





Implementing of Sustainable Fashion Concepts Using Zero Waste Techniques in Garment Design with Production Fabric Waste

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Abstract. This study aims to apply the concept of sustainable fashion through zero waste pattern cutting techniques in the production of ready-to-wear clothing, focusing specifically on a hoodie blouse design. The background of this research stems from the growing problem of textile waste, largely caused by unsustainable fashion production practices. Zero waste techniques are chosen as a strategic approach to designing garment patterns that are both material-efficient and environmentally friendly, without compromising aesthetic and comfort values. The research method employed is a research and development (R&D) approach through product design experimentation. The process includes design conceptualization, zero waste pattern drafting, prototype development, and product evaluation by experts and users. The results show that the application of zero waste techniques successfully increased fabric utilization efficiency up to 98%, resulting in a product that meets the criteria of aesthetics, comfort, functionality, and sustainability. Product evaluation revealed high average scores across all assessed aspects, with the sustainability aspect reaching a score of 4.86 on a 5-point scale. These findings indicate that zero waste design is an innovative solution for environmentally conscious ready-to-wear clothing production. This research is expected to serve as a reference for designers, fashion educators, and industry practitioners in implementing sustainable fashion principles in a practical and applicable manner.

Keywords: Sustainable Fashion, Zero Waste, Garment, Hoodie Blouse, Left Over Fabric from Production.

1 Introduction

The fashion industry is one of the key creative industries that plays a significant role in both the global and national economies. The mass production of clothing particularly in the ready to wear segment has contributed substantially to job creation, economic growth, and cultural development. However, despite these contributions, the industry also poses serious challenges concerning sustainability. According to the United Nations Environment Programme (UNEP), the fashion industry is responsible for approximately 10% of global carbon emissions and is the second-largest consumer of water

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worldwide [7]. Additionally, the fast fashion model accelerates consumption patterns and leads to excessive textile waste, making the environmental footprint of the industry increasingly alarming [6].

As global clothing consumption continues to rise, the textile and garment industries have emerged as some of the largest contributors to water pollution, energy consumption, and solid waste generation worldwide. According to the Ellen MacArthur Foundation [4], the fashion industry is responsible for producing over 92 million tons of textile waste annually. A significant portion of this waste originates from the production stage, particularly from unused fabric scraps resulting from conventional pattern design methods. These inefficiencies highlight the urgent need for more sustainable approaches in garment manufacturing, especially in pattern-making practices that minimize material waste [1].

Conventional pattern making in garment design typically utilizes only about 80–85% of the fabric's surface area, leaving the remaining 15–20% as textile waste that is often difficult to recycle or repurpose. These leftover fabric scraps frequently end up in landfills, where they contribute to soil and water pollution and release microplastics as synthetic fibers degrade [8]. The situation is further exacerbated by the rise of fast fashion a business model characterized by rapid production cycles and short product lifespans designed to meet ever changing consumer demands. Fast fashion not only accelerates clothing turnover but also leads to significant material inefficiencies and increased waste generation [6].

To address these pressing issues, the concept of sustainable fashion has emerged as a new paradigm in garment production, emphasizing environmental, social, and economic responsibility. Sustainable fashion encompasses practices such as the use of eco-friendly materials, ethical production methods, carbon emission reduction, and efficient resource utilization, including waste minimization [3]. One notable innovation that supports these principles is the zero waste pattern cutting technique an approach in garment design that strategically utilizes the entire fabric surface, leaving no offcuts behind [5]. This method not only reduces textile waste but also encourages more thoughtful and intentional design processes aligned with sustainability goals.

Zero waste pattern cutting demands a high level of creativity, as designers must develop patterns that are not only materially efficient but also retain the essential elements of aesthetics, comfort, and functionality [5]. This challenge becomes even more complex in the ready-to-wear segment, which is designed for mass production based on standardized sizing systems. In such contexts, overly intricate or inefficient patterns may be difficult to implement on an industrial scale, limiting their commercial viability [2]. Therefore, research is needed to explore the practical application of zero waste techniques in ready to wear fashion. Such studies should aim to identify effective design strategies, assess potential implementation challenges, and evaluate the impact of zero waste practices on both product quality and environmental sustainability.

This research is important as it provides deeper insights into how sustainable fashion can be implemented on a larger production scale without compromising aesthetic and commercial values. Furthermore, the findings of this study are expected to serve as an inspiration for designers, industry practitioners, and consumers to collectively support sustainability within the fashion sector.

2 Method

This study adopts a qualitative approach using a product development research design. The primary objective is to design and develop a ready-to-wear fashion item by integrating sustainable fashion principles through the application of zero waste pattern cutting techniques. The research focuses not only on the creation of an environmentally responsible product but also on the assessment of its effectiveness in terms of aesthetics, functionality, and material efficiency.

By implementing zero waste strategies in pattern design, the study aims to minimize textile waste at the production stage, aligning with sustainable development goals in the fashion industry [5]. The evaluation process involves expert judgment and user feedback to determine the feasibility and performance of the product, providing empirical insights into the practical application of sustainable design in a mass production context.

The model used is a modified Research and Development (R&D) approach consisting of four main stages, namely:

Planning;

Design;

Production;

Evaluation.

The data sources in this study consist of both primary and secondary data. Primary data were obtained directly from the production process and product testing, including observations, design evaluations, and feedback from respondents. Secondary data included literature related to sustainable fashion, zero waste pattern cutting techniques, fashion design, and quality standards for ready to wear products. The population in this study comprised all users of ready to wear fashion who are concerned with sustainability and material efficiency. The sample consisted of seven respondents selected through purposive sampling, as they were considered competent to provide objective assessments of the evaluated aspects.

The evaluation instrument was a likert scale (1–5) based assessment sheet, with the following indicators :

Aesthetics. Visual appeal, design attractiveness, trend compatibility.

Comfort. Size appropriateness, ease of movement, fabric comfort.

Functionality. Easy of wear, practicality, flexibility for various activities.

Sustainability. Fabric usage efficiency, minimal waste, use of environmentally friendly materials.

The data collection techniques used in this study included observation, documentation, interviews, and questionnaires. The data were analyzed using a qualitative descriptive approach, presenting the findings from observations, interviews, and documentation in a narrative form. This analysis described the design and production process, as well as the technical challenges in applying the zero waste technique, supported by percentage formulas and average score calculations :

Percentage of Fabric Utilization Effectiveness :

$$. \text{Fabric Utilization (\%)} = \frac{\text{Used Fabric Area}}{\text{Total Fabric Area}} \times 100\%$$

Average Evaluation Score :

$$. \text{Score} = \frac{\text{Total Score}}{\text{Number of Respondents}}$$

3 Result and Discussion

This study resulted in a ready to wear fashion prototype in the form of a hoodie blouse, developed using the zero waste pattern cutting technique. The process was carried out in four main stages: planning, design, production, and product evaluation. The final product was analyzed based on fabric utilization effectiveness, aesthetic quality, comfort, functionality, and sustainability.

3.1 Planning

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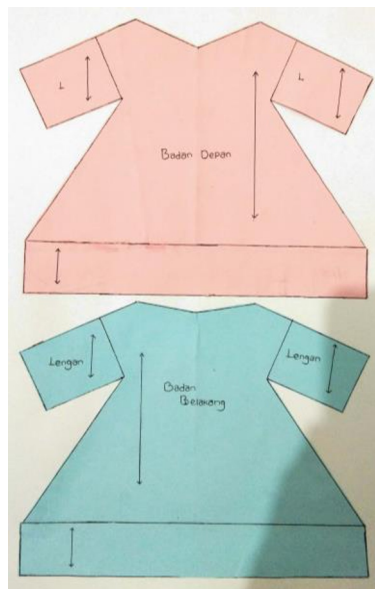


Fig. 1. Fashion Sketch Hoodie Blouse

Through literature review and observation of fashion trends, the product specifications were determined: a hoodie blouse made from maroon colored cotton fabric, designed with a minimalist, functional, and environmentally friendly theme.

3.2 Design

The hoodie blouse pattern was designed using zero waste principles, arranging the pattern pieces within a 150 cm × 250 cm fabric area without leaving any fabric waste. The pattern utilizes simple geometric shapes: rectangles for the body, triangles for the hood, and smaller pieces for the front pocket and cuffs, ensuring that the entire fabric is fully utilized.



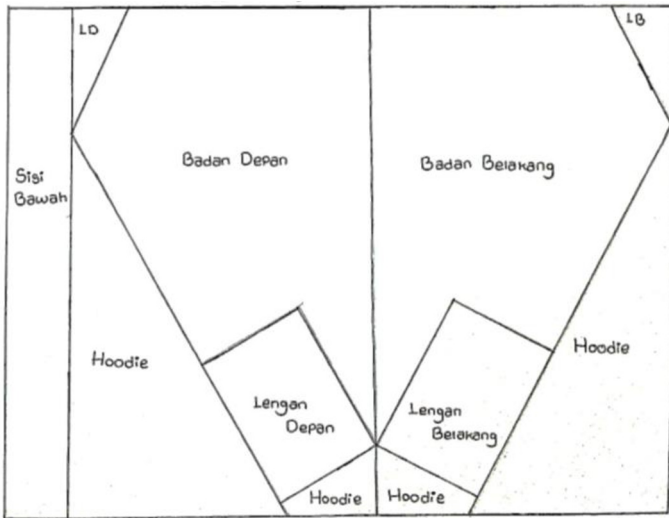


Fig. 2. Garmen Pattern

Total fabric and utilized pattern area : $150 \text{ cm} \times 250 \text{ cm} = 37.500 \text{ cm}^2$

Utilized pattern area : 36.500 cm^2

Remaining fabric waste : 750 cm^2 .

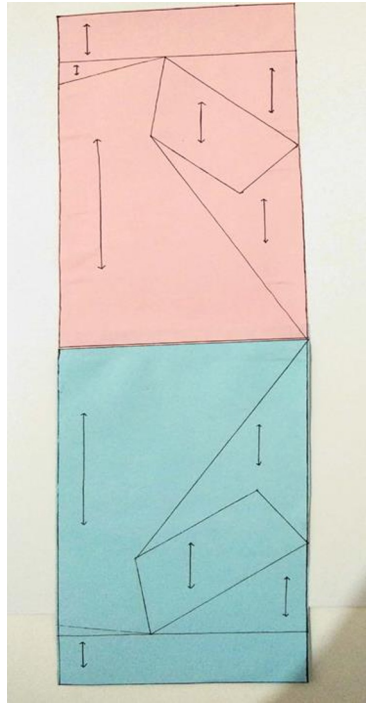


Fig. 3. Pattern Placement on Fabric

Percentage of Fabric Utilization Effectiveness :

$$\begin{aligned} \text{Fabric Utilization (\%)} &= \frac{36.500}{37.500} \times 100\% \\ &= 98\% \end{aligned}$$

Based on the pattern layout and fabric placement, there was no fabric waste produced, achieving a fabric utilization efficiency of 98%.

3.3 Production

The pattern pieces were placed on the fabric and cut accordingly. The process then proceeded to the assembly and sewing stages of the hoodie blouse, which included the following steps :

- 1 Sewing the shoulder seams;
- 2 Sewing the side seams;
- 3 Attaching the sleeves;
- 4 Sewing the hood and attaching it to the neckline;
- 5 Hemming the bottom edge;
- 6 Pressing;
- 7 Final finishing.

3.4 Evaluation



Fig. 4. Fashion Results of Hoodie Blouse

The product was evaluated by seven respondents based on 4 criterias:

Aesthetics. Visual appeal and attractiveness;

Comfort. Fit and ease of movement;

Functionality. Easy of wear and practicality; and

Sustainability. Minimal waste and environmental friendliness.

Based on the respondent's evaluations, the following data were obtained :

Table 1. Results of Product Assessment

<i>Criteria</i>	<i>Average Score (1-5)</i>
Aesthetics	4,2
Comfort	4,5
Functionality	4,3
Sustainability	4,8

4 Chapter of Discussion in Paper

The zero waste pattern cutting technique applied to the hoodie blouse successfully utilized 100% of the fabric, significantly outperforming conventional cutting methods, which typically achieve only 80–85% efficiency. The remaining 2% of fabric waste resulted from defective fabric edges that were unsuitable for use.

4.1 Aesthetics

Although zero waste patterns are often perceived as rigid, the hoodie blouse maintains an appealing and modern appearance with a proportional design that is suitable for both men and women. The geometric shape of the hood integrates harmoniously into the overall design. Respondents rated the aesthetic aspect with an average score of 4.2, indicating a strong visual appeal.

4.2 Comfort

The use of soft, lightweight, and moisture absorbing organic cotton fleece contributes to the overall comfort of the hoodie blouse, resulting in a comfort rating of 4.5. However, several respondents suggested size adjustments to better accommodate larger body types.

4.3 Functionality

Functionality was rated in the high category with a score of 4.3, as the garment is easy to wear, lightweight, and flexible for daily activities.

4.4 Sustainability

The zero waste technique significantly reduced fabric waste and optimized the utilization of all pattern pieces. Respondents gave a high score of 4.8 for the sustainability aspect, indicating strong awareness and appreciation for environmental values.

5 Conclusion

The application of the sustainable fashion concept through zero waste pattern cutting in the hoodie blouse successfully achieved sustainability goals without compromising aesthetics, comfort, or functionality. Fabric utilization effectiveness reached 98%, and the product was well received by both experts and users, offering a realistically environmentally friendly solution for ready to wear garments. Emerging challenges can be addressed through improved skills and design innovation.

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References

1. Fletcher, K. (2014). *Sustainable Fashion and Textiles: Design Journeys* 2nd ed. Routledge.
2. Gwilt, A. (2020). *A Practical Guide to Sustainable Fashion*. Bloomsbury Publishing.
3. Henninger, C. E. (2016). What is Sustainable Fashion? *Journal of Fashion Marketing and Management: An International Journal*, 20(4), 400-416. doi:<https://doi.org/10.1108/JFMM-07-2015-0052>
4. MacArthur, E. (2021). *A new textiles economy: Redesigning fashion's future*. Ellen MacArthur Foundation. Retrieved from <https://ellenmacarthurfoundation.org/a-new-textiles-economy>
5. McQuillan, R. (2023). *Zero Waste Fashion Design*. Bloomsbury Publishing.
6. Niinimäki, K. (2020). The Environmental Price of Fast Fashion. *Nature Reviews Earth and Environment*, 1(4), 189-200. doi:<https://doi.org/10.1038/s43017-020-0039-9>
7. Notten, P. (2020). *Sustainability and Circularity in The Textile Value Chain*. Global Stock-taking. Hg. v. United Nations Environment Programme, 2022.
8. Zahiragić, N. (2024). *Sustainable fashion in Bosnia and Herzegovina: Environmental and Social Responsibility*. [N. Zahiragić].

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