the fabric is issued on the basis of the ticket length, there can be fabric shortage against the estimated value. This loss can be reduced by inspecting the length of the incoming fabric and reporting the fabric supplier in case of yardage short.

iii. Loss at beginning of rolls

The beginning of roll of a fabric is never perfectly straight and square with the selvedge. It is necessary to straighten the end of each new roll when laying up. Additionally, it is usual for an inerasable identification or trademark to be stamped at the end of every roll, and normally this is also cut off. In several instance, it was found that patterns had been cut out indiscriminately by the clothing manufacturer for such purpose as stock recording and identification.

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Chapter- 3
Methodology

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3.1 Methodology:

For completion of the project, a project framework was developed where different steps were followed sequentially as below:

❖ **Identification of Problem:** As garment industry is rapidly developing day by day, the use of automatic machineries are becoming more appropriate. So it is required to explore the feasibility of replacing the existing manual operations with the automatic ones provided, they are beneficial to the economy of the garments industry.

❖ **Selection of Factory:** A garments factory was selected to collect data for carrying out the project work. In order to ensure that the data taken were presentable, the factory selected for data collection had to fulfill some pre-defined requirements as following:

i. Constant style:

In marker making, garment style has a great impact in affecting the marker efficiency, length and splice line position. A change in garment style in the study would cause great variation to the measurement outcomes. So a specific style of an order had to be selected

ii. Production capacity:

The production capacity of the selected factory had to be large enough (at least 100 plies of fabric for each selected cutting lay). Such amount of fabric consumption normally involves 5 to 10 fabric bundles, and thus possible to identify clearly the each type of fabric loss in the sample lay during spreading.

iii Equipment management

The cutting room itself had to be well established in terms of its equipment and management. In order to keep a consistent spreading quality among all cutting tables, it was necessary to choose a well managed cutting floor that is equipped with both manual and automatic spreading facilities simultaneously.

iv. Skill of operator:

The skill of the operator plays an important role in affecting the spreading time and amount of fabric loss. The operators had to be well trained so that the spreading skills among them were similar, thus, the effect of human error could be considered consistent for all the sample lays.

Based on the consideration of the above requirements, Meghna knit composite Ltd. was selected for conducting our field work.

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❖ Selection of Cutting Floor: In order to conduct our project work, we selected the cutting floor naming Meghna knit composite Ltd where only knitted fabric is processed and which had the facility of both manual and automatic fabric spreading methods available at the same floor.

❖ Selection of Order: Among the different orders of different buyers we selected an order of Target buyer which is of a men's short sleeve t-shirt. The details information about the order is given below:

3.1: Information about the order provided by the Target buyer:

Target.	**Style no:** 3750186712	**Designer:** Vera La Rocca	**Style Desc**: SS Garment DYE TEE

Table 3.2: Information about the fabric type and construction:

Construction	Fabric types	Composition	GSM	Finished dia
Single Jersey	knitted	100% Cotton	160	68.5

Table 3.3- Total quantity of the order according to size ratio.

Size	**7**	**8**	**9**	**10**	**12**	**14**	**16**	**Total**
Ratio	1	1	2	5	2	2	1	14
Quantity	100	100	200	500	200	200	100	1400

Figure 3.1: Artwork sheet of the garments provided by the buyer

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Table 3.4- Size wise measurement chart of the order provided by the Target buyer:

CODE	Point of measure	Tol+	Tol-	7	8	9	10	12
10F	Chest 1cm below underarm	1	1	80	82	84	86	91
10Y2	Front width at mid arm hole	0.5	0.5	32.5	33.5	34.5	35.5	37.5
10Y3	Back width at mid armhole	0.5	0.5	33	34	35	36	38
11A	Shoulder breadth frm Shld fold line	0.5	0.5	40	41	42	43	45
11F	Shoulder drop	0.2	0.2	5.5	5.5	5.5	5.5	5.5
12C	Neck width HPS from shld fold line	0.5	0.5	16	16.5	17	17.5	18
13B	Front neck drop hps frm shld fold line	0.5	0.5	6	6.5	7	7.5	8
13H	Back neck drop HPS from shld fold line	0.5	0.5	3	3	3	3	3
14J	Neck band width	0.2	0.2	2	2	2	2	2
15A	Min neck stretched	MIN	MIN	56	58	58	58	60
19B	Hem circ straight	1	1	80	82	84	86	91
29B	Short sleeve length	0.5	0.5	16	16.5	17	17.5	18
30K2	Arm hole drop	1	1	21.2	22	22.75	23.5	24.7
31A	Upper arm girth	.5	0.5	32	33	34	35	37
32B	Short sleeve opening	0.5	0.5	31	32	33	34	36.5
39E	Front length HPS from shlder fold line	1	1	55	57	59.5	62	64.5
52A	Chest pocket width	0.3	0.3	8.5	8.5	8.5	9	9
52C	Chest pocket length	0.3	0.3	9.5	9.5	9.5	10	10
53A	Chest pocket frm HPS shoulder fold line	0.5	0.5	14.5	15	15.5	16	16.5
UU	Chest pocket from side seam	0.2	0.2	7.75	8	8.25	8.5	9
XX	Sleeve head height	0.5	0.5	9.5	10	10.5	11	11.5

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❖ **Observation of the Process:** Then the total spreading process was observed thoroughly from fabric unloading (from store) till lay cutting, for both manual and automatic spreading.

❖ **Data Collection:** Required data for the project work was then collected. The data was taken for four lays of the different order. One of them were for Target buyer and another for H&M buyer. Of them, two were manually spread and two were spread using fabric spreading machine. For each sample lay, a set of information were recorded based on three categories: General information, marker information and actual measurements as stated in table 3.5.

Table 3.5: Information about the order provided by the H&M buyer:

H&M	Style no: 236237	Color: K.Green	Designer: Amy Crofts	Fabric Construction Lecra Waffle

Table 3.6- Total quantity of the order according to size ratio.

Size	XS	S	M	L	XL	Total
Ratio	1	2	4	2	2	11
Quantity	60	120	240	120	120	660

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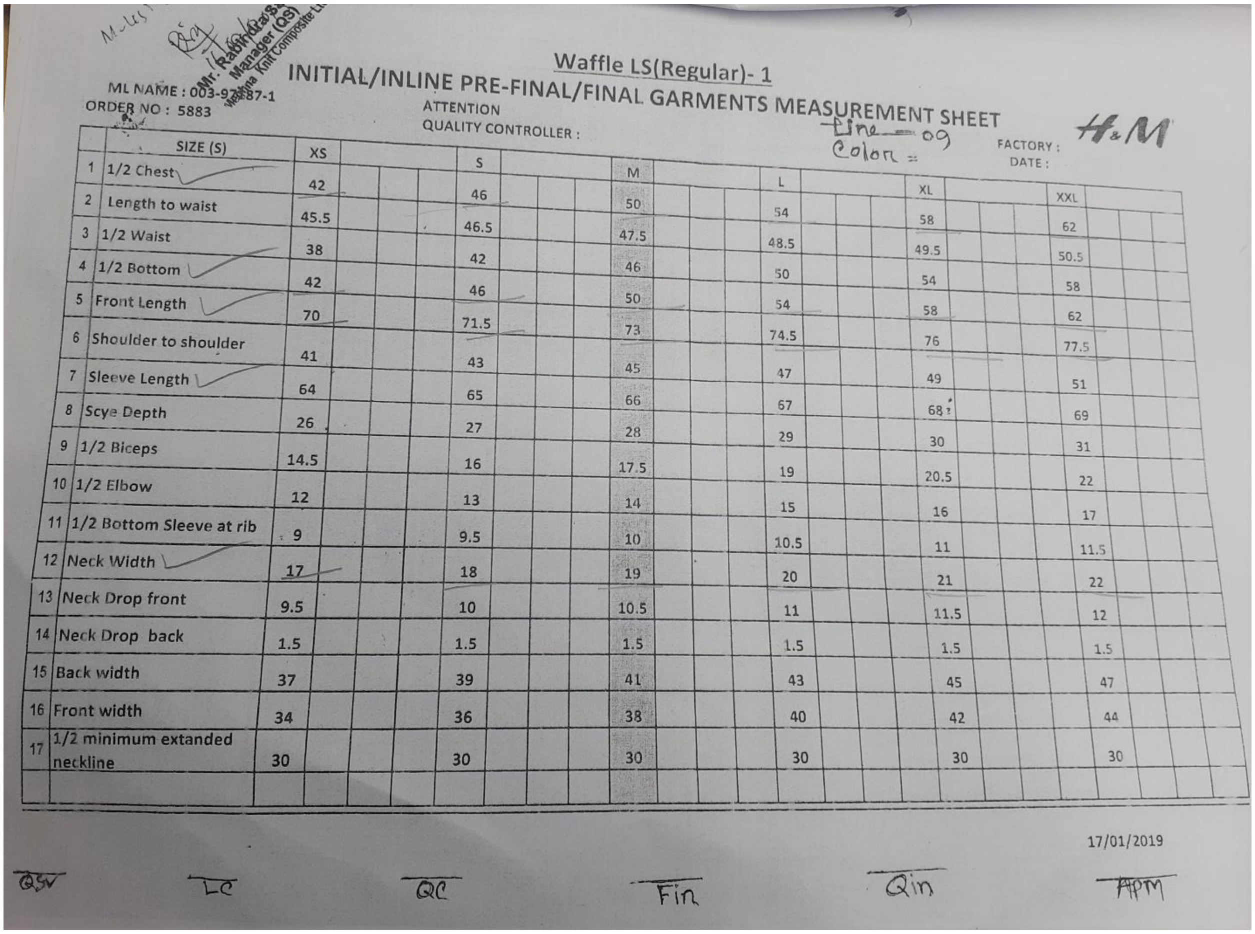

Waffle LS(Regular)- 1

INITIAL/INLINE PRE-FINAL/FINAL GARMENTS MEASUREMENT SHEET

ML NAME : 003-9[illegible]87-1

ORDER NO : 5883

ATTENTION

QUALITY CONTROLLER :

Line — 09

Color =

FACTORY :

DATE :

H&M

	SIZE (S)	XS	S	M	L	XL	XXL
1	1/2 Chest	42	46	50	54	58	62
2	Length to waist	45.5	46.5	47.5	48.5	49.5	50.5
3	1/2 Waist	38	42	46	50	54	58
4	1/2 Bottom	42	46	50	54	58	62
5	Front Length	70	71.5	73	74.5	76	77.5
6	Shoulder to shoulder	41	43	45	47	49	51
7	Sleeve Length	64	65	66	67	68	69
8	Scye Depth	26	27	28	29	30	31
9	1/2 Biceps	14.5	16	17.5	19	20.5	22
10	1/2 Elbow	12	13	14	15	16	17
11	1/2 Bottom Sleeve at rib	9	9.5	10	10.5	11	11.5
12	Neck Width	17	18	19	20	21	22
13	Neck Drop front	9.5	10	10.5	11	11.5	12
14	Neck Drop back	1.5	1.5	1.5	1.5	1.5	1.5
15	Back width	37	39	41	43	45	47
16	Front width	34	36	38	40	42	44
17	1/2 minimum extanded neckline	30	30	30	30	30	30

17/01/2019

QSV LC QC Fin Qin APM

Figure 3.2: Size wise measurement chart of the order provided by the buyer

Table 3.7- Types of information collected from each fabric lay.

General information	Marker information	Actual measurements
Order details	Number of garments in marker (Size ratio)	Total number of fabric rolls used in spreading each lay
Fabric details	Marker length	Length, width and height of each lay
Spreading method	Marker width	Number of complete plies laid by each fabric roll
Spreader specification	Marker efficiency	Time for laying each fabric roll
Cutting method	Marker type	Total time for laying each lay
Manpower details		Fabric wastage outside marker in each lay
Lectra cutter		Cutting duration

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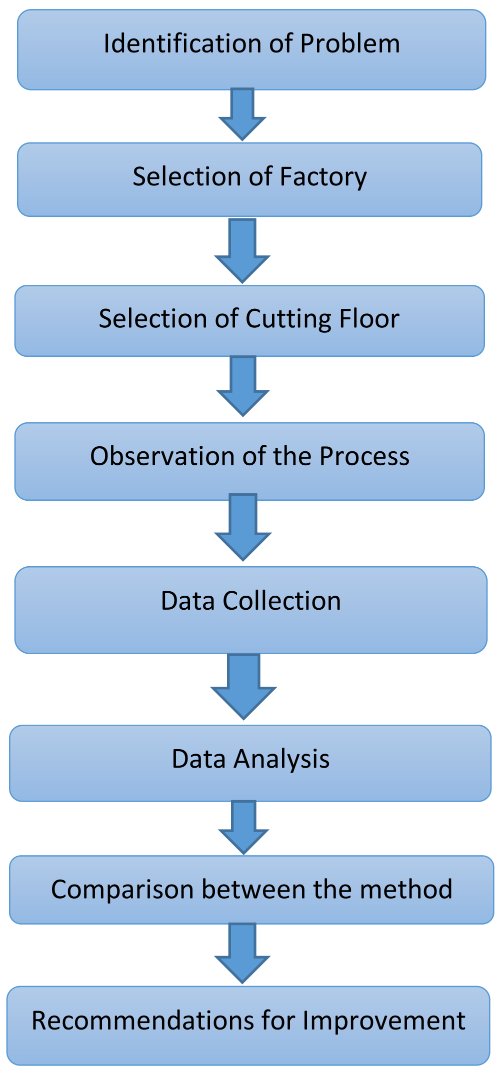
The general information and marker information were obtained for each sample lay from the specification sheet, cutting operation sheet and the CAD section. On the other hand actual measurements of the study were obtained by observing the spreading process at the cutting floor.

❖ **Data Analysis:** From the data collected from the factory; fabric wastage, spreading time, cutting time and other related factors were analyzed for both the processes to find out the productivity of the process.

❖ **Comparison between the Methods:** Then the information obtained previously from both manual and automatic spreading method and cutting method was compared.

❖ **Recommendations for Improvement:** At last, comparing all the aspects of manual and automatic spreading and cutting. a conclusion was drawn about the overall scenario of the spreading and cutting process in the factory. And some recommendations were provided from our side to the management of Meghna knit composite ltd. for the betterment of the productivity and minimization of production cost of the factory based on our educational knowledge.

3.2 Methodology at a Glance:



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Chapter-4
Machine and Materials

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4.1 Machines and Materials:

4.2 Fabric Spreading Machine:

Gerber spreading machine has been used for spreading the fabric in order to construct the fabric lays. There are 4 spreading machines of same model used in Meghna knit composite ltd.

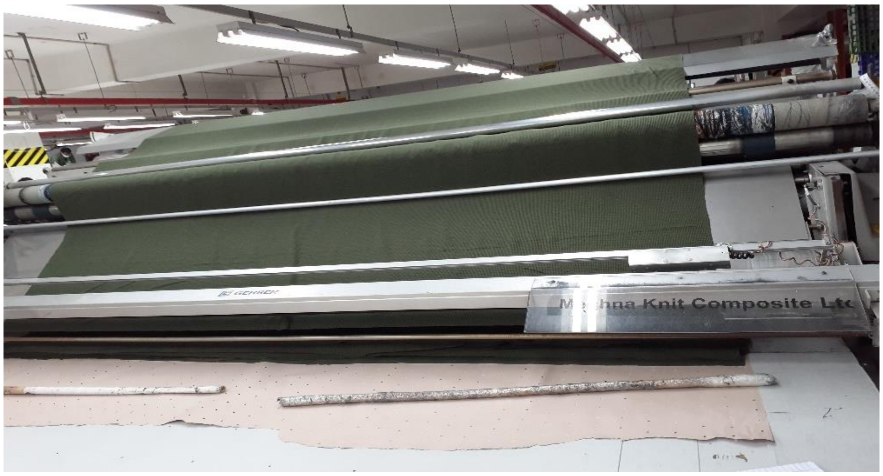

Figure 4.1: Garber fabric spreading machine.

4.2.1 Specification:

Table 4.1- Detailed specification of Gerber fabric spreading machine

Parameters	Information
Machine name	Fabric Spreading Machine
Manufacturer name	Gerber Technology Ltd.
Model no	XLS50-2400
Serial number	16758
Manufacturing year	2013
Country of origin	China
Operational side	Left
Maximum loading weight.kg	50
Max. Roller diameter.cm	40
Machine Weight kg	360
Voltage	1 x 220-240
Amp	10

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4.3 Straight Knife Cutting Machine:

Straight knife cutting machine was used for cutting the fabric lay in order to determine the fabric wastage outside the marker for both manual and automatic spreading.

Figure 4.2: Straight Knife cutting machine

4.3.1 Specification:

Machine Name: Straight Knife Cutting Machine

Brand Name: Mack

Model: KM - AUV.

Country of Origin: Japan

R.P.M: 3000-3600

Volt: 220, HZ- 50/60

Amps: 2.6 / 3.3

4.4 Hand Scissor:

Hand scissor is used to cut the fabric plies while constructing a lay in manual method.

Figure 4.3: Hand Scissor

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4.5 Electronic Weight Balance:

Electronic weight balance was used in this project in order to weight the fabric wastage outside the marker to determine the amount of wastage in each lay.

Figure 4.4 : Electronic weight balance

4.6 Stop Watch:

Stop watch has been used to determine the time required for spreading each of the lays for both manual and automatic methods.

Figure 4.5: Stop Watch

4.7 Measuring Tape:

Measuring tape was used to determine the length, width and height of the lays spread both manually and automatically.

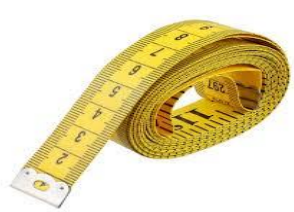

Figure 4.6: Measuring tape

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4.8 Gum Tape:

Gum tape was used in spreading operation for attaching the first ply of the fabric with the spreading table and also to attach the marker paper with the fabric lay for smooth cutting.

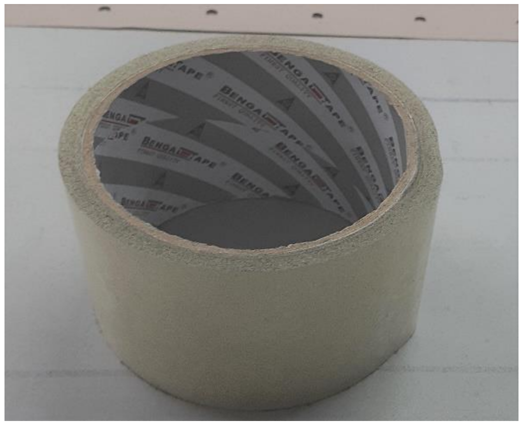

Figure 4.7: Gum tape

4.9 Perforated Brown Paper:

Perforated brown paper was used in this project during spreading operation to provide convenience to the spreading, moving and cutting the fabric lays.

Figure 4.8: Perforated brown paper

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4.10 Calculator:

The calculator has been used to calculate different values which have been obtained during conducting the project work.

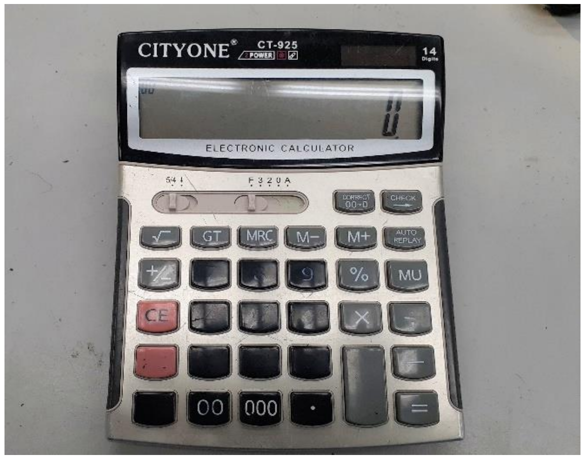

Figure 4.9: CT 925 Calculator

4.11 Lectra Cutter Machine:

Vector fabric cutting room combines lean-oriented production processes with maximum uptime to deliver improved speed and better-quality products at the lowest cost per cut. ... "With Vector, we increased our productivity by up to 30% through which we increased production capacity.

4.10 Figure: Lectra cutter machine

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Chapter-5
Data Collection & Analysis

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5.1 Data From The First Fabric (Single jersey) Lay of Manual spreading:

5.1.1 Order Details:

Buyer	Order no	Designer
Target	3750186712	Vera La Rocca

5.1.2 Fabrics details:

Construction	Composition	Color	GSM	Finished dia
Single Jersey	100% Cotton	White	160	68.5

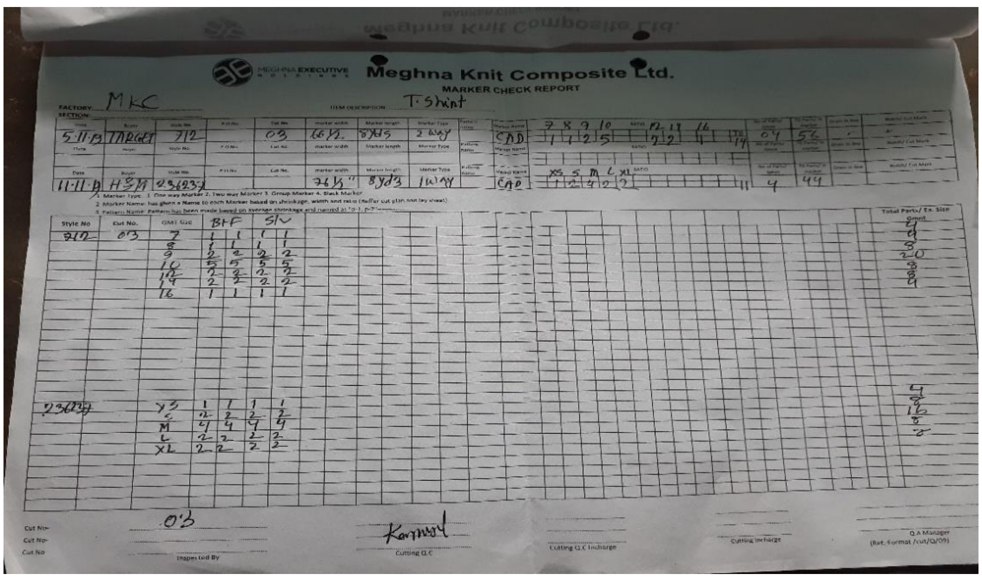

Figure 5.1: Cutting operation sheet

5.1.3 Marker information:

Marker type: Normal

Marker Length: 744 cm

Marker Width: 169 cm

Size	7	8	9	10	12	14	16
Ratio	1	1	2	5	2	2	1

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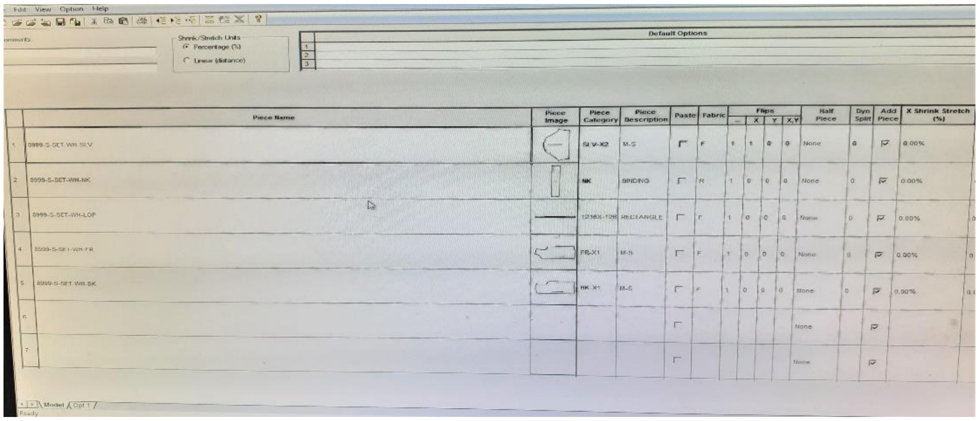
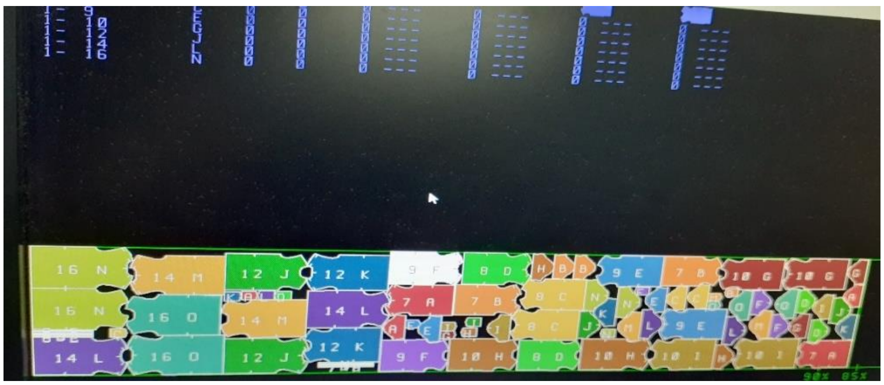


Figure 5.2: CAD patterns of the components of the garments



5.3:CAD marker used for spreading first pair of fabric lays.

5.1.4 Manpower Details:

Designation	Number	Salary/Person(BDT)
Supervisor	1	24000
Scissor man	2	9347
Helper	6	8000
Quality	1	9500

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Figure 5.4: Manual fabric spreading.

5.1.5 Time records:

Table Preparation time (ply paper attaching with table) = 3 minute

Table 5.1-Time noted during the fabric spreading of 1st lay by Manually.

Table 5.1- Time recorded during spreading the first lay manually.

Fabric Rule no:	Number of Plies	Spreading time (minute)
1	12	11
2	11	9
3	13	10
4	9	6
5	14	11
6	12	9
7	13	9
8	13	10
9	6	4
Total	**103**	**79**

Here fabric spreading time =79 minute

Marker Checking and and ply counting time=5 minute

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Marker setting with lay=9 minute

So that total time required to complete enter spreading process= (3+79+5+9) min.

=96 min.

Here,

Average spreading time/ply= Time needed for spreading/ Total number of plies

(79/103) Minute

= 0.766 minute

= 46 second

5.1.7 Lay details:

Lay length (cm)	Lay width (cm)	Lay height(cm)	Number of plies
749	174	6	103

Here,

Length of Lay= 749 cm

= 7.49 meter

Width of fabric =174 cm

= 1.74 meter

5.1.7. Calculation of Fabric wastage outside marker:

Fabric wastage at both side of lay = 6.25 kg

Fabric wastage at both ends of lay= 1.35 kg

Total weight of fabric wastage outside marker (6.25+1.35) kg

= 7.60 kg

Converting the total length of the fabric into weight:

Total weight of the fabric in this lay [{Lay Length (in meter)×Fabric width ×GSM ×total number of plies}/1000]

= {(7.49 × 1.74× 160×103)/1000}

= 214.77 kg

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Fabric wastages outside of fabric in percentage = {Total fabric wastage (in kg)/ Total weight of fabric in this lay (in kg)}× 100%

(7.60/214.77)×100%

= 3.53 %

5.2 Data from the first lay of Automatic Spreading:

5.2.1 Order information:

Buyer	Order no	Designer
Target	3750186712	Vera La Rocca

5.2.2 Fabric information:

Construction	Composition	Color	GSM	Finished Dia
Single Jersey	100% Cotton	White	160	68.5

5.2.3 Marker information:

Marker type: Normal

Marker length: 744 cm

Marker width: 169 cm

Marker effeciency : 85.03%

Figure 5.5: Automatic Fabric spreading process

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Size	7	8	9	10	12	14	16
Ratio	1	1	2	5	2	2	1

Spreading Method: Automatic

5.2.4 Manpower Details:

Designation	Number	Salary/Person(BDT)
Scissor man	1	9350
Helper	2	8000
Quality	1	9500
Superviser	1	21000
Operator	1	17000

5.2.5 Time Record:

Table Preparation time (ply paper attaching with table) = 3 minute

Table 5.2- Time noted during the fabric spreading of 1st lay by Automatically.

Fabric Rule Number	Number of Plies	Spreading time (minute)
1	16	12
2	14	9
3	17	9
4	18	10
5	16	8
6	12	7
7	10	6
Total	**103**	**61**

Here fabric spreading time =61 minute

Marker Checking and and ply counting time=4 minute

Marker setting with lay=6 minute

So that total time required to complete enter spreading process= (3+61+4+6) min.

= 74 Min.

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Here,

Average spreading time/ply = Time needed for spreading/ Total number of plies

(61/103) Minute

= 0.59 minute

= 36 second

5.2.6 Lay details:

Lay length (cm)	Lay width (cm)	Lay height(cm)	Number of plies
750	174	6.3	103

Here, Lay length = 750 cm

= (750 /100) meter

= 7.50 meter

Fabric Width = 174 cm

= (174/100) meter

= 1.74 meter

5.2.7 Calculation of Fabric wastages outside of marker :

Fabric wastage at both side of lay = 8 kg

Fabric wastage at both ends of lay = 1.50 kg

Total weight of fabric wastage outside marker = (8+1.50) kg

= 9.50 kg

Converting the total length of the fabric into weight:

Total weight of the fabric in this lay [{Lay Length (in meter)×Fabric width ×GSM ×total number of plies}/1000]

= {(7.50 × 1.74× 160×103)/1000}

= 215.06 kg

Fabric wastages outside of fabric in percentage = {Total fabric wastage (in kg)/ Total weight of fabric in this lay (in kg)}× 100%

(9.50/215.06)×100% = 4.41 %

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5.3 Data from the Second Fabric Lay(Waffle fabric) of Manual Spreading:

5.3.1 Order details:

Buyer	Order no	Designer
H&M	**236237**	Amy Crofts

5.3.2 Fabric Information:

Construction	Color	GSM	Fabric Width(cm)
Lecra Waffle	K.Green	240	198

5.3.3 Marker Information:

Marker type: Normal

Marker length: 739 cm

Marker width: 193 cm

Marker efficiency : 83.74 %

Size	XS	S	M	L	XL	Total
Ratio	1	2	4	2	2	11

5.3.4 Time Records:

Table preparation time(ply paper attaching with table)= 4 minute

Table 5.3 Time Recorded during spreading of 2nd lay manually:

Fabric Rule number	Number of plies	Spreading time
1	8	9
2	12	8
3	9	6
4	11	8
5	6	7
6	9	10
7	8	6
Total	**63**	**52**

Fabric Spreading time = 52 minute

Marker Checking and and ply counting time=5 minute

Marker setting with lay=8 minute

So that, Total time required= (4+52+5+8) minute

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=69 minute

Average Spreading time/ply= (Time of spreading/Total number of plies)

= (52/63) minute

=0.825 minut

=49 sec

5.3.4 Lay details:

Lay length(cm)	Lay width(cm)	Lay height(cm)	Number of plies per lay
744	198	6	63

Here, Lay length= 744 cm

= (744/ 100) meter

=7.44 meter

Lay width = 198 cm

= (198/ 100) meter

= 1.98 meter

5.3.5 Calculation of Fabric Wastage outside marker:

Fabric wastage at both side of lay = 10 kg

Fabric wastage at both ends of lay = 2 kg

Total fabric wastage = (10 +2) kg

=12 kg

Converting the total length of the fabric into weight:

Total weight of the fabric in this lay [{Lay Length (in meter)×Fabric width × GSM × total number of plies}/1000]

= {(7.44 × 1.98× 240×63)/1000} kg

= 222.73 kg

Fabric wastages outside of fabric in percentage = {Total fabric wastage (in kg)/ Total weight of fabric in this lay (in kg)}× 100%

(12 / 222.73)×100% = 5.38 %

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5.4 Data from the Second Fabric Lay (Waffle fabric) of Automatic Spreading:

5.4.1 Order details:

Buyer	Order no	Designer
H&M	236237	Amy Crofts

5.4.2 Fabric Information:

Construction	Color	GSM	Fabric Width(cm)
Lecra Waffle	K.Green	240	198

Figure 5.6: Automatic fabric spreading of 2nd type of fabric lay

5.4.3 Marker Information:
Marker type: Normal
Marker length: 739 cm
Marker width: 193 cm
Marker efficiency : 83.74 %

Size	XS	S	M	L	XL	Total
Ratio	1	2	4	2	2	11

5.4.4 Time Records:

Table preparation time(ply paper attaching with table)= 4 minute

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Table 5.4 Time Recorded during spreading of 2nd lay Automatically :

Fabric Rule Number	Number of plies	Time of Spreading (Min)
1	6	5
2	10	6
3	9	5
4	11	7
5	9	5
6	8	5
7	10	6
Total	**63**	**39**

Here,

Fabric Spreading Time = 39 minute

Marker Checking and and ply counting time=5 minute

Marker setting with lay=8 minute

So that, Total time required = (4+39+5+8) minute

= 56 minute

Average Spreading time/ply= (Time of spreading/Total number of plies)

= (39/63) minute

=0.619 minute

=37 sec

5.4.5 Lay details:

Lay length(cm)	Lay width(cm)	Lay height(cm)	Number of plies per lay
746	198	6.2	63

Here, Lay length= 746 cm

= (746/ 100) meter

=7.46 meter

Lay width = 198 cm

= (198/ 100) meter

= 1.98 meter

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5.4.6 Calculation of Fabric Wastage outside marker:

Fabric wastage at both side of lay = 12 kg

Fabric wastage at both ends of lay = 2 kg

Total fabric wastage = (12 +2.3) kg

=14.3 kg

Converting the total length of the fabric into weight:

Total weight of the fabric in this lay [{Lay Length (in meter)× Fabric width ×GSM ×total number of plies}/1000]

= {(7.46 × 1.98× 240×63)/1000} kg

= 223.33 kg

Fabric wastages outside of fabric in percentage = {Total fabric wastage (in kg)/ Total weight of fabric in this lay (in kg)}× 100%

(14.3 / 223.33)×100%

= 6.40 %

5.5 Cost Analysis in both cases of Fabric spreading per Month:

i. Manually Spreading Cost:

Total manpower cost per spreading table = {(24000 x 1) + (9347 x 2) + (8000 x 6) + (9500 x1)} BDT/ month

=100194 BDT/ Month

In Manually spreading process it is totally done by manually there is no electricity is used here.

So that Total operating cost in Manual spreading per table = 100194 BDT/Month

ii. Automatic Spreading Cost:

Total manpower cost per spreading table = {(9350 x 1) + (9500 x 1) + (8000 x 2) +(21000 x 1)+(17000 x 1)} BDT/ month

= 72,850 BDT/ month

Electricity consumption of one spreading machine: In MKC electricity is produced by using Gas.

We know, Wattage = (Volt x Ampere) watt

= (220 x 10) watt

= 2200 watt

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= (2200 / 1000) kilowatt

= 2.2 kilowatt

In Meghna knit Composite ltd.

Working hours/ day = 8 hrs (Allowance excluded)

Working days/ month = 26 days

Total working hours per month = (8 x 26) hrs

= 208 hrs

Electricity consumption of one spreading machine/ month = {Wattage (in kilowatt) x Working hours/ month} kWh

= (2.2 x 208) kWh

= 457 kWh

In Meghna knit composite ltd. Cost of electricity per kilowatt= 4.67 BDT

So, total electricity cost of one spreading machine per month= {Wattage (in kilowatt) per month x Cost per kWh} BDT/Month

= (457 x 4.67) BDT/ Month

= 2134 BDT/ Month

Total operating cost in automatic spreading per table = (Total manpower cost + total electricity cost) BDT/ month

= (72850 + 2134) BDT/ Month

= 74984 BDT/ Month

5.6.1 Data From the Fabric cutting process by Manually:

5.6.2 Man power Details:

Designation	**Number**	**Salary/person BDT**
Cutting man	2	17500

Total manpower cost per spreading cutting table= (17500 x 2) BDT/Month

= 35000 BDT/Month

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Figure 5.7: Manual fabric lay cutting method

5.6.3 Fabric Details:

Construction	Composition	Color	GSM	Finished dia
Single Jersey	100% Cotton	White	160	68.5

Here,

Preparation Time for Fabric Lay cutting: 8 Minute

Cutting Duration: 33 minute

So that total time required for fabric lay cutting = (Preparation Time for Fabric cutting + Cutting Duration)

= (8+ 33) minute

= 41 Min.

Electricity consumption of one Cutting Table:

Here Straight knife cutting machine is used for fabric lay cutting.

In MKC electricity is produced by using Gas. Cost of electricity per kilowatt= 4.67 BDT

We know, Wattage = (Volt x Ampere) watt

= (220 x 3) watt

= 660 watt

= 0.66 kilowatt

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= (0.66 x 2) Kilowatt   [2 Staight knife cutting machine used per table]

= 1.32 kilowatt

In Meghna knit Composite ltd.

Working hours/ day = 8 hrs (Allowance excluded)

Working days/ month = 26 days

Total working hours per month = (8 x 26) hrs

= 208 hrs

Electricity consumption of straight knife cutting machine/ month = {Wattage (in kilowatt) x Working hours/ month} kWh

= (1.32 x 208) Kwh

= 274.56 Kwh

So, total electricity cost of Two straight knife cutting machine per month= {Wattage (in kilowatt) per month x Cost per kWh} BDT/Month

= (274.56 x 4.67)

= 1282 BDT/Month

Total operating cost in cutting table by Manually per month is= (35000 +1282) BDT/Month

= 36,282 BDT/Month

5.7.1 Data From the Fabric cutting process by Automatically:

5.7.2 Man power Details:

Designation	**Number**	**Salary/person BDT**
Operator	1	17000
Helper	2	8000

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Figure 5.8: Automatic fabric lay cutting method

Total manpower cost per spreading cutting table = {17000 + (8000 x 2)} BDT/Month

=33000 BDT/Month

Here,

Preparation Time for Fabric Lay cutting :6 Minute

Cutting Duration : 15 minute

So that total time required for fabric lay cutting = (Preparation Time for Fabric cutting + Cutting Duration)

= (6 +15)

= 21 minute

Electricity consumption of one Cutting Table:

Here Lectra machine is used for fabric lay cutting.

In MKC electricity is produced by using Gas. Cost of electricity per kilowatt= 4.67 BDT

We know, Wattage = (Volt x Ampere) watt

= (440 x 15) watt

= 6660 watt

= 6.6 kilowatt

Total working hours per month = (8 x 26) hrs

= 208 hrs

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Electricity consumption of Lectra cutting machine(vector M/C) per month = {Wattage (in kilowatt) x Working hours/ month} kWh

= (6.6 x 208) Kwh

= 1373 Kwh

So, total electricity cost of one Lectra cutting machine per month= {Wattage (in kilowatt) per month x Cost per kWh} BDT/Month

= (1373 x 4.67) BDT/Month

= 6411 BDT/Month

Total operating cost in cutting table by Automatically per month is= (33,000 +6411)BDT/Month

= 39,411 BDT/Month

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Chapter-6
Results & Discussion

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6.1 Results:

6.1.1 Graphical representation of spreading time:

From the collected data it is clear that, for spreading one ply in manual method requires more time on average than that of automatic spreading. Same result is obtained for both pairs of lays that were taken as the sample lays for this project which is shown in the figure below:

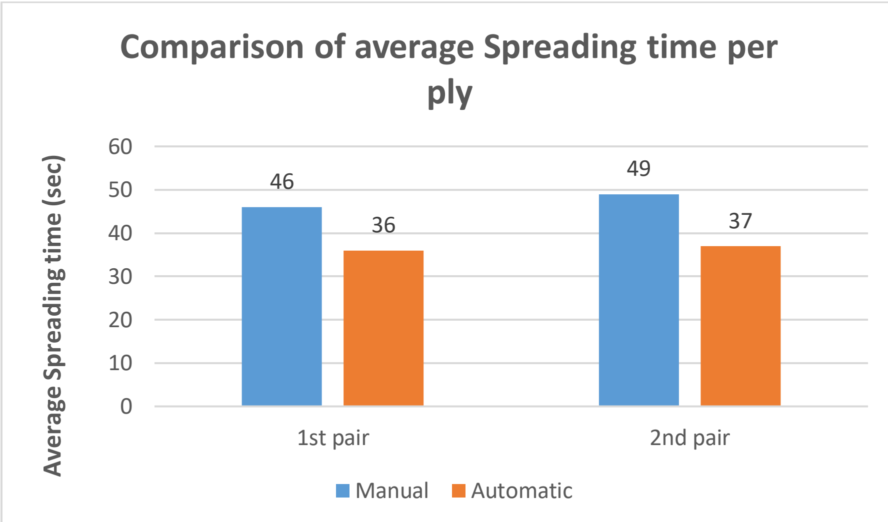

Figure 6.1: The average time required for spreading each ply in both manual & automatic method

❖ **Discussion**:

In the graph (figure 6.1) it can be shown that, for first pair of lays the average time for spreading one ply is 46 seconds and 36 seconds respectively for manual and automatic spreading. And for second pair of lays the average time for spreading one ply is 49 seconds and 37 seconds respectively for manual and automatic spreading. So in both cases, the difference in time for spreading one ply between two methods is 11 seconds.

In manual spreading, the fabric is spread manually by throwing the fabric from one end of spreading table and grabbing from the other end of the table. Then the ply is spread manually and separated by using hand scissors. On the other hand automatic spreading is done by using fabric spreading machine and the ply is separated by using fabric cutter. As a result the time required for spreading one ply is more in manual spreading than in automatic spreading.

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6.1.2 Graphical representation of fabric wastage at the sides of the lay:

As the data were obtained during the project, the fabric wastage outside marker (in terms of weight) at the sides of the lays was almost similar for two pairs of lays of both manual and automatic spreading. Yet the wastage in the lays of automatic spreading was slightly higher than that of manual spreading.

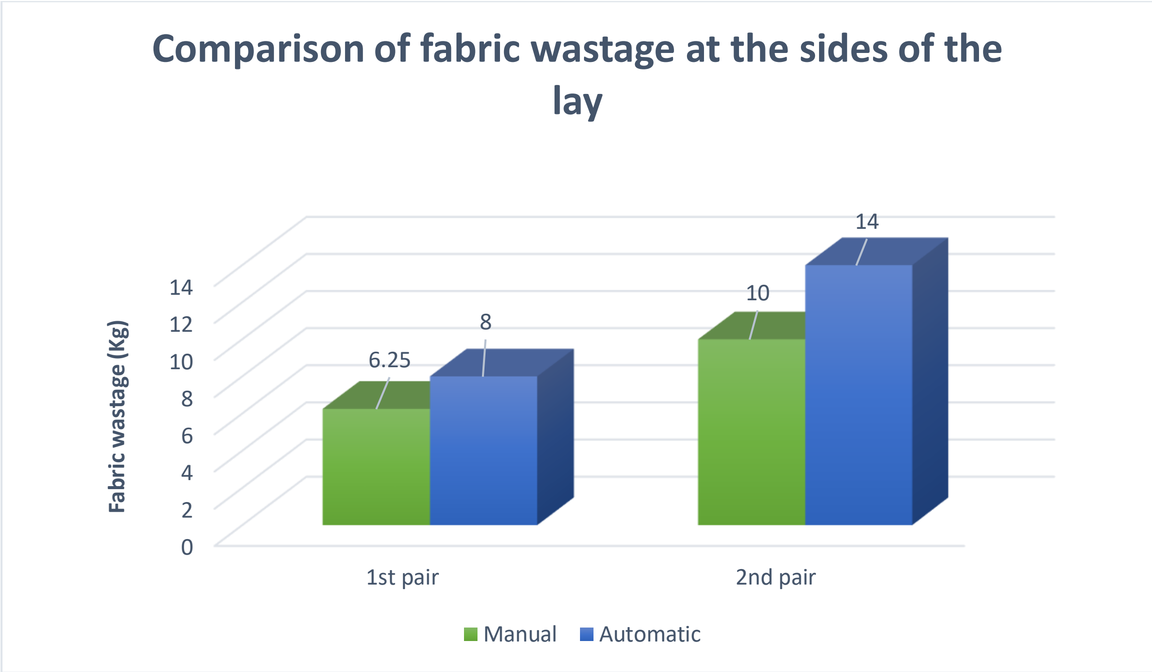

Figure 6.2: Fabric wastage at the sides of the lays in both the methods.

❖ **Discussion:**

As shown in the graph (figure 6.2) it is clear that, there is a small difference in the amount of fabric wastage at the sides of the lays, between manual and automatic spreading. For the first pair of lays which was single jersey, the wastage is 6.25 kg and 8.00 kg respectively in manual and automatic spreading. For the second pair of lays (Waffle fabric), the wastage is 10 kg and 14 kg respectively in manual and automatic spreading. The wastage is slightly higher in case of automatic spreading for both pair of lays.

This is resulted mainly due to the variation in applied tension during laying the fabric plies and the unavoidable variation of fabric width. In Meghna knit composite Ltd., to keep the fabric plies flat and smooth ,tension is applied manually by hand in both the spreading methods.

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6.1.3 Graphical representation of fabric wastage at the ends of the lay:

From the collected data, the total fabric wastage outside marker is calculated by summing up the wastage at the ends and the wastage at the sides of the lays for both methods. The wastage percentage was calculated with respect to the total weight of fabric in each lay. The results obtained are shown in the figure below:

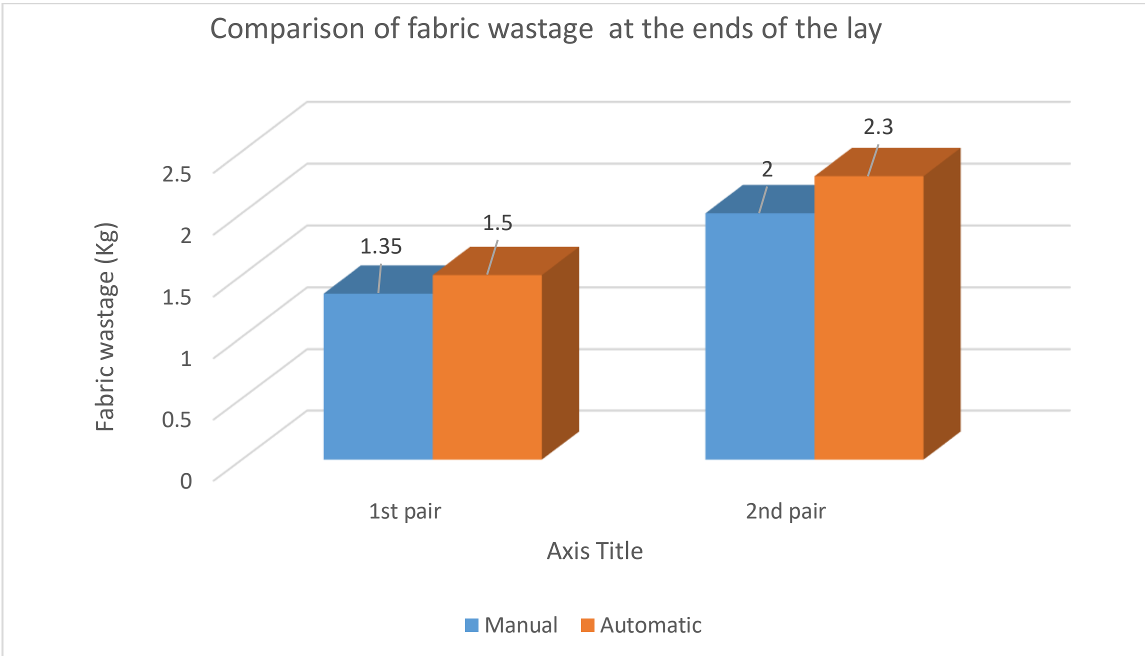

Figure 6.3: Fabric wastage at the ends of the lays in both the methods.

❖ **Discussion:**

In the graph (figure 6.3), it can be shown that, the fabric wastage is higher in case of automatic spreading. For the first pair of lays (Single jersey), the wastage is 1.35 kg and 1.50 kg respectively in manual and automatic spreading. For the second pair of lays (Waffle fabric), the wastage is 2 kg and 2.3 kg respectively in manual and automatic spreading.

This is resulted because the spreading machines used in MKCL are not fully automated. The operators were not able to maintain same end allowance for every ply of the lays. Because after spreading a ply, the machine is stopped at the ends of the table and the ply is separated using fabric cutter by the operator after spreading. On the other hand, the operators of manual spreading have maintained the end allowance to a minimum level constantly throughout the process. As a result the wastage at the ends in automatic spreading process was higher.

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6.1.4 Graphical representation of fabric wastage percentage outside marker:

From the collected data, the total fabric wastage outside marker is calculated by summing up the wastage at the ends and the wastage at the sides of the lays for both methods. The wastage percentage was calculated with respect to the total weight of fabric in each lay. The results obtained are shown in the figure below:

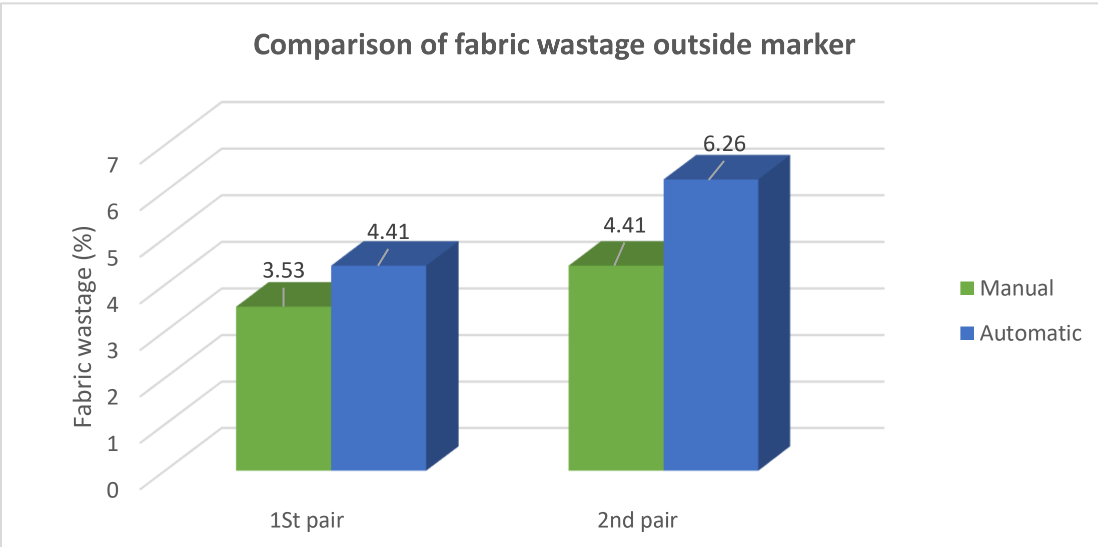

Figure 6.4: Fabric wastage (%) outside marker in both manual and automatic method.

❖ **Discussion:**

In the graph (figure 6.4) it is shown that, the percentages of fabric wastage outside marker in first pair of lays are 3.53 % and 4.41% of the total lays respectively for manual and automatic spreading. And for second pair of lays, the percentages of fabric wastage outside marker are 4.41 % and 6.26% of the total lays respectively for manual and automatic spreading. So it is obvious that the fabric wastage percentage outside marker is higher in case of automatic spreading.

The fabric wastage outside marker occurs due to the allowance that is kept during marker making so that if there is any variation in fabric width, the garments components inside the marker remains unharmed while cut. Here, the percentage of fabric wastage in automatic spreading is higher because the end allowance and edge allowance was higher than manual spreading.

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6.1.5 Graphical representation of required manpower:

If an operation requires less manpower, the cost of manpower and the complexity of manpower management also reduce. From the data obtained during this project, it was clear that the automatic spreading process requires less manpower than manual spreading process.

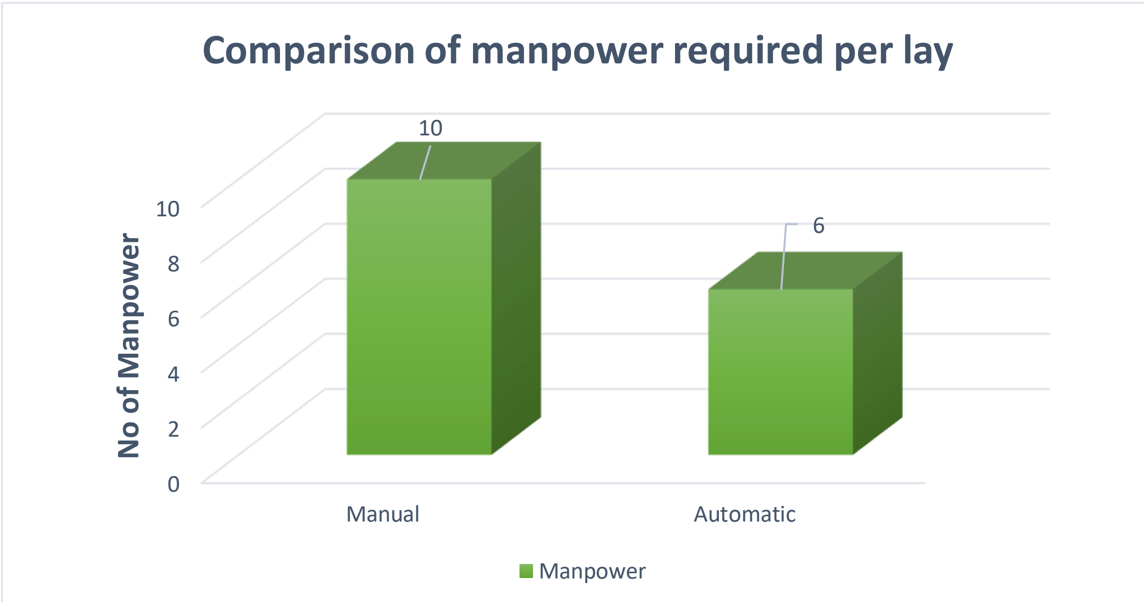

Figure 6.5: No. of manpower required for spreading one lay in both manual & automatic method.

❖ **Discussion:**

As shown in the graph (Figure 6.5), the number of manpower required for manual spreading is Ten (10), where there is one supervisor, two scissor-men and six helpers and one quality needed for spreading one fabric lay. But in case of automatic spreading, the number of manpower required is six (6), where there is one supervisor, one machine operator and five helpers needed for spreading one fabric lay.

In manual spreading process required more manpower because here for maintenance of fabric spreading need to holding two edge of fabric. For properly passes of fabric plies required more helper.

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6.1.6 Graphical representation of monthly cost:

The monthly cost per spreading table includes the monthly salary of the workers assigned to the table and the utility cost of the machine used in that table (if any). From the collected data it is clear that, the monthly cost per spreading table in manual method is higher than that of automatic method.

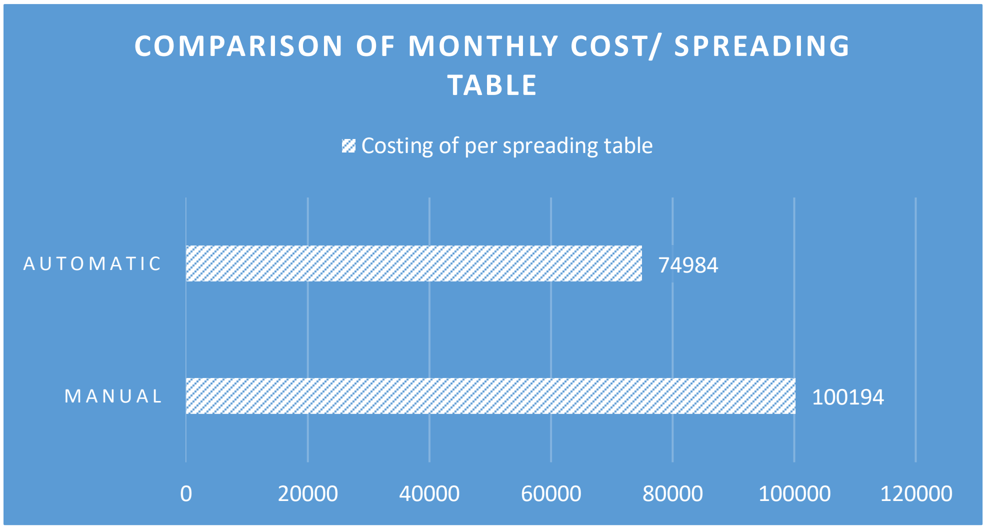

Figure 6.6: Monthly cost per spreading table in both manual and automatic method

❖ Discussion:

In the graph (figure 6.5) it can be shown that, monthly cost of each spreading table in manual method is 1,00194 BDT. On the other hand, monthly cost of each spreading table in automatic method is 74,984 BDT which is less than that of manual fabric spreading.

Generally, automatic fabric spreading is more cost effective than the manual fabric spreading. But in Meghna knit composite Ltd. it was not the case. This is because here manual spreading requires more manpower than the automatic spreading. The monthly operating cost of manual spreading includes only the salaries of the workers involved in spreading. There is no cost of electricity included here. But the monthly cost of each spreading table in automatic method includes both the salaries of the workers and the cost of electricity consumed by the fabric spreading machine in one month.

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6.1.7 Graphical representation of Manpower required in Manual and automatic fabric cutting process:

During the data collection it was found that the man power is required more in case of automatic process than manual process.

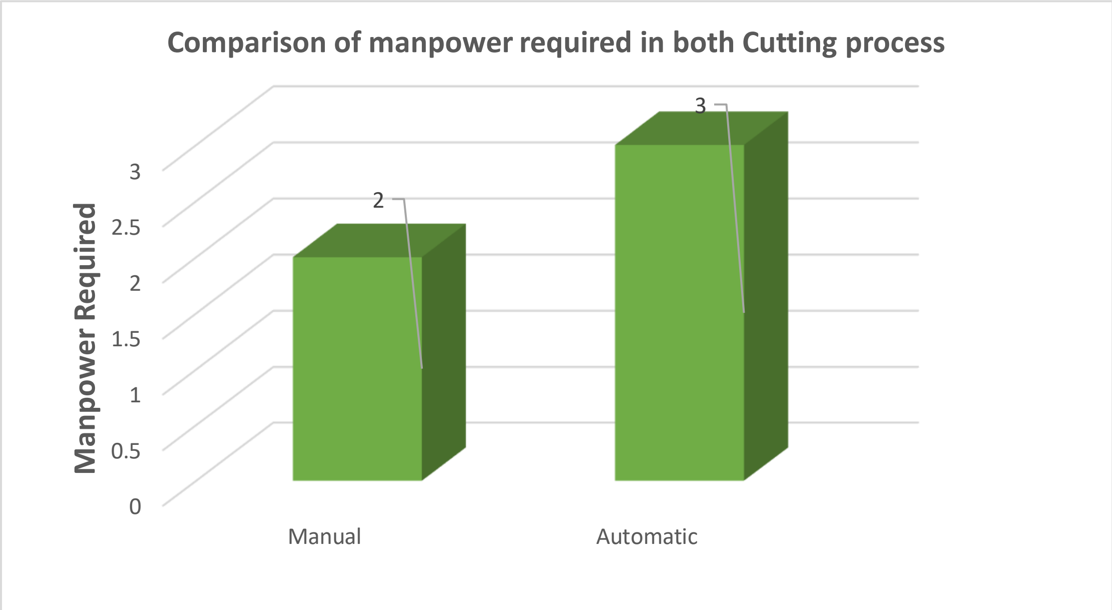

Figure 6.7: No. of manpower required for cutting one lay in both manual & automatic method.

❖ **Discussion:**

From the graph it is easily identified that in case of manual cutting process two operator are required where there are two of them are working as cutting operator of fabric lay. They are using straight knife cutting machine for fabric lay cutting. On the other side in case of automatic fabric lay cutting there are three person required where one of them is machine operator and two person working as helper.

It is general phenomenon that automatic cutting process requires less manpower than manual spreading. But in meghna knit composite ltd automatic in cutting process required one more person than manual. because for properly set up of the fabric lay for cutting according to the marker and set up of poly on above of fabric lay one more helper is required here.

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6.1.8 Graphical representation of Time required per cutting Table:

From the collected data it was clear that for manual method of cutting required more time than automatic cutting method of fabric lay. This Is shown by the figure of below.

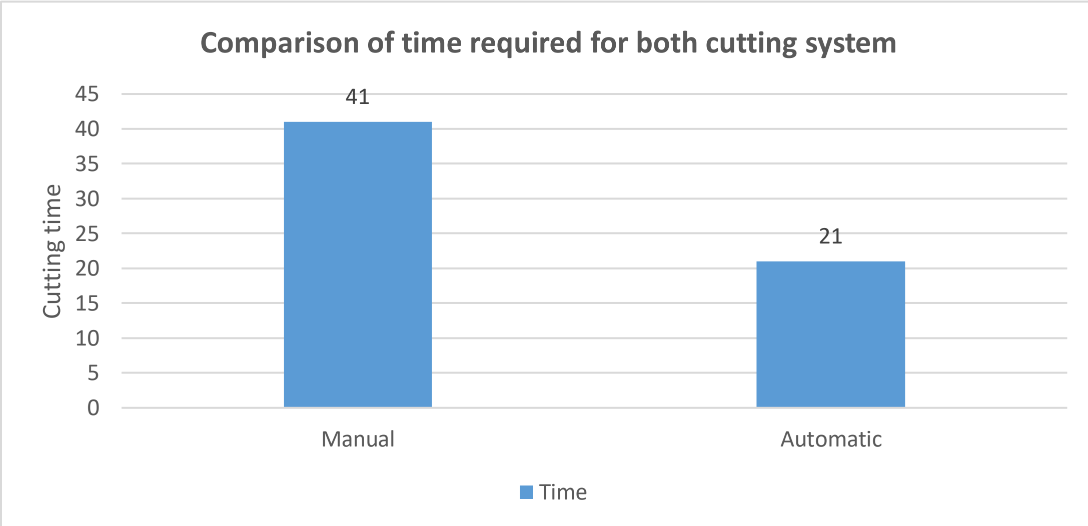

Figure 6.8: The time required for cutting each ply in both manual & automatic method.

In the graph(6.8) it is shown that in automatic cutting process duration of cutting time is very much less than manual cutting process. Where 21 minute is required for fabric lay cutting by automatic process and 41 minute is required for manual process.

So in both cases there are 20 minutes difference between these method of cutting system.

In manual process of cutting straight knife cutting machine is used here and operator are cutting fabric lay according to marker paper. One by one parts of garment are cut down by them but in case of automatic system Lectra cutter machine is used here.it has a high cutting performance. By using garber software marker plan is setup from CAD room and it is cut the fabric lay according to software plan and cutting speed is very high with good quality.

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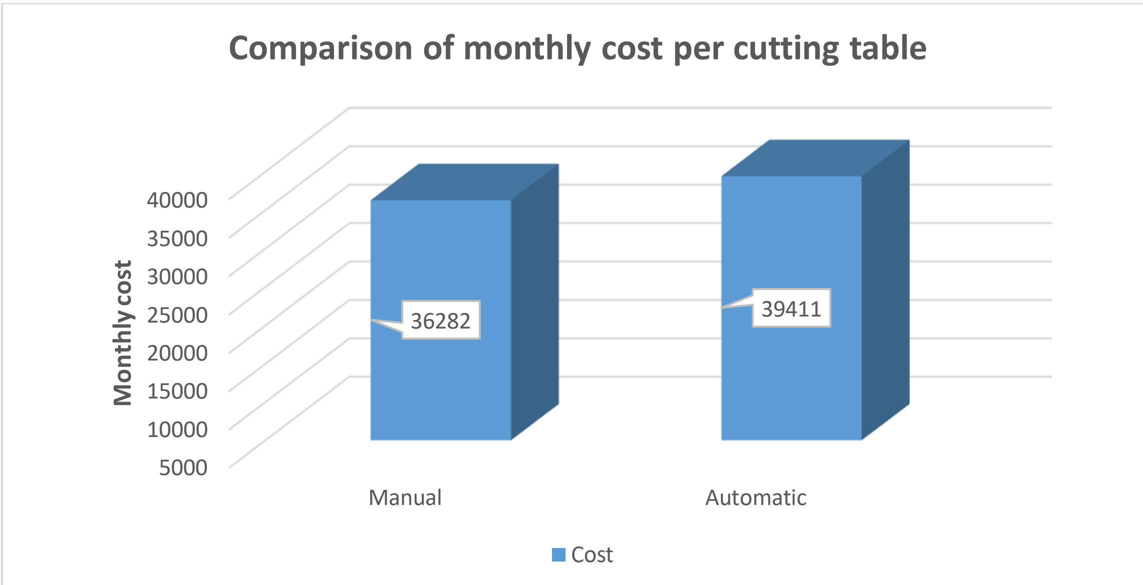
6.1.9: Graphical representation of monthly cost per cutting Table

The monthly cost per cutting table includes the monthly salary of the workers assigned to the table and the utility cost of the machine used in that table . From the collected data it is clear that, the monthly cost per cutting table in automatic method is higher than that of manual method.



6.9: Monthly cost per cutting table in both manual and automatic method

From the above graph we can easily understand that monthly cost of automatic fabric lay cutting table is higher than manual cutting table. in automatic cutting table cost per month is 39,411BDT where only 36,282 BDT is used in case of manual cutting process.

Though salary label of manual cutting operator is high than automatic cutting process but the Lectra machine which is used in automatic process worked in high voltage with high ampere than straight knife cutting machine. In Meghna knit composite limited the electricity is produced by using Gases.

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Chapter-7
Conclusion

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7.1 Key Findings:

The main outcome from this project is the comparison between the two fabric spreading and cutting methods practiced in Meghna knit composite Ltd. - manual spreading and automatic spreading. The key aspects of the spreading and cutting operation which defines the total productivity of the process- time, fabric wastage, manpower and cost were examined during this project. And the findings are shown below in table 7.1:

Table 7.1- Summary of the findings of this project work based on spreading process.

Factor	Measuring Unit	Manual Spreading		Automatic Spreading		Comments
Average spreading time	Seconds/ Ply	1st lay	46	1st lay	36	Automatic fabric spreading takes less time for spreading one ply.
		2nd lay	49	2nd lay	37	
Fabric wastage outside marker	Percentage (%) of total lay	1st lay	3.53	1st lay	4.41	Manual spreading results in less fabric wastage outside marker.
		2nd lay	4.41	2nd lay	6.26	
Manpower required	No. of persons/ Lay	Ten (10)		Six (6)		Automatic spreading operation requires less manpower.
Monthly operating cost	BDT/Spreading table	1,00,194/=		74,984/=		Manual spreading operation is more cost effective.

Table 7.2- Summary of the findings of this project work based on cutting process

Factor	Measuring Unit	Manual cutting	Automatic cutting	Comments
Average cutting time	Minute/lay	41	21	Automatic cutting machine take very short time for one lay cutting.
Manpower required	No. of person per Lay	2	3	Manual cutting process take less manpower
Monthly operating cost	BDT/cutting table	36,282/=	39,411/=	Automatic spreading is more cost effective.

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7.2 Recommendations:

❖ The spreading machines used in Meghna knit composite Ltd. are older model of Garber spreader, which reduces the overall spreading productivity by taking more time to spread and also wasting higher amount of fabric. So in order to increase the productivity of automatic spreading, the latest technology fabric spreading machineries should be introduced to the cutting floor. For example: The XLs-series GERBER spreadersTM (XLs50 & XLs125) is an efficient computer controlled spreading system that assures tension-free spreading of even the most difficult fabrics at a very high speed and requires less number of operator for fabric spreading.

❖ Since manual fabric spreading provides higher fabric utilization and is more cost effective and require more manpower so it may be preferred more than automatic spreading in case of spreading the lays having comparatively lower length (i.e. the marker contains less number of garment components). Whereas, the automatic spreading method should be used

A Comparison between Manual & Automatic Fabric Spreading Process: Meghna knit composiie Ltd. Perspective 67 for those lays that are not possible to spread manually due to the higher lay length. But time factor should also be considered while spreading the lays manually.

❖ In this factory The employee who are work at the CAD department they are not care about increasing the marker efficiency. If they do there duty with good concentration then there productivity will be developed besides wastages will be reduced in good rate. Ultimately the production cost and efficiency of cutting department mostly depend on them.

❖ Another concern for the factory is, some of the workers in the cutting room are not properly concerned about the production efficiency which affects their spreading and cutting performance. To improve this, all the workers involved in both process should be trained about the overall process reminding them about the areas where they need to be more careful. As well as, an operator monitoring system needs to be introduced to monitor the operators to reduce the idle time during production hours.

❖ Another thing observed in this factory is, the variation of fabric width within the same batch and between the different batches of same order is quite high which results in producing a number of CAD markers considering the variable fabric width. So, in order to save both time and cost of making markers of different width, it should be strongly followed up by the management that the width of the fabrics produced for same order remains as constant as possible starting from fabric production to the fabric storage in cutting section.

7.3 Conclusion:

Bangladesh has emerged as a major supplier of quality readymade garments in the global market. Garment industry contributes a high percentage in the country's total revenue but still facing many challenges. One of the major challenges faced by the apparel manufacturers is delivering high quality product in shorter lead time and at low cost. For achieving this, it is necessary to study the

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limitations of current manufacturing process and replace them with the more efficient and effective ones. As, cutting floor is the area where both the material wastage and process loss percentage is high, it is necessary for the management to have good understanding of both spreading and cutting performance. This project work shows that a considerable value of extra profit can be brought through reducing fabric wastage and increasing efficiency of spreading process in the factory by choosing and implementing the proper method. For this reason, this study was aimed to identify the limitations in existing fabric spreading methods of Meghna knit composite Ltd. And it was hoped that the proposed recommendations could help cutting room management to increase the overall productivity and reduce the amount of fabric loss of a particular cutting lay before the cutting takes place.

A Comparison between Manual & Automatic Fabric Spreading Process: Meghna knit composite Ltd. Perspective 68.

7.4 Limitations:

❖ In this project, only two lays of each method were considered for the data collection due to the restrictions of the factory. If more lays were involved, the result of the project would be more accurate.

❖ The fabric used in the study was assumed with no flaws. Even if flaws existed in the fabric, the garments parts with flaws were replaced after the lay has been cut.

❖ In spreading, due to the extensibility of fabric, end loss and width loss at each ply might differ according to the extent of stress and tension at each ply. It was also assumed that the tension at each ply of the lay was exactly the same.

❖ All the fabric bundles used for laying the same lay were considered of same width and GSM. But there might be some variation in those which was neglected in this project.

❖ In Meghna knit composite Ltd., for same order fabrics from different batch have significant variations in width. So marker width is adjusted according to fabric width. For this reason, two markers with different length and width were used for two sets of data.

❖ Human error was also a factor which could affect the overall results of this project. So the effect of human error was considered consistent for all the lays. Also, the nonproductive time of the workers while collecting data for this project were ignored.

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