

# An experiment to create Zero Wastage Clothing by stitching and slashing technique.

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**Abstract**— Fabric consumption is an important issue to earn maximum profit. Apparel production processes generate millions of tons of waste each year globally. Conventional apparel construction techniques utilize about 85% of fabric while the remaining 15 % of the fabric is discarded on the cutting room floor which consider as wastage. In this paper a solution is proposed to apply the wastage small piece of fabric into garments to add value in design of the garment. Biggest challenge of zero-waste fashion is changing the manufacturing processes to reduce wastage. Small changes to large scale manufacturing can have wide ripple effects. Since the garment industry wastes roughly 15% of the fabric uses, diverting even a fraction of this waste from the landfill can reduce environmental hazard. There are challenges to spread moderation the harmful side effects of fashion production motivated on product or result changes, the product focused strategies by using more sustainable materials and renewable source energy. Results focused strategies highlight how the wastage of fabric can add value in the design of the garments. Practice-led research method is adopted to complete the whole research. Professional creative practices of art and design play an instrumental role in the research. The contextual analysis of this study surveys different approaches of fashion creation. This study establishes that the cutting wastage of a garments can add design value to the garments by cutting and slashing technique which will generates new opportunities in fashion designing and garments production process

**Keywords** — Fabric wastage, sustainability, zero wastage, Cutting & slashing, design, technique, garments.

## 1 INTRODUCTION

Zero-waste fashion refers to the items of clothing that produce little or no fabric waste in their production. It can be measured to be a part of the wider sustainable fashion movement. It can be allocated into two general methods including Pre-consumer and post-consumer. Pre-consumer zero-waste fashion eradicates waste during manufacture. Post-consumer zero-waste fashion creates clothing from post-consumer garments such as second-hand clothing, reducing waste at what would usually be the end of the product use of a garment. Initial examples of zero-waste or near zero-waste garments contain Kimono, Chiton, Sari and many other traditional costumes. The main raw material of making garment is fabric. The prime method of manufacturing garments involves cutting fabric and joining the parts through fusing, welding, sewing and using other techniques. Significant quantity of fabric is wasted by using this process – is the reason behind environmental pollution [1]. Fashion trends are formed, promoted, and redundant.

Over the earlier period, the pulse of fashion has stepped up towards what is known as “fast fashion”. For this reason, fast fashion contributes a good amount of wastage generated by the broader fashion industry [2]. Most of the consumers of fast fashions don’t know the product they are buying from where it comes, how they were manufactured and distributed nor that by throwing away their clothing very quickly that they are escalating the speed of textile waste.

Production waste has become a major problem for the textile and fashion industries in terms of increasing waste management costs and figure. Today, we can survey a growing awareness inside the fashion industry about the environmental issues, and efforts to change design and production processes have faced. Many designers who worked independently have started to supply ecofriendly and sustainable products. Sustainable and eco-friendly products are getting popularity day by day. A number of companies have started to

produce their product following eco-friendly way thinking of their conscious consumer. Nonetheless, sustainable fashion still only has a very small share (less than 0.5%) of the global fashion market [3]. There are challenge to enlarge mitigation the damaging side effects of fashion production paying attention on product or result changes, the product alert strategies by using more sustainable materials and renewable source of energy. Results focused approach on highlight how product is marketed, distributed, ecofriendly design, textile recycling, options of reuse clothing and zero-waste fashion etc. these approaches help to handle production, pollution and textile waste so the challenge now is to find appropriate ways to reduction waste.

A concise consideration of the potential reasons for the fabric waste formed during manufacturing fashion garments exposes that where fabric waste is contemplation in the fashion manufacturing procedure – at the marker planning and making, and cutting stages – the intended garment is already unfringeable; it cannot be distorted. This proposes that to remove fabric waste, fabric waste needs to become a distress earlier in the process: contemplation for fashion design and pattern cutting. Manufacture is ruled by what has been designed and the pattern cut. At this point in time, fabric waste is mainly regarded an economic issue [4].

This study responds to calls by Fletcher [5] that fabric waste should also become an environmental and ethical consideration for the fashion industry. In this research study different techniques of zero wastage fashion through literature review and finally find out a new technique that could be adopted when designing and manufacturing zero-wastage garments and make a collection of womenswear.

The research investigates if it is possible to ensure zero-waste in designing and producing women clothes through stitching and slashing technique that will additional to the aesthetic value of the product. It also identifies the problem arise using

this technique in the garment and further possible application of the stitching and slashing technique in garments designing.

## 2 LITERATURE REVIEW

“Zero waste design “or, “zero waste patterns making,” refers to the practice of designing patterns for clothing with little to no fabric waste. This is achieved through careful pattern layouts and creative solutions for eliminating awkward curves that leave too-small scraps left on the cutting room floor. The term is intentionally vague and is being adopted by designers who are using various techniques, materials, and technologies to achieve the “perfect” zero waste garments.

The designers of fashion who have the sustainable fashion mission today have been canalizing their designs into this way with the zero-waste approach in fashion. Zero-waste fashion can be accepted as a part of sustainable fashion movement.

### 2.1 PRODUCTION METHODS

Patternmaking could be one key to reducing unnecessary waste. Rissanen (2008) estimated that the cutting of garments creates 10–20 % fabric waste, which is typically discarded to a landfill or recycled [6]. To avoid that, Rissanen suggested a zero-waste design approach to patternmaking. It is a process that integrates sketching and patternmaking, and requires the consideration of technical and visual elements of design together

### 2.2 Pattern Cutting Methods

In some contemporary approaches, fabric is utilized by using rectangular and triangular shapes that easily fit together like a jigsaw puzzle [1]. Fabric waste for adult outerwear varies on average from 10 to 20 percent, with the estimation of 10 percent for trousers or pants and greater percentages for blouses, jackets, and underwear [7].

### 2.3 Zero Waste

Zero-waste is a design method that eradicates textile waste at the design stage. There are several methodologies to manufacture a zero-waste garment. The rule is that there will be no wastage. So, firstly it should decide what type of garment will be made and which formula will use to make it zero-waste, for example draping, knitting or using a zero-waste pattern, as these will inform one’s design and sourcing options.

#### 2.3.1 Tassellation

A tessellated pattern consists of one shape that repeats by fitting perfectly together, with no gaps between the shapes. In the simplest form, a floor tiled with marble squares makes a tessellating pattern. The Dutch artist M.C. Escher is well known for his complex tessellations, featuring birds, fish, and lizards. McQuillan’s tessellation design featured in *Shaping Sustainable Fashion* appears to be the least developed of her designs, as the garment shown is not fully constructed but pinned together on a dress form. The pattern layout consists of interlocking shell-like curved shapes that reduce in scale as they near the defined straight edge of the piece goods. Within



**Fig. 1 Garment designed from Tassellation, Holly Macquillan**

the garment these shapes are overlapped and layered to mold around the figure. There is a curious contrast between the resulting garment design, which appears somewhat random and unplanned, to McQuillan’s own statement about the pattern tessellation that she ‘wanted a solution that was by design more intentional’ [8]. The overlapping of shapes does create aesthetic interest and texture but would likely be problematic for purposes of mass production.

Unless a shape has straight edges, it will not tessellate perfectly to the selvage of the fabric. This accounts for McQuillan’s need to reduce the scale of her shapes to further diminish the gap created against the selvage. A simpler approach to the tessellation design practice is to use shapes with straight edges that will align with the fabric grains. Such an approach is employed in the gingham top of *Black and White Bias Mix-up* (Figure1) with the additional strategy of supplementing the garment with additional shapes beyond the tessellating pattern. The midriff section of this top is constructed of 12 interlocking trapezoidal shapes forming the tessellation. The bra, facing, and strap patterns are supplementary and consume the remainder of the fabric width. Vertically splitting four of the trapezoid shapes helps accomplish two requirements of the design: first, the straight edges gained from the vertical cuts align gap-free against the selvage for zero waste; and, second, locating the splits at center back creates the opening necessary for the garment. The fabric creates a self-interfaced facing at center back by folding twice. Another example of a supplemented pattern tessellation is Carla Fernandez’s *Chamula Outfit* feature in the *YIELD* exhibition [9] which utilizes tessellating triangles to form the skirt. The remainder of the outfit uses squares and other necessary shapes to meet the fabric width and complete the dress design.

#### 2.3.2 JIGSAW AND EMBEDDED JIGSAW:

Regarding the embedded jigsaw practice, McQuillan states ‘the design process is the same for embedded designs as for traditional jigsaw approaches’ [8]. Indeed, the embedded jigsaw emerged as more of a way to increase efficiencies when multiple garments are being made and less of a new way to design zero-waste patterns. By embedding traditional pattern within a length of fabric, McQuillan proposes that what is

waste from the traditional pattern can be worked into another garment design to achieve zero waste. Since the authors practice designing single garments at a time, the study focused on the jigsaw practice and ignored the embedded. In contrast to the tessellation method, both jigsaw and embedded jigsaw methods allow for designers to use varied pattern shapes, much like traditional pattern design. To achieve zero waste, however, the pattern shapes within a jigsaw are manipulated to interlock with each other and share cut edges. Timo Rissanen and McQuillan both are well known for their designs resulting from this practice. The jigsaw practice provides a way of working that can be comfortable for seasoned pattern-makers as it allows the designer to build around a set shape, whether that shape is a sleeve, pant leg, or other established pattern piece. This process engages the ‘whole’ of a designer’s knowledge – one must call on their experience with pattern-making, fabric drape, garment construction, and design, utilizing all skills in concert with each other. In zero-waste patternmaking, a convex curve for one pattern piece must be complemented by a concave curve within another pattern piece; thus, every adjustment to one garment part impacts another. Such is not always the case in traditional patternmaking. For example, if a jacket sleeve is determined to require additional height in the cap, that adjustment can be made to the sleeve pattern only, with no changes made to other pieces. With the jigsaw method, though, whatever is added to one pattern shape is simultaneously removed from another.



Fig. 2 Jigsaw Puzzle by Mark liu

**2.3.3 MULTIPLE CLOTH APPROACH**

This practice is described by McQuillan as a way ‘to design two or more patterns for different fabrics at the same time’ [8]. This may, in fact, be the most kin to mass production methods for pattern marking, in that multiple styles are combined within one layout. While the embedded jigsaw practice can also produce multiple garments within one marker, the way McQuillan presents the multiple cloth approach, with only illustrated examples of two hooded jackets and two t-shirts, shows results yielding multiple garments. The production of multiple garments related by fabric is fundamental

when designing for mass consumption, as the repetition of fabrics contributes to aesthetic cohesion as well as cost savings. Yet, again, as the authors’ studio practices are not disposed to producing multiple garments they did not undertake the task of designing in the multiple cloth practice. Cutting multiple garment patterns in combination from the same cloth is a shrewd and functional practice and can achieve zero waste.

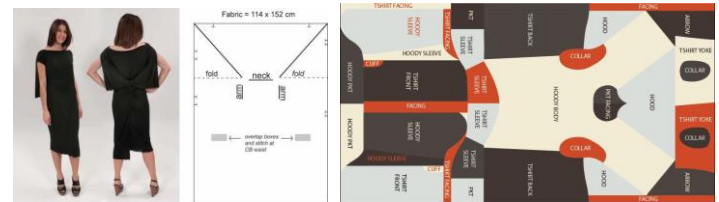


Fig. 3 Designed by Holly Macquillan

**2.3.4 MINIMAL CUT**

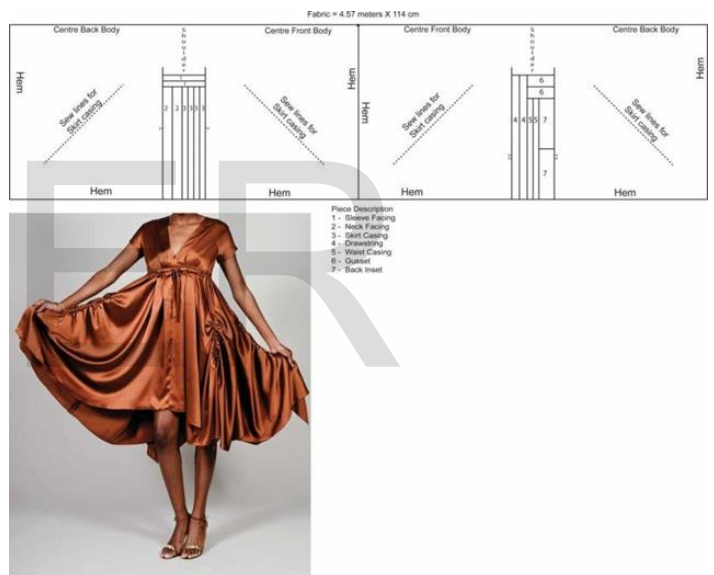


Fig. 4 Minimal cut design

greater level for design development. Marian O’Rourke-Kaplan’s dress High Waist – No Waste (Figure 4) was designed by ‘draping with an uncut piece of cloth to form a silhouette’ [10]; then the remaining casing and gusset pieces were drafted. The resulting dress has short sleeves and a drawstring at the empire waistline. Flanges are folded over the shoulders and additional drawstrings placed vertically in the skirt pieces allow for length adjustments. The pieces that are completely cut away in the pattern layout create casings, gussets, facings, and the drawstrings. The overall area that these rectangular shapes consume is small compared with the entire length of fabric used by the dress, and the designer states that whole cloth draping was used for development. Therefore, O’Rourke-Kaplan’s High Waist – No Waste dress is categorized as a minimal cut design practice [10]. Akin to minimal cut is David Telfer’s method called ‘minimal seam’. While Telfer addresses the reduction of seams as a way of reducing la-



bor costs in several designs that are not zero waste, his Zero Waste Minimal Seam Duffle Coat [8] is an example of minimal seam and minimal cut. The difference between the two methods is slight in this example, but seam and dart can be stitched into the fabric where there are no cuts. Thus, minimizing cuts can be a way to simplify the manufacturing process further. Telfer's duffle coat pattern diagram shows only four cut lines originating at the edge of the fabric and two internal slash lines for pocket openings, thus maintaining a single length of fabric with no separation of pieces after cutting. It is not stated if the design developed through whole cloth draping, but judging from the coat and pattern, it reasonably could have. After studying the work of designers ranging from Madame Gres to Maison Martin Margiela and those discussed above, Untitled (Figure 5) was created by draping the whole cloth on dress form. Through experimentation, a respect for the integrity of the material (cotton jersey in this case), and being open to unexpected results, the final design emerged with only two cut lines originating at the edge of the fabric and three internal slash lines for neck and arm openings. The head passes through the neck opening with the shorter piece folding over the shoulders to create a back bodice whose corners wrap to the front securing underneath the bust. The skirt wraps to the back and is stitched together at the waist, allowing triangular drapes to fall from each shoulder. A small elastic strip is sewn at the front waist to create shaping and visual interest. Minimal cut, then, as a design practice, can be a way of introducing beginners to zero-waste pattern design. In fact, in 2005 Professor Vincent Quevedo (2006) challenged undergraduate draping students at Oklahoma State University to drape garments using three to four yards of fabric without making any cuts into the fabric [10]. The assignment, while achieving zero waste, did not use that term but only challenged students to develop original and creative garments. As demonstrated in this document, the numbering for sections upper case Arabic numerals, then upper case Arabic numerals, separated by periods. Initial paragraphs after the section title are not indented. Only the initial, introductory paragraph has a drop cap.



Fig. 5 Subtraction Cutting

### 2.3.5 SUBTRACTION CUTTING

British designer, Julian Roberts developed a technique called

'Subtraction Cutting', which utilizes the negative spaces in traditional dressmaking.

### 2.3.6 CUT AND DRAPE

Cut and drape " is very experimental, it is based on melted cutting and draping it, where a fashion designer can play with the way fabric falls to create new designs, as designer Carlos Villami: His clothes are designed / built with innovative construction concept the pieces in this collection were made using



Fig. 6 Cut & Drape

a mix of techniques: cutting, draping, folding, steam molding and machine and handstitching, [11].

### 2.3.7 KNITTING

As designer Van Rees, she created textile by using both remnant thread from knitting factories then wave directly the yarns in the shape of the garment so the resulting pieces are completely seamless, no cut - offs or leftovers [11].



Fig. 7 Zero wastage by Knitting

### 2.3.8 RE-USING SCRAPS OF CLOTH AND YARNS

This method based on deal with off cuts of leftover material after finishing product manufacturing; there are different ways to reuse scraps.



Fig. 9 Zero Wastage by Daniel

### 2.3.9 GEO-CUT

This method based on using geometrical shapes as squares, triangles and circles this method has historical roots in, for example, kimono designs [11]. As designer Ada Zanditon, she used zero - waste geometric cutting for origami - inspired to present final garments have 3d form (photo) she took two squares and cut a line through them, and then joined the lines together and used buttons to fix the points of dress into folds [12]



Fig. 10 Hera Dress (Geo-cut)

### 2.3.10

### PLEATING

As designer Angus Tsui Yat Sing, that he created zero - waste garment by pleating rectangular textile waste scraps [12]

### 2.3.11 DRAPING SCRAPS OF FABRIC

As designer Franki Campbell where a fashion designer can play with scraps of fabric on Mannequin to create new designs, by using gathers, pleats, darts and the bias to create shaping without cut anything away.

### 2.3.12 DRAPING AND GEO-CUT:

Dr. Wafaa Abd Elradi made a collection using Macrame



Fig. 8 Zero wastage by draping

technique to boost up the innovation of women garments designs inspired by Nubian motifs.



Fig. 11 Draping & Geo-cut

Different kinds of technique are used to make zero wastage garments by different designers. By keeping an exposed mind concerning the final result, with the similar goal of creating beautiful garments, allowed to discover and formulate new outcomes.

McQuillan [8] have been identified Different ways of eliminating negative space by manipulating pattern pieces. He has tried different ways to overcome this problem; one is using mathematical objects called fractal, which have random shapes to reduce or eliminate the waste at the edges. The other solution would be using smaller sized tessellated shape as they get close to the edges of the fabric [8]. Using tessellated shapes with straight edges instead of curved ones to meet the fabric width [8]. The possibilities of using the new design technique called Transformational Reconstruction, discovered by Japanese designer Shingo Sato, to eliminate fabric waste. This technique manipulates the garment pattern in 3D not 2D.

## 3 METHODOLOGY

To make zero wastage garments I have observed all the previous technique based on zero wastage and experiment a different technique to make zero waste garments. This study is conducted with primary and secondary data. Primary data is collected from practice-based research [7]. The secondary data is

collected from article, Journal, magazines and internet.

### 3.1 MATERIALS AND METHODS

This research follows experimental application study and a garment is made using stitching and slashing technique. Stitch and Slash technique is a beautiful fabric embellishment technique that produces artificial chenille effect on fabric surface.



Fig. 12 Stitching & Slashing

It involves stitching together two or more layers of fabric one on top of the other in parallel diagonal lines (bias) and then cutting through the top layers leaving the base layer intact. A fluffy effect similar to the pile of velvet or chenille is created. This technique is very much used by textile artists to give great texture and interesting effects to their work. It is also used in quilting and in making home decor accessories. A number of samples were created in response to a set of hypothetical design scenarios, which provided the opportunity to reflect on traditional fashion and textile practices through design-driven solutions. The textile samples and the relating reflective analysis are included within the results component. There are various methods to making a zero-waste garment. I have used stitching and slashing methods to ensure zero waste and one sample made.

#### 3.1.1 MATERIAL:

In this research one fabric is used to make the sample,

- Fabric: khadi, 100% cotton (Base Fabric)
- Thread:100% cotton to sew
- M/C: single needle lock stitch machine

#### 3.1.2 METHODS:

In this study I have designed and produced a garment for women without any wastage using stitching and slashing technique depending on some points as following:

1.Firstly, garment type is intended, then make a flat pattern (12 size) according to my garments design, product: women's blazer

2.Set all the pattern on the fabric and find out the length of fabric I need to take

Fabric length -320 cm (3.5 yards) =126"

Fabric selvage - 2 cm = .8" Fabric Width -107 cm = 42.12"

#### 3.1.3 CONSUMPTION CALCULATION:

I have taken 3.5yards fabric to make the Blazer

Total consumption that I need to make the Blazer: 1.9 yards

Fabric wastage: 3.5 Yards-2.74 Yards =.76 Yards

Total consumption: .612 + .44+.612+.44+.64= 2.744 Yards

As I have taken the attempt to make the garment zero waste, so I have to add up this waste scraps into my garment.

I plan to add the scraps between two layer of garment which will add volume of the garment and give stitch on the surface to fix the fabric scraps. To boast up the surface of the garment I have add different color fabric scraps. It fulfills two purposes:

1.As I am using extra fabric between two layers of garment, it will add volume of the garment and will keep warm (body) during winter.

2.I have given stitch on the surface of the fabric and slash several parts which will add aesthetic beauty of the garment.

Also make different patterned garment where I use the scraps into very small portion of the garment and according to the application of scraps I divide its uses into two seasons.

Take two layers of fabric of each pattern where I will use the scraps, Cut the scrapes into very small pieces and distribute it evenly in the middle of two layer; stitch together all layers of fabric one on top of the other in parallel diagonal and straight lines and then cutting through the top layers leaving the base layer intact. A fluffy effect similar to the pile of velvet or chenille is created.



Fig. 13 Illustration of garment design

#### 3.1.4 TECHNIQUE:

Firstly, I illustrate the design collection having a plan where I will use the scraps.



### 3.1.5 DESIGN PROCESS STEP BY STEP



Fig. 14 Step 1



Fig. 15 Step 2

## 4 Implimentation



Fig. 16 Implimentation of stitching & slashing technique to make zero wastage garments

## 5 FINDINGS AND DISCUSSIONS

Zero waste is not new thing in fashion. A lot of investigations are done by the designers to make zero wastage garments. Most of the designers experiment on the pattern. For instance, Japanese designer Shingo Sato discovered Transformational Reconstruction to eliminate fabric waste. This technique manipulates the garment pattern in 3D not 2D. Holly McQuillan has tried different ways to overcome fabric wastage; one is using mathematical objects called fractal, which have random shapes to reduce or eliminate the waste at the edges. The other solution would be using smaller sized tessellated shape as they get close to the edges of the fabric. Carrico and Kim prefer tessellated shapes with straight edges instead of curved ones to meet the fabric width [10]. Everyone tried to reduction the wastage during pattern making, designer Mark Lui's work on last scraps of fabric to make zero wastage design. I have tried to use all the scraps of the fabric but the design technique is different. The advantage of this technique, no worries what kind of scrap will create after cutting the fabric according to pattern. The use of scraps accomplishes two purpose, one is added value and create aesthetic beauty another one is to add volume of the garment.

## 6 CONCLUSIONS

Zero wastage design approach is very important because fashion contributes to large amounts of waste, particularly as a result of the fast fashion culture. Fast fashion has accelerated consumers'

desires to follow the latest trends by increasing clothing consumption, which subsequently leads to an increase in clothing waste. To conclude, the dissertation served to sufficiently demonstrate that implementing the stitching and slashing method in the design process significantly decreases the environmental impact of a garment, alleviates social problems, develops local production, provides a solution to the problem of textile waste, and reduces the use of new material. This research demonstrates that zero-waste as a sustainable method for fashion design can be successfully applied within the fashion industry. It seems feasible and both ecologically and economically important to apply zero wastage in mass production. In this area, most of its environmental as well as social benefits could be realized. Through this project Space Between aim to encourage a shift in industry practices whilst setting up new opportunities for designers, producers and new participants. By engaging in a form of design-led fashion activism they assert that we can explore an 'integration of action into new grids, connecting practices, making new sense of the world'. Space Between proposes a new form of green entrepreneurialism, which advocates business as a way of achieving and sustaining social, environmental and financial, goals, not the opposite.

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