TEKSTİL VE MÜHENDİS

(Journal of Textiles and Engineer)

http://www.tekstilvemuhendis.org.tr

ZERO WASTE AND MODULAR FASHION DESIGN: A SUGGESTED COLLECTION

SIFIR ATIK VE MODÜLER MODA TASARIMI: BİR KOLEKSİYON ÖNERİSİ

Esra ENES*[1]
Başak Boğday SAYGILI[2]

[1]Tarsus Üniversitesi, Meslek Yüksekokulu, Moda Tasarım Böl., Tarsus, Türkiye
[2]İstanbul Bilgi Üniversitesi, Uygulamalı Bil. Fak., Tekstil ve Moda Tasarımı Böl., İstanbul Türkiye

Online Erişime Açıldığı Tarih (Available online):30 Eylül 2023 (30 September 2023)

Bu makaleye atıf yapmak için (To cite this article):

Esra ENES, Başak Boğday SAYGILI (2023): Zero Waste And Modular Fashion Design: A Suggested Collection, Tekstil ve Mühendis, 30: 131, 180- 191.

For online version of the article: https://doi.org/10.7216/teksmuh.teksmuh.1262844

Araştırma Makalesi / Research Article

ZERO WASTE AND MODULAR FASHION DESIGN: A SUGGESTED COLLECTION

Esra ENES[*1]
Başak Boğday SAYGILI[2]

Tarsus Üniversitesi, Meslek Yüksekokulu, Moda Tasarım Böl., Tarsus, Türkiye
İstanbul Bilgi Üniversitesi, Uygulamalı Bil. Fak., Tekstil ve Moda Tasarımı Böl., İstanbul Türkiye

Gönderilme Tarihi / Received: 09.03.2023
Kabul Tarihi / Accepted: 07.09.2023

ABSTRACT: Zero waste fashion design is a way and at the end of the pattern designing process occurs no cut-and-sew waste. Modular fashion design is a process in that one garment can have the appearance of different designs which can be modified by the consumer. The zero waste fashion design and modular fashion design are considered together as a multiple design methodology to supply sustainable fashion production. Although both design techniques are completely unique, the common aim of sustainability design results can be reached through the combination of the two. In this study, a collection was designed by integrating these two design methodologies: zero waste and modular fashion. If consumers have an active role in the sustainable design process, the responsibility for sustainable fashion design falls partially on them. The consumer is one of the three pillars of sustainable design philosophy, so they have a major role in helping create a balance on the sustainable fashion production and a sustainable fashion market. Thanks to this harmony, the design process should consider consumer-centered design options and consumer demands. In this study, an experimental development practicing method via modular and zero waste fashion design methods were used to create a suggested collection. At the end of this study, three garments were designed for that suggested collection, and each can be worn in three or four different looks.

Keywords: Zero waste fashion, modular design, sustainable fashion, modularity

SIFIR ATIK VE MODÜLER MODA TASARIMI: BİR KOLEKSİYON ÖNERİSİ

ÖZ: Sıfır atık moda tasarımı, bir yöntem olarak kabul edilir ve pastal planı tasarım sürecinin sonunda hiç kumaş atığı oluşturmaz. Modüler moda tasarımı ise bir giysiye birden farklı tasarımların görünümünü kazandırma sürecidir ve bu tasarımlar tüketici tarafından değiştirilebilmektedir. Sıfır atık moda tasarımı ve modüler moda tasarımı, sürdürülebilir moda üretimini sağlamak için çoklu bir tasarım metodolojisi olarak bir arada ele alınmaktadır. Her iki tasarım tekniği tamamen farklı olmalarına rağmen, ikisinin birleşmesiyle ortak amaçları olan sürdürülebilir tasarım sonuçlarına ulaşılabilmektedir. Bu çalışmada, sıfır atık ve modüler moda tasarım, bu iki farklı tasarım metodolojisinin entegre edilmesi ile bir koleksiyon tasarlanmıştır. Tüketici, sürdürülebilir tasarım sürecinde aktif rol aldığı sürece, sürdürülebilir moda tasarımının sorumluluğu tüketici açısından önem kazanmaktadır. Tüketici, sürdürülebilir tasarım felsefesinin üç ayağından biridir ve bu nedenle sürdürülebilir moda üretimi ve sürdürülebilir moda tüketimi arasında bir denge oluşturmak için önemli bir role sahiptir. Bu uyum sayesinde, tasarım süreci, tüketici merkezi tasarım seçenekleri ile tüketici taleplerini dikkate alınmalıdır. Bu çalışmada deneysel geliştirme uygulama yöntemi aracılığı ile modüler ve sıfır atık moda tasarımı yöntemleri bir koleksiyon önerisi oluşturmak için kullanılmıştır. Bu çalışmanın sonucunda, önerilen koleksiyon için üç farklı giysi tasarlanmış ve bu giysiler üç veya dört farklı görünümde giyilebilmektedir.

Anahtar Kelimeler: Sıfır atık moda, modüler tasarım, sürdürülebilir moda, modülerlik

Sorumlu Yazarlar/Corresponding Author: *esraenes@tarsus.edu.tr*
DOI: https://doi.org/10.7216/teksmuh.teksmuh.1262844 *www.tekstilvemuhendis.org.tr*

1. INTRODUCTION

The fashion industry is considered, along with the oil industry, as one of the most responsible for global warming. This is related to the environmental destruction caused by the overexploitation of natural resources [1]. The fashion industry's uncontrollable production and consumption cycle have led to a waste problem, making it one of the most harmful industries to both human beings and the natural environment [2]. Sustainable fashion design methods naturally affect the environment, people, and economy. The three pillars of sustainability [3], while ensuring a more balanced and responsible future for all. Sustainable fashion aims to minimize ecological impact, foster social equity, and support economic resilience.

The philosophy of sustainable design aims to design while considering the reduction of negative effects on the natural environment [4]. According to waste management strategies for natural resources, sustainable development is achieved by avoiding the production of waste altogether [5],[6]. So, creating a sustainable design and finding a solution to waste before it becomes a problem is possible by zero waste fashion design method [7]. Approximately half of the cost of a garment is fabric and 10-15% of this fabric turns into cut-and-sew waste [8], [9],[10]. That range can be 68.5% to 87.6% depending on the fabric pattern and width [11]. Given that this rate pertains to conventional mass fashion production, the issue of cut-and-sew waste becomes more significant. The zero-waste fashion design method offers a solution by avoiding waste rather than filling the planet with cut-and-sew waste [12]. Therefore, the objective of designing a garment can be attained by utilizing the entire fabric through the zero-waste fashion design method, not only conserving raw materials but also benefiting the environment [13], [14]. Zero waste fashion design is a design process begun with fabric width information and by progressing unpredictable shapes and fitting all gaps by setting block patterns on the whole fabric. This is a spontaneous process and should be improved on the marker plan making process not on the process of drawing sketches [15], [16]. By designing a zero-waste fashion garment using the draping method, excess of fabric can be manipulated [17]. Zero waste fashion design is actually an ancient clothing design method [18]. This line indicated zero waste fashion design historical background in the literature.

The fashion industry naturally generates waste during garment manufacturing. Garment patterns consist of various shapes, including curvy corners and straight lines. When garment patterns are arranged on a marker plan, gaps can form, leading to the generation of cut-and-sew waste [19]. In the literature, there are various zero waste fashion design methods such as: Tessellation by Holly McQuillan, Subtraction cutting by Julian Robert, and Jigsaw puzzle by Timo Rissanen [4]. The tessellation method is invented by McQuillan and created by a piece variance and repeating of pattern in the marker plan. Geometrical fabric pieces such as hexagonal were removed, replaced, and finally after the tailoring process reached the garment look [20],[14]. The Jigsaw method was improved by Rissanen and is defined as all pattern pieces interlocking with each other [14]. This method's pattern pieces are so similar to block pattern pieces and potential gaps evaluated as minor pattern pieces can be used in the design of a garment. Rissanen's hoodie jacket patterns are an example of the jigsaw puzzle method for the zero-waste fashion design (Figure 1) [21]. Subtraction cutting method is explored by Julian Robert, the design and pattern making process works in synchrony [19]. Besides this, the subtraction cutting method is regarded as a modular design method.

Figure 1. Tessellation and jigsaw puzzle method zero waste fashion design methods [21]

The concept of modularity is defined as the ability to create a unit whose structural elements connect among themselves and demonstrate a relative connection with other units [22]. Initially, the term 'modularity' was used in the context of architectural design. Nowadays, this term has started to be used in other fields such as fashion. Modular cloth design has two different applications in view of zero waste fashion design. In the initial application, the consumer plays a central role in the design of the garment, allowing them to modify the design based on the owner's preferences. As a result of this process, the garment enjoys an extended lifecycle [23]. The other method presents taking off small and necessary parts of a garment, specifically parts that can be laundered easily. Fletcher and Grose established a creative and playful connection between the designed garment and its user, a process that results in a satisfied user, fulfilling the necessary personal perceptions and requirements. In view of using requirements and modification adaptation, designing a modular garment demands much more from the designer because the designed cloth should be adapted to user expression and user-friendliness rather than being the designer's opinion [24]. Through smart design, the active usage period of the garment is extended [25]. A well-designed modular garment preserves consumer preference which changes the fashion producers' design strategy. So, creating a bridge between consumers and fashion designers can be a little step in this long sustainability journey. Considering cradle-to-cradle by Braungart and McDonough, saving material is a design criterion for more sustainable design [3]. Gwilt and Pal have highlighted that supporting ecological improvement opportunities through the enhancement of a garment's designability during its life cycle, based on the original design conditions, contributes to its extended longevity [26]. The focus of the design ideas utilized in this study was to prevent textile waste in garment design, achieved through zero waste design and modular design. The modular design places the consumer in the role of a designer, thus assigning consumers the responsibility to engage more sustainably in their consumption of zero waste fashion design clothing. The creation of a collaborative relationship between users as consumers and designers aims to design a garment while encouraging consumer responsibility, by empowering them with a designer role.

In the modular fashion design system, the designer focuses on enhancing the analyzed concept beyond the dimensions of a cloth design. This process aims to address sustainability issues by incorporating consumer behaviors, purchasing habits, social coding, and incorporating these elements into the design [24]. Modular fashion design aims to lengthen the life cycle of a design so that consumers explore fashion with creating more responsibility consciousness. This application plan involves the consumer as a co-designer in the process of using a modular garment through personalized design. Thus, it is expected that there will be strong satisfaction between the designed product and the user. The fact that the modular clothing design can be changed by the person provides variety in the consumer's closet [27]. In modular garment design, the consumer is also at the center of the design. The modular apparel approach enables consumers to individualize their garments in line with their changing tastes and wishes [28].

In modular fashion design, the consumer can take an active role in the post-purchase design stage, influencing the appearance of the clothing based on their experience. Deploy's designs are a good example of a woman's apparel brand. Their philosophy is to "Create smart clothes for smart women and a smarter future" and improve sustainable garment design. Founded by Dr.Bernice Pan in 2006, the company aimed to achieve various looks with a single-piece modular garment design (Figure 2). It transforms a dress into a blouse and a trench coat into a jacket, offering a multi-garment look from one perfectly designed garment [29].

1.1. Zero Waste Modular Garment Design Applications

There are several examples of modular garment design applications in zero waste fashion design. Two approaches are examined as illustrative examples. The first of these involves the assembly of mold parts, formed by combining modular components through stitching. Ariel Bishop's modular zero waste design serves as an example. (Figure 3) [20].

Figure 2. Various look examples of a modular garment [29]

Figure 3. Ariel Bishop's modular zero waste design [20]

The concept is realized using hexagonal pieces that can be shifted, removed, completely reconfigured, or rearranged in the zero-waste modular suit designed by Ariel Bishop (Figure 3) [20]. Another example of a zero waste modular design application is the "Subtraction Cutting" technique, which places the user at the center of the design, as created by Julian Robert.

This approach assigns an active role to the user in zero-waste clothing design and involves them in the design process, resulting in a garment that can be utilized in various ways. The objective of this application is to promote sustainability through the zero-waste clothing design approach. Additionally, with the modular clothing design method, the consumer can achieve multiple appearances while using the garment (Figure 4).

Figure 5 displays a red dress designed by the subtraction cutting zero-waste design method, as created by Julian Robert [21]. The dress is showcased in multiple distinct styles. The red dress is a product of the sub-cut method, combining two different colors with seven meters of fabric allocated to each. Engineered with a large fabric aperture that the body threads through, this dress is adaptable for use in a minimum of five diverse manners through user modification [21]. This method, developed through the incorporation of the covering technique, boasts the flexibility to assume any shape, allowing any part of the garment to be removed by the user or designer for reasons of aesthetics or harmony. This adaptive nature can yield unexpected outcomes, thereby entailing a certain level of risk due to the unpredictable final appearance [7]. The garment ultimately presents modular versatility, providing a range of appearances in equal measure.

Figure 4. The red dress was designed by subtraction cutting method [30]

Figure 5. Various ways of the red dress wearing

Figure 6. Sub-cut zero waste designed garment examples [31]

Figure 6 illustrates various examples of zero-waste designed garments. Each of these pieces can be worn in distinct styles based on user experience and preference [21]. The subtraction cutting method prioritizes modularity perception for the consumer rather than the designer, where the designer's role is confined to creating garments that facilitate modular constructions.

1.2. Zero Waste Fashion Design through Draping Techniques

Essentially, draping is a French word that means to mold or sculpt in order to create the structure of a garment. The draping technique has been used to create a garment since ancient times as seen in historical garments from artwork [32]. Before the invitation of cloth pattern drawing, draping was the only way to create a garment pattern. Although zero waste fashion design has been in the academic literature for the last 20 years, it is actually a very old method that has been preferred for centuries. Mostly known examples of them are the himation, chiton as an ancient Greek dress “peplon” and the Indian traditional cloth “Sari” designed by draping technique (Figure 7) [33].

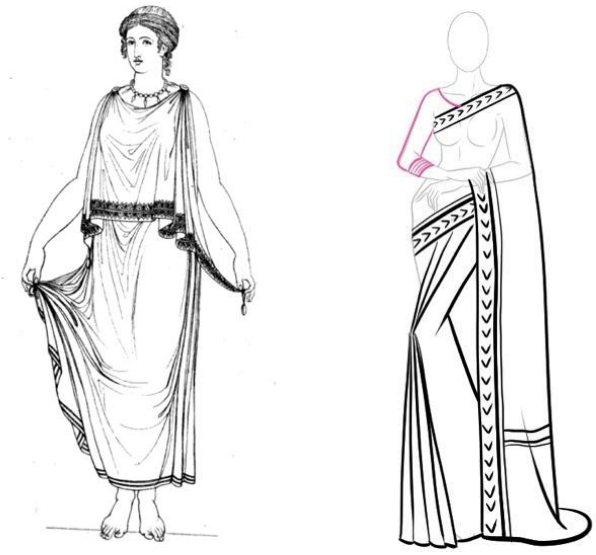

Figure 7. Peplon and Sari illustrations [34],[35]

Zero waste pattern designers predominantly opt for the draping technique to manipulate fabric, allowing unshaped fabric pieces to conform to the body. Zero waste fashion design methods, such as tessellation, jigsaw puzzle, and subtraction cutting, involve practicing the draping technique in conjunction with pattern drawing methods [7]. In this study, the draping technique was employed to craft a collection of modular garments designed for zero waste.

2. METHOD

In this study, a literature search methodology was employed to access information pertaining to the zero-waste fashion design method (ZWFD), modular garment design method, and zero waste fashion designed modular garment designs through studies. The literature review is the analysis, synthesis, and summary of the information about the research problem [36]. In line with this information obtained, it is planned to use the experimental practice method for the application phase of the research. The experimental development method is a systematic study of the production of new inventions with new materials, producing new systems, or improving an existing product or system with the knowledge obtained from research or practical experience [37]. This study employed an experimental practice that aimed to explore new methods of eliminating textile waste from the production of clothing by way aimed at zero waste modular clothing design. This study sought to create modular zero waste designed clothes by using draping techniques.

3. FINDINGS

Three different multi-functional garments were created with the aim of producing zero waste using the draping technique. The garments were designed to be multi-functional. The first ZWFD modular garment was designed to be manipulated by the user to create three different looks. The second ZWFD modular garment can be manipulated by the user to create four different looks. The third ZWFD modular garment can also be manipulated by the user to create three different looks. The garments were created using draping techniques, such as pleats, gathers, tunnel gathers, clips, and cloth accessories, to achieve different visual effects.

3.1. The First ZWFD Modular Garment

The first modular garment produced using zero waste fashion design (ZWFD) requires 150 x 210 cm (width x length) fabric. The width is designed with a fully-filled pleat that merges with the cross of the fabric corner. The length and width of the fabric line have a separable zipper, which allows for easy adaptation to different looks. The first ZWFD modular garment can be worn in three different ways, including two different dresses and one skirt. Figure 8a demonstrates one of the options, a one-shoulder draped dress made via a fully pleated design.

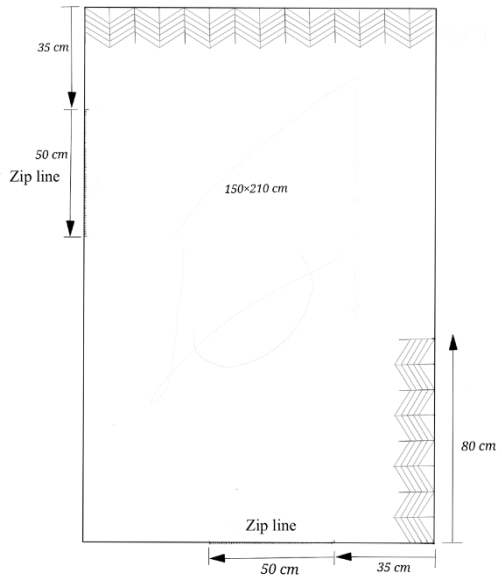

Figure 8. The pattern of the first ZWFD modular garment

As illustrated in Figure 8a, an asymmetrical black dress and its technical drawing. The dress is draped using the entire width of the fabric, with the length of the fabric forming the skirt hem and neckline. The garment is constructed using the draping method, and the selvages of the fabric are connected via a separable zipper.

Figure 8b presents an alternate rendition of Figure 8a, showcasing a backless dress along with its accompanying technical drawing. The dress features a distinct zip line that runs down the front center. The complete length and width of the fabric are utilized for both the skirt hemline and neckline. This modularity culminates in a fully draped dress design.

As indicated in Figure 8c, this presents a distinct iteration of both Figure 8a and Figure 8b. The fully draped section of the fabric is secured as a side seam for the skirt. The separable zipper functions as an extended side seam, reaching up to the waistline and allowing for size adjustment according to the user. The skirt exhibits a fully draped design, as evidenced by the skirt line.

Figure 8a. One shoulder draped dress look and technical drawing

Figure 8b. Backless dress look and technical drawing

Figure 8c. Draped skirt look and technical drawing

3.2. The Second ZWFD Modular Garment

The second modular garment in the ZWFD series is crafted from a fabric measuring 70 x 150 cm (width x length). The fabric's central line is adorned with a smock tunnel, which aligns with the left shoulder. The left sleeve's hem is equipped with a detachable zipper line, facilitating effortless transformation into various styles. The versatility of the second ZWFD modular garment allows the user to wear it in four distinct ways: two distinct blouses, a skirt, and a shalwar (Turkish pants).

Figure 9a showcases a blouse meticulously designed to exhibit an asymmetrical appearance, achieved through a single shoulder and its corresponding skirt line. A smock tunnel is positioned atop the single shoulder, enhancing user-adjustability. The blouse achieves a snug fit using clips and a separable zipper that extends along the sleeve hem.

Figure 9b shows a different version of Figure 9a. This blouse is quite similar to the first version. This look shows a shorter sleeve with the help of the smock tunnel. A belt accessory is added to the look of the blouse as an alternative look for the user.

As seen in Figure 9c, this skirt is strikingly different from Figure 9a and 9b. This skirt model was achieved by modifying the fabric. To accomplish this, the smock tunnel was moved to the side seam of the skirt, and the separable zipper line was moved to the other side seam of the skirt, extending the waistline. This skirt has an asymmetrical look for the user, and the clips have a role that is out of order.

Figure 9d presents another version of Figure 9c. Figure 9c was modified and inspired by Turkish pants (shalwar), and the clips of the fabric are connected to achieve that shalwar look. The waistline was made higher with the assistance of a separable zipper line. This asymmetrical look can be easily modified by the user. The shalwar look is more comfortable compared to the skirt model (Figure 9c).

3.3. The Third ZWFD Modular Garment

The third ZWFD modular garment is produced using 110 x 150 cm (width x length) fabric. The length of the fabric line has a separable zipper that can be easily adapted to different looks, as seen in Figure 10a. The width of the fabric has an armhole to allow for different looks. The upper side of the fabric has an accessory (clip) to be able to connect it as a dress look. The third ZWFD modular garment can be worn in three different ways by the user, as three different dresses.

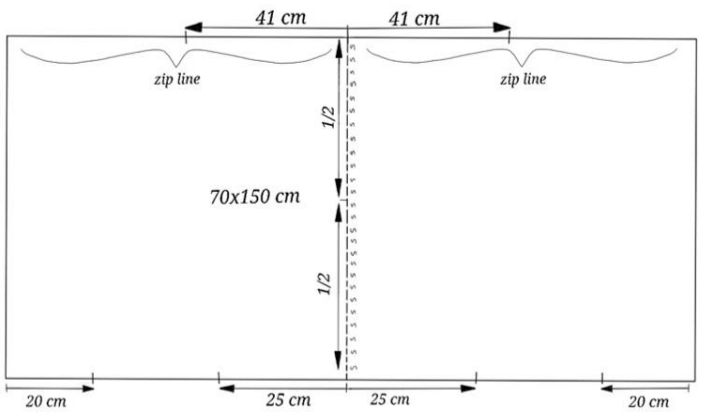

Figure 9. The pattern of the second ZWFD modular garment

Figure 9a. One shoulder blouse look and technical drawing

Figure 9b. One-shoulder blouse with belt look and technical drawing

Figure 9c. Skirt look and technical drawing

Figure 9d. Shalwar's look and technical drawing

As seen in Figure 10a, the third ZWFD modular dress practice is a version of the one-shoulder dress look and its technical drawing. This dress has an asymmetrical look via its one-shoulder and overall appearance. The dress fits the body through one armhole and a separable zipper, which is designed as a side seam of the dress.

Figure 10b indicates another version of Figure 10a. This asymmetric dress model is completely modified with a draping technique, using the entire fabric. This backless dress has a neckline with clips, and its center has a cross node (using the armhole) to create the entire structure of the dress.

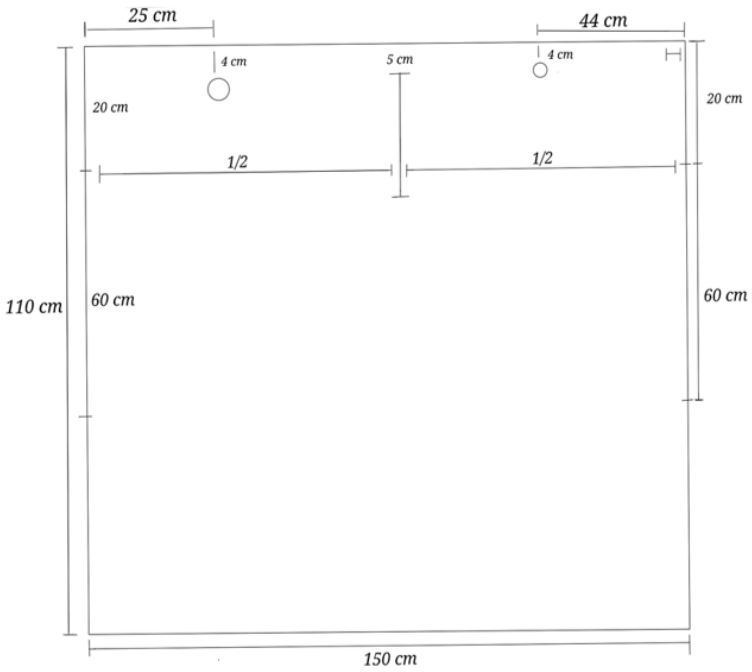

Figure 10. The pattern of the third ZWFD modular garment

Figure 10a. One-shoulder dress look and technical drawing

Figure 10b. Cross-dress look and technical drawing

Figure 10c. Zipper dress look and technical drawing

Figure 10c shows a different version of Figure 10b. In this model, the zipper is moved to the center of the dress, and the armhole of the pattern is used to create a backline, which connects to the neckline by clips. This dress has an asymmetrical look with a unique design, and it can be easily modified by the user to create different styles.

4. CONCLUSION

Today's waste problems of the fashion industry have brought attention to its role in ecological responsibility. In the view of sustainable design, working to save material could be possible by managing zero waste design methods. According to the zero waste fashion design, fashion design and pattern making processes should be improved simultaneously. Zero waste pattern pieces are crafted with the goal of utilizing every inch of fabric, thereby eliminating the issue of cut-and-sew waste by the conclusion of the fashion production process. On the other hand, the modular garment design gives the user the ability to choose various appearances for one garment for the post-consumer process. Both ideologies support sustainability in the fashion system by providing three or four looks for one garment through modular garment design, extending the life cycle of a garment which avoids making it a waste problem. Sustainability can be achieved by using one garment with multiple design methodologies, such as the modular design and the zero waste design.

The literature review conducted for this study highlighted subtraction cutting as a zero-waste design technique aimed at achieving modular design variations. However, this methodology is intricate, and its implementation within the fashion industry can be challenging. Although, Ariel Bishop's modular zero waste designed garment comprises numerous pattern pieces, which can prove time-consuming for the fashion industry. Regarding the literature on zero waste modular fashion design, this study aimed to offer a simple option for the fashion industry which can be applied more practically by centering on the consumer. In this research, we aimed to explore new methods to eliminate textile waste from the production of clothing by designing zero-waste modular clothing. So, a collection consisting of three different zero waste fashion and modular garment designs was designed. Ultimately, ten different looks were provided, including five dresses, two skirts, two blouses, and one shalwar. Zero waste patterns were designed on the model mannequin using draping techniques and accessories. This subject was approached carefully with the aim of achieving modular changes through the zero waste fashion design method. The consumer is regarded as the central role in this aesthetic modularity design application.

Consequently, those different techniques are harmonized in this study to eliminate the waste problem of the fashion industry with sustainable design methodologies. At the end of the study, ten different garment looks were achieved by using variances of three different garments. These garments were conceived with a focus on both utility and aesthetic allure. For future research, delving into diverse modularity concepts within the realm of zero waste fashion design would be beneficial. Furthermore, the simultaneous integration of two or more distinct sustainable design ideas could yield meaningful contributions to the fashion industry.

REFERENCES

1. WFTO . (2013, 9). 10 Prıncıples of Faır Trade. (World Fair Trade Organization): www.wfto.com: http://www.wfto.com/fair-trade/10-principles-fair-trade Erişim tarihi: 08.05.2023
2. Kipöz, Ş., (2015), *Kuşaklararası Sürdürülebilirlik ve Dişil Bilgeliğin Aktarımı.* Şölen Kipöz (Edt.), Sürdürülebilir Moda. 113-123. Yeni İnsan, İstanbul.
3. McDonough, W., & Braungart, M., (2002), *Remaking the Way, We Make Things Cradle to Cradle*, North Point Press, New York.
4. MClennan, J. F., (2004), *The Philosophy of the Sustainable Design*, Ecotone Design Publishing Company, Canada.
5. El-Haggar, S., (2010), *Sustainable Industrial Design and Waste Management Cradle-to-cradle for Sustainable Development*, Elsevier Academic Press, USA.
6. Cho, S., (2014), *A Master Thesis: Development of Zero Waste Fashion Design Process Guideline from an Educational*, The Graduate School Yonsei University, Department of Human Environment and Design. Seoul: Yonsei University.
7. Enes, E., (2021), *Zero Waste Fashion Design and Jigsaw Puzzle, Tessellation, and Analyzing of Subtraction Cutting Methods*, STAR Sanat ve Tasarım Araştırmaları Dergisi, 2 (2), 116-128.
8. Yeşilpınar, S., & Aytaç, V., (2009), *An Approach Aimed at Fabric Consumption in T Shirt Production,* Textile Research Journal, 5(79), 461-467.
9. Abernathy, F. H., Dunlop, J. T., Hammond, J. H., & Weil, D., (1999), *A stitch in time. Lean retailing and the transformation of manufacturing - Lessons from the apparel and textile industries.* Oxford University Press, New York & Oxford.
10. Cooklin, G., (1997), *Garment Technology for Fashion Designers.* Blackwell Sciences, Oxford.
11. Enes, E. & Kipöz, Ş., (2020), *The role of fabric usage for minimization of cut-and-sew waste within the apparel production line: Case of a summer dress.* Journal of Cleaner Production. Volume 248, 1 March 2020, 119221, https://doi.org/10.1016/j.jclepro. 2019.119221
12. Rissanen, T. (2005). From 15% to 0: Investigation the Creation of Fabric Waste. Kreativ Institute for Design og Teknologi.
13. Rissanen, T., (2008), *Creating Fashion without the Creation of Fabric Waste.* In J. H. Connie Ulasewicz (Ed.), Sustainable Fashion: Why Now? A conversation exploring issues, practices, and possibilities (184-206), New York: Fairchild Books.
14. McQuillan, H., (2011), *Zero-Waste Design Practice: Strategies and Risk Taking for Garment Design*. In T. R.
15. McQuillan, H., (2019), *Zero Waste Design Thinking*, University of Boras Studies in Artistic Research, The Swedish School of Textiles.
16. Enes, E., (2019), *Adaptation of Zero-waste Pattern Design Method to Fashion Industry with the case of Turkey.* Yayınlanmamış Doktora Tezi, İzmir Ekonomi Üniversitesi, İzmir.
17. McQuillan, H., (2012), *ZWPC Workshops. Holly McQuillan Designer and Researcher*, https://hollymcquillan.com/zwpc-workshops/ Erişim Tarihi: 12.12.2022

18. Aakko, M., & Niinimaki, K., (2013), *0% Waste, 100% Aesthetics.* 10th European Academy of Design Conference - Crafting the Future. Gotenburg: Gothenburg University, School of Design and Crafts.

19. Enes, E. & Durakovic Korosec, Zero Waste Fashion Design Method as a Necessary İntegral Part of Fashion Design Education. II. International Congress on Art and Design Research, 20-21 June 2022. Niğde, Türkiye, 2022.

20. Fletcher, K., (2008), *Sustainable Fashion & Textiles*, Earthscan Ltd., London, UK.

21. Rissanen, T., & Mcquillan, H., (2015), *Zero Waste Fashion Design*. Fairchild Books, Bloomsbury Publishing, London, New York, UK, USA.

22. Baldwin, C. Y., & Clark, K. B. (2000). Design rules: The power of modularity (Vol. 1). MIT press.

23. JA Clothing, *The Role of Modularity in Sustainable Fashion,*

https://www.ja-clothing.com/post/the-role-of-modularity-in-sustainable-fashion Erişim Tarihi: 26.12.1022

24. Fletcher, K., & Grose, L., (2011), *Fashion & Sustainability Design for Change*, Laurence King Publishing Ltd., London.

25. Laitala, K. M., Boks, C., & Klepp, I. G., (2015), *Making clothing last: A design approach for reducing the environmental impacts*, International Journal of Design. Vol9 (2). 93-107.

26. Gwilt, A. & Pal, R. (2017, 8-10 November) *Conditional garment design for longevity, Product Lifetimes and The Environment Conference*, Delft University of Technology. DOI: 10.3233/978-1-61499-820-4-149

27. Karell, E., (2013), *Planned continuity – Multi-life Garments through Modular Structures & Supplemental Services*, K. Niinimäki Inside, Sustainable Fashion: New approaches. Aalto University publication series, Helsinki, Finland.

28. Nadasbaş, S.E., (2018), *Bedeni ve modeli değiştirilebilen modüler giysilere yönelik tüketici eğilimleri analizi,* Gazi Üniversitesi, Güzel Sanatlar Enstitüsü, Moda Tasarımı Anabilim Dalı, Yayımlanmamış Doktora Tezi, Ankara.

29. Deploy, (2022), *Sustainability*. https://deployworkshop.com/pages/about Erişim Tarihi: 05.01.2022

30. McQuillan, H., & Rissanen, T., (2011), *YIELD exhibition catalog*. Textile Arts Center: Brooklyn, NY. http://yieldexhibition.com/yieldexhibition-catalogue.pdf Erişim Tarihi: 22 November 2022

31. Runway Dream. *Julian Robert Subtraction Cutting.*

https://runwaydreamblog.wordpress.com/2019/02/19/julian-roberts-subtraction-cutting/ Erişim tarihi: 23.12.2022

32. Kiisel, K., (2020), *Draping*. United Kingdom, Hachette.

33. Rissanen, T., (2013), *Zero-Waste Fashion Design: A study at the intersection of cloth, fashion design and pattern cutting.* Doctor of Philosophy, University of Technology, Design, Sydney.

34. Baxter, T. (1810). An Illustration of the Egyptian, Grecian, and Roman Costume; in forty outlines, with descriptions, selected, drawn, & engraved, London.

35. Bozhilova, T. How to draw a saree? I Draw for Fashion. https://www.idrawfashion.com/clothes/basics-clothes/how-to-draw-saree/ Erişim tarihi: 09.05.2023

36. Balcı, A., (2011), *Sosyal Bilimlerde Araştırma Yöntem, Teknik ve İlkeler*. Pegem Akademi Yayıncılık, Ankara.

37. Gök, A., (2007), *Frascati Kılavuzu: Frascati Kılavuzu Işığında Işığında Ar-Ge* From TUBİTAK: https://www.tubitak.gov.tr/tubitak_content_files/BTYPD/kilavuzlar/Frascati_Presentation.pdf Erişim tarihi: 25.11.2022