



## What Got Us Here, Won't Get Us There

15th International Conference of the European Academy of Design

ONLINE and in PERSON in Brazil, Finland, India, Spain and the UK.

16-20 October 2023

# Impact of Personality traits on Collaborative Fashion Consumption: A Review

Siva Ganesh Babu<sup>b</sup> and Sanjay Gupta<sup>a</sup>

<sup>a</sup>World University of Design, Sonipat India

<sup>b</sup>School of Design, UPES University, Dehradun India

\*profsgbabu@gmail.com

**Abstract:** The fashion industry is a major contributor to environmental damage, particularly through fast fashion practices. Collaborative Fashion Consumption (CFC) has emerged as a promising form of sustainable consumption. Studies on CFC have primarily focused on consumer motivation, intention, drivers, and barriers, as well as apparel disposal behavior (ADB), with little attention being given to the potential impact of personality traits on CFC adoption. This review paper takes a holistic approach to examine the impact of personality traits, particularly the Five-Factor Model, on CFC and apparel disposal behavior (ADB). By integrating these different parameters, the paper aims to provide insights into how CFC can be positioned to appeal to consumers based on their individual personality traits, offering practical guidance for the fashion industry to reduce its environmental impact. The paper provides a comprehensive understanding of CFC adoption and its potential impact on the fashion industry's sustainability.

### Key Words:

Collaborative Fashion Consumption, Apparel Disposal Behavior, Five Personality Traits, Five-Factor Model, Impulse buying, Subjective norms, Sustainability.

## 1. Introduction

The clothing industry, which includes uniforms, casual wear, office wear, business wear, and undergarments, impacts every individual on earth by serving as a tool of self-expression, luxury, and meeting basic needs. The industry is expected to grow from US\$1.9 trillion in 2019 to US\$3 trillion by 2031 (Statista, 2020; WRAP, 2020). From 2000 to 2015, the global output of clothing more than quadrupled, exceeding GDP growth, while the number of times a garment is worn before being discarded decreased by 36% (WRAP, 2020). Premature apparel disposal worldwide amounts to US\$500 billion (Ellen MacArthur Foundation, 2017). The fashion product lifecycle has three stages: pre-consumption (design to production), consumption (product distribution to end-user utilization), and post-consumption (after product use). Overconsumption has emerged as a major challenge to sustainability in the clothing industry (Armstrong et al., 2016). A way to make the industry sustainable is to shift from a linear model (take, make, and waste) to a circular model of extending the life of fashion products through reuse, recycling, or regenerative systems based on closed loops (Henninger et al., 2021).

The fashion industry is the second largest polluter globally, accounting for 8% of all carbon emissions and contributing to 20% of the world's wastewater (Bailey et al., 2022). Unfortunately, despite initiatives such as the Sustainable Clothing Action Plan 2020 (SCAP 2020), the industry continues to rely on environmentally damaging practices, particularly in fast fashion, where garments are manufactured cheaply, consumed quickly, and disposed of after limited use (Niinimäki et al., 2020).

While previous studies have explored factors such as customer intention and motivation to participate in collaborative fashion consumption (CFC) and apparel disposal behavior (ADB), little attention has been given to the potential impact of personality traits on CFC adoption and how to effectively position CFC based on these traits (Navia et al., 2021). This review paper aims to take a holistic approach to examining the impact of the Five-Factor Model (FFM) of personality traits and ADB on CFC, providing insights into how CFC can be positioned to appeal to consumers based on their individual personality traits. By integrating these different parameters, this paper aims to contribute to a more comprehensive understanding of CFC adoption and offer practical guidance for the fashion industry to reduce its environmental impact.

## 2. Background

### 2.1 Collaborative Consumption

Collaborative consumption (CC) has emerged as a promising form of sustainable consumption, in which individuals share access to resources for a fee or other compensation. CC, also known as the "sharing economy" or "peer-to-peer" exchange, is not a new concept and can be traced back to thousands of years. However, the recent attention to CC is due to the increased awareness of sustainable forms of consumption, especially in academia (Hellwig et al., 2015). Collaborative consumption can be defined as "those events in which one or more persons consume economic goods or services in the process of engaging with one or more others" based on Hawley's theory by Felson and Spaeth. CC can be classified based on the place and time of contact as direct-contact collaboration, system-hookup collaboration, and segregated collaboration (Felson & Spaeth, 1978).

CC can also be classified based on Demand and redistribution (Figure 1). Based on demand it is classified into three types based on redistribution: Product Service System (PSS), Redistribution market (RM), and Collaborative lifestyle (CL), based on redistribution into two as: P2P and B2C (Tünde & Nabradi, 2021). PSS involves marketing products as services, while RM involves giving products free of cost or selling them for a price to those in need. CL involves people with common desires and needs forming a group and sharing resources (Botsman & Rogers, 2010). CC customers' approach to sharing varies based on individual temperaments, evaluated through parameters like personality traits, motivation, and perceived socioeconomic status. Based on this approach, they can be classified into four groups: idealists, pragmatists, opponents, and normatives. Idealists are generous customers with integrated motivation and general reciprocity, and they find joy in sharing. Opponents are perfectionists, who have a low motivation to share due to high perceived scarcity of resources. Normatives have the highest perceived scarcity of resources but are also highly motivated to share, and they exhibit high levels of general reciprocity. Pragmatists are guided more by practical

situations than internal motivation, and sharing is a necessity for them to address existing situations (Hellwig et al., 2015)

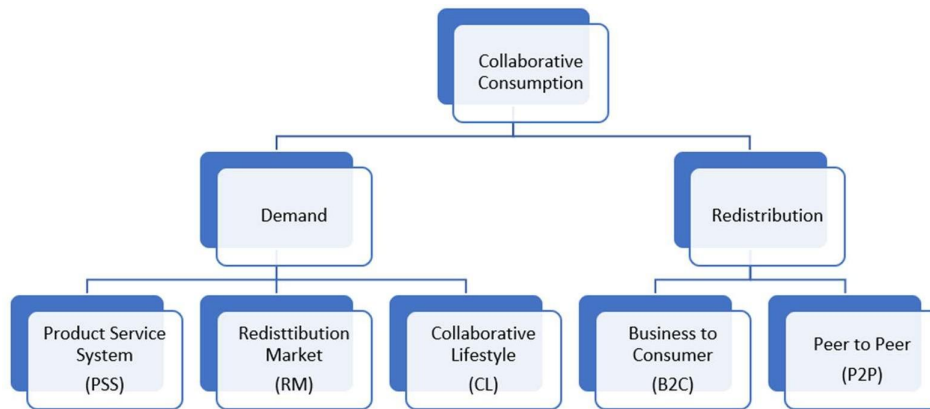


Figure1: Types of Collaborative consumption

## 2.2 Collaborative Fashion Consumption

Collaborative Fashion Consumption (CFC), also known as Alternate Apparel Consumption, is a sustainable consumption approach in which consumers have access to pre-existing garments through various means such as gifting, swapping, secondhand purchase, sharing, lending, renting or leasing. As defined by Iran and Schrader (2017), CFC is "in which consumers, instead of buying new fashion products, have access to already existing garments either through alternative opportunities to acquire individual ownership (gifting, swapping, or second hand) or through usage options for fashion products owned by others (sharing, lending, renting, or leasing)."

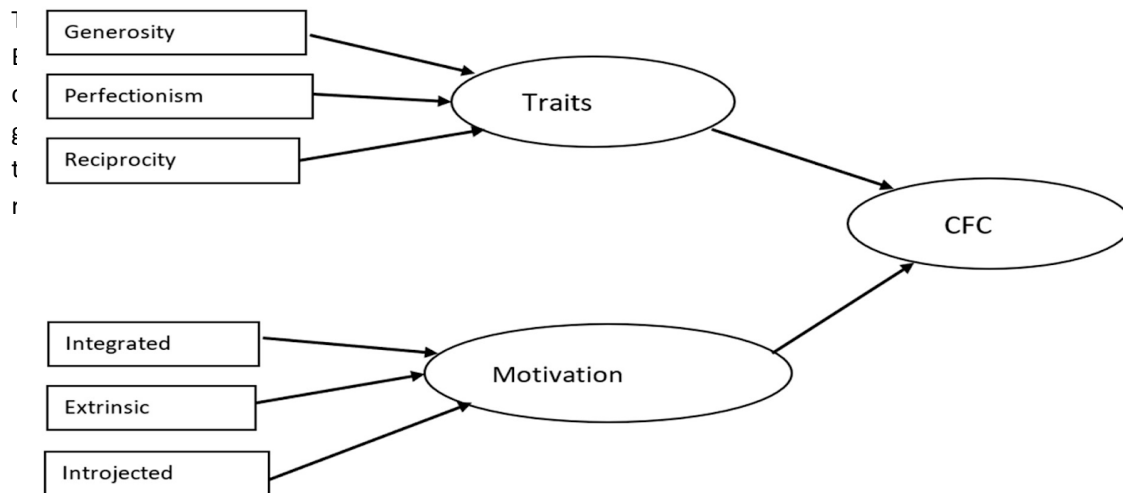


Figure2: Traits and Motivation impacting Collaborative Fashion Consumption

The intention to share varies based on the quality of sharing, what to share, and to whom to share with, and with individual turn of mind. According to Hellwig et al. (2015), traits like generosity, perfectionism, and reciprocity, as well as motivational values like integrated motivation that comes from the inner self of an individual, extrinsic motivation in which customers are forced to share due to one or other reason like the cost etc., and the introjected motivation that is imposed on the customers because of the social and religious norms, which are deeply rooted in the emotion of feeling bad conscience or responsible of not complying to it, affect the intention to participate in sharing, and socio-economic factor of perceived scarcity of resources while actually, when it is not, affects the intention to participate in sharing. It is more a psychological disposition than a demographic variable. Sharing idealists are more open to sharing than sharing opponents.

It should be noted that both models of CFC are successful in imparting sustainability in fashion consumption, but no model is able to meet all the criteria of sustainability (Guthrie, 2019).

## 2.3 Types of CFC

### 2.3.1 Secondhand clothing

According to recent research, there is a difference in perception of secondhand clothing between different age groups. Gen X and Gen Y perceive secondhand clothing as low status and poverty, whereas millennials and Gen Z consume more of it as a means of saving time and money. This shift in attitude may be due to the increased environmental awareness among younger generations, as well as the influence of mass media (Henninger et al., 2021).

### 2.3.2 Rental and Swapping

Rental and swapping have gained popularity among young consumers who consider clothing as a means of personal expression. However, some consumers are concerned that swapping may reduce the emotional satisfaction of impulsive buying, and may require more time and planning (Armstrong et al., 2016). The obsession with fashion aesthetics has led consumers to be trapped in a cycle of excessive consumption (Armstrong et al., 2016).

Women who are more oriented towards fashion tend to have a positive attitude towards using product-service systems (PSS) over traditional product-based systems. PSS encourages smarter purchasing decisions, personal styling choices, and creative upcycling of already owned products, thus reducing excessive consumption. PSS also helps save money and the environment, satisfies the desire for change, and offers product satisfaction. However, consumers have expressed concerns about the hygiene of shared goods, quality, and maintenance (Armstrong et al., 2016).

## 2.4 CFC Factors of Evaluation, Drivers, and Barriers

Collaborative Fashion Consumption (CFC) can be evaluated from the perspective of customers, businesses, and sustainability. To understand the acceptance and adoption of CFC by customers, five major factors are considered, namely economic, demographic, psychosocial, cultural, and socio-material. Economic factors analyze the impact on business and customer benefits, while psychosocial factors explore the impact on customer attitudes, motivations, environmental values, and subjective norms. Among these factors, economic and psychosocial factors were found to be the main drivers in the collaborative consumption literature related to fashion (Arrigo, 2021).

However, there are several barriers to the adoption of CFC, including hygiene/health concerns, consumption habits, lack of ownership, performance/quality risk, and social risk. The pleasure of

impulsive buying and the skills and efforts required to comprehend various collaborative consumption modes are other barriers in CFC. Contamination effects have also been found to be obstacles to customer intention, attitude, and adoption towards CFC (Arrigo, 2021).

CFC is influenced by various drivers, such as utilitarian factors, sustainable factors, hedonistic factors, and environmental concerns. The COVID-19 pandemic has caused a significant shift in customers' consumption practices, making them more aware of the negative environmental impact of fast fashion choices (Arrigo, 2021).

## 2.5 Personality Traits

The OCEAN model, which stands for openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, is a five-factor model (FFM). Studies have shown that neuroticism, extraversion, and conscientiousness have an impact on impulse buying (Thompson & Prendergast, 2015). However, previous research has suggested that personality is not a strong predictor of Collaborative Consumption (Ayob & Mohamed Makhbul, 2020). Personality traits and trait affect can affect impulsive buying, with affect describing an individual's feelings of emotion and mood, which may vary based on intensity, duration, and arousal level, and can influence cognition, behavior, and social interaction (Thompson & Prendergast, 2015). In terms of Collaborative Fashion Consumption (CFC), personality traits such as Fashion Leadership have been found to have a positive impact on intention and attitude towards CFC, while the Need for Uniqueness only influences attitude and materialism has no influence (Navia et al., 2021).

## 2.6 Apparel Disposal Behavior

Apparel disposal behavior refers to the way people dispose of their clothes when they no longer need or want them. Common ways of disposal include donating clothes to charity or secondhand stores, recycling clothing items made of natural fibers, upcycling clothes to make something new, selling clothes online or at consignment stores, or simply throwing them in the trash, which contributes to landfill waste (Joung & Park-Poaps, 2013).

Environmental, monetary, kindness, and convenience concerns, as well as a lack of information, are factors that influence apparel disposal behavior. Resale is influenced by environmental and economic concerns, while donation is influenced by charitable concerns. Reuse is primarily influenced by economic concerns and subjective norms, and environmental concerns (Joung & Park-Poaps, 2013).

Antecedents to apparel disposal behavior are factors that influence people's decisions to dispose of their clothes (Figure 3). Common antecedents include changes in fashion trends, wear and tear, personal style changes, life events like weight changes or career changes, emotional attachment, and consumerism and fast fashion. Younger generations tend to have a "use and dispose" attitude rather than a "repair and reuse" attitude (Sharma & Pant, 2019).

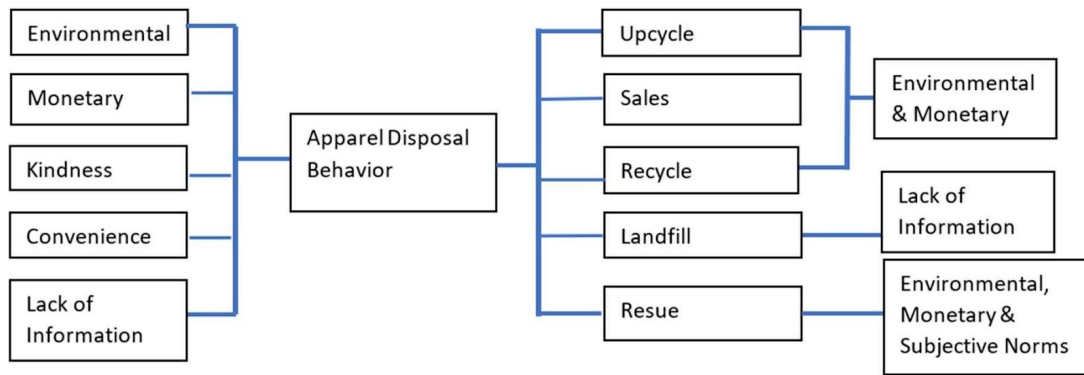


Figure3: Apparel Disposal Behavior

Antecedents to sustainable apparel disposal behavior refer to factors that encourage people to dispose of their clothes in an environmentally friendly way. These include environmental awareness, access to recycling facilities, social norms, alternative disposal options, emotional attachment, and education and information. Online clothing recycling platforms (OCRP) have emerged as an alternative method of disposal, but consumer acceptance is still limited (Zhang et al., 2020).

Understanding these antecedents can help in developing strategies to promote sustainable apparel disposal behaviors, such as reducing overconsumption, promoting upcycling or recycling, and increasing environmental knowledge. Economic factors also play a role in apparel disposal behavior, and positioning recycling and donation as economically advantageous can help attract more consumers to engage in these behaviors (Hwang et al., 2020).

### 3. Methodology

This review was conducted by searching papers for intention and motivation to participate in CFC. Then a search was conducted to find the papers for ADB of customers. Papers were narrowed to papers that were focusing on the personality traits. A comparison was to identify the commonality between customers participating in CFC and responsible ADB. In ADB antecedent were analysed in comparison with CFC intentions and motivations and ways to communicate and position CFC to make it appealing in relation to the personality traits is suggested.

### 4. Discussions

The budget for clothing purchases is the biggest expenditure for youths, and 85% of teens play a major role in decision-making about buying clothes (Roy & Goswami, 2007). To promote sustainable apparel consumption behaviors, consumers need to be made aware of the personal wellbeing benefits and new identity creation that can be achieved through reinventing and restyling already owned fashion goods. Use-oriented PSS is desired by consumers, but the system is still material-centered, and it requires high-quality products and consumers who value product quality (Armstrong et al., 2016). Impulsive buying occurs when self-regulation fails, and individuals' self-regulation is aided by monitoring themselves, adhering to their financial goals and budgets, and impulsive-restraint capacity. Compulsive buying is done by individuals to balance their emotions, maintain their image, and get support. The lack of pleasure in impulsive buying is a barrier that needs to be addressed in closed-loop fashion consumption (Arrigo, 2021).

Life extension of owned garments is influenced by perceived quality, damage, and the garment itself (McNeill et al., 2020). Attitudes towards the environment and subjective norms of family and friends significantly influence clothing disposal behaviors (Joung & Park-Poaps, 2013). Environmental apparel knowledge positively affects environmentalism and environmental apparel consumption behavior (Sadachar et al., 2016). Economic and psychosocial factors were found to be the main drivers in the collaborative consumption literature related to fashion (Arrigo, 2021). Common antecedents for ADB and CFC include changes in fashion trends, wear and tear, personal style changes, life events like weight changes or career changes, emotional attachment, and consumerism and fast fashion (Sharma & Pant, 2019).

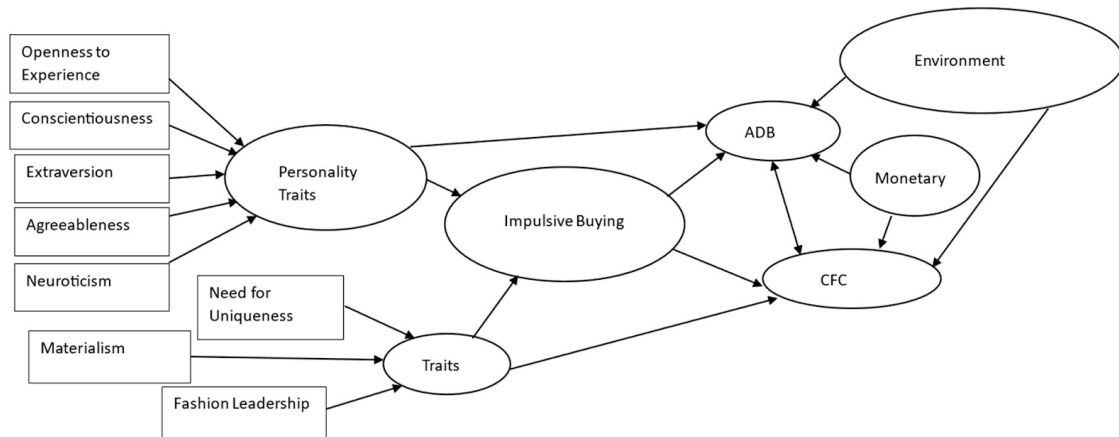


Figure4: Impact of ADB on CFC

Consumer education about the environmental impact of fast fashion and unsustainable apparel disposal is inadequate, leading to the nascent stage of closed-loop fashion consumption. Utilitarian factors, sustainable factors, hedonistic factors, and environmental concerns are some of the drivers that influence closed-loop fashion consumption (Arrigo, 2021). Subjective norms also influence participation in closed-loop fashion consumption, and environmentally concerned consumers influenced by subjective norms are more likely to participate in closed-loop fashion consumption than others. Knowledge and involvement in fashion and hedonic consumption positively impact impulsive buying (Vazifehdoust et al., 2014) and closed-loop fashion consumption (Lang & Joyner Armstrong, 2018). FFM influences both impulsive buying and closed-loop fashion consumption, and further research on the impact of FFM on the intention and motivation to get involved in closed-loop fashion consumption would help in positioning closed-loop fashion consumption with an appropriate message targeting the consumers' personality traits (Thompson & Prendergast, 2015). It is observed that there is a great commonality between the antecedents of CFC and ADB. The most significant seeming to be Environmental and Monetary benefits. Considering the common antecedents it is proposed that ADB has an Impact on CFC and ADB can be considered as an antecedent for CFC and vice-versa.

## 5. Conclusions

Fashion businesses have been criticized for their environmental impact, but many are making progress by participating in cross-sector sustainability initiatives such as Textiles 2030 and The Sustainable Clothing Action Plan 2020 (SCAP 2020). However, there is a need for a change in the fashion business model to achieve sustainability by 2030, with a focus on using sustainable materials, low-impact processing techniques, circular business models, and repair services and take-back

schemes. Fashion industries and brands must follow sustainable practices throughout their supply chain to ensure sustainability. One of the major challenges for sustainable fashion is the issue of overconsumption and frequent discarding of fashion goods by consumers. Therefore, fashion industries must focus on changing consumer behavior and advocating for lower purchases and increased garment longevity.

New business models that can decrease the need for more production, by focusing on increasing the usage of fashion products can close the loop of fashion products and its adverse impact on the environment. Second-hand retailers, rental retailers, and fashion entrepreneurs can use features characterizing collaborative fashion consumption entrepreneurial initiatives as the basis for developing their own business strategy and achieving a competitive edge.

While 90% of consumers in India and the US are willing to participate in a new model of fashion business, involvement varies among them based on their socio-economic factors, motivational level, personality traits, and subjective norms. Therefore, it is important to strategically position CFC initiatives to appeal to environmentally concerned consumers, highlighting the economic advantages and involving family and friends in the message conveyed to them. Despite efforts being made, what CFC leads to in the fashion industry is still unclear. More research is needed to understand the impact of personality traits on CFCs and how it can be used to drive sustainable fashion.

In summary, the fashion industry has a significant role to play in achieving sustainable development goals, and collaborative efforts between businesses, consumers, and governments are crucial in achieving this goal. The adoption of sustainable practices throughout the supply chain, the promotion of circular business models, and the adoption of collaborative fashion consumption can go a long way in achieving a more sustainable fashion industry but for it to be more impactful CFC and ADB correlation needs to be analysed and strategy to be devised that ADB should end more in reuse and recycle than in Landfilling. For it to be achieved the benefits of CFC and ADB should be conveyed to Individuals taking into consideration FFM.

## Bibliography

- Armstrong, C. M., Niinimäki, K., Lang, C., & Kujala, S. (2016). A Use-Oriented Clothing Economy? Preliminary Affirmation for Sustainable Clothing Consumption Alternatives. *Sustainable Development*, 24(1), 18–31. <https://doi.org/10.1002/sd.1602>
- Arrigo, E. (2021). Collaborative consumption in the fashion industry: A systematic literature review and conceptual framework. In *Journal of Cleaner Production* (Vol. 325). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2021.129261>
- Ayob, A. H., & Mohamed Makhbul, Z. K. (2020). The effect of personality traits on collaborative consumption participation. *Malaysian Journal of Society and Space*, 16(2). <https://doi.org/10.17576/geo-2020-1602-16>
- Bailey, K., Basu, A., & Sharma, S. (2022). The Environmental Impacts of Fast Fashion on Water Quality: A Systematic Review. *Water (Switzerland)*, 14(7). <https://doi.org/10.3390/w14071073>
- Belk, R. (2007). Why not share rather than own? *Annals of the American Academy of Political and Social Science*, 611(1), 126–140. <https://doi.org/10.1177/0002716206298483>
- Botsman R, Rogers R. 2010. *What's mine is yours: the rise of collaborative consumption*. Harper Business: New York, NY
- Ellen MacArthur Foundation. (2017). "A New Textiles Economy: Redesigning Fashion's Future." [online] available at: [https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy\\_Full-Report\\_Updated\\_1-12-17.pdf](https://www.ellenmacarthurfoundation.org/assets/downloads/publications/A-New-Textiles-Economy_Full-Report_Updated_1-12-17.pdf)
- Felson, M., & Spaeth, J. L. (1978). Community structure and collaborative consumption: A routine activity approach. *American behavioral scientist*, 21(4), 614-624.



- Goudeau, C., & Lee, H.-J. (2022). Exploring the antecedents of apparel disposal behaviors. *International Journal of Research in Business and Social Science* (2147- 4478), 10(8), 01–11. <https://doi.org/10.20525/ijrbs.v10i8.1517>
- Guthrie, R. (2019). Master's Programme in Innovation and Global Sustainable Development Does collaborative fashion consumption support sustainable consumption? An exploration of two collaborative fashion consumption models.
- Hellwig, K., Morhart, F., Girardin, F., & Hauser, M. (2015). Exploring Different Types of Sharing: A Proposed Segmentation of the Market for "Sharing" Businesses. *Psychology and Marketing*, 32(9), 891–906. <https://doi.org/10.1002/mar.20825>
- Henninger, C. E., Brydges, T., Iran, S., & Vladimirova, K. (2021a). Collaborative fashion consumption – A synthesis and future research agenda. In *Journal of Cleaner Production* (Vol. 319). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2021.128648>
- Henninger, C. E., Brydges, T., Iran, S., & Vladimirova, K. (2021b). Collaborative fashion consumption – A synthesis and future research agenda. In *Journal of Cleaner Production* (Vol. 319). Elsevier Ltd. <https://doi.org/10.1016/j.jclepro.2021.128648>
- Hwang, Y. Y., Jo, G. Y., & Oh, M. J. (2020). The persuasive effect of competence and warmth on clothing sustainable consumption: The moderating role of consumer knowledge and social embeddedness. *Sustainability (Switzerland)*, 12(7). <https://doi.org/10.3390/su12072661>
- Iran, S., & Schrader, U. (2017). Collaborative fashion consumption and its environmental effects. *Journal of Fashion Marketing and Management: An International Journal*, 21(4), 468-482.
- Joung, H. M., & Park-Poaps, H. (2013). Factors motivating and influencing clothing disposal behaviours. *International Journal of Consumer Studies*, 37(1), 105–111. <https://doi.org/10.1111/j.1470-6431.2011.01048.x>
- Lang, C., & Joyner Armstrong, C. M. (2018). Collaborative consumption: The influence of fashion leadership, need for uniqueness, and materialism on female consumers' adoption of clothing renting and swapping. *Sustainable Production and Consumption*, 13, 37–47. <https://doi.org/10.1016/j.spc.2017.11.005>
- McCoy, L., & Chi, T. (2022). Collaborative Consumption: A Study of Sustainability Presentation in Fashion Rental Platforms. *Sustainability (Switzerland)*, 14(14). <https://doi.org/10.3390/su14148537>
- McNeill, L. S., Hamlin, R. P., McQueen, R. H., Degenstein, L., Wakes, S., Garrett, T. C., & Dunn, L. (2020). Waste not want not: Behavioural intentions toward garment life extension practices, the role of damage, brand and cost on textile disposal. *Journal of Cleaner Production*, 260. <https://doi.org/10.1016/j.jclepro.2020.121026>
- Navia, C. R., Khire, R. U., & Lyver, M. (2021). Investigating the impacts of personality traits on collaborative consumption intention of luxury fashion products among middle-aged women. *Independent Journal of Management & Production*, 12(2), 506–525. <https://doi.org/10.14807/ijmp.v12i2.1313>
- Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., & Gwilt, A. (2020). The environmental price of fast fashion. In *Nature Reviews Earth and Environment* (Vol. 1, Issue 4, pp. 189–200). Springer Nature. <https://doi.org/10.1038/s43017-020-0039-9>
- Roy, S., & Goswami, P. (2007). Structural equation modeling of value-psychographic trait-clothing purchase behavior: A study on the urban college-goers of India. *Young Consumers*, 8(4), 269–277. <https://doi.org/10.1108/17473610710838626>
- Sadachar, A., Feng, F., Karpova, E. E., & Manchiraju, S. (2016). Predicting environmentally responsible apparel consumption behavior of future apparel industry professionals: The role of environmental apparel knowledge, environmentalism and materialism. *Journal of Global Fashion Marketing*, 7(2), 76–88. <https://doi.org/10.1080/20932685.2015.1131433>
- SHARMA, S., & PANT, S. (2019). Clothing Disposal Behavior of Teenage Consumers: A study with Reference to Bhopal City. *International Journal of applied social science*, (Vol.6)

- Statista. (2020). Global apparel market – Statistics & facts. Retrieved from <https://www.statista.com/topics/5091/apparel-market-worldwide/>
- Textiles 2030 TM Getting started in Sustainable Fashion-Guide for Fashion Brands | 1 Getting Started in Sustainable Fashion. (n.d.).
- Thompson, E. R., & Prendergast, G. P. (2015). The influence of trait affect and the five-factor personality model on impulse buying. *Personality and Individual Differences*, 76, 216–221. <https://doi.org/10.1016/j.paid.2014.12.025>
- Tünde, K., & Nabradi, A. (2021). Types of Sharing Economies and Collaborative Consumptions. <https://www.researchgate.net/publication/349811576>
- Vazifehdooost, H., Rahnama, A., & Mousavian, S. J. (2014). Evaluation of the influence of fashion involvement, personality characteristics, tendency to hedonic consumption and store environment on fashion-oriented impulse buying. *Mediterranean Journal of Social Sciences*, 5(16), 223–231. <https://doi.org/10.5901/mjss.2014.v5n16p223>
- WRAP, 2020. “Changing our clothes: Why the clothing sector should adopt new business models.” available at <https://wrap.org.uk/resources/report/changing-our-clothes-why-clothing-sector-should-adopt-new-business-models#download-file>. Accessed on 3 April 2023.
- Zhang, L., Wu, T., Liu, S., Jiang, S., Wu, H., & Yang, J. (2020). Consumers’ clothing disposal behaviors in Nanjing, China. *Journal of Cleaner Production*, 276. <https://doi.org/10.1016/j.jclepro.2020.123184>