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**Turkey Fashion Industry's Cut-and-Sew Waste Problem and Its Waste Management Strategies**

**Türkiye Moda Endüstrisinin Kesim Atık Problemi ve Atık Yönetim Stratejileri**

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**Arastırma Makalesi / Research Article**

## **TURKEY FASHION INDUSTRY'S CUT-AND-SEW WASTE PROBLEM AND ITS WASTE MANAGEMENT STRATEGIES**

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**ABSTRACT:** The linear production model of the conventional fashion industry creates “pre-consumption waste” which has devastating environmental impacts. This study focuses on ‘Cut-and-sew waste’, a type of pre-consumption waste which occurs in the pattern cutting phase of the design development process. Thus, the aim of the study is to determine the scope of Turkish fashion industry’s cut-and-sew waste problem, and identify its waste management strategies. Through an analysis on Turkey’s fashion industry, the study addresses “cut-and-sew waste, through an analysis of the opportunities for, and limitations to, the creation of a sustainable design and production system to improve waste management. As a part of the study, a survey was conducted with women’s wear manufacturers producing their own brands in the Turkish fashion industry. A semi-structured questionnaire, responded to by 84 clothing manufacturers, identified the level of the cut-and sew waste problem, and possible waste management strategies are proposed. Data were collected regarding production methods, revealing waste rates within the preparation of the 2016 spring/summer collection. The findings illustrate the current state of the waste problem, and levels of awareness of the fashion industry towards the environmental effects of waste, and the need for waste management strategies.

**Keywords:** Pre-consumption waste, cut-and-sew waste, sustainable fashion production, waste management strategy

### **TÜRKİYE MODA ENDÜSTRİSİNİN KESİM ATIK PROBLEMİ VE ATIK YÖNETİM STRATEJİLERİ**

**ÖZET:** Konvansiyonel moda endüstrisinin doğrusal üretim modeli yıkıcı çevresel etkileri olan “tüketim öncesi atıklar” üretmektedir. Bu çalışmada tüketici öncesi atık tiplerinden biri olan, tasarım geliştirme sürecinin kalıp kesim aşamasında ortaya çıkan ‘kesim’ atıklarına odaklanılmıştır. Buradan hareketle bu çalışmanın amacı Türkiye moda endüstrisinin kesim atıkları probleminin ve atık yönetim stratejilerinin belirlenmesidir. Türkiye'deki moda endüstrisi üzerine yapılan bir analiz aracılığı ile, çalışma sürdürülebilir bir tasarım ve üretim sisteminin oluşturulmasına yönelik imkanların ve sınırlamaların kapsamında “kesim atıkları” nı ele almaktadır. Bu çerçevede, Türkiye moda endüstrisinde kendi markası için üretim yapan 84 kadın giyim üreticisine uygulanan yarı yapılandırılmış bir anket, kesim atıkları probleminin derecesi ve olası atık yönetim stratejilerini önermek için değerlendirilmiştir. Veriler 2016 ilkbahar/yaz koleksiyonu hazırlama aşamasındaki üretim yöntemleri ve atık oranlarından elde edilmiştir. Bulgular atık probleminin şu anki durumunu ve moda endüstrisinin atığın çevresel etkileri ve atık yönetim stratejilerine yönelik farkındalık seviyesini göstermektedir.

**Anahtar Kelimeler:** Tüketici öncesi atıklar, kesim atığı, sürdürülebilir moda üretimi, atık yönetim stratejisi

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### 1. INTRODUCTION

Waste is a human activity by-product; it occurs when a useable material becomes unusable, and loses its worth [1,2]. Strasser defined waste as “a material which becomes undesirable or unnecessary” [3]. In addition to its lack of worth, industrial waste has environmental impacts such as pollution and environmental degradation [4]. Particularly the waste produced by fashion and textile industry does not biodegrade for at least 200 years, and disposal in landfills, by incineration or burying increases its carbon footprints to the extent that it has an effect on global warming [5].

The fashion industry produces two types of waste as (figure 1): pre-consumer and post-consumer waste; the first is created by the fashion industry before the product reaches the consumer, the second is created by consumers after the product is used [7-8]. This study focuses on pre-consumer waste, particularly on cut-and-sew waste, which occurs at the cutting stage of the fabric in the fashion production line. This is described by Rissanen as “any fabric in the pattern floor / cutting stage that is not used in the finished garment has been “wasted” [9].

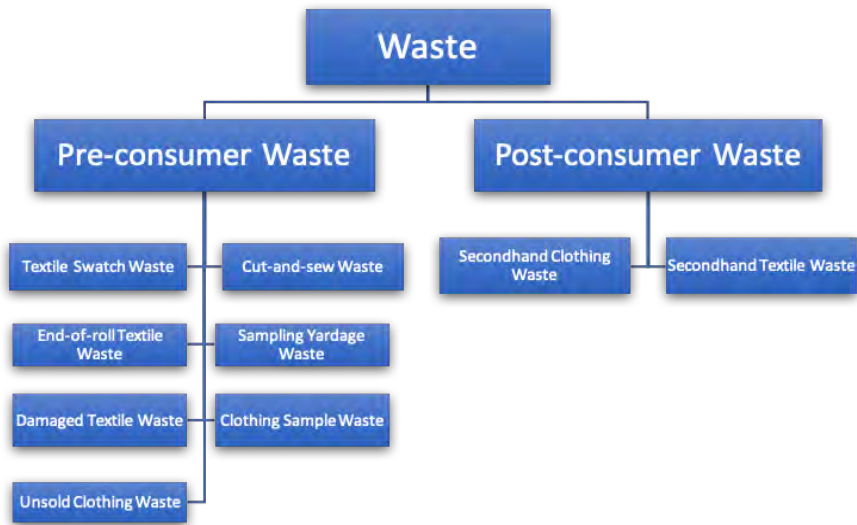


Figure 1. Classification of the waste in fashion industry [6].

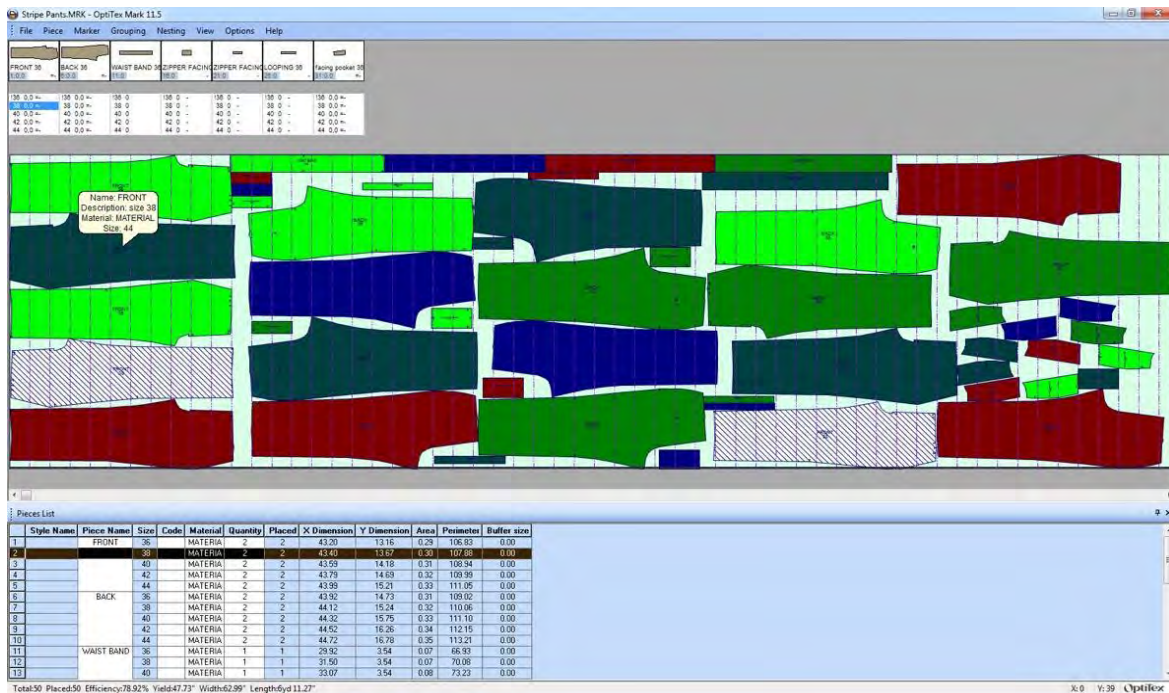


Figure 2. Marker plan shows that how waste occurs during the pattern cutting phase [10].

Estimates of cut-and-sew waste in the form of textile scrap varies from 10% to 15% of the total fabric used during garment manufacturing [11,12]. This results in enormous amounts of waste fabric on the cutting room floor during mass production, which cannot be considered ecologically sound production, as shown in Figure 2. The designed garment pattern pieces are positioned to ensure minimum waste according to order numbers, cutting table length, fabric width, feature of fabric (plaid, pile fabric, chintz ect.) and type of fabric (knitting or woven). In this regard, variations in pattern shape, in other words, alterations in pattern design, can have a major effect in reducing the amount of the fabric waste. In order to minimize production costs the marker plan is designed to allow maximum efficiency in fabric use in the industry. However, this is mainly for economic reasons, and the ecological dimension of the problem in regards to the impact of waste on environmental ethics is often ignored [13].

In case of Turkey's clothing industry, the amount of waste and the level of awareness of managing this waste has to be seriously considered in regards to the potential of reducing its ecological impacts. As the textile sector represents 16% of total industrial production, developing a sustainable system in the industry will make a major contribution to Turkey's sustainable development [14]. In regards to the rates of waste per production, Turkey's total garment production reached 441.195.934 by 2009 [15], and total industrial waste was 458,485 tons/years in the same year, of which 15,082 tons/years derived from readymade clothes manufacture. Waste from the manufacturing of readymade clothes is generally 2-20% of all industrial waste [16]. This enormous amount of waste represents a hazard in terms of its ecological impact. In the light of these concerns, Turkey's fashion industry is the focus of this study, which aims to increase the level of sustainability awareness by proposing possible waste management strategies. Hence, the study presents an analysis of Turkish fashion industry's cut-and-sew waste problem, and discusses potential waste management strategies.

## 2. MATERIAL AND METHOD

This study presents survey findings conducted as an extension of the author's PhD thesis; the survey was designed to investigate Turkey's fashion industry's cut-and-sew waste problems and waste management strategies, and identify the nature of the waste problem. By 1970s, Turkey had become one of the leading countries in apparel manufacturing supplies worldwide, due to advanced know-how and relatively low-cost production. Since 1990s, clothing industry in Turkey has transformed into a fuller package supplier, with design and branding capacity. While most supplier companies contract as the design and production of collections for global fast fashion companies, a smaller number of manufacturers have their own brands, for which they design, produce and distribute collections. Due to latter's instrumental role in making their own design decisions relating to alterations in pattern designs, these companies were taken as a focus group for the survey. Within the frame of the survey, manufacturers which produce with their own brands were chosen on the basis of the likelihood of which they would agree to share their own

information, which could then be compared to global brands contractor manufacturers. The survey was conducted with women's wear manufacturers in Turkey, and the universe group consisted of 130 women's wear brand manufacturers registered at the İTKİB (Istanbul Textile and Raw Materials Exporters Union) and/or the İHKİB (Istanbul Apparel Exporters' Association). The survey was aimed at design managers responsible for coordination between design, pattern making and marker making processes within the production line. The survey was sent to 130 companies, and 84 from İstanbul, Ankara, Eskişehir, and İzmir agreed to semi-structured interviews, 56 face to face in İstanbul and İzmir, and 28 were implemented through e-mail correspondence, and the rest of the universe group gave no feedback. The collected data from the survey was about profile of the companies, their production and design methods, waste types, cut-and-sew waste rates, and waste management methods of cut-and-sew waste. At this time, data was available for companies' 2016 spring/ summer collections, and the questionnaire specifically focused on analysis of waste rates for this season. Also, a dress model from this collection was chosen as a paradigmatic model of a garment, particularly because the pattern of a dress creates more waste than other garments. In this regard, internationally well-known zero-waste fashion designers, such as Rissanen, Mcqueen, Liu, and Robert, all focus on dress models as a paradigm in addressing the cut-and-sew waste problem [17-19]. The collected data was analysed with the SPSS 15.0 package program, reliability and validity tests were not considered necessary, and descriptive statistics were used to find frequencies and percentages.

## 3. RESULTS AND DISCUSSION

### 3.1. Analyses of the amount of cut-and-sew waste

The survey questionnaire analyses the fashion firms' overall position regarding the cut-and-sew waste problem, and these positions were compared with the firms' waste level in the production of 2016 summer collection. Thus, this part of the survey examined cut-and-sew waste rates of the dress production.

The fashion firms' waste was divided into six different types. Accordingly, findings of the first part showed the types of waste within the firms (Figure 3), and indicated that all have cut-and-sew waste problem. These numbers indicate a serious cut-and-sew waste problem within clothing manufacturing; of all the various types in the fashion industry, cut-and-sew waste constitutes a major problem, at 30.8% of total waste.

Fashion firms have their own minimum acceptable efficiency percent range for the marker plan, according to various factors, such as the type of clothing, model of the garment, and pattern of the fabric. The range of efficiency percent tolerance varies according to individual firms' waste management policies. The acceptable ranges of percentage efficiency according to the number of firms are as follows: 80-85% efficiency, 29.8% of firms; 75-79%, 21.4% of firms, 65-69%, 15.5% of firms, and 85-90% efficiency, 14.3% of firms (Table 1). The figures indicated a large variation across firms in minimum permissible efficiencies of the marker plan.

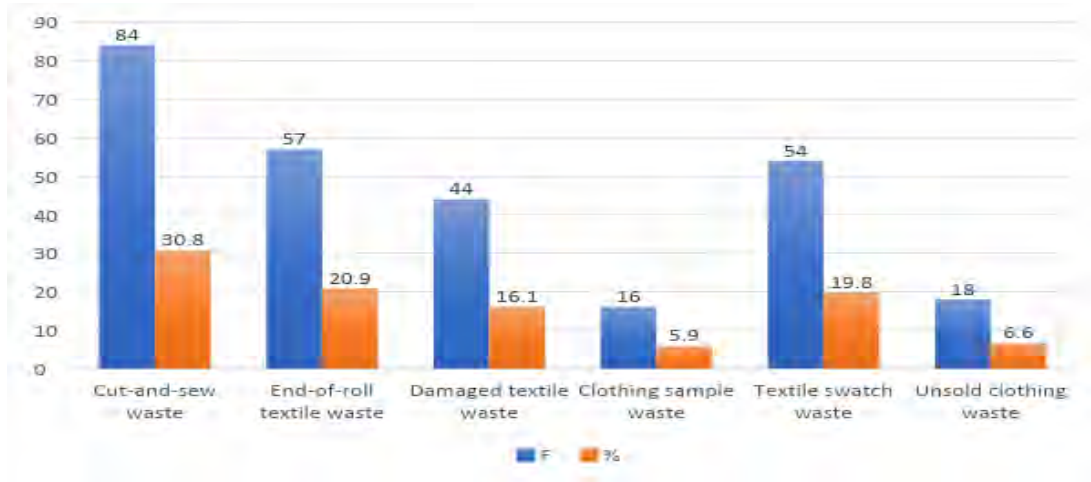


Figure 3. Waste types of fashion firms

Table 1 and 2 show a composition of fashion firms' efficiency rates for the 2016 summer collection, and 2016 summer dress model collection. (Table 1 & 2). The marker plan's efficiency rate shows the cut-and-sew waste rate, with corresponding percentage rates. Table 1 shows the 2016 Summer collection's lowest, average, and highest efficiency rates of the marker plan. According to this analysis, the lowest rate is 70-74% (33.3% of firms) the average is 80-84% (42.9% of firms) and the highest rate is 85-89% (44% of firms) (Table 2). The efficiency rates vary between 65-69% (lowest), and 90-95% (highest).

For the 2016 Summer dress collection, the lowest range of the efficiency is 70-74% (33.3% of firms) (Table 2), the average range is 80-84% (42.9%), and the highest range is 85-89% (44%). Regarding the table 1, the efficiency range levels for the marker plan for a dress, (the lowest, average, and the highest) are lower than for the collection as a whole. Waste management hierarchy is a key tool in resolving fashion industry waste problems. The following section illustrates the second part of the research, the analysis of waste management strategies.

Table 1. 2016 Summer collection efficiency rate of the marker plan (N=84)

	Lowest		Average		Highest	
	F	%	F	%	F	%
<b>65-69</b>	16	19	1	1.2	-	-
<b>70-74</b>	20	23.8	10	11.9	3	3.6
<b>75-79</b>	24	28.6	15	17.9	5	6
<b>80-84</b>	20	23.8	31	36.9	18	21.4
<b>85-89</b>	4	4.8	26	31	37	44
<b>90-95</b>	-	-	1	1.2	21	25
<b>Total</b>	84	100	84	100	84	100

Table 2. 2016 Summer collection's dresses efficiency rate of the marker plan (N=84)

	Lowest		Average		Highest	
	F	%	F	%	F	%
<b>65-69</b>	15	17.9	-	-	-	-
<b>70-74</b>	28	33.3	11	13.1	6	7.1
<b>75-79</b>	21	25	22	26.2	8	9.5
<b>80-84</b>	18	21.4	36	42.9	33	39.3
<b>85-89</b>	2	2.4	15	17.9	37	44
<b>Total</b>	84	100	84	100	84	100

### 3.2. Analysis of Waste Management Strategies

The second part of the survey indicated which waste management methods were being implemented by the fashion firms. The effective “waste management” approaches are key to achieving a sustainable system fashion industry [4]. The waste management strategies are divided into five: avoiding, reducing, reusing, recycling, and disposal (see figure 4), which can be adapted to the fashion production line. Another approach to the fashion industry waste problem is that Fletcher’s 3R approach: reduce, reuse, and recycle as textile waste management strategies [20]. An expanded version is El-Haggar’s 7Rs approach: reducing, recycle, regulations, reuse, renovation, rethinking and recovering [21]. In the following diagram, the waste management hierarchy is presented as a pyramid within the framework of the survey (see figure 4) [22-24].

Figure 4 shows an overview of the 2016 summer dresses cut-and-sew waste management strategies in accordance with five different levels: avoiding, reducing, reusing, recycling, and disposal. As the essential aim of the waste management strategies is to conserve the product/materials, avoiding waste is preferable to finding a solution for the waste [20]. However, despite this awareness, none of the firms were able to avoid cut-and-sew waste in the summer dresses’ marker plan cutting, as seen in figure 4.

Reducing the use of fabric would be an alternative solution [21]. The sample firms generally try to minimize the percentage of cut-and-sew waste in the marker plan, and then use this waste to manufacture various products [20]. Other key methods for the management of the cut-and-sew waste include reusing waste in the design of new garments, reusing the waste in production line trial, or storing the waste for the use in the later stages of the production. The importance that firms give to this dimension is critical for understanding the level of environmental awareness of the fashion firms. 31.3% of firms checked the finished marker plan to further reduce cut-and-sew waste, 30.8% preferred to minimize the waste percentage of the marker plan as it was drawn up 14.1% manufactured varied products from the waste

fabric, and 11.1% altered the model of the clothing to reduce waste rates.

In addition to reuse by finding another use for fabric instead of allowing it to become waste [25], reclassifying and resorting can create opportunities, such as identifying markets for their waste in other industries. 23.8% of these fashion firms reused cut-and-sew waste in the design stage of another garment, 14.8% reused cut-and-sew waste within the trial process when setting up the sewing machines on the production line, and 14.1% stored waste for reuse when required. However, 10.6% made no effort to reuse the cut-and-sew waste.

Recycling also appears as a measure to alleviate the problem by recovering materials such as cut-and-sew waste for an alternative usage to reduce its environmental effects (26). Analysis of recycling methods of fashion firms’ cut-and-sew waste are valuable in understanding the industry’s environmental awareness level. In this part of the survey, it was found that 27.9% of firms sell their cut-and-sew waste to various industries. Further, it was seen that 15.6% of firms sent waste to the recycling facilities; however, as many as 19.7% made no effort to recycle this waste.

Finally, disposal involves sending cut-and-sew waste to the landfills, which ends up with processes such as incineration or burning, may produce methane and leach toxic chemicals and ammonia (20). Apart from being the least ecologically sound, this is financially the least desirable method (26). 36.7% of the firms completely avoided disposal, whereas 31.1% preferred landfill, and 28.9%, storage. None of the firms used the burial method. Compared to the disposal method, other waste management methods (recycle, reuse, and reduce) are greatly more sustainable. Nearly half of the firms completely avoided disposal methods, preferring alternative waste management strategies (reducing, reusing, and recycling). These findings indicate that although some fashion firms in the sample have an awareness about the damaging effect of cut-and-sew waste, none were able to completely eliminate this waste, partly due to the low level of environmental consciousness.

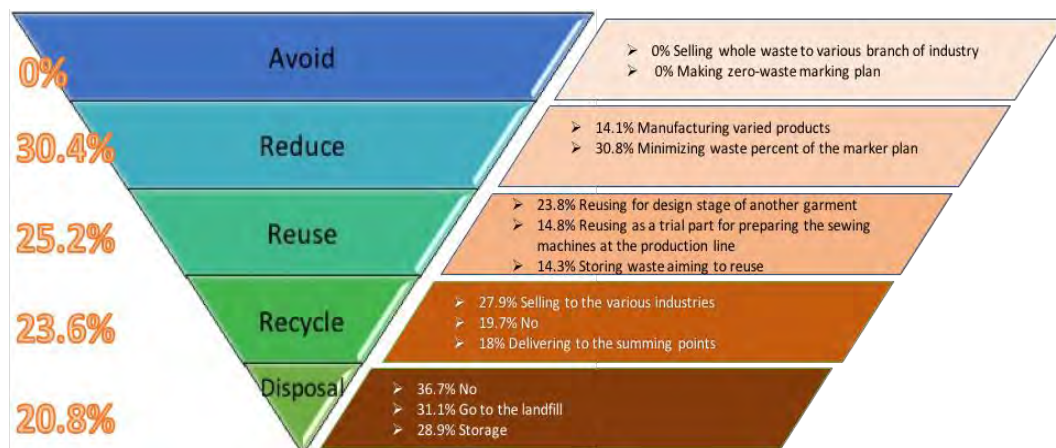


Figure 4. General cut-and-sew waste management strategies in the fashion industry (adopted from those sources: 22,23,24)

#### 4. CONCLUSIONS

In this study, the cut-and-sew waste problem- a pre-consumer waste- and waste management methods in fashion industry was investigated, through an insight to the importance and level of the waste problem in regard to environmental ethics. With a particular focus on Turkey's apparel industry a survey is conducted with womens' wear brand manufacturers to understand in which conditions and levels pre-consumer waste is created. Within the linear conventional clothing manufacturing stage, it is observed that most manufacturers use the CAD system to make a marker plan and then assess its efficiency before the cutting stage to minimise the waste problem. In this process, the lowest efficiency range limit of the marker plan is estimated as 65-70%, and the highest as 90-95%. In 2016 summer collection, the lowest acceptable ranges of percentage efficiency was 75-79%, and the highest was 85-90%. In regard to the same season's dress collection, the figures were lower; the lowest range of the efficiency was 70-74% and the highest range was 85-89%. A dress's cut-and-sew waste rate was considerably larger than the rate of the summer collection as a whole. This discrepancy can be related the design of the dress and marker making process. It is true that these firms make adjustments to dress patterns on the marker plan to reach higher efficiency; however, the survey analysis revealed that these patterns could have been adapted to further reduce cut-and-sew waste rates. Hence, different variances of cut-and-sew waste rates can be explored in marker planning stage, and if the waste problem cannot be solved in this stage, the design or/and pattern making stage should be revisited. Other than design and pattern modification of a product, various waste management methods were used by fashion firms, such as avoiding, reducing, reusing, recycling, and disposal. However, the firms' aim was to minimize, rather completely avoid waste. Amongst them reducing cut-and-sew waste is found to be the most preferred method of minimizing the waste percentage on the marker plan, followed by reusing cut-and-sew waste in another garment's design stages. Fashion firms also recycle by marketing cut-and-sew waste to various industries, while less preferred methods were disposal in a landfill or storage for another usage. Many fashion firms try to minimise cut-and-sew waste on the production line.

In regards to developing a waste management strategy with an insight into the cut-and-sew waste, the interviews showed that the major motivation is economic, with an exception of few larger-scale firms with higher levels of environmental awareness. It is clear that a wide range of waste management implementations is essential for creating a sustainable design and production system. However, in regards to minimizing cut-and-sew waste, the firms' approach to marker planning stage in particular is of greater importance than the other waste management methods. Each fashion firms' approach shows their particular attitude to the cut-and-sew waste problem. This preliminary survey, which represents a valuable new contribution to the understanding of the waste problem in the industry, may

prepare the way for further studies, possibly leading to a zero-waste pattern design method, tailor-made for industrial production in this sector.

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