Sustainable Fashion Principle-Based Multifunctional Clothing

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Abstract. The rapid growth of the fashion industry has intensified environmental pressures, including excessive textile waste, high resource consumption, and increasing carbon emissions. In response, sustainable fashion has emerged as an approach that emphasizes efficiency, long-lasting use, and reduced environmental impact. This study examines multifunctional clothing design as an environmentally responsible strategy aligned with the Sustainable Development Goals (SDG 12), particularly responsible consumption and production. Multifunctional clothing enables users to wear a single garment in multiple contexts, thereby reducing clothing accumulation, minimizing textile waste, and extending product lifespan. Using a quantitative evaluative method, four multifunctional blouse designs were assessed by expert panelists against product quality and sustainability indicators. Results show consistently high scores across all sub-indicators, indicating that multifunctional clothing effectively integrates functional adaptability, aesthetic value, and sustainability principles. This research strengthens the argument that multifunctional design contributes to environmental conservation efforts, promotes resource efficiency, and supports the transition toward circular fashion systems..

1 Introduction

The global fashion industry contributes significantly to environmental degradation through high material consumption, rapid turnover of trends, and extensive textile waste generation. According to the Ellen MacArthur Foundation, the fashion sector produces 92 million tons of textile waste annually, with most items being discarded far before the end of their potential lifespan. This challenge calls for sustainable innovations in design and production.

Recent developments in sustainable fashion underscore the importance of creating long-lasting, resource-efficient garments through environmentally responsible practices [1,2]. Multifunctional clothing garments designed with transformable, adaptable, or modular features represents a promising innovation that simultaneously meets user needs and reduces environmental impact. By enabling a single piece to serve multiple functions, multifunctional clothing supports reduced consumption while encouraging eco-conscious behavior.

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For career women and individuals with high mobility, multifunctional clothing offers practical value by accommodating professional, semiformal, and casual contexts without requiring multiple outfits. This adaptability directly corresponds with sustainability principles by minimizing wardrobe redundancy [3]. Within the framework of SDG 12, such solutions are highly relevant for advancing responsible consumption patterns and promoting circular fashion systems [4].

This research addresses a gap in the literature by evaluating multifunctional fashion design from both aesthetic and ecological perspectives, emphasizing its role in mitigating fashion-related environmental impacts.

2 Literature Review

2.1 Sustainable Fashion and Environmental Impact

Sustainable fashion involves ethical and ecological considerations across a garment's lifecycle from material sourcing to production, use, and end-of-life processes. Core principles include reducing waste, minimizing environmental pollution, and designing products with extended longevity [5]. The textile industry remains one of the largest polluters due to water intensive production, chemical usage, and inadequate waste management. Circular fashion models propose extending a garment's lifecycle through durability, repairability, and multifunctionality [6]. These strategies aim to reduce virgin material consumption and slow the rate of textile disposal.

2.2 Multifunctional Clothing as a Sustainable Solution

Multifunctional clothing comprises garments that can be adapted, transformed, or reconfigured to serve diverse functions, contexts, or aesthetics. Prior studies highlight that multifunctional apparel reduces consumption frequency and supports environmental conservation by maximizing utility per item [7]. Examples include reversible clothing, transformable silhouettes, and modular components.

2.3 Design for Longevity and Circular Economy

Designing for longevity entails prioritizing durability, timelessness, and multifunctionality. These approaches align with circular economy principles by keeping products in use for longer periods, delaying disposal, and reducing demand for new garments [8]. Multifunctional clothing inherently supports circularity by increasing wear frequency per item, thus mitigating the fast fashion cycle.

3 Methods

This study employed a quantitative evaluative method to assess multifunctional clothing designs based on two core indicators: product quality and sustainability, both aligned with sustainable fashion and circular design principles. Five expert panellists evaluated four multifunctional blouse designs using structured assessment criteria covering features, conformance quality, style, customization, durability, resource efficiency, and design longevity. These indicators directly connect to environmental impacts by assessing the potential of each design to reduce consumption, extend lifecycle, and optimize resource use.

a) Product Quality

This indicator included technical and functional characteristics of products, with the following four sub-indicators.

1. Features
   Assessing the implementation of multifunctional elements in the design which made a product have double or multiple functions.
2. Conformance Quality
   Measuring the degree to which multifunctional clothing products fulfil high-quality standards in accordance with predetermined criteria.
3. Style
   Evaluating the visual and aesthetic appeals of the design and determining if it suited market demands.
4. Customization
   Identifying the product capacity of meeting individual needs.

b) Sustainability

A product design also considered sustainable fashion principles, which encompassed three primary sub-indicators, as follows:

1. Durability
   Products were designed for long-term use through the selection of high-quality materials and potent construction techniques to lessen purchase frequency and mitigate textile waste.
2. Resource Efficiency
   Multifunctional fashion allowed consumers to wear one piece of clothing in a variety of contexts, reducing the need for a new additional one. Modular and convertible clothing designs enabled their wearers to change their look without changing their entire attire, thus helping them attain resource efficiency.
3. Design for Longevity
   A particular design was focused on a timeless style of clothing, employing a modest silhouette, neutral colors, such as black, and flexible elements to ensure continued relevance across fashion trends.

Overall, this design approach not only underlined functional and aesthetic aspects but also reflected the commitment to environmental sustainability. The goals were integrated into the design process, creating high-value products while also nurturing ecological responsibilities.

4 Results and Discussion

The process of designing our multifunctional blouse products began with determining the concept and exploring sources for gaining inspiration. The key inspiration was **the primrose flower**, widely recognized as a symbol of gentleness, motherhood, and femininity, constituting relevant values with the characters of modern women, specifically working mothers who endeavored to appear graceful and expressive in many different situations. The selected clothing style was **feminine casual**, with simple silhouettes yet incorporating elegant feminine elements. Additionally, the chosen look was **coquette**, identified by details, e.g., **ribbons** or other decorative elements, which elevated a sweet and romantic impression.

This research developed **four main designs** (Fig. 1), all in black and congruent with current fashion trends, as well as embodying modular and multifunctional concepts.

Fig. 1. Multifunctional Clothing Transformation

Descriptive Analysis of Data on Multifunctional Blouse Products

a) Based on the Product Quality Indicator

Product quality based on differentiation refers to distinctively differentiated products which can provide a significant competitive advantage. This can be realized by creating unique characteristics which set the products apart from their competitors. In this study, product quality was assessed by features, conformance quality, style, and customization.

1. Features

Features reflect product function enhancement through the addition of elements which improve product utility and appeal among consumers. Features are developed to complement the basic functions of clothing while maintaining aesthetic and comfort aspects.

Table 1. Evaluation Results of Multifunctional Product Design

No	Statement	Design 1	Design 2	Design 3	Design 4	Total Score
1	This product is designed with multifunctional features that allow it to be used in more than one form or fashion style.	19	17	18	20	74
2	The product has multifunctional features that allow users to style it in various ways according to their personal preferences and different occasions.	17	18	18	18	71
3	This product is designed with multifunctional features that make it easier for users to adjust their fashion style, both for formal and casual use,	17	18	19	19	73

	and it can be worn by all ages and genders.					
Total Design Score		**53**	**53**	**55**	**57**	**218**
Overall Total						**218**

Category = Weight Score × Number of Panelists × Number of Designs × Number of Statements
Very Good = 4 × 5 × 4 × 3 = 240
Very Good score = 240 / 240 ×100 = 100
Good = 3 × 5 × 4 × 3 = 180
Good score = 180 / 240 × 100 = 75
Poor = 2 × 5 × 4 × 3 = 120
Poor score = 120 / 240 × 100 = 50
Very Poor = 1 × 5 × 4 × 3 = 60
Very Poor score = 60 / 240 × 100 = 25
Sub-indicator score = 218 / 240 × 100 = 90.8

Table 2. Product Quality Assessment Scale

Scale (Score Range)	Category
0 – 25	Very Poor
26 – 50	Poor
51 – 75	Good
76 – 100	Very Good
Result: 90.8	**Very Good**

2. Conformance Quality

Conformance quality refers to the extent to which a product satisfies predetermined specifications and standards. In this research, conformance quality refers to the capacity of multifunctional clothing products to fulfill the predefined criteria, both as **clothing products in general and as multifunctional ones** designed with additional functions following the formulated concepts.

Table 3. Evaluation Results of Multifunctional Product Design

No	Statement	Design 1	Design 2	Design 3	Design 4	Total Score
1	This product is designed with multifunctional features that allow it to be used in more than one form or clothing style. The product has additional practical features such as sleeve variations, collar, and skirt that help facilitate user convenience.	17	18	19	19	73
Total Design Score		**17**	**18**	**19**	**19**	**73**
Overall Total						**73**

Category = Weight Score × Number of Panelists × Number of Designs ×

	Number of Statements
Very Good	= 4 × 5 × 4 × 1 = 80
Very Good score	= 80 / 80 × 100 = 100
Good	= 3 × 5 × 4 × 1 = 60
Good score	= 60 / 80 × 100 = 75
Poor	= 2 × 5 × 4 × 1 = 40
Poor score	= 40 / 80 × 100 = 50
Very Poor	= 1 × 5 × 4 × 1 = 20
Very Poor score	= 20 / 80 × 100 = 25
Sub-indicator score	= 73 / 80 × 100 = 91.25

Table 4. Product Quality Assessment Scale

Scale (Score Range)	Category (English)
0 – 25	Very Poor
26 – 50	Poor
51 – 75	Good
76 – 100	Very Good
Result: 91.2	**Very Good**

Description:
Referring to the previous table, our **multifunctional clothing** products exhibited a positive result in the **conformance quality** sub-indicator. All designs were thus declared to fulfil the predefined specifications and criteria, both as **clothing** in general and **multifunctional products** set to be adaptive when dealing with various situations.

3. Customization

Customization refers to the ability of a product to respond to consumer needs and preferences, specifically through features which allow for personalization or individual customization. In this research context, customization in question is how **multifunctional clothing** is designed in order to suit **a range of situations and personal style of the user**, enabling them to express their identity and adjust their appearance consistent with the demands of different activities without the need for changing their entire outfit.

Table 5. Evaluation Results of Multifunctional Blouse Product Design

No	Statement	Design 1	Design 2	Design 3	Design 4	Total Score
1	The neatness of the stitching on the multifunctional blouse product.	20	19	17	19	75
2	The product has a trendy appearance.	19	18	18	19	74
3	The suitability of the style of the multifunctional blouse product with the 2024/2025 Trend Forecasting.	17	18	18	19	74
Total Design Score		**56**	**55**	**53**	**57**	**221**
Overall Total						**221**

Category	= Weight Score × Number of Panelists × Number of Designs × Number of Statements	
Very Good	= 4 × 5 × 4 × 3	= 240
Very Good score	= 240 / 240 × 100	= 100
Good	= 3 × 5 × 4 × 3	= 180
Good score	= 180 / 240 × 100	= 75
Poor	= 2 × 5 × 4 × 3	= 120
Poor score	= 120 / 240 × 100	= 50
Very Poor	= 1 × 5 × 4 × 3	= 60
Very Poor score	= 60 / 240 × 100	= 25
Sub-indicator score	= 221 / 240 × 100	= 92

Table 6. Product Quality Assessment Scale

Scale (Score Range)	Category (English)
0 – 25	Very Poor
26 – 50	Poor
51 – 75	Good
76 – 100	Very Good
Result: 92	**Very Good**

Description:
Referring to the previous table, our **multifunctional blouse** products scored **92** in the **customization** sub-indicator. All designs were hence evaluated as capable of providing flexibility in use and adjusting the appearance following individual needs and preferences.

b) Based on the Sustainability Indicator

Sustainability in our **multifunctional blouse** designs was assessed through three key sub-indicators. To begin with, in terms of durability, the blouses were designed for long-term use, thereby reducing the frequency of new clothing purchases. Additionally, **resource efficiency** was reflected by the functionality of the blouses, which could be worn in diverse situations and styles, enabling users to be cost-efficient and reducing excessive consumption. Finally, **design for longevity** was supported by the selected color, i.e., black, and a minimalist design renowned for its timelessness, helping the products remain in line with fashion trends over an extended period. With this approach, our blouses embraced functionality and aesthetic characteristics and were favorable for those concurring with more eco-friendly lifestyles.

1. Durability

Durability is considered pivotal in sustainability principles. In fashion design contexts, durability refers to a product's ability in relation to long-term use without damage or loss of function. Our multifunctional blouses, designed with high-quality materials and strong construction, will have an extended lifespan, hence **reducing the frequency of new clothing**

purchases and **minimizing textile waste**. In other words, by wearing the blouses, consumers can contribute to a sustainable lifestyle through durable and efficient clothing selection.

Table 7. Evaluation Results of Multifunctional Blouse Product Design (Durability)

No	Statement	Design 1	Design 2	Design 3	Design 4	Total Score
1	The selection of materials is appropriate and not easily damaged.	19	17	18	19	73
2	The multifunctional blouse product can be worn repeatedly in various styles.	18	19	17	18	72
3	The multifunctional blouse product can be used from time to time using a single product.	19	17	18	19	73
Total Design Score		**56**	**53**	**53**	**56**	**218**
Overall Total						**218**

Category = Weight Score × Number of Panelists × Number of Designs × Number of Statements
Very Good = 4 × 5 × 4 × 3 = 240
Very Good score = 240 / 240 × 100 = 100
Good = 3 × 5 × 4 × 3 = 180
Good score = 180 / 240 × 100 = 75
Poor = 2 × 5 × 4 × 3 = 120
Poor score = 120 / 240 × 100 = 50
Very Poor = 1 × 5 × 4 × 3 = 60
Very Poor score = 60 / 240 × 100 = 25
Sub-indicator score = 218 / 240 × 100 = 90.8

Table 8. Product Quality Assessment Scale (Durability)

Scale (Score Range)	Category (English)
0 – 25	Very Poor
26 – 50	Poor
51 – 75	Good
76 – 100	Very Good
Result: 90.8	**Very Good**

Description:
As indicated by the evaluation results, our multifunctional clothing products scored 90.8 in the durability sub-indicator, attesting to good and strong construction and readiness for long-term use.

2. Resource Efficiency

Resource efficiency is one of the sub-indicators of sustainability reflected in our multifunctional blouse designs through detachable components and transformable forms, such as modular sleeves and skirt-converted trousers. These designs enabled users to wear one clothing piece product for many different style purposes and various activities, including formal, semiformal, and leisure, without the need for adding additional clothing. Accordingly, wearing these designs supports space efficiency, reduces excessive clothing

consumption, and complies with slow fashion principles, which give primacy to longer and flexible use of clothing.

Table 9. Evaluation Results of Multifunctional Blouse Product Design (Effciency)

No	Statement	Design 1	Design 2	Design 3	Design 4	Total Score
1	The multifunctional blouse product can adjust its appearance simply by changing the style of wear.	20	20	20	20	80
2	The multifunctional blouse product can be used for various occasions without needing other clothing.	19	17	19	19	74
Total Design Score		**39**	**37**	**39**	**39**	**154**
Overall Total						**154**

Category = Weight Score × Number of Panelists × Number of Designs × Number of Statements
Very Good = 4 × 5 × 4 × 2 = 160
Very Good score = 160 / 160 × 100 = 100
Good = 3 × 5 × 4 × 2 = 120
Good score =120 / 160 × 100 = 75
Poor = 2 × 5 × 4 × 2 = 80
Poor score = 80 / 160 × 100 = 50
Very Poor = 1 × 5 × 4 × 2 = 40
Very Poor score = 40 / 160 × 100 = 25
Sub-indicator score = 146 / 160 × 100 = 91.2

Table 10. Product Quality Assessment Scale (Efficiency)

Scale (Score Range)	Category
0 – 25	Very Poor
26 – 50	Poor
51 – 75	Good
76 – 100	Very Good
Result: 91.2	**Very Good**

Description:
Our multifunctional blouse products scored 91.2 in the resource efficiency sub-indicator, suggesting that all designs were wearable in diverse contexts, e.g., formal, semiformal, and casual, thereby eliminating the necessity of changing outfits for users.

3. Design for Longevity

Design for longevity is the sub-indicator of sustainability, which emphasizes the necessity for creating products which remain usable and desirable over an extended period, without being easily influenced by short-lived trends. Related to our multifunctional blouses, design for longevity was achieved through the use of black color, which was considered neutral and timeless, and minimalist design styles, which resisted obsolescence from shifting fashion trends. Besides, modular features, including detachable sleeves, flexible decorative ornaments, and convertible trousers to a skirt, promote long-term functionality of the

clothing. These blouse designs helped users continuously modify their appearance as needed in order to make the blouses remain relevant and wearable for a longer period, encouraging repeated and sustained use and contributing to the reduction of excessive fashion consumption.

Table 11. Evaluation of Multifunctional Blouse Product Design (longevity)

No.	Statement	Design 1	Design 2	Design 3	Design 4	Total Score
1.	The multifunctional blouse product design is not outdated.	18	16	18	19	71
2.	The multifunctional blouse product model is timeless and suitable to be worn anytime and anywhere.	18	18	19	19	74
Total Design Scores		**36**	**34**	**37**	**38**	**145**
Overall Total						**145**

Category = Weight Score × Number of Panelists × Number of Designs × Number of Statements
Very Good = 4 × 5 × 4 × 2 = 160
Very Good score = 160 / 160 × 100 = 100
Good = 3 × 5 × 4 × 2 = 120
Good score = 120 / 160 × 100 = 75
Poor = 2 × 5 × 4 × 2 = 80
Poor score = 80 / 160 × 100 = 50
Very Poor = 1 × 5 × 4 × 2 = 40
Very Poor score = 40 / 160 × 100 = 25
Sub-indicator score = 145 / 160 × 100 = 90.6

Table 12. Product Design Evaluation Scale (longvity)

Score Range	Category
0 – 25	Very Poor
26 – 50	Poor
51 – 75	Good
76 – 100	Very Good
Score Obtained	**90.6**

Description:
As demonstrated by the evaluation results, our multifunctional blouse products scored 90.6 in the design for longevity sub-indicator. This score exhibited that the blouse designs were considered high potential for remaining relevant and desirable in the long term.

5 Conclusion

This study demonstrates that multifunctional clothing grounded in sustainable fashion principles offers a practical and impactful solution for reducing textile waste and supporting environmentally responsible consumption. High evaluation scores across product quality and sustainability indicators confirm that the designs successfully integrate functionality, aesthetic appeal, and ecological responsibility.

By fostering resource efficiency, longevity, and multifunctional adaptability, such designs align with SDG 12 and support the transition toward circular fashion systems. The

findings reinforce the potential of multifunctional clothing as a strategic innovation in reducing environmental pressure from the fashion industry.

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