The effects of fabric type, fabric width and model type on the cost of unit raw material in terms of apparel

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Abstract. The cost of the fabric which is the raw material of apparel constitutes approximately the half of the total product cost. So, it is highly important that the fabric should be used with the greatest productivity. Cost analysis are of great importance in terms of competitiveness of readymade clothing and apparel sector both in national and international markets. The proximity of costs to international average and the average cost of the countries that are competitors of Turkey in clothing market is essential for Turkey to sustain its effect in textile sector. In the contrary case, the sector won’t be able to maintain its competitive capacity sustainably [1]. The main cost elements of textile and apparel sector consist of raw material, labor, energy and financing [2].

1. Introduction

Cost analysis has importance in terms of compatibility of confection sector both in national and international markets. The long-term cost average of Turkey getting close to the averages of its rivals or international averages seems inevitable to maintain the influence of the country in textile sector. Otherwise sector won’t be able to keep its power to compete sustainably [1]. National production of cotton which is the main input for apparel and confection sector creates a great advantage for the sector. Labor cost being lower than that of EU countries has affected the costs significantly because of the intensity of labor-intensive manufacturing. Although the available cost advantages have begun to decrease with the increasing competition, Turkey still has an important advantage in terms cost among EU suppliers. The basic cost elements of apparel sector consist of raw material, labor, energy and financing costs [2].

On the other hand it is clear that economical use of fabric creates an intense source in terms of decreasing the product cost. It is known that a great part of the fabric loss in apparel arises during the making of marker plans [3-7].

The aim of this study is to determine the parameters that may effect fabric productivity, thereby raw material cost, in the preparation of the cutting placement (marker) plans and to examine these parameters. Model type, fabric type and fabric width are chosen as the variables to influence marker productivity within this scope. The chosen models are different in terms of both level of difficulty and number of patterns. Fabric types different from each other in terms of shrinking percentage are chosen because the fabric type is one of the most important factors effecting marker productivity. Fabric width is another important criteria influencing marker productivity, so marker plans are prepared in different widths.

There are studies on cost of unit raw material in the literature, however these studies are not comprehensive enough to analyze the variables chosen in this study in together in different levels. In this study, model type is analyzed in 6 levels, fabric type in 4 levels and fabric width in 3 levels and
they are all evaluated together. The outcome of the study is also analyzed statistically and the relationship between cost of unit raw material and the selected variables are presented.

2. Experimental
2.1. Materials
2.1.1. Selected Models. Nowadays, consumers prefer clothing from knitted fabric that provides mobility comfort. In addition, knitted garments are the most exported product group in Turkey. Therefore, six different models for women knitted tops are chosen in this study. The shapes and numbers of the patterns are selected differently. Figure 1 shows the technical features and marker images of the models. The same assortment is used in the making of markers for each model in order to identify mode soundly the relation among the marker productivities. The chosen assortment is 16 and it comprises of different sizes, M size being more abundant. 16 is the most widely used assortment number in the enterprise in which the study was conducted.

![Figure 1. Technical drawings of selected models](8)

2.1.2. Selected Fabrics. 100% cotton, 100% viscose and 95% viscose-5% lycra blended fabrics are preferred in this study. The shrinkage values of these fabrics are different from each other. Most knitted fabrics are prone to shrink in size unless they are exclusively handled [9]. While seam allowance is 1 cm in the fabrics that do not shrink in warping direction, the allowance may be assigned as 5 cm in the fabrics that shrink in the warping direction [10]. Dimensional change test is applied to the samples taken from the batches ordered by the enterprise in accordance with DIN 53892 and AATCC 135: Dimensional changes in home laundry. The means of obtained data are calculated and presented in Table 1. The allowable value for every kind (washing, steam, ironed, etc.) of shrinking value generally for apparel enterprises is accepted as 2-3% [11, 12].
Table 1. The dimensional change values of knitted fabric types after washing [13]

| Fabric material       | Knitting | Shrinking value | Evaluation |
|-----------------------|----------|-----------------|------------|
| 100% Viscose Jersey   | Width: 1%, Length: 1% | Low         |
| 100% Viscose Interlock| Width: 2%, Length: 3% | Med         |
| 95% Viskose-5% Lycra Jersey | Width: 5%, Length: 5% | High        |
| 100% Cotton Rib       | Width: 3%, Length: 5% | Very high   |

2.1.3. Width of Selected Fabrics. Fabric width is one of the most important parameters that influence marker productivity. Fabric width is the width of marker plan at the same time. This width needs to be usable. Usable width is the fabric width to be used in the cutting process. Three different fabric widths (145 cm, 165 cm and 170 cm) that are most common in this enterprise are used in this study [13].

2.2. Method
2.2.1. Pattern Preparation, Grading and Marker Plan Preparation. Gerber-Cad system is used in the preparation and grading process of the patterns for selected models for this study. Preparation process of marker plans is carried out automatically with Gemini Nest Expert program. The patterns should be placed to minimize the loss between the patterns and effective fabric width should be selected in the preparation of cutting placement (marker) plans. The proportion of marker area to the total pattern area is based on during the assessment of productivity of cutting placement plan.

72 different marker plans are prepared for 3 different fabric width, 4 different shrinking value and 6 different models in this study. The assortment plan for all marker plans is composed of size 10(1), size 12(1), size 14(3), size 16(4), size 18(3), size 20(2), size 22(1) and size 24(1) that are generally available on the market [13].

2.2.2. Statistical Analysis Method. To be applied the parametric tests, the data must be conformed to the normal distribution. Suitability of normal distribution of the data used in the study is analyzed by K-S test and supported by histogram graphs according to "central limit theorem" [14, 15]. Analysis of Variance (ANOVA) is used to test the hypothesis on whether the difference of average among the groups more than two is significant or not. It has been used to analyze how independent variables chosen in this study interact among themselves and the effects of this interaction on dependent variables.

3. Results and Discussion
The varieties in raw material cost of the models are shown in the bar graph on the basis of fabric width (Figure 2). According to the graph, raw material costs are likely the change as the model and the numbers of patterns are changing. As it can be seen in the graph, the higher fabric width gets, the less raw material cost is. This trend is observed in all model types.
Shrinking value of the fabric is reflected on the patterns belonging to each model. The patterns are enlarged in accordance with the shrinking value of the fabric. This decreases marker plan productivity and increases fabric waste. Thus shrinking value is considered and analyzed as an independent variable.

Figure 2. Bar graph for model type-fabric width-cost of unit raw material [16]

In the graphical evaluations, shrinking values are observed to have a significant effect on raw material cost per unit (Figure 3). Raw material costs per unit of models prepared with low shrinking values are obtained lower.

Figure 3. Bar graph for model type-% of shrinkage-cost of unit raw material [16]
ANOVA analysis results of the data are summarized in Table 2. According to the table, when the effects of variables of fabric width, model type, total number of patterns and total number of small patterns on marker on raw material cost per unit is evaluated, it can be said that these variables have an statistically significant effect on raw material cost per unit because significant values on ANOVA table is lower than 0.05. Shrinking value doesn’t have any statistically significant effect on raw material cost per unit. In other words raw material cost per unit doesn’t present any significant difference through shrinking value. However, the important effect of shrinking value on raw material cost per unit can be clearly seen in Figure 3. This difference is just not statistically significant.

Table 2. ANOVA analysis for unit raw material cost

|                | Sum of Squares | df | Mean Square | F    | Sig. |
|----------------|----------------|----|-------------|------|------|
| Fabric Width   |                |    |             |      |      |
| Between Groups | 66,085         | 2  | 33,043      | 7.942| .001 |
| Within Groups  | 287,060        | 69 | 4,160       |      |      |
| Total          | 353,145        | 71 |             |      |      |
| Model Type     |                |    |             |      |      |
| Between Groups | 266,620        | 5  | 53,324      | 40,675| .000|
| Within Groups  | 86,525         | 66 | 1,311       |      |      |
| Total          | 353,145        | 71 |             |      |      |
| Shrinking Value|                |    |             |      |      |
| Between Groups | 17,964         | 3  | 5,988       | 1.215| .311 |
| Within Groups  | 335,181        | 68 | 4,929       |      |      |
| Total          | 353,145        | 71 |             |      |      |
| Total number of patterns on marker | | | | | |
| Between Groups | 266,620        | 5  | 53,324      | 40,675| .000|
| Within Groups  | 86,525         | 66 | 1,311       |      |      |
| Total          | 353,145        | 71 |             |      |      |
| Total number of small patterns on marker | | | | | |
| Between Groups | 252,405        | 4  | 63,101      | 41,968| .000|
| Within Groups  | 100,739        | 67 | 1,504       |      |      |
| Total          | 353,145        | 71 |             |      |      |

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