

Zero-Waste Shirt Design from Pattern to Sustainability with Size Development and Consumer Evaluation

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ABSTRACT

The apparel industry is increasingly required to address environmental issues associated with mass production, overconsumption, and textile waste. In particular, the patternmaking and cutting stages generate considerable fabric waste before garments are even worn by consumers. Although conventional marker planning can improve fabric efficiency, fabric scraps inevitably remain because garment patterns usually consist of curved and irregularly shaped parts. Therefore, reducing fabric waste at the design and patternmaking stage is an important challenge for developing more sustainable apparel production systems.

Zero-waste fashion design has attracted attention as one promising approach to this issue. It aims to eliminate cutting waste by designing garment patterns so that all fabric is used within a given fabric area. However, applying this concept to practical garments remains challenging. Dress shirts, for example, require not only efficient fabric use but also appropriate fit, comfort, ease of movement, and a neat appearance. Furthermore, for broader application in apparel production, zero-waste garments should be developed across multiple sizes rather than as a single experimental design.

This study introduces a method for developing zero-waste dress shirts (ZWSs) through size development. Graded conventional shirt patterns were transformed into rectangular layouts to eliminate fabric waste, and a sewing method was proposed to handle the large seam allowances created during this process. The developed ZWSs were then compared with conventional shirts in terms of appearance, comfort, satisfaction, and purchase intention. Consumer evaluations were also examined before and after explaining the concept of zero-waste fashion design.

The results showed that the ZWSs successfully achieved zero fabric waste while maintaining an overall appearance comparable to that of conventional shirts, although they were perceived as slightly more wrinkled. Some comfort issues were observed around curved areas such as the neckline and armholes, mainly due to stiffness and bulk caused by large seam allowances. However, participants' satisfaction and purchase intention improved after they were informed about the environmental significance of the zero-waste design.

These findings suggest that zero-waste dress shirts can be developed across sizes while maintaining acceptable appearance and functionality. The study also highlights the importance of consumer awareness in increasing the acceptance and perceived value of sustainable apparel products. This research contributes to the advancement of zero-waste fashion design by connecting patternmaking innovation, garment evaluation, and consumer perception.