Digital Technologies Increase Consumer Acceptance of Circular Clothes

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Experimentation with, and the implementation of, circular business models (CBMs) has gained rapid traction within the textiles and fashion industry over the last five years. Substitution of virgin materials with bioderived alternatives, extending the lifecycle of garments through resale, and rental services and the recycling or upcycling of garments are some of the strategies being used to reduce the 1.2 billion tonnes of greenhouse gas emissions and 92 million tonnes of waste associated with the sector in 2017. However, whilst CBMs demonstrate environmental and economic benefits, low consumer acceptance is considered by business professionals and policymakers to be one of the main barriers to the transition towards a circular economy. Digitisation is widely acknowledged as a catalyst for innovation in many sectors and digital technologies are driving new ways to exchange and share goods and services, enabling companies to match the supply, and demand for, otherwise underused assets and products. Online platforms, in particular, have played a crucial role in driving the growth of used goods and resale in other consumer goods markets, such as consumer technology.

sustainability　　fashion　　circular economy　　consumers　　digitisation　　technology

second hand　　enagement

1. Introduction

Clothes are a fundamental part of human daily life. Population growth and lifestyle changes have resulted in a very significant growth of the global apparel market, which was expected to reach a value of USD 1.5 trillion in 2020 [1]. However, the way we design, produce and use clothes today is both inefficient and detrimental to the environment.

According to a report by the Ellen MacArthur Foundation [2], textile production alone generates around 1.2 billion tonnes of greenhouse gas emissions annually, which exceeds those from all international flights and maritime shipping combined. Textile production is inherently wasteful, with over 35% of all materials in the apparel supply chain ending up as waste even before a garment reaches the consumer, according to a report from the Global Fashion Agenda [3].

When considering the full product lifecycle, the environmental impact is even worse. This is driven by various inefficiencies across the supply chain, which is currently based on the wasteful linear 'take–make–waste' model [2]. Among many issues, as highlighted in **Figure 1**, is the extremely low percentage (−1%) of clothing material that is

currently recycled into new clothing and the significant amount (73%) that ends its life being incinerated or in landfills.
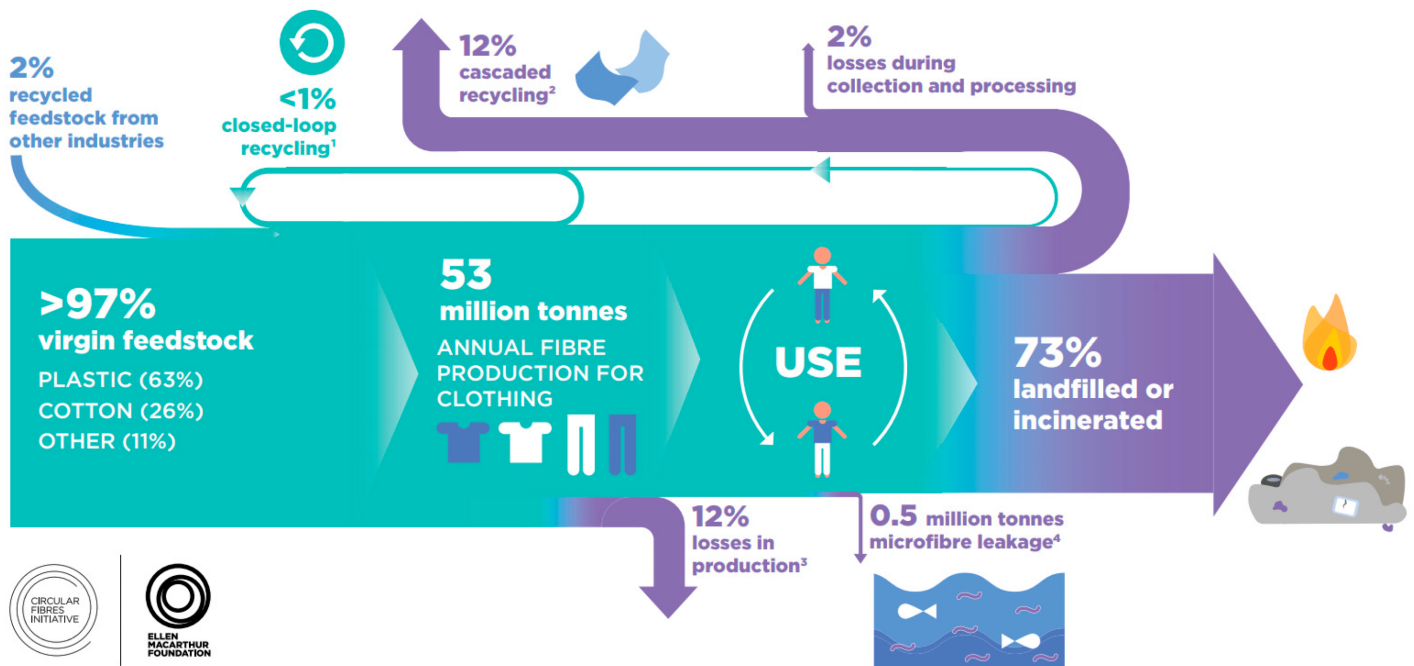
¹ Recycling of clothing into the same or similar quality applications.
² Recycling of clothing into other, lower value applications such as insulation material, wiping cloths, or mattress stuffing
³ Includes factory offcuts and overstock liquidation
⁴ Plastic microfibres shed through the washing of all textiles released into the oceans

Figure 1. Global material flows for clothing in 2015 [2].

In addition to these inefficiencies throughout the fashion supply chain, lifestyle changes have resulted in clothes being materially underutilised. The average number of times a piece of clothing was worn before being disposed of decreased by 36% between 2000 and 2015 [2]. This waste mountain sees no signs of decline, with an additional 57 million tonnes of fashion waste expected to be generated annually [3].

Collectively, not only does this inflict significant pressure on our global ecosystem, but it also destroys economic value. It is estimated that more than USD 500 billion of value is lost each year because of this underutilisation of clothing and lack of recycling [2].

With the world population expected to grow and increased pressure on resources such as water, the fashion industry is increasingly under pressure to become more sustainable. Without a radical shift away from the current linear 'take–make–waste' model, the industry's negative impacts on the environment will increase exponentially.

The principles of a circular economy (CE) offer potential solutions for a more sustainable fashion value chain. According to the EMF, a CE applies design principles that enable the avoidance of waste and pollution. Products and materials remain in use, allowing natural systems to regenerate via biological and technical cascades.

The link between CE models in fashion and environmental benefits is well researched. The key findings of various analyses [2], [4], [5], [6] can be summarised as follows:

- Reusing clothes has environmental benefits;

- Reusing clothes is more beneficial than recycling;

- Life cycle analysis (LCA) shows that one also has to consider potential negative side effects, mainly from increased transportation and logistics to hand over garments from one person to another.

Today, CE based models can be seen emerging within the fashion industry. For example, the sourcing of materials from waste streams for the production of garments, the recycling or upcycling of garments, and fashion resale businesses and rental services. However, despite the significant amount of research [4], [5], [6] demonstrating the environmental benefits of these CE models, low consumer acceptance and engagement is considered by professionals and policymakers to be one of the main barriers to the transition towards a CE [7].

Potential solutions to address low consumer engagement are offered by industry 4.0, which revolutionises traditional manufacturing and industrial practices by using modern smart technology. Industry 4.0 is widely acknowledged as a catalyst for innovation in many sectors and is frequently linked to CE concepts ,.

2. Digital Technologies Increase Consumer Acceptance of Circular Clothes

2.1. Recent Trends and New Concepts in Research

One important concept is collaborative fashion consumption (CFC), established by Iran and Schrader [8]. CFC describes a consumption trend in which the purchase of new fashion products is replaced either by alternative forms of attaining ownership, such as swapping or second hand buying, or by different usage options such as sharing, lending, renting, or leasing.

Several concepts similar and complementary to CFC exist, each of which also addresses alternative consumption patterns. Schor and Fitzmaurice [9] established the 'connected consumption' concept, which emphasizes the social aspects of a 'sharing economy', studied by, among others, Belk [10]. Bardhi and Eckhardt [11] coined the term 'access-based consumption', which moves away from the concept of owning a fashion product, and, instead, focusses on transferring it to the next consumer.

The interactions between consumers across the various forms of CFC, such as swapping, sharing, lending, renting, leasing or else, can either be peer to peer (P2P) or business to consumer (B2C) [8]. P2P describes an interaction that is arranged by the consumers themselves, whilst B2C includes an organization that facilitates such interaction.

Several factors, including trust and ownership, influence consumers' choices as to what types of P2P and B2C in CFC they accept [12]. For instance, consumers who prefer owning a fashion item will prefer swapping over renting. On the other hand, consumers who value companies guaranteeing the quality and hygiene of a fashion item will prefer renting over swapping.

CFC can only work if consumers and the companies operating in the fashion value chain accept these alternative patterns of consumer behaviour.

2.2. Analysis of Barriers to Consumer Engagement

Silva et al. [13] identify three types of barriers to consumer engagement in SHF: functional, psychological and social. Functional barriers are defined as those arising from functional or utilitarian purposes. Functional barriers were also found to be among the most prominently cited in research. Focus was placed on identifying barriers to buying SHF instore and that remain relevant in a digital environment.

There are four key barriers were identified. These are not mutually exclusive and do overlap:

- Inconvenience;

- Concerns about hygiene;

- Lack of trust; and

- Lack of transparency around pricing.

The focus is on barriers to buying SHF instore and that remains relevant in a digital environment. This also means that only 'functional barriers,' defined as those arising from their functional or utilitarian purposes, were included in the analysis and not 'psychological barriers' [13].

2.2.1. Inconvenience

According to a survey of 15,000 consumers conducted by ING Bank [14] across the Americas, Europe and Asia Pacific, inconvenience is one of the key barriers to engaging in solutions relating to CFC.

Tukker and Tischner [15] and Catulli [12] highlight how the lack of the immediate availability of SHF is often perceived by consumers as a sacrifice. Armstrong et al. [16], Catulli [12], and Rexfelt and Hiort Af Ornäs [17] emphasise the lack of accessibility or the additional efforts that are required to obtain SHF. Hirschl et al. [18] argue that these perceived additional efforts derive from a resistance to diverting from past consumption patterns of new products.

2.2.2. Concerns about Hygiene

Fashion products either touch a person's skin or are close to it. Armstrong et al. [16] and Catulli [12] found that this fact increases consumers' focus on hygiene. In another report by Armstrong et al. [19], which focused on the rental of clothes, consumer concerns related to bugs and mites were highlighted. Additionally, the report emphasised the importance of the overall cleanliness of clothes to the consumer experience, as well as the ability of a services provider to guarantee such cleanliness.

Roux [20], Na'amneh and Al Husban [21] and Perry and Chung [22] provide further insights into this area. They highlight additional consumer concerns such as bacteria from pre-owners, transmission of diseases, odour, and dirtiness. Fisher et al. [23] additionally argue that the adoption of CFC may be complicated by the stigma relating to SHF, even when the products are used for redesign.

The key argument of this section is that contaminations can be real or imagined, the latter often being the result of past experiences. In addition, both types of contaminations need to be considered when developing CE solutions. Failure to do so may result in consumers rejecting CE solutions by prematurely disposing of clothes, even in cases without any objective physical contamination.

2.2.3. Lack of Trust

This barrier overlaps with the subsequent one: 'Lack of transparency around pricing'. Additionally, whilst this barrier refers to trust only, trust is also often linked to information. For instance, more information on product features and the seller itself could increase seller credibility and buyer trust in the overall process.

Individuals lack trust in SHF providers because of perceived value for price challenges and a perceived lack of transparency around how prices are formed [15], [17], [18]. From P2P to B2C models, consumers are reluctant to incur recurring costs unless they are related to renting.

Another key concern of consumers pertains to the risk that a business offering CFC solutions may cease to exist, which would prevent a consumer from further engaging with such company [16]. Consumers may also have doubts about the motives of a CFC solutions provider [17]. Armstrong et al. [16] stress the importance of guarantees that can be provided by companies offering CFC solutions to consumers, and the potential barrier to consumer engagement that is created by a lack thereof.

Hence, a failure to address the issue of trust and information may also result in consumers not engaging in CE solutions.

2.2.4. Lack of Transparency around Pricing

This barrier focuses specifically on the information provided on a product's price and platform pricing structures.

The ING Bank consumer survey [14] revealed that price remains the most important factor for consumers when deciding on buying clothes. A total of 56% of all survey respondents said that the price is their key consideration,

followed by quality and convenience, which were cited by 54% and 41% of the respondents, respectively.

This underlines the importance of transparent pricing structures for SHF, which will allow consumers to commercially assess the value of the offering.

2.3. Analysis of Digital Solutions to Overcome Barriers to Consumer Engagement

Digital solutions related to the Internet of Things (IoT), blockchain, digital platforms, artificial intelligence, algorithms, and software tools, are amongst the most popular CE solutions seen in academic literature [24] and such technologies are driving new ways to exchange and share goods and services [25],[26]. According to an EMF report [2], many industries have already been disrupted by the digitalisation of services, and the fashion industry is following this trend.

The pandemic has not only caused digital fashion appetites to soar, it has also shifted the focus from physical products to storytelling and digital aspiration. In some instances, brands today are engaging consumers on virtual platforms by creating games and avatars [27]. The most sophisticated online fashion retail platforms deploy artificial intelligence and taxonomy systems to assign more comprehensive descriptions to products. This data can be utilised to personalise recommendations for customers based on personality traits, and use live streaming and augmented reality, including try on technology [28],[29].

With growing consumer demand and digital platforms that facilitate P2P commerce, the digital resale market is quickly becoming the next big thing in the fashion industry and is growing more than four times faster than the traditional second hand physical store market [2],[30]. The EMF [2] also revealed that 'resale disruptors' represent a specific segment of the SHF market, as they offer a more curated product assortment and sell their products via P2P marketplaces. Technology has also changed the image of SHF. Any cultural stigma associated with SHF has been overcome by how professionally consumers can now trade SHF online [31]

PwC [31] indicates that generating data is crucial in fashion resale and rental. The emerging technological development related to that is blockchain, QR (quick response) and RFID (radio frequency identification) codes or NFC (near field communication) tags. Although not yet widely used in the fashion industry, these technologies can help make the journey of a garment more transparent. With these technologies, brands will be able to tell the story of the origin of their products, and consumers could check the age and original value of clothes to subsequently decide a resale price.

The market for second hand luxury goods is also substantial, reaching a market value of USD 2 billion in 2019 [32]. The luxury resale market has historically been fragmented into boutique stores or in person with limited consumer reach, but with digital platforms, the market is moving towards consolidation. Online luxury resale platforms are transforming the second hand market by offering a seamless end to end experience with a far greater certified preowned brand and product assortment. Resale websites are also competing to offer premium services such as curation and authentication, with some even using blockchain technology to tackle luxury goods counterfeiting and support growth, trust and personalised experiences driven by deep data insights [33].

References

1. Shahbandeh, M. Global Apparel Market—Statistics & Facts. Statista; 2021.

2. Ellen MacArthur Foundation. Circular Fashion—A New Textiles Economy: Redesigning Fashion's Future. 2017.

3. Global Fashion Agenda. Pulse of the Fashion Industry. Global Fashion Agenda & The Boston Consulting Group; 2017. Available online: https://www.globalfashionagenda.com/publications-and-policy/pulse-of-the-industry/ (accessed on 21 July 2021)

4. Gustav Sandin; Gregory Peters; Environmental impact of textile reuse and recycling – A review. *Journal of Cleaner Production* **2018**, *184*, 353-365, 10.1016/j.jclepro.2018.02.266.

5. Maria Luisa Di Silvestre; Salvatore Favuzza; Eleonora Riva Sanseverino; Gaetano Zizzo; How Decarbonization, Digitalization and Decentralization are changing key power infrastructures. *Renewable and Sustainable Energy Reviews* **2018**, *93*, 483-498, 10.1016/j.rser.2018.05.068.

6. Laura Farrant; Stig Irving Olsen; Arne Wangel; Environmental benefits from reusing clothes. *The International Journal of Life Cycle Assessment* **2010**, *15*, 726-736, 10.1007/s11367-010-0197-y.

7. Julian Kirchherr; Laura Piscicelli; Ruben Bour; Erica Kostense-Smit; Jennifer Muller; Anne Huibrechtse-Truijens; Marko Hekkert; Barriers to the Circular Economy: Evidence From the European Union (EU). *Ecological Economics* **2018**, *150*, 264-272, 10.1016/j.ecolecon.2018.04.028.

8. Samira Iran; Ulf Schrader; Collaborative fashion consumption and its environmental effects. *Journal of Fashion Marketing and Management* **2017**, *21*, 468-482, 10.1108/jfmm-09-2016-0086.

9. Schor, J.; Fitzmaurice, C. Collaborating and connecting: The emergence of the sharing economy. In Handbook of Research on Sustainable Consumption; Edward Elgar Publishing: Cheltenham, UK, 2015.

10. Belk, R. You are what you can access: Sharing and collaborative consumption online. J. Bus. Res. 2014, 67, 1595–1600.

11. Bardhi, F.; Eckhardt, G. Access-based consumption: The case of car sharing. J. Consum. 2012, 39, 881–898.

12. Maurizio Catulli; What uncertainty?. *Journal of Manufacturing Technology Management* **2012**, *23*, 780-793, 10.1108/17410381211253335.

13. Susana Costa e Silva; Ana Santos; Paulo Duarte; Božidar Vlačić; The role of social embarrassment, sustainability, familiarity and perception of hygiene in second-hand clothing

purchase experience. *International Journal of Retail & Distribution Management* **2021**, *49*, 717-734, 10.1108/ijrdm-09-2020-0356.

14. Bani, M.B.M. Rethinking the Road to the Circular Economy; ING Economics Department: Amsterdam, The Netherlands, 2020.

15. Arnold Tukker; Ursula Tischner; Product-services as a research field: past, present and future. Reflections from a decade of research. *Journal of Cleaner Production* **2006**, *14*, 1552-1556, 10.10 16/j.jclepro.2006.01.022.

16. Cosette Armstrong; Kirsi Niinimäki; Sari Kujala; Essi Karell; Chunmin Lang; Sustainable product-service systems for clothing: exploring consumer perceptions of consumption alternatives in Finland. *Journal of Cleaner Production* **2015**, *97*, 30-39, 10.1016/j.jclepro.2014.01.046.

17. Oskar Rexfelt; Viktor Hiort Af Ornäs; Consumer acceptance of product-service systems. *Journal of Manufacturing Technology Management* **2009**, *20*, 674-699, 10.1108/17410380910961055.

18. Hirschl, B.; Konrad, W.; Scholl, G. New concepts in product use for sustainable consumption. J. Clean Prod. 2003, 11, 873–881. https://doi.org/10.1016/S0959-652600162-2.

19. Cosette M. Armstrong; Kirsi Niinimäki; Chunmin Lang; Sari Kujala; A Use-Oriented Clothing Economy? Preliminary Affirmation for Sustainable Clothing Consumption Alternatives. *Sustainable Development* **2015**, *24*, 18-31, 10.1002/sd.1602.

20. Roux, D. Identity and Self-Territory in Second Hand Clothing Transfers; In NA – Advances in Consumer Research; The Association for Consumer Research (ACR): Denver, CO, USA, 2010; 37, 65–68.

21. M.M. Na'amneh; A.K. Al Husban; Identity in old clothes: the socio-cultural dynamics of second-hand clothing in Irbid, Jordan. *Social Identities* **2012**, *18*, 609-621, 10.1080/13504630.2012.69289 7.

22. Anna Perry; Te-Lin Chung; Understand attitude-behavior gaps and benefit-behavior connections in Eco-Apparel. *Journal of Fashion Marketing and Management: An International Journal* **2016**, *20*, 105-119, 10.1108/jfmm-12-2014-0095.

23. Brendan Fisher; Kerry Turner; Matthew Zylstra; Roy Brouwer; Rudolf de Groot; Stephen Farber; Paul Ferraro; Rhys Green; David Hadley; Julian Harlow; et al.Paul JefferissChris KirkbyPaul MorlingShaun MowattRobin NaidooJouni PaavolaBernardo StrassburgDoug YuAndrew Balmford ECOSYSTEM SERVICES AND ECONOMIC THEORY: INTEGRATION FOR POLICY-RELEVANT RESEARCH. *Ecological Applications* **2008**, *18*, 2050-2067, 10.1890/07-1537.1.

24. Konstantinos Demestichas; Emmanouil Daskalakis; Information and Communication Technology Solutions for the Circular Economy. *Sustainability* **2020**, *12*, 7272, 10.3390/su12187272.

25. Gillpatrick, T.; Blunck, E.; Boğa, S. Understanding the role of consumer behavior in forecasting the impact of industry 4.0 and the wave of digital disruption driving innovation in retailing. Diem. Dubrov Int. Econ. Meet 2019, 4, 165–176.

26. Ocident Bongomin; Gilbert Gilibrays Ocen; Eric Oyondi Nganyi; Alex Musinguzi; Timothy Omara; Exponential Disruptive Technologies and the Required Skills of Industry 4.0. *Journal of Engineering* **2020**, *2020*, 1-17, 10.1155/2020/4280156.

27. High-Tech Fashion: Pandemic Shifts Focus from Physical Garments to Storytelling and Digital Aspiration. Financ Express 2020. Available online: https://www.financialexpress.com/lifestyle/high-tech-fashion-pandemic-shifts-focus-from-physical-garments-to-storytelling-and-digital-aspiration/2107954/ (accessed on 10 July 2021).

28. Amed, I.; Balshandani, A.; Berg, A.; Ekeløf Jensen, J.; Rölkens, F. The State of Fashion 2021: In Search of Promise in Perilous Times; McKinsey & Company: Atlanta, GA, USA, 2020.

29. Nast, C. Taxonomy is the New Fashion-Tech Essential. Vogue Bus 2020. Available online: https://www.voguebusiness.com/technology/taxonomy-is-the-new-fashion-tech-essential-the-yes (accessed on 10 March 2021).

30. Velasquez, A.; Velasquez, A. 21 Fashion Trends to Know for 2021. Sourc. J. 2021. Available online: https://sourcingjournal.com/denim/denim-trends/21-fashion-trends-2021-resale-environmentalism-gaming-hemp-jeans-vegan-252558/ (accessed on 10 March 2021).

31. PricewaterhouseCoopers. Renting or Buying Second-Hand Clothing as a Sustainable Option 2020. Available online: https://www.pwc.nl/en/insights-and-publications/services-and-industries/retail-and-consumer-goods/renting-or-buying-second-hand-clothing-as-a-sustainable-option.html (accessed on 10 July 2020).

32. Davis, G. Digital Retail Innovations 2020. 2020. Available online: https://www.retailinsider.com/wp-content/uploads/2020/11/Digital-Innovations-Report-2020.pdf (accessed on 10 March 2021).

33. ForwardPMX. Luxe Trend Report: Luxury Brands Online 2020. 2020.

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