

PROVISION OF NEW MODELS OF ORGANIZATION IN THE FASHION INDUSTRY WITH THE USE OF ELECTRONIC LABELS

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Abstract: *The article substantiates the implementation of electronic tags in clothing to ensure the product-service system in the fashion industry. A model that provides for the introduction of labels at the stages of design, construction, production, implementation, and service has been developed. The proposed model provides a practical implementation of the product service system in the garment industry. The analysis carried out in the implementation of the approach based on RFID or NFC technologies allows for choosing a rational type of electronic tags for the implementation of the model.*

Key words: *fashion industry, product-service, electronic label, RFID technology, NFC technology.*

1. INTRODUCTION

In particular, the "product-service" model has developed, which involves an emphasis on the development of "slow" fashion to extend the life cycle of clothing.

Research [1] describes a circular model of the product-service system in clothing with storage and updating of information about the textile product. The article [2] emphasizes the need for information about the composition and origin of clothing in the process of its processing and disposal; it is not clear how to obtain this information. In the article [3], the main ways of implementing the product-service system in clothing are proposed about the production, logistics, sale, and support of clothing items, which requires continuous access to information about it. Also, this article proposes discrete cluster circles for the use of tags in smart clothes. The article [4] states that the consumer's ability to access information about clothing increases the consumer's interest and increases the opportunity for interaction between the consumer, the brand, the manufacturer, and the retailer. Article [5] describes digital transformations in the fashion industry and describes the possibilities of supply chains, implementation, and customer support, including the provision of three-dimensional images, which is possible by using tools with the ability to access large volumes of information. As a conclusion from previous studies, it is possible to note the need to promptly save information about clothes, the source of which is stored directly on the clothes.

Electronic labels can be an effective technical tool that can to some extent resolve this contradiction, which can carry a large amount of information and at the same time are easily incorporated into the design of clothing. The article [7] substantiates the main factors of introducing electronic labels into the process of sewing production.

Research [8] is devoted to modeling the prospective application of electronic labels

for tracking garment goods. Such a model can be a first step but does not reveal a real strategy for using labels in the "product-service" system.

A real approach to providing consumers is the article [9], which describes the process of introducing radio frequency identification into electronic labels in the process of selling sewing products. The study [10] presents a product sample management system based on electronic labels for managing the iterative process of evaluating samples of sewing products during the introduction of new fashion products. Article [11] is devoted to the creation of conditions for the optimization of the supply chain based on the introduction of electronic labels.

Thus, the state of the issue indicates the expediency of introducing electronic labels in the process of implementing the "product-service" model of sewing products, as well as the first steps implemented in this direction.

The main purpose of this study is to justify the feasibility of introducing electronic labels in the process of implementing the "product-service" model in the garment industry.

2. JUSTIFICATION OF THE NEW PRODUCT-SERVICE MODEL WITH THE USE OF ELECTRONIC LABELS

The product-service model turns the process of production, sale, and consumption of clothes into an interactive process of mutual influence of the brand, producer, and consumer. Such a model also has a positive effect on the environment, as it includes, in particular, recycling or disposal. In addition, it can add the effect of promotion and advertising of the brand due to the exchange or reconstruction of clothes. Secondhand can be a separate branch.

Effective management of the product-service process involves prompt access to information that determines the properties of clothing. Such information can contain the composition of raw materials, the manufacturer of raw materials, environmental properties (possibility of processing, recycling), data on the brand, place and time of purchase (possibility of setting exchange conditions), data on dimensional characteristics of design features (acceleration of individual clothing selection, simplification of further reconstruction), individual data of the owner (if this owner wishes to improve personal security).

Such a model needs to ensure the preservation of a fairly large amount of information about clothing. Modern means of storage (bar codes) firstly, store a small amount of information; secondly, they have little resistance to erasure, washing, etc.

Electronic labels meet all requirements, are easy to integrate into clothing design, and provide an opportunity to communicate with customers. At the same time, the product-service model proposed in the publication [12] should be rebuilt taking into account the use of electronic labels.

Tracking, authentication, marketing, logistics management, ownership, further processing... The reasons for using innovative digital technologies are as varied as the articles of clothing themselves.

We suggest adding several elements to the structure of the implementation model that can significantly increase the effectiveness of the model and provide real directions for its implementation (Figure 1).

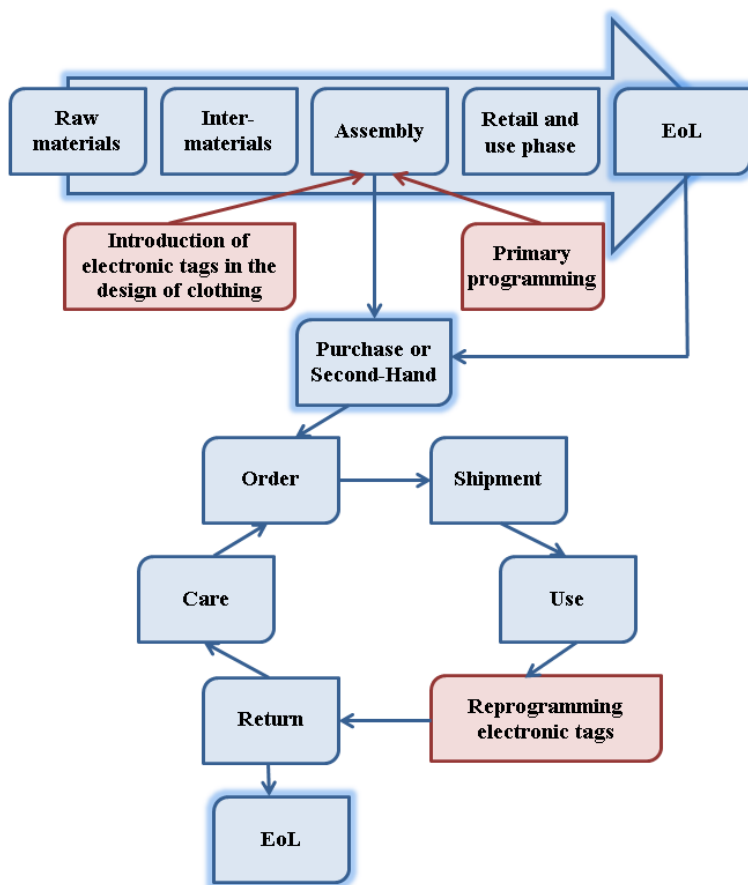


Figure 1: Model "product-service" of the fashion industry with the use of electronic labels

In the proposed model, a block for introducing electronic tags into the design, their initial programming, as well as reprogramming in a cyclical service block is added to the known elements and cycles. Such a model ensures practical implementation of the model with constant quality control.

3. BASIC TECHNOLOGICAL APPROACHES TO THE INTRODUCTION OF ELECTRONIC TAGS IN CLOTHES

The use of RFID/NFC technologies at various stages of the life cycle of textile products allows clothing manufacturers to track their products around the world, guarantee their authenticity and create a direct two-way communication channel with consumers through smartphones and other devices.

The possibility of adopting the principles of a circular economy in the fashion industry, provided by digitalization, is also being considered, including innovative models of resale and exchange.

RFID technology took a long time to become mainstream due to the high costs associated with manufacturing each tag. However, advances in technology allow manufacturers to create new types of RFID tags that are much thinner and more flexible than their bulky counterparts. As a result, digitalization experts predict that this new type of RFID tag can be combined with other types of technology, including printed batteries and electronic printing. This means that soon, retailers will be able to print their RFID tags, further reducing costs.

Near Field Communication (NFC) and Radio Frequency Identification (RFID) technologies are used to exchange data using radio waves. RFID technology is a method of identification using radio waves of different ranges (from medium to ultra-high), while NFC is a specialized subspecies of RFID that works only at high frequencies. It is designed for effective short-distance communication and is the basis of contactless actions carried out with the help of a smartphone.

The apparel and footwear industry is a highly competitive market driven by a new generation of consumers who are increasingly using digital technologies to shop online, find recommendations and interact with brands. At the same time, consumers expect fashion brands to step up their sustainability initiatives and consider environmental commitments as an important factor in purchasing decisions. NFC technology can solve these problems as it provides a means to communicate with customers and can facilitate recycling initiatives.

Adding an NFC tag to an item of clothing or footwear connects it to the digital world. The use of NFC technology allows fashion brands to track their products around the world, guarantee their authenticity and create a direct two-way communication channel with consumers through a smartphone used as an NFC reader.

By implementing NFC technologies, fashion brands provide their customers with a digital experience and can more easily interact with their audience.

NFC tags can also be used to help consumers learn more about a brand's products before and after purchase. By using their NFC-enabled smartphone to read the NFC tag, consumers can access additional information about the brand, its products, and its origin.

NFC technology provides several advantages of digital marketing of physical products.

Secure and ready-to-use NFC tags can be easily customized with personalized content (authentication, product information, and more) that consumers can access by simply touching the tag with their smartphone.

By providing access to product information (origin, fabric), offering personalized buying advice, and providing details on sustainability initiatives such as where to recycle or donate a garment after use, NFC technology helps fashion brands establish a direct communication channel with their customers. On a wider scale, NFC technology can also be implemented to organize the recycling of used items: by including an NFC reader in the company's containers and an NFC tag on an item of clothing, fashion brands can track their products and measure the impact of their recycling initiatives.

The information stored in the tag must conform to a specific format that can be read by an NFC-enabled mobile phone (NDEF format). Therefore, any mobile phone with NFC can interact with the connected product (Figure 2).

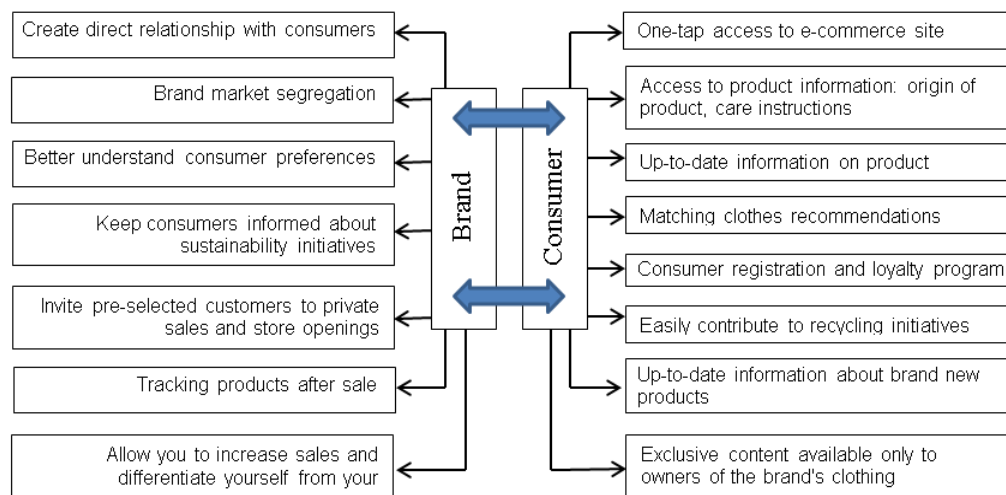


Figure 2: Ways of brand-consumer interaction using NFC technology

In addition to the above ways of brand-consumer interaction, the use of NFC technology provides a number of additional benefits, as the same NFC tag can be used in several different cases. However, in practice, the successful integration of NFC technology into fashion products involves multiple stakeholders and requires technical expertise, time and resources.

4. CONCLUSIONS

The product-service system in the fashion industry requires constant storage and updating of information about clothing. The structural model includes data on the introduction of electronic labels at the stage of design, production, purchase, and consumption of clothing that was developed for this purpose. This fact allows for ensuring the relationship between the designer, manufacturer, consumer, and service departments. Reasonable selection of electronic labels for the clothing product-service system based on RFID or NFC technologies was justified. A number of advantages of using RFID/NFC technology in the interaction between the brand and the end consumer of fashion industry products are presented.

5. References

1. COSCIEME, L., MANSHOVEN, S., GILLABEL, J., GROSSI, F., MORTENSEN, L.F. A framework of circular business models for fashion and textiles: the role of business-model, technical, and social innovation, In: *Sustainability: Science, Practice, and Policy*, 2022, 18(1), pp. 451-462. <https://doi.org/10.1080/15487733.2022.2083792>
2. AFIEF, N.F., GABRIEL, D.S., FARIZAL, F. Proposed Criteria to Design a Product-Service System Based Circular Business Model for the Apparel Industry. In: *ACM International Conference Proceeding Series*, 2021, pp. 340-347. <https://dl.acm.org/doi/10.1145/3468013.3468368>

3. RIABCHYKOV, M., MYTSA, V., ANDROSHCHUK Y., ROMANENKO L. The structure of the use of electronic labels in smart clothing. In: *ARTTE. Applied Researches in Technics, Technologies and Education*, 2022. Volume 10, No. 3, pp. 174-180. ISSN 1314-8788 (print), ISSN 1314-8796 (online), doi:10.15547/artte.2022.03.006
4. HOLTSTRÖM, J., BJELLERUP, C., ERIKSSON, J. Business model development for sustainable apparel consumption: The case of Houdini Sportswear. In: *Journal of Strategy and Management*, 2019, 12(4), pp. 481-504. <https://www.emerald.com/insight/content/doi/10.1108/JSMA-01-2019-0015/full/html>
5. CASCIANI, D., CHKANIKOVA, O., PAL, R. Exploring the nature of digital transformation in the fashion industry: opportunities for supply chains, business models, and sustainability-oriented innovations. In: *Sustainability: Science, Practice, and Policy*, 2022, 18(1), pp. 773-795. <https://doi.org/10.1080/15487733.2022.2125640>
6. LEE, C.K.H., CHOY, K.L., HO, G.T.S., LAW, K.M.Y. A RFID-based Resource Allocation System for garment manufacturing. In: *Expert Systems with Applications*, 2013 Volume 40, Issue 2, pp. 784-799. <https://doi.org/10.1016/j.eswa.2012.08.033>
7. NGAI, E.W.T., CHAU, D.C.K., POON, J.K.L., CHAN, A.Y.M., CHAN, B.C.M., WU W.W.S. 4 - The role of radio frequency identification (RFID) technologies in improving garment manufacturing operations. In: *Fashion Supply Chain Management Using Radio Frequency Identification (Rfid) Technologies*, 2014, pp. 70-98, <https://doi.org/10.1533/9780857098115.70>
8. OVEZMYRADOV, B., KURATA H. Omnichannel fulfillment and item-level RFID tracking in fashion retailing. In: *Computers & Industrial Engineering*, 2022, Volume 168, 108108. <https://doi.org/10.1016/j.cie.2022.108108>
9. TU, Y.J., PIRAMUTHU, S. Models to address RFID-based ticket-switching in retailing. In: *Decision Support Systems*, 2022, Volume 153, 113666. <https://doi.org/10.1016/j.dss.2021.113666>
10. CHOY, K.L., CHOW, K.H., MOON, K.L., ZENG, X., LAU, H.C.W., CHAN, F.T.S., HO G.T.S. A RFID-case-based sample management system for fashion product development. In: *Engineering Applications of Artificial Intelligence*, 2009, Volume 22, Issue 6, pp. 882-896. <https://doi.org/10.1016/j.engappai.2008.10.011>
11. CHAN, H.-L. 3 - Using radiofrequency identification (RFID) technologies to improve decision-making in apparel supply chains. In: *Information Systems for the Fashion and Apparel Industry, Woodhead Publishing Series in Textiles*, 2016, pp. 41-62. <https://doi.org/10.1016/B978-0-08-100571-2.00003-8>
12. PIONTEK, F.M., AMASAWA, E., KIMITA, K. Environmental implication of casual wear rental services: Case of Japan and Germany. In: *Procedia CIRP*, 2020, Volume 90, pp. 724-729. <https://doi.org/10.1016/j.procir.2020.01.076>