

Investigation And Development Of sustainable Garment Pattern Making And Fabrication

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ABSTRACT

Sustainable garment design is a way of creating garments where waste is designed out of a garment from the very beginning of the process. Zero-waste design patterns often include clever fabric manipulations and cutting layouts. The amount of fabric utilization is determined by knowing the cutting efficiency. Conceptual idea leads to the development of fashion design which uses the full width of the fabric. Using specific fabric width for each garment in pattern making and using aesthetic dimension contributes for zero waste pattern cutting. Balancing tailored and square cut or rectangular cut pattern cutting approaches can facilitate later fabric waste elimination. For any style of garment, all the cut panels of one garment should be placed within the specified length and width of rectangular piece of fabric. The length and width of fabric can be determined from the style, measurement, specsheet of the garment. The circumference, which has the highest measurement compared to others can be used as the width of rectangular piece. Length is determined from the full length of the garment. A new method is developed from the inspiration of all the researches and techniques used by experts to achieve zero-waste.

The main aim of this research work is to achieve sustainable zero-waste garment with maximum efficiency. Totally twenty five styles of garments have been achieved, namely men's formal shirt and suitings, women's formal shirt and suitings, women's kurthi, men's polo t-shirt, men's round neck t-shirt, ladies top with frill, Ladies top with mandarin collar, Butterfly top, leggings, night pant, tight fitted capris, loose fitted capris, treggings, tank top, ladies top hooded cardigan, sleeveless hooded cardigan, turtle neck sweater, denim $\frac{3}{4}$ th pant for women, denim full length trouser for men, denim $\frac{3}{4}$ th pant for men, kid's $\frac{3}{4}$ th pant, kid's denim full length trouser, kid's denim shirt. Design alteration has been done for back bodice by dividing it into three parts, pattern arrangement is done in the way how the pattern pieces are attached. Efficiency calculation and fit checking is done for all the developed garments. These sustainable garments are compared with existing garments in various aspects to show the improvements achieved by the proposed method and to determine how far it is suitable for industry. Comparing with the industrial efficiencies, the efficiency achieved in the proposed method is 13% (average) increased for all products in commercial market. Based on the result, it is found that the proposed method of garment construction reduces the landfill and the waste generation is minimized during the garment manufacturing process.

1. INTRODUCTION

Reduction in the negative impact of waste on environment, waste management (i.e) collection, treatment & disposal of waste is done. Waste having economical value are recycled and received [1]. Zero waste approach in garment manufacturing can be done by innovative fashion designing and by modifying the existing manufacturing

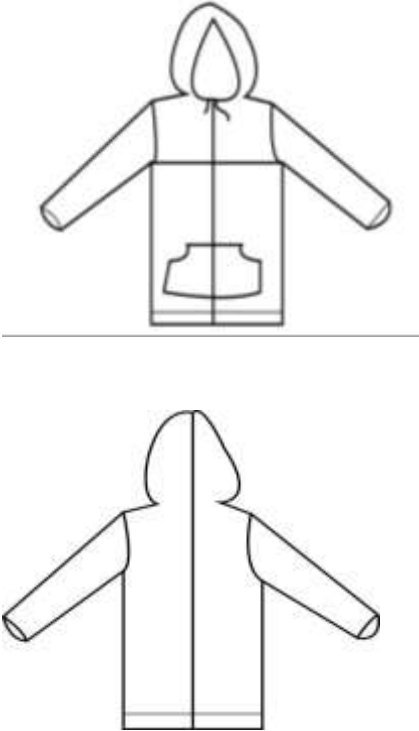
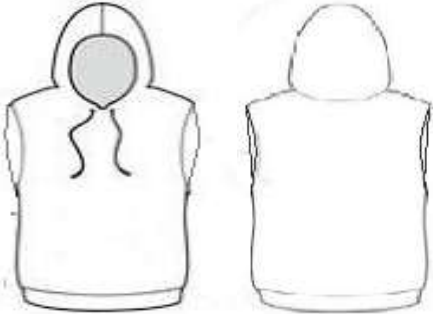

process. Conventional design approaches waste approximately 15% of fabric used in the design and make cut and sew garments. [2]. The investigation of fabric wastage in different sections of knit T-Shirts and it was observed that 13.57% is unavoidable in cutting [3]. Zero waste fashion is globally focused on creating garments with little or no textile waste and could be classic or experimental. It aims to establish sustainability through optimization & waste reduction as a part of design process [4]. The cube method of pattern making i.e. draping of fabric around the body form in order to explore negative space, silhouette & shape, Then Computer Aided Pattern designing is followed for mass production to follow the intellectual property of design [5]. There are different sections of a garment industry like sampling, cutting, sewing and finishing section, where for different cause's fabric wastages are happened. During cutting there are two different fabric wastages like one for marker efficiency and another for panel checking followed by different types of fabric faults. Apart from this, a garment industry in Thailand shows that waste is generated in cutting, sewing and in the process of quality control [6]. Sustainability in fashion design has an impact on the aesthetics of garment. Zero waste pattern cutting method integrates the process of pattern making to full fill 0% waste & 100% aesthetics [7]. Gemini CAD is used for manipulating & plotting which results in different efficiency. The influence of different marker efficiency on cut plan efficiency and consumption of fabric. Marker has direct impact on cut plan. High efficiency marker has high efficiency and low consumption of cut plan [8]. A wide variety of practices fall under the umbrella of sustainable fashion. Calling something "sustainable" easily obscures the fact that a certain product may have only one sustainable aspect, such as organic cotton, from which the term is misleadingly applied to the entire product. Improving one aspect towards sustainability is not enough. Therefore we need to look at matters holistically, in order to see multiple issues at the same time and respond to them as fully as possible. Nevertheless, the goals of sustainability are hard to meet if they remain abstract, but we can get closer to the objectives through practical methods that a designer can apply in their work. [9]. Fashion designers presented with different principle for pattern cutting and the proposed cutting is developed through concrete experiments by cutting and draping fabrics on live model The result of a proposed model is an alternative principle for dressmaking that challenges the fundamental relationship between dress, pattern making and the body, opening up for new expressions in dress and functional possibilities for wearing [10]. Refashioning/Sustainable fashioning with the textile waste has a growth in taking up the business model. It is oriented towards addressing sustainability issues such as resource depletion, fabric consumption and production [11]. Marker planning is important planning process and the relationship between objective function is that, it has cost combination and garment characteristics. So the cut plan scheduling, assembly planning and marker making are concentrated [12]. Different types of marker making method is followed to improve fabric utilisation by CAD system. Automatic generation of markers help the manufacturers to keep up with customer demands for different styles & sizes [13]. Advancement in Computer technology for garment industry is used in marker making though there are little disadvantages of using CAD [14]. Focuses on experimental garment and textile design process in the area of zero waste fashion and its connection to textile appreciation. It is possible to facilitate a new kind of appreciation for how fabric is used in fashion design. Additionally it is possible to design new fashion aesthetics through intergrading textile design and fashion design in ZWF practices [15].

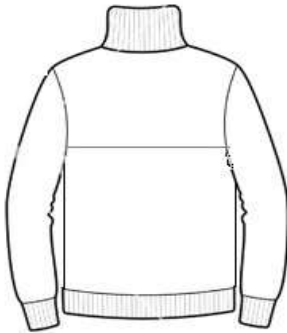
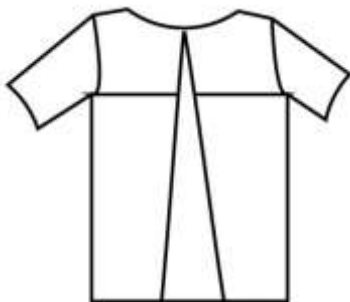
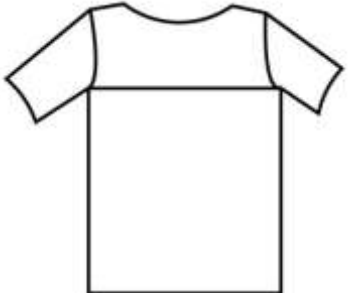

2. METHODOLOGY

A Garment with maximum efficiency is developed for five styles. Style 1: Tanktop, Style 2: Kids top, Style 3: Hooded Cardigan, Style 4: Turtle neck sweater, Style 5: Sleeveless hooded

cardigan. The maximum efficiency is achieved by altering the standard of existing pattern into new pattern. Designing and sketching of each garment is done.

Table 1 Specs sheet for all the Styles

	S.no	Description	Measurement in Inches	
STYLE 1	1	Full length from HPS	25.5	
	2	Chest circumference	40	
	3	Waist circumference	41	
	4	Sleeve length	24	
	5	Armscye depth	9	
	6	Shoulder width	3	
	7	Pocket length	7	
	8	Pocket width	14	
	9	Hood length	15	
	10	Hood width	20	
STYLE 2	1	Full length from HPS	21	
	2	Chest circumference	40	
	3	Waist circumference	41	
	4	Cap height	1	
	5	Armscye depth	9	
	6	Shoulder width	3	
	7	Hood length	15	
	8	Hood width	20	
STYLE 3	S.no	Description	Measurement in Inches	
	1	Full length from HPS	21	
	2	Chest circumference	40	

	3	Waist circumference	41	
	4	Sleeve length	24	
	5	Armhole depth	9	
	6	Shoulder width	3	
	7	Pocket length	6	
	8	Pocket width	6	
	9	Neck length	3	
	10	Neck width	17	
STYLE 4	1	Full length from HPS	20	
	2	Chest circumference	11.5	
	3	Waist circumference	13	
	4	Neck depth (front)	3	
	5	Neck width	8	
	6	Sleeve length	7	
	7	Sleeve opening	7	
	8	Armhole depth	4.5	
	9	Neck Depth (back)	1	
	10	Open at Front	3.5	
STYLE 5	1	Full length	16	
	2	Chest circumference	28	
	3	Armhole depth	1	
	4	Strap Length	6.5	

Fabric Selection is done based on the requirement of the garment. Fabric details for each style are specified. For Style 1,2 & 3 the fabric remains the same. Fabric used is Fleece Fabric, GSM-225 and the colour of fabric is Purple. Style 4 the fabric used is Single Jersey, GSM-185 and the colour is white. Style 5 the fabric used is Single jersey, GSM- 178 and the colour is yellow. Based on the fabric detail, Fabric Sourcing is done for each style. Simultaneously,

Pattern making is also done. To achieve maximum efficiency and to save land fills of fabric after cutting, standard existing pattern has been completely changed into different method.

3. PATTERN MAKING PROCEDURE FOR STYLE1,3 & 4:

Rectangle size of fabric with length x and width y . Mark Sleeve length from right and left side. Mark the Armscye depth from the top of the rectangle. Mark Armhole Circumference from the top. Mark “a” measurement line from right and left side below Armhole Circumference. Mark the center width of complete rectangle in the marking line of Armscye depth which helps to mark Neckline and Shoulder. The rearrangement of the pattern is shown in Figure 1, 2 &3

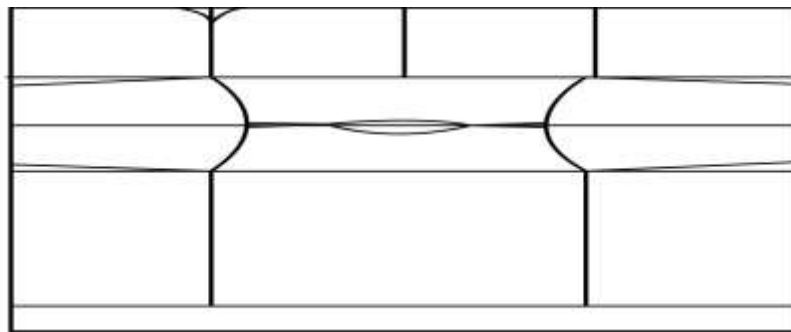


Fig. 1 Style 1

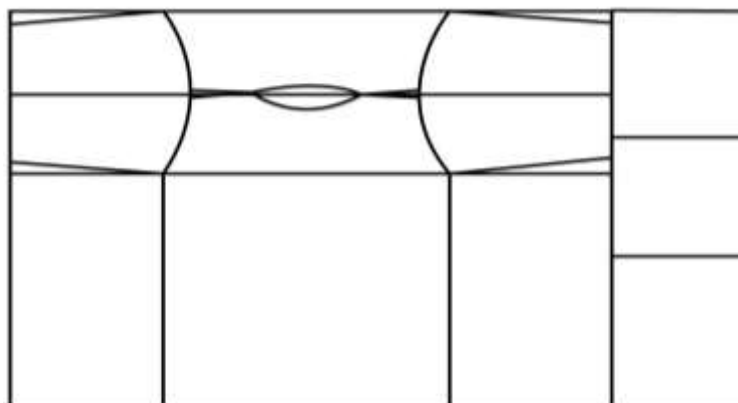


Fig. 2 Style 3

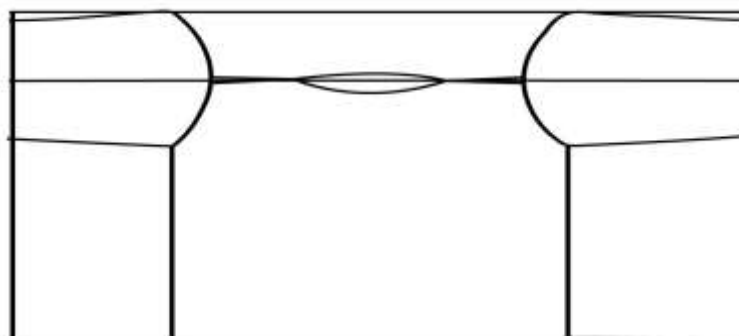


Fig. 3 Style 4

4. PATTERN MAKING PROCEDURE FOR STYLE 2 & 5

For style 2 & 5 Fabric may be taken in onfold or Tubular fabric is preferred. This type of pattern making is similar to the existing style but there is minor changes which reduce wastage of fabric. The pattern is shown in Fig 4 &5

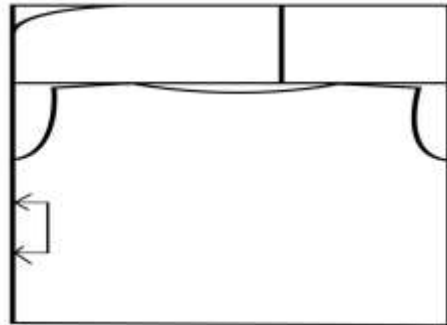


Fig. 4 Style 2

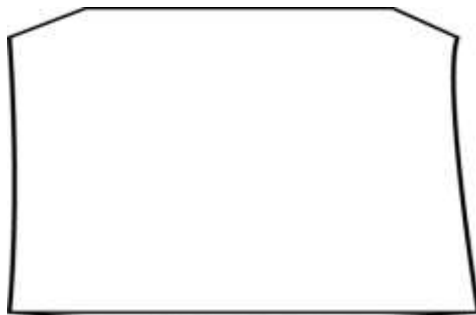


Fig.5 Style 5

After drafting the pattern, pattern cutting is done followed by fabric cutting. While cutting the fabric, patterns are layed on the fabric.



Fig. 6 (Layout of style 1)



Fig. 7 (Layout of style 2)



Fig.8 (Layout of style 3)



Fig.9 (Layout of style 4)



Fig.10 (Layout of style 5)

5. GARMENT CONSTRUCTION:

After pattern making the cutting process is done. The waste obtained from the cutting process is not thrown off. Instead it is created into some trims or decorative stuff and is attached to the garment. Then sewing is carried out using single needle lock stitch machine, overlock machine, flat lock machine. After sewing finishing is done it is worn on live model to check for fit analysis.

6. RESULTS AND DISCUSSION

Cutting Efficiency is calculated for all the styles in terms of both weight and dimension. Table 2 gives the details of how Cutting efficiency calculation is done for all the Styles.

Table 2. Cutting Efficiency

	S.NO	PARTICULARS	UNITS
STYLE 1	1	Length of fabric	48"
	2	Width of fabric	41.5"

	3	Total Fabric used	347.79 g
	4	Fabric consumed to construct Garment	326.43 g
	5	Weight of waste generated	21.36 g
	6	Efficiency	93.85 %
STYLE 2	1	Length of fabric	35"
	2	Width of fabric	41"
	3	Total Fabric used	224.7 g
	4	Fabric consumed to construct Garment	216.3 g
	5	Weight of waste generated	16.77 g
	6	Efficiency	96.54 %
STYLE 3	1	Length of fabric	34"
	2	Width of fabric	41.5"
	3	Total Fabric used	243.5 g
	4	Fabric consumed to construct Garment	229.56 g
	5	Weight of waste generated	13.85 g
	6	Efficiency	94.54 %
STYLE 4	1	Length of fabric	25"
	2	Width of fabric	28"
	3	Total Fabric used	76.56g
	4	Fabric consumed to construct Garment	74.30 g
	5	Weight of waste generated	2.26g
	6	Efficiency	97.06%
STYLE 5	1	Length of fabric	16.5"
	2	Width of fabric	15"
	3	Total Fabric used	70.47 g

	4	Fabric consumed to construct Garment	69.97 g
	5	Weight of waste generated	0.46 g
	6	Efficiency	99.2 %

FINAL GARMENTS



Fig.11 Final Garment Style 1



Fig.12 Final Garment Style 2

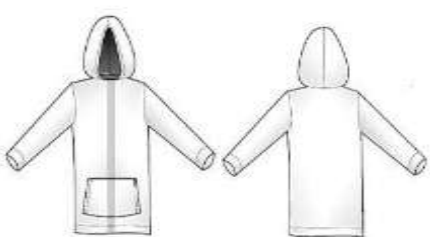
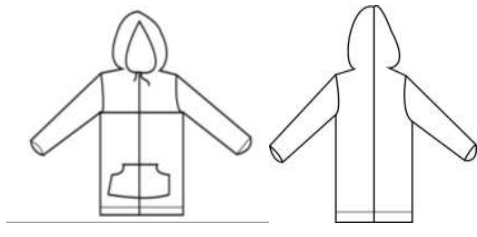


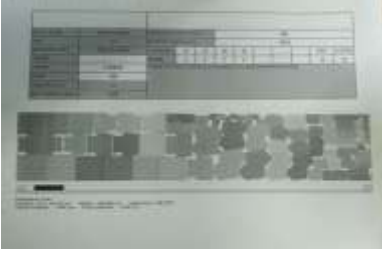



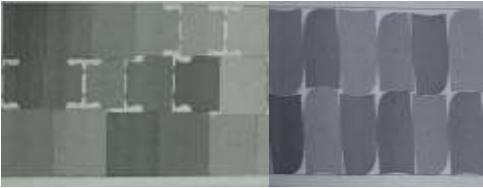

Fig.13 Final Garment Style 3

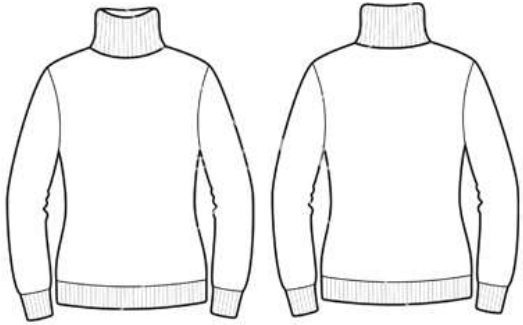

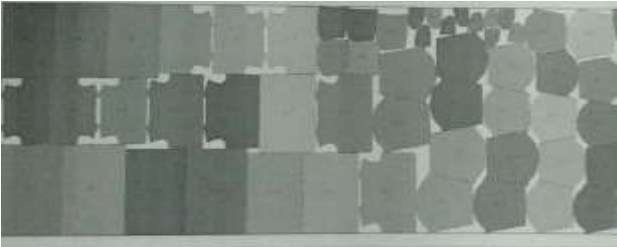

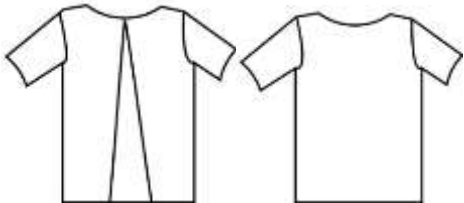
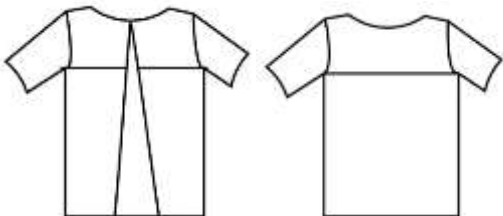


Fig.14 Final Garment Style 4 & style 5

COMPARISION OF EXISTING AND NEW PRODUCT

STYLE 1	
EXISTING METHOD	PROPOSED METHOD
	

	
<p>Efficiency achieved is 88.68%</p>	<p>Efficiency achieved is 93.85%</p>
<p>STYLE 2</p>	
<p>EXISTING METHOD</p>	<p>PROPOSED METHOD</p>
	
	
<p>Efficiency achieved is 89.78%</p>	<p>Efficiency achieved is 96.54%</p>
<p>STYLE 3</p>	
<p>EXISTING METHOD</p>	<p>PROPOSED METHOD</p>

	
	
<p>Efficiency achieved is 89.48%</p>	<p>Efficiency achieved is 99.54%</p>
<p>STYLE 4</p>	
<p>EXISTING METHOD</p>	<p>PROPOSED METHOD</p>
	



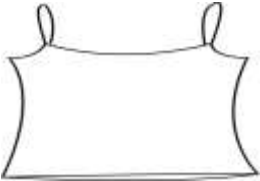
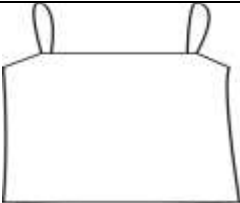

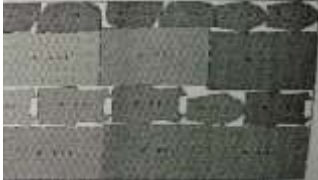


	
<p>Efficiency achieved is 87.16%</p>	<p>Efficiency achieved is 97.56%</p>
<p>STYLE 5</p>	
<p>EXISTING METHOD</p>	<p>PROPOSED METHOD</p>
	
<p>Manual Marker making</p>	
<p>Efficiency achieved is 87%</p>	<p>Efficiency achieved is 99.2%</p>

Table 3 Comparison between existing and new method with current industrial specification

Particulars	Existing method	New method	
		Computerised method	Manual method
Marker width	62.00 inch	62.00 inch	62.00 inch
Sizes And Quantities	S-1 M-1 L-1	S-1 M-1 L-1	S-1 M-1 L-1
Layout			
Cutting efficiency	87.20%	90.56%	93.27%

7. CONCLUSION

A new method has been developed to provide a solution for the problem of fabric wastage, with a little alteration in existing method by deciding fabric width, pattern drafting and pattern placement. This method produce garments with same fit and appearance as that of existing method, but it produce garments with higher efficiency than the existing method. A "T" shape seamline appears In the back bodice or in the front bodice of cardigans and overcoat which gives a new aesthetic design to the garment, but there is no change in the silhouette or fit of the garment. Other than this seam line and all the other aspects remains same as that of industrial practice. Industry which is concerned of more wastage can educate the workers to try to incorporate this new method and they can develop a new styles like this in solid colour fabric.

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