



DESIGNING EFFICIENCY: ANALYZING THE IMPACT OF PRODUCT DESIGN ON GARMENT MANUFACTURING COSTS

Professional paper
DOI: 10.5937/CT_ITI24041M

Nikola Maksimović^{1,a}, Gordana Čolović^{1*}, Danijela Paunović^{1,b}

¹ATUSS, Odsek Visoka tekstilna škola za dizajn, tehnologiju i menadžment, Beograd

^anikola.maksimovic@vtts.edu.rs, ORCID 0009-0007-3143-7490

^{*}gordanacolovic@gmail.com, ORCID 0000-0003-0089-4262

^bvspaunovic@gmail.com, ORCID 0009-0009-9062-9809

ABSTRACT: *This study investigates the influence of product design on the cost of manufacturing garment products. By examining design elements and their direct impact on production expenses, the research aims to identify key factors that contribute to cost efficiency in garment manufacturing. Data was collected from two design approaches to the product, comparing the end results. The findings reveal that strategic design choices can significantly reduce material waste, labor time, and overall production costs. This study highlights the importance of integrating cost-effective design principles in the garment industry to enhance profitability and sustainability.*

Keywords: *garment industry, design efficiency, production cost, sustainability.*

EFIKASNOST DIZAJNA: ANALIZA UTICAJA DIZAJNA PROIZVODA NA TROŠKOVE PROIZVODNJE

APSTRAKT: *Ova studija istražuje uticaj dizajna proizvoda na cenu proizvodnje odevnih proizvoda. Ispitivanjem elemenata dizajna i njihovog direktnog uticaja na troškove proizvodnje, istraživanje ima za cilj da identifikuje ključne faktore koji doprinose isplativosti u proizvodnji odevnih predmeta. Podaci su prikupljeni iz dva dizajnerska pristupa proizvodu, upoređujući krajnje rezultate. Nalazi otkrivaju da izbori strateškog dizajna mogu značajno smanjiti otpad materijala, vreme izrade i ukupne troškove proizvodnje. Ova studija naglašava važnost integrisanja isplativih principa dizajna u industriji odeće kako bi se povećala profitabilnost i održivost.*

Ključne reči: *odevna industrija, efikasnost dizajna, troškovi proizvodnje, održivost.*

1. INTRODUCTION

In the competitive garment industry, manufacturing costs are crucial for profitability and sustainability [1]. The cutting room, a pivotal stage in production, offers significant opportunities for cost savings. The design of a garment not only affects its aesthetics but also directly impacts manufacturing efficiency and costs. Effective product design decisions, such as pattern layout and fabric selection, can substantially reduce fabric waste and material costs. Optimizing cutting techniques further enhances labor productivity and minimizes resource expenditure [2].

This study examines the impact of product design on garment manufacturing costs, focusing on savings in the cutting room and fabric consumption reduction. By comparing two design approaches, the research aims to identify key factors that enhance cost efficiency [3]. The findings will provide valuable insights for designers and manufacturers seeking to improve profitability and sustainability in the garment industry.

2. METHODS

To investigate the impact of product design on garment manufacturing costs, we conducted a comparative analysis of two sweatshirt designs. The first design featured a single front, back and sleeves pattern piece, while the second design consisted of a front, back and sleeve pieces each composed of three pattern pieces. This study aimed to evaluate fabric consumption and cutting efficiency for both designs. Specialized CAD software is used for this experiment [4,5].

Design and Pattern Layout

Sweatshirt 1 (Single Piece Design):



Figure 1: Sweatshirt 1 (Single Piece Design)

Front, back and sleeves each made from a single pattern piece.
Simple, continuous design.

Sweatshirt 2 (Multi-Piece Design):



Figure 2: Sweatshirt 2 (Multi-Piece Design)

Front piece, back piece and sleeves each composed of three separate pattern pieces.
More complex, segmented design.



Figure 3: 3D simulated layout of the patterns for the Sweatshirt 2 [6]

Marker Creation

Markers were created using CAD software for both sweatshirt designs in three sizes: Small (S), Medium (M), and Large (L). The width of the fabric used for both designs was kept constant at 160 cm to ensure consistency in comparison.

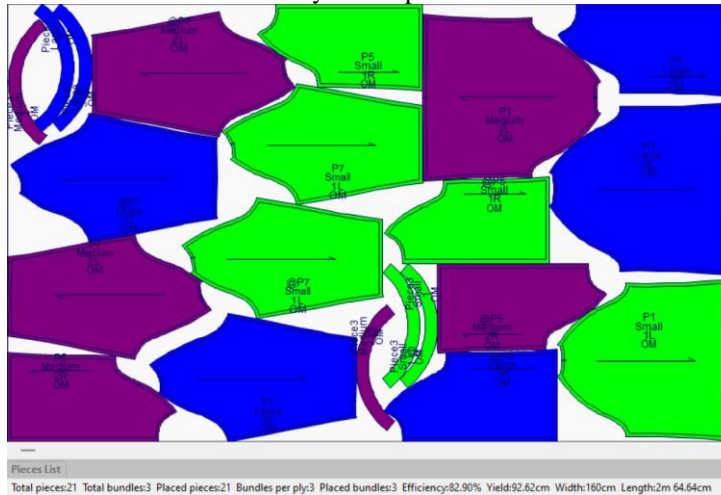


Figure 4: CAD marker layout result for Sweatshirt 1

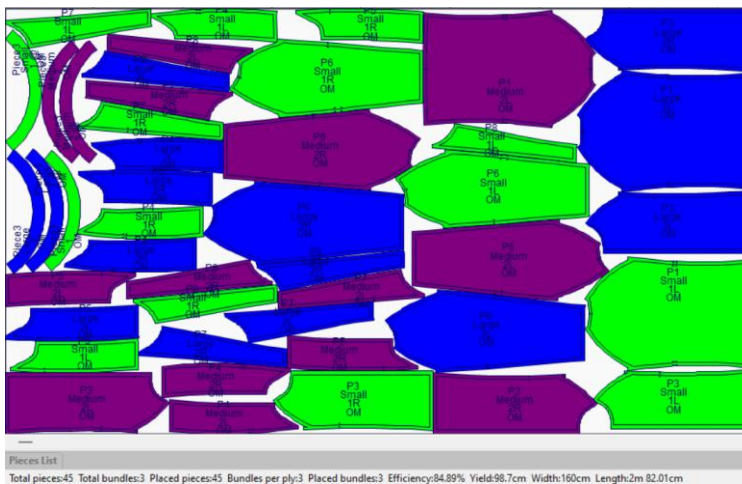


Figure 5: CAD marker layout result for Sweatshirt 2

Fabric Utilization

The length of the marker, which represents the total length of fabric required for cutting all pattern pieces of a single sweatshirt in all sizes, was measured for both designs. For the Sweatshirt 1, the marker length was 2.65 meters. For the Sweatshirt 2, the marker length was 2.81 meters.

Results

The comparison of fabric consumption between the two sweatshirt designs revealed significant differences:

Sweatshirt 1:

Marker length: 2.65 meters, 82.90% utilization.

Fabric utilization: This design demonstrated more efficient use of fabric due to fewer pattern pieces, resulting in less fabric waste.

Sweatshirt 2:

Marker length: 2.81 meters, 84,89% utilization.

Fabric utilization: The increased number of pattern pieces in this design led to a higher marker length, indicating more fabric was required. The complexity of the pattern also likely contributed to increased fabric waste.

Table 1: Results of the analysis

Design	Marker Length (meters)	Fabric Utilization Increase (%)	Fabric Utilization Efficiency (%)	Yield (cm)
Sweatshirt 1	2.65	0	82.9	92.62
Sweatshirt 2	2.81	6.037735849	84,89	98.7

Comparative Analysis

The results indicate that the Sweatshirt 1 design is more fabric-efficient compared to the Sweatshirt 2 design. The marker length difference of 0.16 meters translates to approximately 6% more fabric required for the multi-piece design. This increase in fabric consumption not only elevates material costs but also impacts overall production efficiency. Fabric utilization efficiency percentage wise is better in Sweatshirt 2 design due to the shape characteristics of its pattern pieces, while fabric consumption per product unit is better in Sweatshirt 1 (92.62cm) while Sweatshirt 2 requires 98.7cm. [7]

3. CONCLUSION

This study underscores the significant impact of product design on fabric consumption in garment manufacturing. It showed the importance of considering and adopting a design solution from an economic point of view, depending what effect on the market the manufacturer wants to achieve in terms of competitiveness, quality and expediency, it is important to consider this aspect in the decision-making process. By adopting simpler, faster to produce designs, manufacturers can achieve substantial savings in fabric usage and time savings thereby reducing material costs and enhancing production efficiency, while at the same time this can have an affect on the end product quality in both direction. The findings highlight the importance of considering fabric utilization in the design phase



to optimize manufacturing costs in the garment industry and it calls for further analysis and research of the subject.

REFERENCES

- [1] Paunović M., Maksimović N., Stojanović D. (2021). Redesign Process Optimization of Clothing Items Inspired by Textile Structures in the Art Work, *IV International Scientific Conference Contemporary Trends Innovations in the Textile Industry*, SITTS, Belgrade.
- [2] Paunovic D., Colovic G., Maksimovic N., Paunovic M. (2019). Innovation culture of organization, *Savremeni trendovi i inovacije u tekstilnoj industriji*, Savez inženjera i tehničara tekstilaca Srbije, Beograd, 237-241
- [3] Colovic, G. (2010) *Management of technology systems in the garment industry*, Woodhead Publishing Ltd., Elsevier, Cambridge
- [4] M. Kocareva Ranisavljev, M. Reljić, N. Maksimović (2015). Primena računarskih sistema u modnoj industriji sa tendencijom prilagođavanja unikatnih modela serijskoj proizvodnji,” in *Synthesis 2015 - International Scientific Conference of IT and Business-Related Research*, Belgrade, Singidunum University, Serbia, 248-253. doi:10.15308/Synthesis-2015-248-253.
- [5] Paunović, D., Čolović, G., Maksimović, N., Marić, V. (2009). Optimization Of Design Work Flow, *International Scientific Conference UNITECH 09*, Zbornik radova, str. (s9p96), Gabrovo.
- [6] Maksimović N. (2020). Metode digitalizovanja fizičkih svojstava tekstilnih materijala namenjenih za virtualnu simulaciju, *Tekstilna industrija*, 68(3), 36-43.
- [7] Shaw J., Maksimović N. (2010). Fabric Testing Unit V7, II Naučno stručni skup sa međunarodnim učešćem; Tendencije razvoja u tekstilnoj industriji - Dizajn, Tehnologija, Menadžment; Zbornik radova, DTM , Beograd, 91-96.