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RESEARCH ARTICLE

Reduction of Garments Cutting Wastage for Bulk Production by Increasing or Decreasing Pattern Size Matching with Garments Size Tolerance

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Abstract

Objectives: The purpose of this study is to reduce fabric consumption by improving marker efficiency. The improvements of the existing markers lead to reduce fabric wastage during the cutting process. **Methods:** The Gerber CAD/CAM software version AccuMark 8.5.1 is used in the present study was made pattern and marker. A noble approach is used to conduct this experiment through Gerber CAD/CAM software. Easy marker produced at the initial stage then it replaces by the actual market by considering the allowance of developed specimen. Wastes have decreased and overall efficiency has increase up to 9.25%. **Findings:** The marker efficiency considerably varies in accordance to the aggregate of pattern size, size ratio and adjustment of pattern size with garments size tolerance. The enhancements in the marker efficiency decrease the fabric consumption per garment and amplify aid effectively while preventing waste generation. A saving of up to 9.25% material that saves millions of lots per year has an enormous impact on reducing aid depletion and environmental pollution. **Novelty:** A novel method is used to increase the marker efficiency and the style no S22BL202, Polo-TsT101, S22-W20201, S22-W20201 have used to conduct our research. As based of our knowledge, this noble approach with above style is not reported yet. So, this study will contribute to increase the increase marker efficiency followed by the save fabric and money.

Keywords: Garments cutting wastage; bulk production; pattern size; marker making and garments size tolerance

1 Introduction

The cloth organization is one of the world's fundamental industries related to the new world shopping for and promoting gadget and globalization, new utilized technological know-how encountered in wider acceptance of such as photochromic and thermochromic colorants in garment technological understanding in addition to different purposes [(1)]. On the other hand, the garment industry as a large one within

the provided chain of the cloth enterprise is quintessential to enhance competitiveness in the global garment market, and to provide purchaser satisfaction, at an ideal cost. The biggest challenges of the garment enterprise are to reduce the cost[(2)]. In the garment industry, more than 1/2 of the rate of making clothes is the charge of cloth[(3)]. The amount of waste in our garment industry has gone up to about 15 percent which is of no use to us but we have to spell it out as a pair at a lower price. We are not able to use that part of the waste in any good way and it has become harmful to the environment. Garment costing can be reduced as much as the amount of wastage of cloth can be reduced. Creating a new style of marker requires good skills, experience and some special techniques to increase the efficiency of the marker, which can reduce the wastage of cutting. To decrease the wastage of cutting, The Apparel Computer-aided sketch (CAD) system offers a magnificent tool for the reducing branch[(4)]. And a third-dimensional (3D) software program is used in zero-waste vogue sketch with a focal factor on its utility in the industry[(5,6)]. A mathematical mannequin used to be developed to be used in combined integer nonlinear programming for a manual minimize order plan, and a software code used to be created in LINGO optimization software, ideal effects that cannot be manually calculated[(7,8)]. The working association of the reduced template is dealt with as a cut order format (COP) to optimize slicing templates of cloth lowering feature in clothing manufacturing. The customer's order affords a specific extent of parts with a particular marker which has parts of pieces in one-of-a-kind sizes, fabric and colors. The work ranges consist of making geared up samples, buying for raw materials, storing and checking materials, and getting prepared all different supplies, Fabric decreasing is one of the main value-adding tactics in the garb manufacturing method[(9)]. Sleeve Types (Set-in Sleeve, Raglan Sleeve and Kimono Sleeve) of short-sleeve T-shirts and long-sleeve T-shirts affect marker efficiency. Marker efficaciously is extra for prolonged sleeve T-shirts[(5)]. Marker successfully notably varies in accordance to the mixture of sizes and trend and usable cloth width[(10,11)]. Increase marker efficiency with the aid of potential of altering the sample placement areas (Marker making barring easiness) and by way of using a low buffer marker[(12)]. The current day regular style organization manufacturing model inevitably factors a decrease and sewn waste problem. The reply is the adoption of a modern and practical perspective such as domestic fabric engineering resolutions to reduce cut-and-sew waste, as well as world format picks for zero-waste production. An appropriate reply with the useful resource of minimizing the reduction and sewn waste trouble via way of making more than a few correlations on the marker format in phrases of cloth width and factors[(13)].

This study worked on action markers created by increasing or decreasing pattern size matching with garments length tolerance to reduce fabric consumption. No previous article has been written on this subject.

2 Methodology

2.1 Creation of garments pattern

In this step, the CAD & CAM department develops a pattern in accordance to tech pack/file requirements. The sample is a challenging piece of paper that consists of all single parts of a garment. In this step the pattern of the garment's parts has been created which will be ultimately used in the main garments. By using those patterns, marker have to prepare. Different fashion quantity creates many patterns. It is saved for future reference. Every section is made in a garment[(14)].

2.2 Pattern grading

Pattern grading is the manner of turning a sample dimension (sometimes referred to as base size) into an additional smaller or large size. Pattern grading is completed using a dimension specification sheet. Grading does now not create a new shape; it increases or decreases the dimension of the special structure of the garment. Grading functionality the size version from the hold close size. Firstly, a sample is created with the considerable size, and then it would be graded in accordance to all sizes. Suppose, S, M, L, XL, and XXL sizes are ordered. L is the grasp size pattern. Then S, M, XL, and XXL are created primarily based definitely on draw close size.

2.3 Marker making for a sample

For Sample making marker is created. A marker is a skinny piece of paper that bears all the components of garments. Here Marker is created by way of CAD & CAM software. Marker-making method: Marker efficiency will be greater for the computerized marker-making technique than received in the manual method. But if the marker-maker is distinctly experienced, then the manual marker-making method may also be a properly efficient way to make a marker as well. Keep in mind that manual marker-making has many limitations along with Not being able to mass-produce markers in a quick tempo environment the identical way a CAD marker-making system can, Not being capable to keep markers in a pc file for future reprints, etc.

2.4 Edit Pattern Grading / Pattern engineering

We can change the ratio of patterns like XL+S, and M+L, reduce the measurement of tolerance and change grading according to tolerance. Earlier when we made a marker of the basis for the idea there was a front neck drop 9 in an XL size and a small size back moon size drop 10. The tolerance is XL neck drop $\pm$ 0.5 and no measurements for the back moon we are changing the front neck drop is 9.5 and the back moon to 9.5. Operation 1 for we are minimizing 1 cm pocket size.

2.5 Edit Marker Making

Marker efficiency is largely ruled by way of the experience, honesty, sincerity, and technological knowledge of the marker planner. It also depends on the variety of trials given for marker making. Marker effectively is largely governed through the experience, honesty, sincerity, and technological understanding of the marker planner. It additionally depends on the wide variety of trials given for marker making. Marker ratio choosing earlier than marker for example if more sizes of clothes can be included e.g. S, M, L, XL, XXL for a precise fashion in the marker, then greater will be the efficiency. So that the large empty house can be moved into smaller pieces.

2.6 Calculation of fabric consumption

Consumption ability how plenty fabric wishes to produce a garment. With the revolution of scientific invention at present it does not need to calculate manually. It is calculated by using CAD & CAM area automated Gerber CAD & CAM software.

$$\text{Consumption kg/dozen} = \frac{(\text{ Marker length in inch } \times \text{ marker width in inch X GSM }) \times 12}{1550 \times 1000 \times \text{ marker pcs quantity}}$$

3 Results and Discussion

3.1 Optimization of pattern size to increase marker efficiency for operation 1

In M.M. Knitwear Ltd, we conducted this experiment. The size of the pattern and their arrangement has played a significant impact on the marker efficiency. As for the style S22BL202, we created a ratio such as 6/9(1), 9/12(1), 12/18(1), 18/24(3), 24/26(4) to save the residual fabric. At the very first, an easy marker has prepared as mentioned in Table 1. After that, an action marker is produced by considering the allowance of patterns. The saving fabric through the good arrangement of the pattern in marker paper was the prime concern. In such a way, the pattern size was modified by increasing or decreasing the pattern length and width. The experimental parameters are mentioned in Table 1.

Table 1. Parameters of style S22BL202 ofeasy and action marker

Parameters	Easy Marker	Action Marker
Style	S22BL202	S22BL202
Size ratio	01:01:01: 03:04	01:01:01: 03:04
Marker length (inches)	110.27	104.61
Marker width (inches)	67	65
Marker efficiency %	87.29	89.27
GSM	240	240
Fabric consumption (kg/dozen)	1.37	1.26

Fig 1. Action Marker

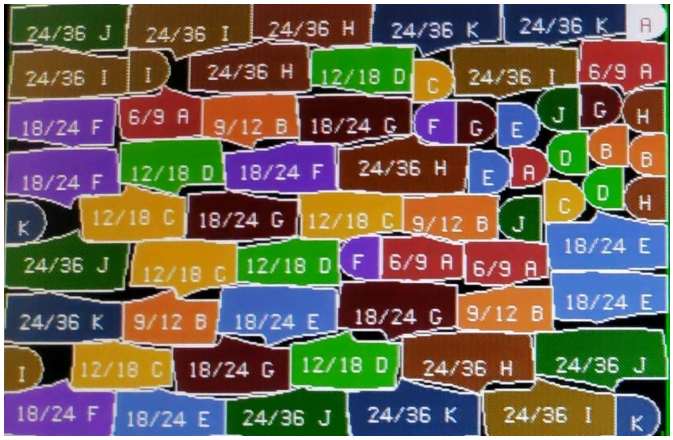

Fig 2. Easy Marker

3.2 Optimization of pattern size to increase marker efficiency for operation 2

For a style Polo-TsT101, the factory created a ratio such as S (1), M (1), L (1), XL (1), XXL (2), XXXL (2), XXXXL (1). Pattern size was modified by increasing or decreasing the pattern length and width. All parameters are listed in the below Table 2.

Table 2. Parameters of style Polo-TsT101 of easy and action marker

Parameters	Easy Marker	Action Marker
Style	Polo-TsT101	Polo-TsT101
Size ratio	01:01:01: 01:02:02:1	01:01:01: 01:02:02:1
Marker length (inches)	186.43	182.81
Marker width (inches)	75	70
Marker efficiency %	87.29	90.04
GSM	180	180
Fabric consumption (kg/dozen)	2.16	1.98

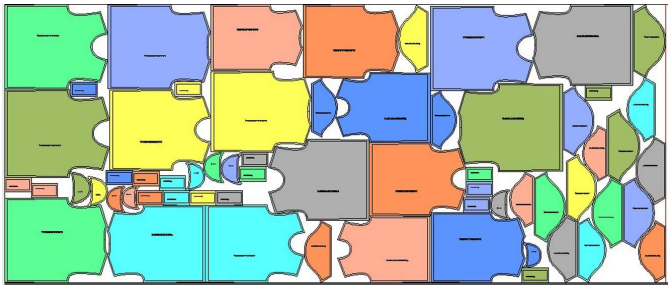

Fig 3. Action marker

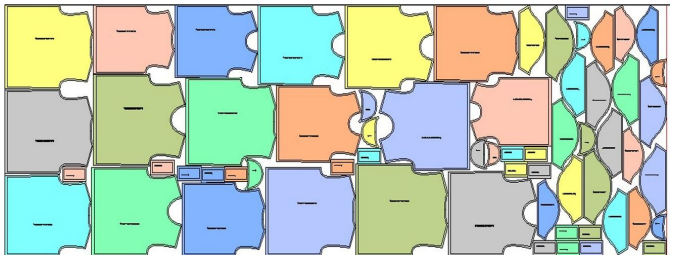

Fig 4. Easy marker

3.3 Optimization of pattern size to increase marker efficiency for operation 3

For a style S22-W20201, the factory created a ratio such as S (1), M (1), L (1). Pattern size was modified by increasing or decreasing the pattern length and width. All parameters are listed in the below Table 3.

Table 3. Parameters of style S22-W20201 ofeasy and action marker

Parameters	Easy Marker	Action Marker
Style	S22-W20201	S22-W20201
Size ratio	01:01:01	01:01:01
Marker length (inches)	103.42	98.5
Marker width (inches)	41.4	40.15
Marker efficiency %	81.02	89.27
GSM	160	160
Fabric consumption (kg/dozen)	1.77	1.63

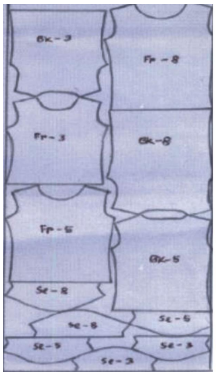

Fig 5. Action marker

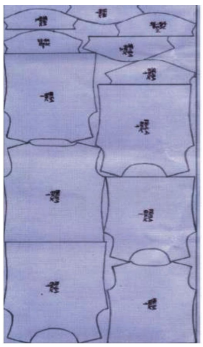

Fig 6. Easy marker

3.4 Optimization of pattern size to increase marker efficiency by changing size ratio for operation 4

For the style S22-W20201, the factory created a ratio such as S (1), M (1), L (1). Pattern size was modified by increasing or decreasing the pattern length and width. All parameters are listed in the below Table 4.

Table 4. Parameters of style S22-W20201 of easy and action marker

Parameters	Easy Marker	Action Marker
Style	S22-W20201	S22-W20201
Size ratio	01:01:01	01:02:01
Marker length (inches)	103.42	128.84
Marker width (inches)	41.4	40.15
Marker efficiency %	81.02	90.27
GSM	160	160
Fabric consumption (kg/dozen)	1.77	1.60

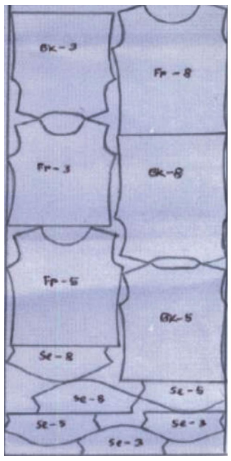

Fig 7. Action marker

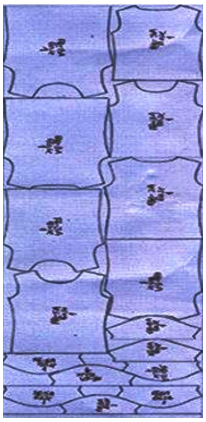

Fig 8. Easy marker

3.5 Marker efficiency and required fabric consumption for all operation

Size ratio 6/9(1), 9/12(1), 12/18(1), 18/24(3), 24/26(4) for style S22BL202 and size ratio S (1), M (1), L (1), XL (1), XXL (2), XXXL (2), XXXXL (1) for style Polo-TsT101 and size ratio S (1), M (1), L (1) for style S22-W20201 are operated by changing marker measurement and size ratio. The results are listed in the below Table 5.

Table 5. Marker efficiency and required fabric consumption for alloperations

Operation	Style	Size Ratio	Easy Marker efficiency %	Efficiency % after action	Overall Increased Marker efficiency	Fabric consumption per dozen (kg) for easy marker	Fabric consumption after action per dozen (kg)
01	S22BL202	01:01:01:03:04	87.29	89.27	1.98	1.37	1.26
02	Polo-TsT101	01:01:01:01:02:02:1	87.29	90.04	2.75	2.16	1.98
03	S22-W20201	01:01:01	81.02	89.27	8.25	1.77	1.63
04	S22-W20201	01:02:01	81.02	90.27	9.25	1.77	1.60

3.6 Comparison of marker efficiency between action marker and easy marker

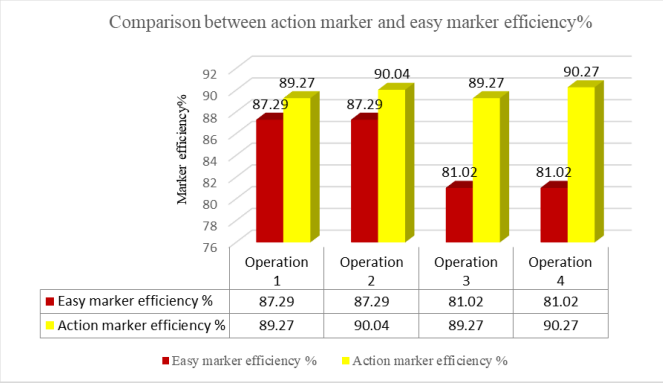

Fig 9. Comparison between action marker and easy marker efficiency

3.7 Comparison of fabric consumption between action marker and easy marker

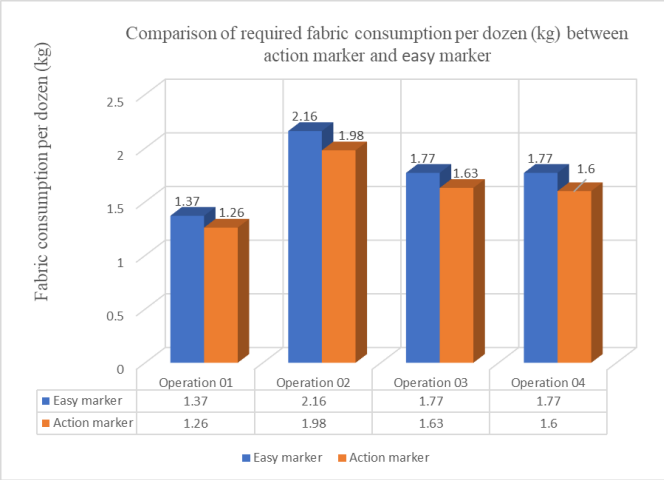

Fig 10. Comparison of required fabric consumption per dozen (kg) between action marker and easy marker

According to the quantitative study, marker efficiency %, which resembles how much percentage of fabric is utilized for garment production varies according to the usable fabric width, and the combination of different sizes and styles. The rest (100 - marker efficiency %) is the cutting marker loss or wastage. Higher the marker efficiency the wastage reduces correspondently. However, usable fabric width and interaction, affect insignificantly. Apart from that, the interaction effect between style combinations and the usable fabric width is significant, indicating that the overall impact on marker efficiency variations is significantly affected by the garment's size tolerance. According the result of our research, the marker efficiency has significantly increased by the applying our noble approach. This approach increased marker efficiency up to 9.25% which ultimately have great significance in the overall productivity of the industry.

4 Conclusion

In this study the marker making of garment styles from plain fabrics was analyzed to reduce the fabric consumption for certain production orders. The main reasons for increased fabric losses compared with easy marker were determined. It was tried to find possibilities to reduce fabric consumption conforming to the garment's size tolerance. It was worked on action marker created by increasing or decreasing pattern size matching with garments size tolerance to reduce fabric consumption. Specifically, it was found that up to 9.25% of material consumption was reduced. For this, marker need to be developed many times. A saving of up to 9.25% of a fabric that ate up tens of millions of tons per year has a significant effect on lowering aid depletion and environmental pollution.

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