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Can Digital Technologies Increase Consumer Acceptance of Circular Business Models? The Case of Second Hand Fashion

Fiona Charnley [1,*], Fabienne Knecht [2], Helge Muenkel [3], Diana Pletosu [4], Victoria Rickard [5], Chiara Sambonet [6], Martina Schneider [7] and Chunli Zhang [8]

1 Exeter Centre for the Circular Economy, University of Exeter, Rennes Drive, Exeter EX4 4PU, UK
2 Clariant International Ltd., Hardstrasse 61, 4133 Pratteln, Switzerland; fabiennesophie.knecht@clariant.com
3 Sustainable Finance, DBS Bank, 12 Marina Boulevard, Singapore 018982, Singapore; helgemuenkel@dbs.com
4 Sustainable Finance, Crédit Mutuel Arkea, Descartes Street, 29480 Le Relecq-Kerhuon, France; pletosu.diana@gmail.com
5 Victoria Rickard Consultancy, 116, Priory Road, London N8 7HP, UK; rickardconsultancy@gmail.com
6 Tommy, Jordan House, 47 Brunswick Place, London N1 6EB, UK; chiarasambonet@gmail.com
7 RSchneider, Weg am Schaechle 5, 78144 Schramberg, Germany; martina@rschneider.de
8 WeeKett Ltd., 64a Cumberland Street, Edinburgh EH3 6RE, UK; info@weekett.com
* Correspondence: f.charnley@exeter.ac.uk

Abstract: 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. A mixed methods approach, including a review of 40 organisations operating second hand fashion models, a consumer survey of over 1200 respondents and in-depth interviews with 10 organisations operating second hand fashion models, is adopted to reveal (a) the barriers to consumer acceptance of reuse models in the fashion industry, and (b) how digital technologies can overcome these barriers. Findings highlight the significant progress that organisations have made in using digitalisation, including data analytics, algorithms, digital platforms, advanced product imagery and data informed customer communications, to address barriers associated with convenience, hygiene, trust and security. Furthermore, the study identifies opportunities for the development of more sophisticated digital technologies to support increased transparency and address concerns associated with the quality, authenticity and sourcing of materials. Positioned at the interface of digitisation and consumer acceptance of circular business models, this study makes an important contribution to understanding consumer barriers and how to address them and concludes with a set of recommendations for practitioners.

Keywords: sustainability; fashion; circular economy; consumers; digitisation; technology; second hand; resale; reuse; engagement

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.
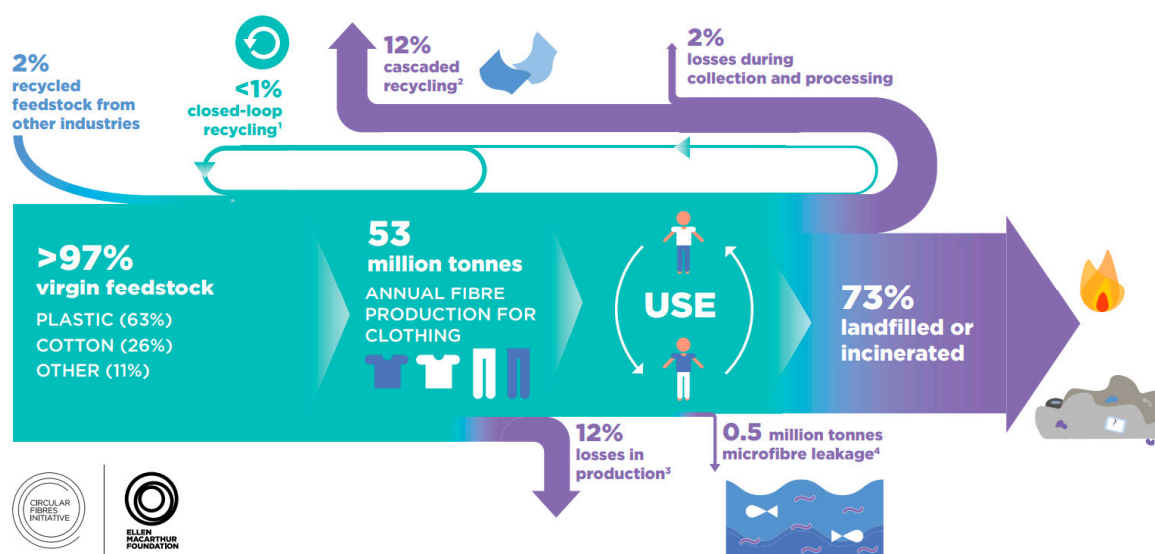
[1] Recycling of clothing into the same or similar quality applications.
[2] Recycling of clothing into other, lower value applications such as insulation material, wiping cloths, or mattress stuffing
[3] Includes factory offcuts and overstock liquidation
[4] Plastic microfibres shed through the washing 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 [2,4–6] 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 [4–6] 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 [7,8].

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 [9,10].

The aim of the research is to identify the main functional barriers to a greater consumer engagement in fashion reuse business models and evaluate possible digital solutions to overcome these barriers in the online environment.

The research aim is informed by market research that shows that second hand and rental fashion markets have been booming in recent years. The global second hand market for clothing reached USD 28 billion in 2019 and is predicted to reach USD 64 billion by 2024 [11]. Similarly, the global rental market for clothing reached a value of USD 1.26 billion in 2019 and it is expected to reach USD 2.08 billion by 2025 [12]. The pandemic has further accelerated this development [13–15]. However, despite the aforementioned material growth of the second hand and rental fashion markets, their share in the overall global apparel market, which reached a value of USD 1.5 trillion in 2020 [1], remains very small, at only USD 28 billion.

This leads to the first research question: what are the barriers to greater consumer engagement in second hand fashion (SHF)? This is an area that is so far relatively under-researched, according to a literature review by Camacho-Otero et al. [16]. To date, most literature has focused on CE engagement on the production side of the value chain, rather than on consumers.

The second area of this research is to understand enablers of greater consumer engagement in fashion reuse models. According to the EU's Circular Economy Action Plan [17] and various research reports [1,17], digital technologies and related technological trends such as the Internet of Things (IoT), data analytics, robotics, artificial intelligence (AI), augmented reality, blockchain, cloud computing, and many others, hold significant potential to unlock value and facilitate consumer engagement and the transition towards a more circular economy.

This leads to the second research question: how can digital technologies be used to overcome the barriers to greater consumer engagement in second hand fashion? This second research question is deemed especially important as the role of digital technologies in everyday life has grown in recent years and increased further during the global pandemic in 2020, including in fashion retail, which saw a definitive shift to online [18].

The research aim and the two research questions will be addressed by the following research objectives:

- Identify the key consumer barriers associated with SHF;
- Identify business models that facilitate fashion reuse;
- Assess the use of digital technologies within identified business models; and
- Assess how these digital technologies address consumer barriers and enable a greater engagement in SHF.

To address the aforementioned research questions and objectives, we establish a framework by conducting a review of existing literature including over forty industry reports, academic journals and research papers that analysed the barriers to consumer engagement in SHF retail and fashion rental environments and identified engagement orientated digital solutions. We conduct a survey to gather consumer perspectives on second hand fashion and undertake in depth interviews with organisations operating second hand fashion models. This methodology reveals both barriers to consumer acceptance of reuse models in the fashion industry and how digital technologies can overcome these barriers.

The findings are expected to address a gap in empirical research: evaluating the application of digital technologies in current industry case studies. The recommendations provide fashion industry stakeholders with an understanding of consumer barriers to CE concepts and how digital technologies can change the way consumers engage in SHF.

The rest of this paper is organised as follows: Section 2 focusses on relevant research into consumer barriers and digital enablers in fashion retail environments. The subsequent analysis takes into account the two specific research questions defined in Section 1. Question one is addressed in Section 2.2 and question two is addressed in Section 2.3; Section 3 presents the primary research materials and methods; Section 4 discusses the key findings from the primary research; Section 5 concludes by presenting the digital functionalities available within the evolving fashion technology landscape.

2. Literature Review

The authors undertook a systematic review of academic literature relevant to the goals of the research, utilising the key words: digital, technology, second hand fashion, consumer behaviour and barriers, and focusing on literature published between 2010 and 2021. A saturation of findings on barriers to consumer engagement and engagement orientated digital solutions was achieved.

2.1. Overview of Recent Trend and New Concepts in Research

Before exploring the barriers to consumer engagement in second hand fashion retail and fashion rental in more detail, a few key recent trends and concepts identified during the literature review will be highlighted, as they provide a framework for the subsequent analysis.

One important concept is collaborative fashion consumption (CFC), established by Iran and Schrader [19]. 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 [20] established the 'connected consumption' concept, which emphasizes the social aspects of a 'sharing economy', studied by, among others, Belk [21]. Bardhi and Eckhardt [22] 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) [19]. 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 [23]. 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. [24] identify three types of barriers to consumer engagement in SHF: functional, psychological and social. In our literature review, we focus on functional barriers, which 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.

From the literature review, four key barriers were identified. These are not mutually exclusive and do overlap:

1. Inconvenience;
2. Concerns about hygiene;
3. Lack of trust; and
4. 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' [24].

2.2.1. Inconvenience

According to a survey of 15,000 consumers conducted by ING Bank [25] across the Americas, Europe and Asia Pacific, inconvenience is one of the key barriers to engaging in solutions relating to CFC.

Tukker and Tischner [26] and Catulli [23] highlight how the lack of the immediate availability of SHF is often perceived by consumers as a sacrifice. Armstrong et al. [27], Catulli [23], and Rexfelt and Hiort Af Ornäs [28] emphasise the lack of accessibility or the additional efforts that are required to obtain SHF. Hirschl et al. [29] 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. [27] and Catulli [23] found that this fact increases consumers' focus on hygiene. In another report by Armstrong et al. [30], 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 [31], Na'amneh and Al Husban [32] and Perry and Chung [33] 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. [34] additionally argue that the adoption of CFC may be complicated by the stigma relating to SHF, even when the products are used for redesign.

Several other studies [35–38] provide an additional perspective and focus on psychological biases, which may prevent the adoption of CE models due to consumer avoidance behaviours. Furthermore, business models such as rental platforms have faced new challenges in the COVID-19 pandemic due to hygiene concerns around the sharing of garments [14].

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 [26,28,29]. 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 [27]. Consumers may also have doubts about the motives of a CFC solutions provider [28]. Armstrong et al. [27] 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 [25] 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 [39] and such technologies are driving new ways to exchange and share goods and services [10,40,41]. 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 [42]. 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 [18,43].

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 [2,44]. 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 [13].

PwC [13] 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 [45]. 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 [46].

Whilst the literature review of digital solutions pointed to the potential to enable companies to establish new business models and improve transparency in their value chains, it revealed limited discussion on digital solutions specifically for SHF. Furthermore, it exposed a lack of focus on how digital solutions can help overcome the consumer engagement barriers in this area. This gap will be addressed in Section 3, which summarises the overall methodology of the research.

3. Materials and Methods

The findings of the literature review informed the research methodology (Figure 2), in which a mixed approach of primary and secondary data collection and analysis was used to answer the research questions over a period of four months.
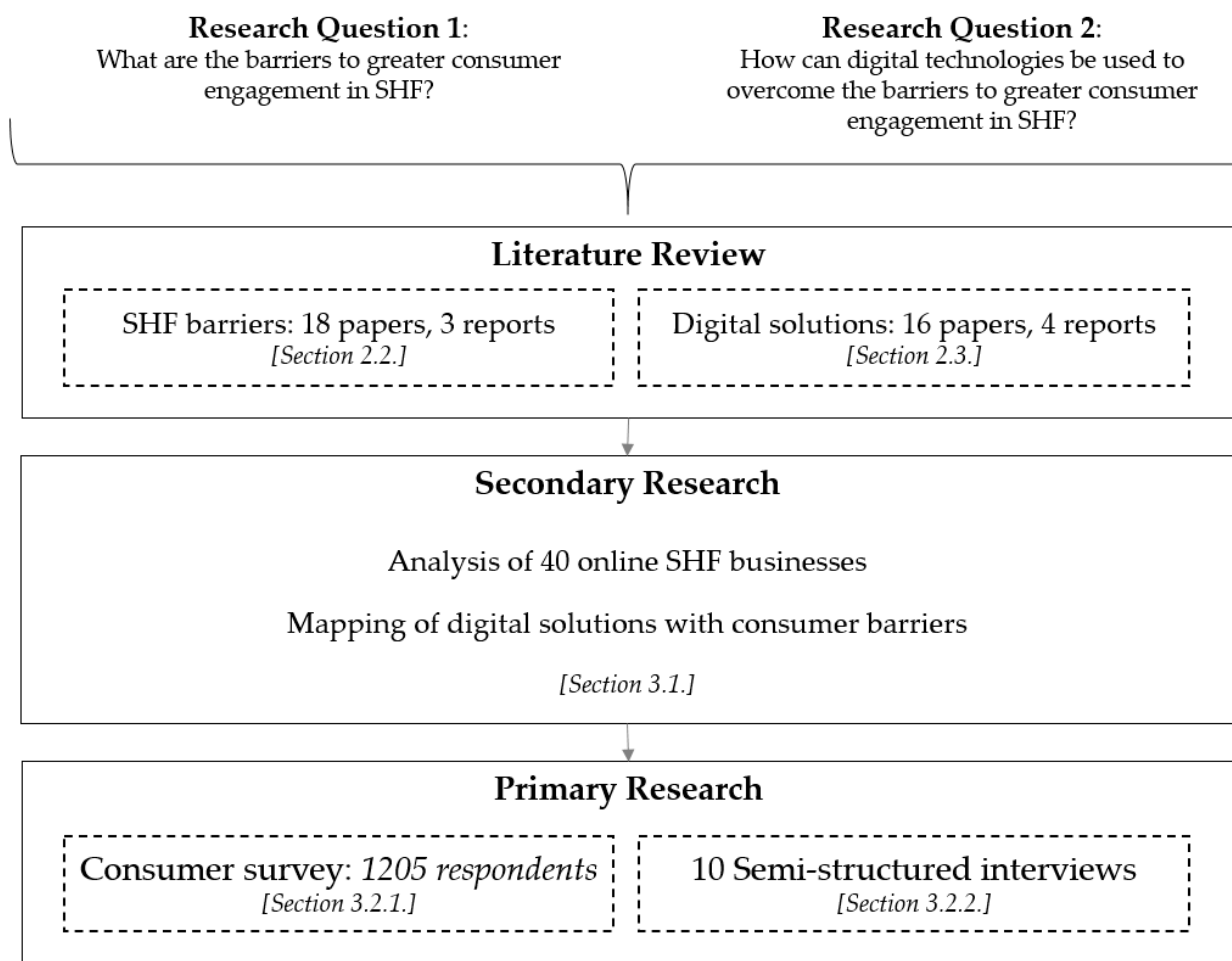

Research Question 1:
What are the barriers to greater consumer engagement in SHF?

Research Question 2:
How can digital technologies be used to overcome the barriers to greater consumer engagement in SHF?

Literature Review

SHF barriers: 18 papers, 3 reports
[Section 2.2.]

Digital solutions: 16 papers, 4 reports
[Section 2.3.]

Secondary Research

Analysis of 40 online SHF businesses

Mapping of digital solutions with consumer barriers

[Section 3.1.]

Primary Research

Consumer survey: *1205 respondents*
[Section 3.2.1.]

10 Semi-structured interviews
[Section 3.2.2.]

Figure 2. Overview of the research methodology.

3.1. Secondary Research

The literature review revealed a lack of research linking digital technologies and the SHF industry. Research of secondary sources was, therefore, necessary in order to identify the digital tools being used by online fashion retailers. Over 40 companies operating in the CE fashion sector globally were identified. Detailed desk research was then carried out on 20 of these, to determine business model types and to identify the industry 4.0 digital tools in use relevant to consumer engagement (Appendix A). The companies were selected to ensure a range of business models and different company sizes, from start-ups to established retailers. Eight operated platforms with rental subscriptions, eight reuse platforms, and four others served as reuse partners.

The outcome of this analysis was corroborated by the seven researchers involved in the project and is shown in Figure 3. It maps:

a.   The selected companies' approaches to CE solutions (i.e., the digital solutions in use), versus

b.   The consumer barriers (as per Section 2.2) being addressed by such an approach; whilst also aligning with

c.   The customer journey on a SHF platform, with six individual phases that a customer goes through from pre- to postpurchase [47].

Figure 3. Mapping of consumer barriers and digital solutions in the consumer journey.

While the terminology used for these stages varies across the marketing literature, for this analysis, descriptions were chosen that begin with awareness and considerations for the pre-purchase phase, followed by engagement and payment during the purchase phase, and leading on to the postpurchase phase, described as after sale and loyalty.

Online firms have a broad range of options to apply digital tools or touchpoints to interact with and guide the consumer. Figure 3 shows the digital touchpoints found as part of the secondary research. They were subsequently linked to the barriers and mapped to the stages in the customer journey, to provide a deeper understanding of customer experiences on SHF platforms. This mapping was undertaken and reviewed by all authors.

The outcome of this secondary research was subsequently used as input for the design of a consumer survey and semi-structured interviews with relevant companies, industry experts and digital solutions providers, the aim being to verify the findings from the literature review and secondary research and to assess the effectiveness of various digital technologies to overcome consumer barriers.

3.2. Primary Research

3.2.1. Survey

In order to take the consumer perspective into account in an objective and conclusive manner, a survey was conducted, gathering a significant amount of data for quantitative analysis.

The survey was delivered through SurveyMonkey, an established crowdsourcing survey platform. The main advantages of using such platforms include the ability to generate large data samples across a wide geographical spread, in a limited timeframe and a cost effective manner [48]. Honest opinions are also encouraged through the possibilities of anonymisation [19]. The limitations of crowdsourcing survey platforms are associated mainly with whether they are truly representative and can be considered a reliable source of decision-making data [48]. These limitations were overcome by using a diverse and robust sample, as suggested by Stewart et al. [49], Goodman et al. [50] and Buhrmester et al. [51].

The primary objective of the survey was to investigate the impact of digital platforms and tools on SHF purchasing behaviours and on overcoming the SHF barriers identified in Section 2. A secondary objective was validating the literature findings regarding barriers.

As can be seen in Figure 4, the survey segmented between two types of respondents: SHF consumers who have had previous exposure to online SHF shopping and non-SHF consumers who, therefore, have not yet had such exposure. The SHF consumer survey path focused on the primary survey objective, whilst the non-SHF consumer path focused on the secondary survey objective.

The title of the survey, 'Second hand fashion: yay or nay', did not reference the term 'sustainability,' in order to attract a broad sample in terms of size and attitudes without creating a bias towards sustainability oriented people (Appendix B includes samples).

The survey was posted on the social media of the seven researchers involved in this project, several Facebook groups and the discussion board Reddit, a US based social news aggregation and discussion website. The focus of these groups and forums spanned from advice on fashion, sustainable fashion and frugal fashion, to more generic university discussion forums. The objective of this was to accomplish a broad reach across different geographies and demographics.

Prior to launch, the survey was evaluated in a pilot phase with approximately 30 participants. After analysing the survey responses as well as overall feedback from respondents, questions relating to digital tools were fine tuned to focus more on the benefits.

The survey was open for six weeks and generated 1205 responses, with a completion rate of 83%. Key statistics on the respondents are shown in Figure 5. The survey data was quantitatively analysed to find relationships between variables to support or reject the barriers identified in the literature review.
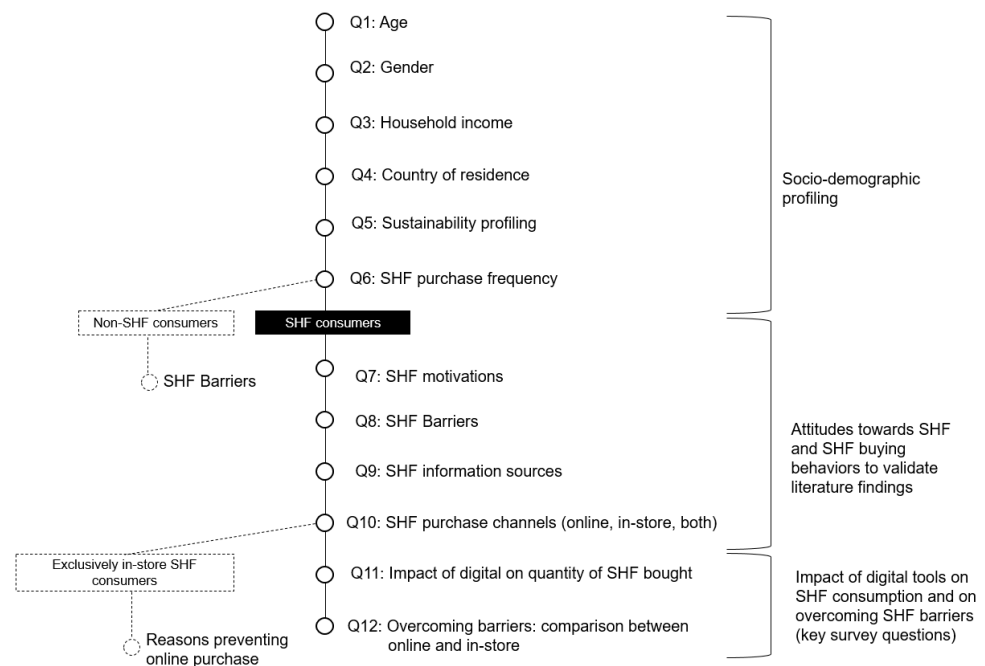
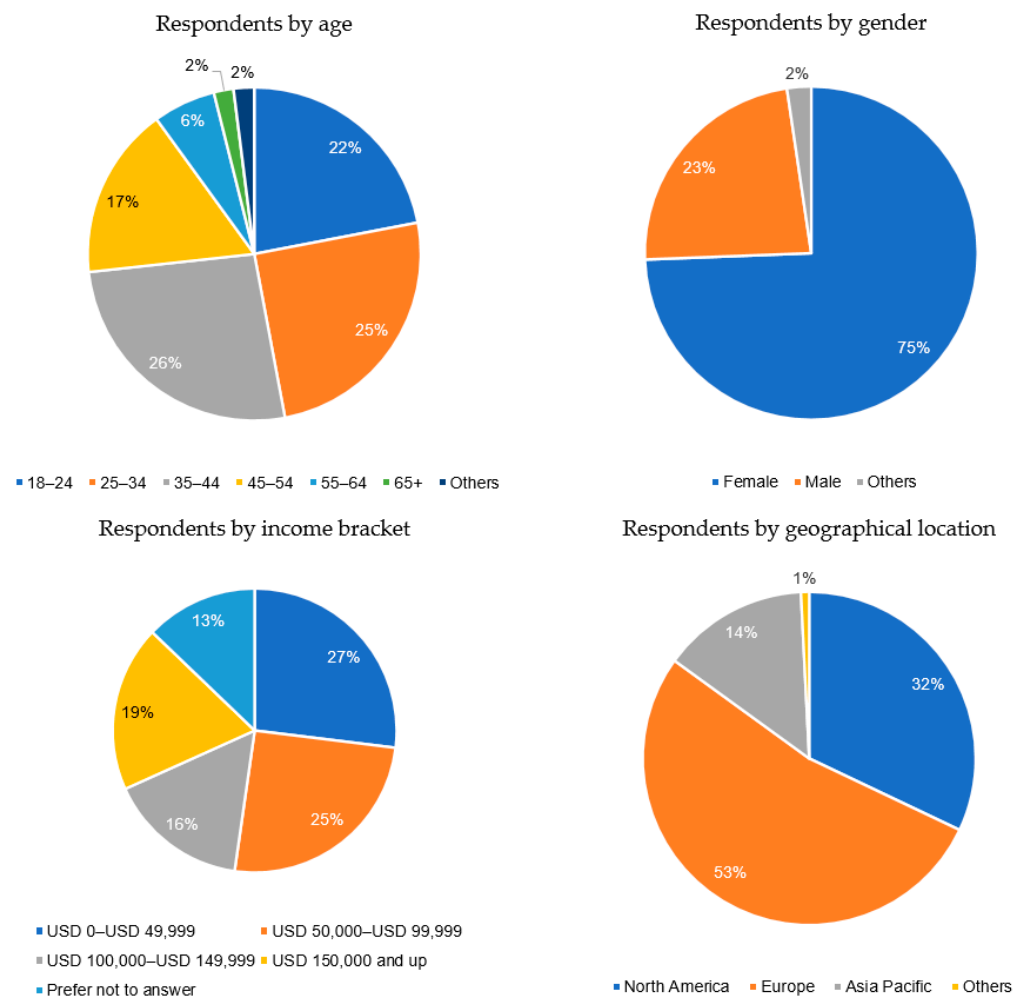**Figure 4.** Overview of survey questions.

Figure 5. Overview of statistics on the survey respondents.

3.2.2. Interviews

10 semi-structured interviews were carried out with organisations and individuals operating in the online SHF retail and rental industry in order to gain information about the main consumer barriers associated with CE fashion models and how digital technologies can be used to address and/or overcome these barriers.

The companies were selected for their SHF experience and to ensure representation of different company sizes, from start-ups to established global retailers. The sample, shown in Figure 6, included a wide range of business models that enable CE reuse principles. All companies interviewed operated in the online space and the business models ranged from retailing SHF P2P and consumer to business to consumer, to other activities linked to CE such as refurbishing services, and the rental and resale of unused but unwanted items. Interviewees were chosen due to their expertise, their leadership or sustainability role.

#	Organisation type	Country	CE activity launched	Reach	Number of customers/ followers	Interviewee's title	App	Web- site	Social media	Business model
C1	Luxury large brand	UK	2020	Global	Confidential	Corporate Responsibility Programme Manager		●		C2B2C
C2	Premium large brand	Sweden	2020	UK, Germany	Confidential	Sustainability Project Manager		●		C2B2C
C3	Luxury rental platform	Australia	2016	Australia, US	45000	Co-founder		●		P2P
C4	CE consultancy	Denmark	2015	N/A	N/A	Co-founder		●		B2B
C5	Baby clothing resale platform	UK	2020	Global	4600 followers	Founder/CEO		●		P2P
C6	Baby clothing resale platform	UK	2020	Global	3300 followers	Founder			●	P2P
C7	Luxury & premium resale platform	US	2015	Global	15 million	Co-founder	●	●		P2P
C8	Resale platform	Lithuania	2012	US, EU	30 million	Sustainability Manager	●	●		P2P
C9	NGO CE Consultancy	UK	2000	Global	N/A	Head of Citizen Behaviour Change		●		B2B
C10	Digitised take- back solutions	Switzerland	2020	Switzerland	Confidential	Co-founder	●	●		B2B

Figure 6. Overview of interviews: companies and experts.

In the sample, there was a clear split between those brands piloting circular models and purpose driven start-ups serving niche markets.

The semi-structured interviews were undertaken via video or conference call and conducted by two of the project researchers using a script (Appendix C), to reduce the risk of interviewer bias and enable transcription [49]. The themes and statements are summarised in Section 4.

The interview questions covered the following topics:

1. CE business models in use and the type of CE business strategy;
2. Target markets, main customers, and any target consumers that are hard to reach;
3. Typical barriers observed among consumers;
4. Current and emerging digital solutions in the fashion industry; and
5. Importance of sustainability to consumers and if/how organisations are measuring and marketing their environmental impact.

The interviewees were mostly 'founders' or 'sustainability managers', which provided holistic insights into the business model and its sustainability aspects. However, this also set limitations on the level of information that could be gathered on digital technology and its

potential. Additionally, some companies were unable to disclose confidential information about strategic digital developments.

The interviews were conducted during a three-month timeframe.

4. Results

4.1. Survey Results

The survey showed online platforms and tools have a positive impact on SHF consumer purchasing behaviour. A total of 42% of respondents (60% belonging to the 18–24 age bracket) said that they have bought more SHF since the launch of dedicated apps and websites (Figure 7).
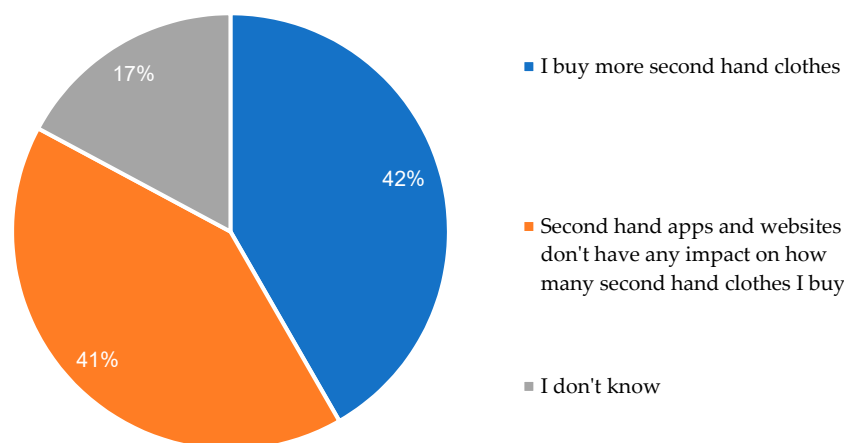

Figure 7. Influence of recent digital developments on shopping behaviour.

The survey results also revealed the following:

Online solutions appear most effective in overcoming the inconvenience barrier. SHF consumers believe that, when shopping online, there is more choice than in-store, as confirmed by 69% of the respondents overall (and 78% of those in the 18–24 age bracket). Furthermore, 84% of respondents overall (94% in the 18–24 age bracket), stated that finding a specific item is easier when shopping online as compared to shopping in-store (Figure 8).
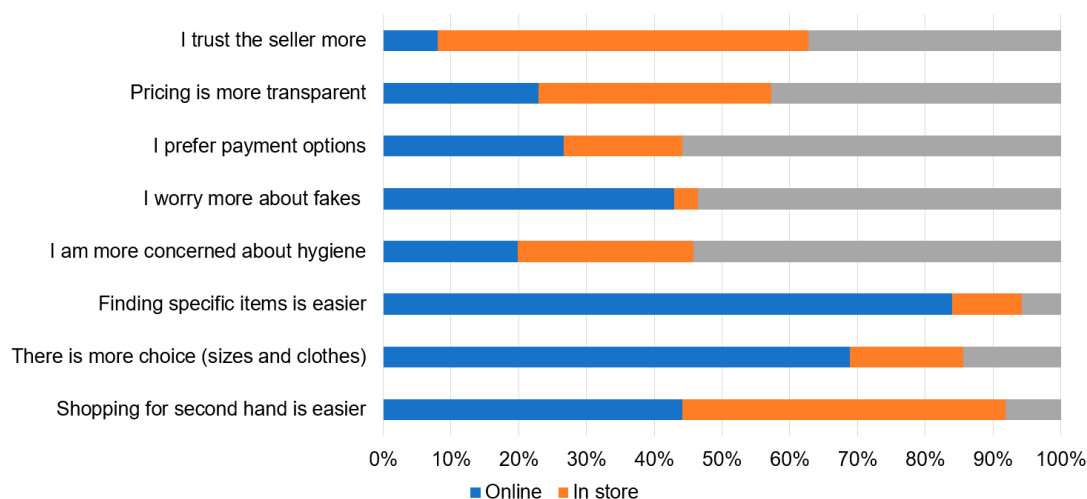
Figure 8. Opinions on second hand fashion online versus in-store.

Online solutions appear to slightly lower the hygiene barrier, as 26% of SHF consumers said that they are concerned about hygiene when buying in-store, compared to 19% when buying online. This is more pronounced for the younger 18–24 age group, with 43% being more concerned about hygiene when buying in-store compared to 16% when shopping online.

Online platforms do not currently help overcome the lack of trust barrier. A total of 43% of SHF consumers (51% of respondents belonging to the 18–24 age bracket) worry about fakes when shopping online, compared to only 4% when shopping in-store. Furthermore, 55% of SHF consumers trust the seller when buying fashion in-store versus only 8% when buying online (Figure 8).

Lack of transparency around the price was not visibly overcome by the use of online solutions. A total of 34% of respondents found the pricing of SHF to be more transparent when shopping in-store, whilst 23% felt the pricing of SHF is more transparent when online. The remaining 43% of respondents did not express an answer, which suggests that there was no strong consensus. The findings indicate that digital solutions that help to build trust in online shopping environments are not currently being exploited to their full potential.

The survey validated the literature findings, highlighting significant barriers for the non-SHF consumer group. In particular, 66% of non-SHF consumers are concerned about inconvenience and 71% about hygiene. The survey also revealed that having previous experience in purchasing SHF appears to influence consumers' perceptions of the barriers, with barriers being more pronounced for non-SHF consumers, which is in line with the literature review findings [19].

The survey also analysed reasons why respondents do not buy fashion online. When looking at respondents who had either already bought SHF or were open to it but had only ever done so in physical stores, it is noteworthy that 88% would like to try items on before purchasing.

4.2. Interview Results

4.2.1. CE Business Models

For established companies, the barriers to fully implementing CE models are significant. There are high investment costs and risks of the potential cannibalisation of existing business. 'Usually companies have reuse and recycling models for only a very small part of their activity (2–5%) with very intensive marketing and communication efforts' said C4. CE models must be scalable and shift from tokenistic projects or greenwashing exercises.

Start-ups spoke of purpose driven business models. When asked why they engage in the SHF market, C1 said that 'it reflects our company's brand values—quality clothing that can be passed on to the next generation'. Some put sustainability at the heart of their strategy and collaborate with their value chains to improve their environmental impact, such as C8, who said: 'Through partnerships we can integrate sustainable payments, shipping ('the last mile'), and optimise the energy we are using'. Some garnered inspiration from other successful sharing models such 'Airbnb and Uber,' as mentioned by C3.

4.2.2. Identified Barriers

The main barriers mentioned by companies in marketing SHF to consumers were inconvenience and lack of trust.

Frequently cited was the 'high effort needed to make the product attractive to buyers in a digital environment,' as mentioned by C2. This was reinforced by C1, who said that 'There's a challenge to replicate the customer interaction in a digital or virtual environment'.

Inconvenience was also found to disincentivise seller engagement. C7 observed that 'Resale platforms for used clothing are still very manual with 20 to 30 manual steps necessary to list an item of clothing. Describing the condition requires uploading many photos'. P2P models work because the platform reduces some of the effort through its functionality and offloads it from the business to the consumer. C10 emphasised this point, adding that digital technologies that reduce manual steps are essential in many CE models and critically so in high cost labour markets.

When queried about digital solutions and tools that are of paramount importance for their strategy, an important theme was the platform used. Clearly established brands opted for partnerships with a specialist platform provider, often in pilot form (C1: 'We have a preference to test the market with partners as this reduces the financial and resource investment

needed for in-house microsites'). Start-ups also deployed specialist SHF platforms. Three of the ten were in the app business or had apps as part of ecommerce (Figure 6). These platforms are chosen, mainly, for their user friendliness and features to provide scale and SHF consumer choice. C8 commented that 'Cost effective, access-enabling digital platforms that automate the marketing and sales process are essential. These platforms are customisable to the local market culture and needs. We focus on maximum user friendliness'.

However, limitations remain in terms of recreating the experience of 'shopping for new, cutting edge fashion,' as confirmed by C5. Digital tools were used to recreate the in-store experience and foster customer relationships, but the level is immature. In P2P models, where expectations are lower, more important were the product marketing aspects.

Product taxonomy tools such as algorithms and filters to enable users in finding the right product, discovery tools such as 'you might like', weekly 'top picks', 'clothing trends', and search functions were cited as adding value. C8 said that: 'By design we are a big data-driven platform using AI allowing us to make predictions and customise and improve the user experience'. C5 also recommended to 'Categorise styles that suit the customer to enable more targeted recommendations for customers'.

Image curation software and emotion building marketing functionalities were mentioned as important tools. Built upon with socially interactive marketing communication functions such as videos with real time commenting functionality and messaging, they may, cumulatively, work towards the tangible sense of an in-store experience.

The barrier hygiene, identified in the literature review, is closely related to lack of trust and information. However, congruent with the consumer survey findings, organisations said that hygiene concerns are generally low. C8 said that 'COVID has increased hygiene concerns among a small number of SHF customers. Transparency is key to avoiding hygiene and quality concerns'. The tactics used to address this fear included a cleaning service as part of the offering. For C3 'Hygiene is not so much of a big factor. All dresses have to be dry cleaned and have a tag on it that proves it'. For C8, 'The stigma that someone else wore the clothing exists but this barrier is declining. Its gravity depends on the country'.

Lack of trust was confirmed as one of the biggest barriers to SHF engagement among the organisations and individuals interviewed. C7's 'intention was to have a platform with full transparency'. They pointed to one of the biggest challenges being the lack of a common standardisation for product condition descriptions. They also pointed out that 'There are many definitions of 'used' which complicates the customer experience'. To overcome this barrier, several retailers deployed standardised condition grading systems and nomenclature.

Several organisations pointed to on the label digital or QR codes, or the use of blockchain technologies, to improve product traceability. Discussions pointed to more sophisticated authentication tools expected in the future, especially at the luxury end of SHF, i.e., digital chips and digital passports in fashion. C7: 'There is a very advanced authenticity verification process which is a combination of digital, chemical and human verification. The future might include the use of 3D scans and light testing'. Partnerships were again mentioned to tackle this challenge. C8 confirmed that 'it is important to identify fake high value products by working together with brands'.

Platforms have invested in ID verification technologies and increased payment security to address the issue of trust. Other solutions included secure payment functionalities and a rent now pay later service. For C3: 'The 'rent now pay later' solution encourages trust, knowing they will pay after they use the dress'.

According to C5, 'Consumers lack knowledge about where to buy second hand'. Additionally, then, when they do, 'They have difficulty finding what they want on second hand platforms,' said C2. Both these concerns are thought to be best addressed by improved product taxonomy and filtering functionalities.

Several organisations followed 'Local, community-based models with specific products by region'. C6 is convinced that 'Social and community aspects are important. We're predominantly a local peer-to-peer network and people appreciate sharing their products

and seeing its continued use'. The P2P model also offers high flexibility, which is important where local trends are influencing product popularity. C7′s platform 'Is dedicated especially to popular products and it varies a lot depending on the local market and culture and influencers that resonate'.

Several companies also said that consumers are more willing to trust these new exchange forums. C3 is convinced that 'Consumer driven models are currently more successful than B2C platforms and brand campaigns, peer-to-peer models also having less costs, less environmental impact and consumers trusting their peers more than brands'.

Lack of transparency around price did not come through strongly in discussions with organisations, although one company displayed sophisticated pricing technology and consumer engagement C7: 'This enables consumers to see product market value and all past transaction prices, similar to a stock market trading platform'.

Some acknowledged pricing as a hindrance to higher engagement (C9) and it was evident that sellers in P2P models needed reliable ecommerce platforms, consignment platforms and intuitive payment functionalities to succeed. Digital pricing support tools were considered valuable within P2P models.

5. Discussion and Conclusions

Our research confirmed that, from start-ups to global brands, digital tools are helping to create the scale and taxonomy needed for SHF to work. Online tools are driving SHF consumption growth, enabling consumers to become sellers through P2P and sharing networks—the community factor being vital to making these models thrive. Furthermore, the analysis highlighted that digital technology presents a growth opportunity for SHF businesses that do not yet have a digital presence, whilst also outlining opportunities for further growth for those with an established online presence.

5.1. The Key Engagement Barriers and Digital Solutions

Four key barriers were identified in the literature review. Our research found that inconvenience and trust are the most relevant barriers to consumer engagement in SHF. While digital platforms can present challenges to consumer engagement compared to the physical SHF shopping environment, overall, they have a positive impact on SHF engagement and consumption. The survey findings address a gap in quantitative research on consumer behaviours and perceptions related to digital tools to overcome SHF barriers, as limited quantitative research has been undertaken on this specific topic.

Inconvenience is the barrier that digital tools are able to address most effectively: digitalisation has transformed the way we shop for SHF and brought it more on a par with buying new. Businesses that would like to build an online presence should prioritise product taxonomy, marketing and innovative tools to overcome this barrier and recreate the human aspects of the in-store SHF shopping experience.

Digital solutions are not currently being exploited to their full potential, to help consumers overcome trust barriers. Businesses that would like to build an online presence should consider adopting the most innovative digital tools to overcome this barrier. CE businesses highlighted several concerns relating to trust, namely, consumer uncertainty and missing standardisations for a product's condition, all factors that preserve the preference for new and create barriers to SHF engagement. The clear demand for end of life services, especially in the luxury market, highlighted in the research, indicates that a product's emotional and physical durability are fundamental to increasing reuse.

Digitalisation also does not currently help overcome the barrier related to price transparency. People appear to trust prices more in physical stores. This consumer engagement barrier also did not come through strongly in the discussions with organisations. Nevertheless, it was evident that sellers in peer to peer models need reliable ecommerce and consignment platforms and intuitive payment functionalities to succeed.

5.2. Opportunities for SHF Businesses

The model shown in Figure 9 captures the current range of sophistication and functionalities available within the evolving fashion technology landscape to provide research based guidance for companies planning to develop online SHF businesses. Generated from the findings of the company interviews, and supported by our consumer research, Figure 9 demonstrates how digital solutions can be applied to negate dominant *barriers*, such as inconvenience and trust, and create *opportunities* from consumer needs and expectations.
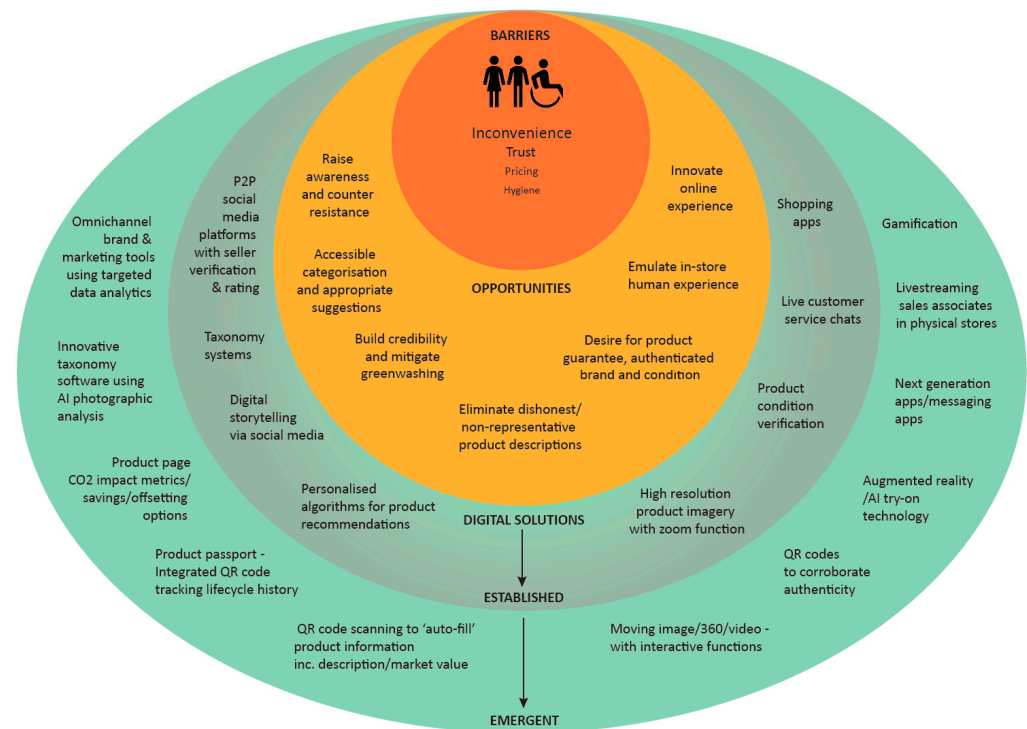
Figure 9. Recommended digital solutions to overcome certain consumer barriers and drive SHF opportunities.

Radiating from the customer's standpoint, the barriers indicated present specific opportunities for the SHF industry, opportunities that can be addressed with *established* digital solutions that have been observed in this research. Additionally, the model captures *emerging* digital solutions, which have not yet been fully implemented in the SHF industry but carry a high impact potential in terms of accelerating growth and, therefore, the adoption of CE practice.

This model can be used as a practical tool to support strategic decisions for SHF business and should be adapted as the sector continues to evolve.

5.3. Limitations and Future Research Areas

There is no one size fits all business model or solution for SHF retail. P2P appears to be one of the most impactful ways to scale CE effectively. Our findings confirmed that it is a very adaptable model being adopted by individuals right through to global brands. While the sample was moderate, the big brands interviewed are noticeably piloting CE models in carefully chosen markets and the SHF leaders are, foremost, sustainability and purpose driven businesses deploying established platforms and leveraging value chain partnerships to fill technical competency gaps, and increase sustainability and customer reach.

Our research confirmed the literature findings of a lack of sustainability impact measurement beyond what is regulatory or investor driven. There are significant opportunities for companies to build their environmental impact measurement methodology and use digital tools to quantify and communicate impacts to reward and further incentivise SHF consumers.

While the primary research undertaken focussed on the consumer part of the fashion value chain, it is clear that SHF should not exist separately to new fashion. It must become a normal part of a product's concept and lifecycle. To proliferate the reuse model, the industry and all its players will need to design for a circular economy, integrate technology into the product and shift customer perceptions towards seeing fashion as a long term investment.

Appendix A

Sample of framework developed from a review of 20 organisations.

Figure A1. Sample from the secondary research undertaken by the authors which examined 20 organisations and identified business model types and industry 4.0 digital tools in use relevant to consumer engagement.

Appendix B

Samples of the survey marketing assets (Figure A2a,b) and survey (Figure A2c).

(a)

(b)

(c)

Figure A2. Samples of the survey marketing assets (**a**,**b**) and survey (**c**). (**a**,**b**) Visual assets were used to market the survey to consumers in social media channels. The title of the survey, 'Second hand fashion: yay or nay', did not reference the term 'sustainability,' in order to attract a broad sample in terms of size and attitudes without creating a bias towards sustainability oriented people.

Appendix C

Interview script.

Introduction:

- We are interviewing X companies;
- Interviewees are anonymous and will not be named in the report, unless you ask us to list your name/company name;
- We would be pleased to share with you a copy of the report/research findings; and

- To make best use of the time we have today, we plan to record the interview audio as this will help to ensure we capture things accurately and make the best use of our time today.

Interview:

- Company name:
- Interviewee's role, length of service, etc.

Business Model

1. What is your business model type?

 What strategy do you follow? Why/how is this strategy part of business and growth? Typical Customer and Barriers

2. Who is your main customer for this model?

 Prompts:
 Have you undertaken market research? What does that research tell you?

3. What are the customer barriers you experience and how do you counter these?

 Prompts:
 Do you observe barriers such as (as identified in Lit. Rev.)?
 Do digital solutions play a role?
 Digital Solutions

4. What digital solutions/digital tools do you think are paramount to your investment in this strategy?

 Prompts: name some digital solutions used by competitors.

5. What current digital projects or initiatives on customer engagement are you working on?

 Sustainability

6. How do you measure the environmental impact of your model?
7. How important is this/sustainability to your customers?

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