The Circular Economy: Take-Back Systems for Textile Recycling

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Introduction

The fashion industry is the second-most polluting industry in the world after the energy sector, so textile disposal is an increasing global concern. According to the Korea Ministry of the Environment (2015), domestic garment waste, which in 2008 averaged 161.5 tons per day (54,677 tons per year), increased by 32.4% to 213.9 tons in 2014 (73,461 tons per year). In the United States, the amount of textile waste in 2014 was 16.22 million tons (the United States Environmental Protection Agency, 2016), and countries such as China (26 million tons), Britain (1.7 million tons), and Japan (1 million tons) produce huge amounts of textile waste every year (EcoOutfitters, 2016). Most of the waste is discarded without being recycled. Textile waste, like other waste, has a negative impact on the environment, but its exact impact remains unknown. Textile waste not only contains hazardous chemicals and heavy metals, but also takes a long time to decompose naturally, and in the process produces harmful greenhouse gases. Thus, to reduce waste and protect the environment, a "closed-loop" system, which recycles waste as a new product is required.

Literature Review

Efforts have sought to achieve economic growth while minimizing the consumption of resources. In the business world, the concept of a circular economy aimed at a world without waste emissions has emerged, which allows the output of one process to be an input to another process (e.g., the energy or resource flows of natural ecosystems). Business models for a circular economy require a fundamental shift in the purpose of business and offer a potential approach to deliver the required change through re-conceptualizing the purpose of a firm, for example, and its value-creation logic, and even rethinking perceptions of value (Bocken, Short, Rana, & Evans, 2014). The transition to a circular business model requires business model innovation, which involves considerable effort, including the development of reusable components or biodegradable materials.

The textile waste lifecycle model depicts three categories of textile and apparel waste: post-producer waste generated by manufacturers, pre-consumer waste generated by retailers, and post-consumer waste generated by the public (Domina & Koch, 1997). Within the textile waste, post-consumer waste refers to fibrous products discarded after their service life. This type of waste is contaminated with used fibers, and the fiber materials are often unclear. They are commonly called "ragged clothes" and account for about 80% of textile waste. Therefore, to build a circular business model in the fashion industry, it is necessary to develop a take-back system, which allows consumers to return the textile waste they want to dispose of after use.

Methods

The aim of this study was to provide a framework for a sustainable business model in the fashion industry. For this, we summarized previous research, books, articles, and press releases, and designed the business models according to the method suggested by Lewandowski (2016).

Results & Conclusion

According to the results of this study, the most important step in the business model for a circular economy in the fashion industry is to build a strong take-back system. The three elements for building a robust take-back system are as follows.

1. Digital technologies to help consumer participation According to Lacy and Rutqvist (2015), one of the most important factors in the success of a circular business model is customer involvement. Continued customer participation not only allows a deeper understanding of customer needs, but can also encourage customers to return their end-of-life products. Used clothes can be collected from consumers, clothing stores, and trash dumps. Digital technologies (e.g., mobile devices, IoT, and big data) could help consumers recognize the importance of recycling and encourage the return of used products. Such technologies could enable them to evaluate the quality and value of the returned products accurately and provide financial and psychological rewards to the consumer. Consumers could easily get information about the time of production and textile composition of the clothes through their mobile phone, and information about the number of washes and the product value could be automatically handed over to the recycling company using IoT technology. In addition, through these digital technologies, consumers could also track the recycling process of their disposed products.

2. New technologies for circular economy Usually, the first step in recycling textile waste is to classify recyclable and non-recyclable clothes and then sort the products by material or color. In this process, every item is sorted by hand and categorized based on its next best possible use. However, the manual sorting process is not only inefficient but also has limitations, such as low sorting accuracy. The optical coherence tomography (OCT) imaging method for identifying weave patterns, and automated textile defect detection systems (Kumbhar, Mathpati, Kamaraddi & Kshirsagar, 2016) are useful technologies for the automatic selection and disposal of textile waste.

3. Product design strategies for a circular economy The process of recycling textile waste begins with cleaning the textiles and removing buttons, zippers, tags, etc. Since the removal of buttons and zippers in the recycling process of textile waste is done by human hands, it is time-consuming and labor-intensive. Therefore, in the early stages of the product design process it is important to establish strategies, such as the use of easy-to-remove buttons, zippers, and labels, for the circular flow of materials.

In this study, we sought to contribute to the revitalization of the recycling industry and to increase the garment recycling rate by proposing a circular business model. Future research on the development of an integrated system to increase the collection rate of discarded clothes and textile waste is expected to contribute to environmental protection and sustainable development.

References

Bocken, N.M.P., Short, S.W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. *Journal of Cleaner Production, 65*, 42-56. doi:10.1016/j.jclepro.2013.11.039

Domina, T., & Koch, K. (1997). The textile waste lifecycle. *Clothing and Textiles Research Journal, 15*(2), 96-102. doi:10.1177/0887302X9701500204

EcoOutfitters. (2016, January 25). *Fast fashion & the destruction of developing countries* [Blog post]. Retrieved from https://www.ecooutfitters.co.uk/blog/fast-fashion-the-destruction-of-developing-countries.

Kumbhar P. Y., Mathpati T, Kamaraddi R, & Kshirsagar N. (2016). Textile fabric defects detection and sorting using image processing. *International Journal for Research in Emerging Science and Technology*, *3*(3), 19–24.

Lacy, P., & Rutqvist, J. (2015). *Waste to wealth.* Basingstoke, UK: Palgrave Macmillan.

Lewandowski, M. (2016). Designing the business models for circular economy: Towards the conceptual framework. *Sustainability, 8*(1), 43-72. doi:10.3390/su8010043

[Korea] Ministry of Environment (2015). *National waste generation and disposal treatment status* (Report No. KECO2015-PE18-35). Retrieved from http://eng.me.go.kr/

United States Environmental Protection Agency (2016). *Advancing sustainable materials management: 2014 tables and figures.* https://www.epa.gov

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