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Feasibility Test for Ready-To-Wear Clothing using Upcycled Denim and Tenun Bulu

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Abstract
This study aims to develop and determine the feasibility of ready-to-wear clothing made from upcycled denim and tenun bulu fabric as an implementation of the sustainable fashion concept. The study utilized the PPE (Planning, Production, and Evaluation) framework developed by Richey and Klein. The research stages included planning, production, and product evaluation. The feasibility test was conducted by three expert panelists from the fashion industry and ten trained panelists from the Fashion Design Education Study Program at Semarang State University. Data collection used an evaluation questionnaire, while data analysis was performed using quantitative descriptive methods in the form of percentages. The results of the study indicate that ready-to-wear apparel products made from upcycled denim and tenun bulu fabric achieved an average feasibility percentage of 96%, falling into the "highly feasible" category. Evaluations of each aspect showed a percentage of 96% for design, 95% for sizing, 93% for aesthetics, 98% for sewing techniques, 98% for garment performance, and 97% for uniqueness. These results indicate that the use of upcycled denim and woven tenun bulu fabric can produce ready-to-wear garments that meet quality standards and have the potential to support the development of sustainable fashion through the utilization of textile waste.

Keywords: *ready to wear; sustainable fashion; tenun bulu; upcycled denim*

INTRODUCTION

The fashion industry is one of the sectors that significantly contributes to global economic development. Mass production of clothing with short lifecycles has led to an increase in used clothing waste, including denim a material known for its strength and durability which often ends up as textile waste (Li et al., 2025). This situation has spurred the emergence of the concept of sustainable fashion, which emphasizes reducing environmental impact through the reuse of textile materials via upcycling techniques (Ferayanti et al., 2025). Sustainable fashion through the upcycling of denim waste using eco-friendly textile dyeing techniques. This situation calls for innovation in textile waste management that can support the concept of sustainable fashion. One strategy that can be implemented is upcycling the process of transforming used materials into new products with higher functional and aesthetic value.

In addition to the utilization of textile waste, Soyer and Dittrich (2021) note that the rapid growth of sustainable fashion particularly through the fast fashion model has driven increased clothing consumption and generated ever larger volumes of textile waste. This situation has led to the emergence of the concept of sustainable fashion as an effort to reduce the environmental impact of the fashion industry. One of the most widely produced and consumed materials is denim, prompting fashion designers and manufacturers to adopt upcycling techniques to minimize the environmental impact of textile waste (Tersinaningsih & Pratiwi, 2024).

The development of sustainable fashion can also be achieved through the optimization of woven fabrics as part of Indonesia's cultural heritage. Woven fabrics possess high cultural, aesthetic, and local identity value; however, their use in modern apparel remains relatively limited. The incorporation of

woven fabrics into ready-to-wear products is considered capable of enhancing market appeal while supporting the preservation of Nusantara textiles (Aini & Krisnawati, 2025). The development of ready-to-wear clothing based on woven fabrics can also increase the market value of traditional products through design approaches that better align with consumer needs (Muliadi & Soelistyowati, 2025). Based on preliminary observations of ready-to-wear fashion trends on social media platforms such as Instagram, TikTok, and Pinterest, It is evident that platforms such as TikTok and Instagram are helping to drive the popularity of sustainable fashion, thrift fashion, and upcycling through content created by creators who showcase the transformation of used clothing into new fashion products that are more valuable and appealing to young consumers (Wianuari & Chairil, 2024; Kaivonen et al., 2024).

Creators transform used jeans into skirts, patchwork jackets, corsets, bags, and various ready to wear products with more modern designs. Content showcasing the creation process receives positive feedback because it is considered creative and supports the concept of sustainable fashion. Additionally, the use of used denim is seen as capable of producing unique products because each piece of material has distinct color and texture characteristics (Amallina et al., 2024). Ready to wear clothing refers to garments produced in standard sizes and ready for immediate use without requiring special alterations. The concept of ready-to-wear emerged in response to the needs of modern society, which seeks practical, functional clothing that follows fashion trends (Novitasari & Nurmasitah, 2025). In the fashion industry, these garments hold a significant position because they can reach a broader market while maintaining aesthetic appeal and product quality.

One approach that supports the development of sustainable fashion is the upcycling technique. Upcycling is the process of reprocessing used materials into new products that have higher utility and economic value than their original forms. Unlike recycling, which generally transforms materials through industrial processes, upcycling preserves some of the material's original characteristics, thereby reducing energy and resource consumption (Amallina et al., 2024). In the fashion industry, upcycling is a key application of sustainable fashion principles because it helps reduce textile waste generated by the industry. Material selection is a crucial aspect of fashion design because it influences a product's quality, functionality, and aesthetic value. One material widely utilized in the development of sustainable fashion is denim. Denim is a cotton-based fabric characterized by its strength, durability, and stable structure. These properties make denim one of the most widely used materials in upcycling. Used denim can be transformed into various types of garments, such as jackets, skirts, and other ready-to-wear items, without losing its strength (Kencana et al., 2025).

In addition to denim, the use of traditional fabrics is also one of the efforts to develop fashion products with cultural value. One example is "bulu" woven fabric, a type of traditional Indonesian woven fabric characterized by a raised texture resembling fur on the fabric's surface. This characteristic is achieved through a technique of inserting additional threads during the weaving process, resulting in a three-dimensional effect that lends the fabric aesthetic value and visual uniqueness (Amanda et al., 2025). Bulu woven fabric serves not only as a material for clothing but also represents cultural identity, symbolic value, and traditional skills passed down through generations by local communities. In contemporary fashion, tenun bulu is not only used in traditional attire but is also combined with various other materials to create more modern and versatile ready-to-wear garments (Faza & Krisnawati, 2025).

Brocade fabric is also a material frequently used to enhance the aesthetic value of an outfit. Brocade is a type of decorative fabric featuring raised motifs created through weaving or embroidery with decorative patterns that convey a sense of luxury and elegance. Brocade is widely used as a material for formal attire, such as kebayas, evening gowns, and wedding dresses, due to its high aesthetic value and ability to enhance the character of a garment's design (Maulydya & Rahayu, 2023). With their distinct characteristics, denim, fur-woven fabric, and brocade can be combined in ready-to-wear garment design to produce products that not only possess material strength and functional value but also showcase cultural uniqueness and more appealing aesthetics.

The feasibility assessment of ready-to-wear garments generally covers aspects such as design, sizing, sewing techniques, comfort, aesthetics, and product uniqueness (Novitasari & Nurmasitah, 2025). These aspects serve as key indicators in determining the quality of a garment product, including those developed using upcycled materials. The feasibility assessment process is generally conducted through evaluations by expert or trained panelists using specific assessment instruments to determine the product's quality level before further development. Although research on the feasibility of producing ready-to-wear garments using upcycled denim techniques has been extensive, there

remains room for development in terms of material innovation and enhancing the product's aesthetic value through combinations with other textile materials. The use of used denim holds great potential due to its strength, durability, and distinctive appearance; however, design exploration is necessary to ensure that the resulting products not only possess sustainability value but also meet the feasibility standards for ready-to-wear apparel (Kencana et al., 2025).

The urgency of this research lies in the need to produce sustainable fashion innovations capable of addressing textile waste issues while simultaneously enhancing the utility of used materials into fashion products with aesthetic value. By applying denim upcycling techniques combined with brocade fabric, this study aims to create ready-to-wear garments that not only support the concept of sustainable fashion but also possess the quality and suitability required for fashion products that are acceptable to consumers. Furthermore, this research is expected to contribute to the development of fashion design with an eco-friendly approach through the utilization of materials.

METHOD

This study employs the PPE (Planning, Production, and Evaluation) framework developed by Richey and Klein. According to Richey and Klein as cited in Sugiyono (2018), the PPE framework focuses on the activities of initial analysis, planning, production, and evaluation in the product development process. The PPE development framework is a research and development approach centered on three main stages: planning, production, and evaluation. This framework was chosen because it provides a development procedure that aligns with product design research conducted through the stages of design, manufacturing, and product feasibility evaluation (Ermalena et al., 2023).

This study consists of several stages, beginning with planning, production, and evaluation. The planning stage involves the process of formulating design concepts, as well as preparing materials and production requirements. The production stage involves the realization of the concept through material processing, manufacturing, and the development of apparel products in accordance with the predetermined design. Next, the evaluation stage is conducted to assess the feasibility of the resulting product through testing based on aspects of design, materials, manufacturing techniques, and product functionality.

This study was conducted in the Fashion Design Education Program, Faculty of Engineering, Semarang State University (UNNES). The product feasibility test involved three expert panelists—the owner of Tya Chandra, the owner of Vita Collection, and the owner of Kuncoro Project—and ten trained panelists, namely students in the Fashion Design Education Program who had completed courses in tailoring and fashion design. Data collection utilized a questionnaire in the form of an evaluation sheet used to assess product quality and suitability based on predetermined indicators. The assessment data was analyzed using quantitative descriptive techniques in the form of percentages to determine the product suitability. The suitability percentage was calculated using the following formula:

$$P = \frac{f}{N} \times 100\%$$

Explanation:
P = suitability percentage
f = total score obtained
N = maximum possible score

Table 1. Assessment Percentage Categories

Percentage (%)	Wealth Category
81%–100%	Highly Eligible
61%–80%	Eligible
41%–60%	Fairly Acceptable
21%–41%	Not Acceptable
0%–20%	Very Unacceptable

Source: Sasi et al., 2025

RESULTS AND DISCUSSION

Based on the application of the PPE (Planning, Production, and Evaluation) development model, this study produced data on the development process and the level of suitability of ready-to-wear clothing using upcycled denim and woven fabric. The research results are presented based on three development stages, namely:

Planning Stage

Analysis

Concept development began with the creation of a mood board inspired by the dynamics of ocean waves, resulting in shades of dark blue, light blue, and black as the collection's visual identity. This process involved identifying the characteristics of ready-to-wear consumers and exploring materials such as used denim and woven fabric that have the potential to be transformed into fashion products. The growing public interest in eco-friendly fashion products has also driven the development of the upcycling concept as a solution to reduce textile waste. Consumers, particularly the younger generation, are beginning to consider aspects of sustainability, design uniqueness, and a product's "story value" in their purchasing decisions. This trend opens opportunities for the development of ready-to-wear clothing that utilizes used materials without compromising the product's quality or aesthetic value.

The analysis results show that the used denim came from blue jeans and snow-white jeans. These two types of denim were chosen because their characteristics complement each other. Blue jeans give a classic, casual look and are easy to pair with various materials, while snow-white denim provides a bright color accent that creates contrast and enhances the design's visual composition. In addition to having a strong, durable, and stable fabric structure, both types of denim still possess good material quality, making them suitable for being repurposed into ready-to-wear garments. The combination of used denim with tenun bulu fabric is expected to produce products that are aesthetically pleasing, functional, and innovative, while also supporting the concept of sustainable fashion through the reuse of textile waste.

Figure 1. Mood Board

Materials and Characteristics

The primary materials used are upcycled denim and tenun bulu fabric. Denim was chosen because it is strong, durable, and easily combined with various other materials, making it suitable for use in ready-to-wear garments. Tenun bulu fabric was chosen for its high cultural and aesthetic value, as well as its ability to impart a unique visual appeal to the products. The combination of these two materials creates a harmonious blend of textures, colors, and patterns that supports the design concept. Additionally, the use of used denim reflects the application of the "reduce, reuse, and recycle" principles in the fashion industry.

As a complementary material, navy-colored brocade is used to provide decorative accents while reinforcing the garment's elegant appeal. Brocade features raised patterns that add visual dimension and enrich the texture when paired with denim and woolen woven fabric. The use of brocade as an accent also serves to balance the casual feel of denim with the aesthetic value of the tenun bulu fabric, resulting in ready-to-wear garments that are both unique and functional.

Figure 2. Materials

Design Visualization

The visualization takes the form of ready-to-wear garment designs to provide a comprehensive overview of the shape, details, composition, and application of materials in the garments to be developed. The designs are based on a mood board inspired by the dynamics of ocean waves, resulting in shades of blue in various gradations combined with the textures of denim and tenun bulu fabric.

Figure 3. Fashion Design

Figure 4. Production Design 1

Figure 5. Production Design 2

The garment design consists of two main parts: the top and the bottom. The top is a sleeveless cropped vest with a semi-fitted silhouette that follows the wearer's body shape. The front of the top features a square neckline, giving it a modern and simple look. Light blue denim is used for the main body, while the center panel uses darker denim to create a harmonious visual contrast. It is complemented by a short jacket designed to look modern, practical, and easy to pair with various types of bottoms. The jacket's length, which ends right at the waistline, helps create more balanced body proportions while highlighting the details of the skirt. The sleeves are designed to reach the elbows, ensuring comfort during daily activities. The relatively short sleeve length also reinforces the practical nature of this ready-to-wear piece.

The bottom piece is a straight-silhouette midi skirt designed for comfort. The skirt uses upcycled blue jeans as its main material, incorporating construction details derived from jeans—such as stitching lines and pocket details. The use of these elements aims to preserve denim's identity as the primary material while enhancing the aesthetic value of the upcycled product. At the bottom of the skirt, a dark blue patterned woven fabric is added and shaped into a ruffle accent. This detail serves as a focal point of the design, creating a dynamic impression and adding decorative value to the garment.

Production Stage

Garment Pattern Making

The pattern-making stage serves as the foundation for realizing the garment design. Patterns are created using standard adult women's sizes, taking into account the characteristics of the designed garment. This process involves creating a base pattern and developing it into a cropped vest pattern with a square neckline and cut lines for each section. The jacket pattern uses a princess-seam cut that cuts across the armholes, features a notch lapel collar, and incorporates short sleeves. The skirt pattern is created by converting a pair of jeans into a skirt and adding ruffles. The resulting patterns are then evaluated to ensure proper sizing, design proportions, and material requirements, thereby facilitating a smooth fabric-cutting and garment-assembly process in the subsequent production stages.

Figure 6. Garment Patterns

Fabric Cutting

Fabric cutting is a production stage carried out after the garment pattern has been completed and laid out on the fabric. The pattern is then positioned on the fabric surface, taking into account the grain direction, pattern continuity, and optimal use of material. Cutting is performed by accurately following the pattern lines to produce each garment component according to the designed size and shape. At this stage, sewing marks are also applied to serve as a guide during the construction and assembly of garment parts, thereby ensuring the accuracy of the final product.

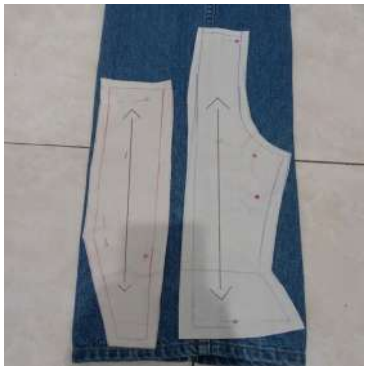

Figure 7. Fabric Cutting

Sewing Process

This process begins with joining the main parts of the garment—both the top and bottom—and is followed by attaching various construction details according to the design plan. For the top, the sewing process involves joining the front and back panels, attaching the notch lapel collar, sleeves, and facings to refine the garment's structure. Meanwhile, for the skirt, the denim is cut, and a brocade fabric accent is incorporated at the bottom of the skirt as a decorative element. The sewing techniques used are adapted to the characteristics of upcycled denim and woven fabric to produce a strong, neat, and comfortable construction. Checks are performed on the accuracy of measurements, the balance of the shape, and the alignment of the stitching with the planned design to ensure product quality.

Figure 8. Joining garment pieces

Finishing

The finishing stage is the final phase in the garment production process, aimed at refining product quality before a feasibility assessment is conducted. Processes carried out at this stage include trimming excess thread, inspecting the neatness and strength of seams, attaching supporting

accessories, and ironing to shape the garment's silhouette according to the designed pattern. In addition, a thorough check is conducted on the aesthetics, construction, functionality, and comfort, as well as any design discrepancies. Through this stage, ready-to-wear garments made from upcycled denim and woven fabrics are produced garments that are of good quality, ready for use, and suitable for the product evaluation stage.

Figure 9. Final garment

Evaluation Stage

The evaluation stage is conducted to determine the level of suitability of the developed ready-to-wear garments. The assessment covers six aspects: design, sizing, aesthetics, sewing techniques, garment performance, and product uniqueness. Based on the assessment results, all aspects were categorized as "highly suitable." The assessment instrument used the Guttman scale with two response options: "Yes" and "No." The assessment results were then converted to a 1–5 ordinal scale to interpret the product's suitability level, ranging from the "Highly Unsuitable" category to "Highly Suitable." The suitability category was determined based on the cumulative number of "Yes" responses for each indicator, where the highest score was converted to a value of 5 ("Highly Suitable") and other scores followed the predetermined category intervals.

Table 2. Product Feasibility Test Results

Research Aspects	Score Obtained	Maximum Score	Percentage	Criteria
Design	311	325	96%	Highly Recommended
Size	309	325	95%	Very Good
Aesthetics	303	325	93%	Very Good
Sewing Techniques	319	325	98%	Highly Recommended
Fashion Performance	318	325	98%	Very Good
Uniqueness	316	325	97%	Highly Recommended
Average Total	1,876	1,950	96%	Highly Acceptable

The data in the table shows the results of the feasibility test conducted by three expert panelists from the fashion industry and ten trained panelists from the Fashion Design Education program, with an average score of 96%. This indicates that this work objectively falls into the "Highly Feasible" category.

Design Aspects (96%)

The design aspect received a score of 96% and falls into the "Highly Acceptable" category. These results indicate that the developed ready-to-wear fashion designs have met the principles of fashion design, such as harmony, balance, proportion, focal point, and unity. The use of upcycled denim combined with woven fabric produces a unique design with high aesthetic value without compromising the garment's functionality.These findings align with research by Rosidah and Suhartini (2021), who state that upcycled clothing designs—as a form of sustainable fashion—must consider elements such as color, center of interest, and harmony to produce products with high aesthetic value and strong appeal. Furthermore, research by Nabil and Suhartini (2019) indicates that applying design principles to upcycled denim products results in a "very good" rating and serves as a key factor in product quality assessment.

Size Aspect (95%)

The sizing aspect received a score of 95% and was categorized as "very satisfactory." This indicates that the sizes of the garments developed align with the body size standards of the target users, thereby ensuring comfort when worn and enhancing the overall appearance of the garments. This aligns with the research by Dewi and Karyaningrum (2018), which states that proper sizing is a key indicator in determining the quality of finished garments. Accurate sizing affects the shape, balance, and comfort of the garment when worn.

Aesthetic Aspect (93%)

The aesthetic aspect received a score of 93% and falls into the "very satisfactory" category. This score indicates that the combination of colors, the textures of denim and woven fabric, the silhouette, and the decorative details applied to the garments successfully create an attractive and harmonious appearance. This aligns with the research by Aprianto et al. (2024), which states that the aesthetic evaluation of garments is influenced by aspects of form or appearance, content, and presentation that collectively create the overall beauty of the product. Additionally, the study by Rosidah and Suhartini (2021) also explains that aesthetic value in upcycled design is one of the primary indicators of the success of sustainable fashion products.

Sewing Technique Aspect (98%)

The sewing technique aspect received a score of 98% and was one of the aspects with the highest scores. This indicates that the process of joining garment components, the neatness of the stitches, the strength of the seams, and the finishing were all executed exceptionally well. Research by Dewi and Yulistiana (2023) explains that the quality of craftsmanship in upcycled denim products significantly determines the final product quality, particularly in the selection of sewing techniques and the application of decorative details to produce a neat and durable texture. Research on the use of recycled jeans also states that proper cutting and sewing techniques influence the strength and quality of the resulting garments.

Garment Performance Aspect (98%)

The garment performance aspect received a score of 98% and falls into the "highly satisfactory" category. This result indicates that the garments function well, are comfortable to wear, are easy to put on, and effectively showcase the design's character in line with the ready-to-wear concept. According to Putri's (2018) research, the final garment is a key indicator in assessing the success of upcycled products because it demonstrates the integration of function, comfort, and visual appeal. Research on the creation of high-quality garments from textile waste using mixed-media techniques also explains that product performance serves as an indicator of success in creating sustainable fashion products suitable for reuse by consumers.

The uniqueness aspect received a score of 97% and falls into the "highly satisfactory" category. This indicates that the combination of upcycled denim and woven fabric produces garments with distinctive characteristics that set them apart from conventional apparel. This aligns with the research by Fitri et al. (2021), which states that modifying secondhand clothing through upcycling techniques produces products with unique patterns, high quality, and production viability. The study shows that creativity in processing used materials can enhance aesthetic value and create fashion products with their own distinctive characteristics.

CONCLUSION

Based on the results of the research and development conducted, it can be concluded that the development of ready-to-wear clothing using upcycled denim and woven fabric was successfully carried out through the three stages of the PPE model: planning, production, and evaluation. The planning stage involved needs analysis, design concept determination, and the selection of materials that support the concept of sustainable fashion. The production stage involved pattern-making, fabric cutting, sewing, and finishing the products to produce garments that matched the established designs. Subsequently, the evaluation stage was conducted to determine the products' suitability based on design, sizing, aesthetics, sewing techniques, garment performance, and uniqueness. The feasibility test results show that the ready-to-wear garments made from upcycled denim and tenun bulu fabric achieved an average score of 96%, falling into the "highly feasible" category. The scores for each aspect

were as follows: design 96%, sizing 95%, aesthetics 93%, sewing techniques 98%, garment performance 98%, and uniqueness 97%. These results indicate that the developed products meet the feasibility criteria for ready-to-wear garments and possess aesthetic, functional, and innovative value. This study contributes to the development of sustainable fashion products through the utilization of denim waste and the optimization of tenun bulu fabric as a material with cultural value. Therefore, the development of similar products can continue by exploring other designs, construction techniques, and material combinations to produce a wider variety of fashion innovations and support the implementation of the sustainable fashion concept.

DECLARATION OF GENERATIVE AI

The authors declare that no generative AI or AI-assisted technologies were used in the writing process of this manuscript.

CONFLICTING INTEREST STATEMENT

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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