

UNDERSTANDING BARRIERS TO THE CIRCULAR ECONOMY: THE CASE OF THE REUSE AND REDISTRIBUTION OF CAMERAS

Abstract:

The implementation of business models which facilitate the transition to a circular economy, is hindered by a set of ‘barriers to the circular economy’. These are categorized in a general framework. To further develop our understanding of these barriers, this thesis performed a qualitative case study on a specific sector and researched how and what kind of challenges are experienced by organizations facilitating the reuse and redistribution of cameras. The results reveal a set of insightful challenges which can be categorized within the existing broad themes of barriers. However, some detailed barriers differ from the general framework, showing that its specifics change per context. The cultural, regulatory, market-related, and technological barriers found, present considerations for organizations transitioning to similar business models and propose topics for discussion for regulation and policymakers.

Pelle Menke (4457056)

MSc Sustainable Entrepreneurship

Supervisor: Drs. J. (Hans) van Polen

Co-Assessor: Eric M. Fath-Kolmes, P.Eng., MBA

Rijksuniversiteit Groningen

Campus Fryslan, Leeuwarden

p.j.menke@student.rug.nl

INTRODUCTION

The world's current process of economic development is igniting global sustainability pressures, as it carries the depletion of natural resources and a multitude of environmental issues (Su, Heshmati, Geng & Yu, 2013). This is related to the fact that our economy is based on linear material flows, in which the discarding of products after usage, while (parts of) it could still be used, is the norm. To move away from the 'take-make-disposal' model and help reduce the global sustainability pressures, transitioning towards a circular economy is proposed as a promising solution (Nazlı, 2021). This proposed concept of the circular economy refers to an economy in which all of its actors and processes do not have any net effect on the environment. Instead, it aims to restore natural damage from gathering resources, and ensure minimal waste generation during both production processes and the lifetime of the product (Murray, Skene & Hayes, 2017).

An example of business models that would serve and fit in such a circular economy, are the ones that are concerned with extending the lifetime of a product (Lüdeke-Freund, Gold, Bocken, 2019). In this category, one could think of business models related to the reuse and redistribution of products, which are of great importance for enabling the circular economy (Ertz, Leblanc-Proulx, Sarigöllü & Morin, 2019), as they could replace the use of virgin materials and the purchasing of newly made products. Although this sector seems promising and impactful, Lüdeke-Freund et al. (2019) further mention that more insights into these business models are needed to show how they capture value, in order to promote its use.

The transition towards the circular economy has gained momentum in literature as the topic sparked the interest of many economic and sustainable development academics (Kirchherr et al., 2018). However, the practical implementation of the circular economy appears to be challenging, resulting in a body of literature on the barriers to a successful transition (Kirchherr et al., 2018; de Jesus & Mendonça, 2018). Authors like de Jesus and Menconça (2018) have summed up the different barriers, while Kirchherr et al. (2018) have tested which were most problematic. Ultimately, the main categories of barriers that have been identified are; ‘cultural’, ‘regulatory’, ‘market’ and ‘technological’ (Kircher et al., 2018). Both papers suggest the need for more empirical studies to specify their frameworks and Kircher et al. (2018) in particular propose the need for research in more specific sectors.

In addition to contributing to academic literature and existing frameworks, insights into challenges, faced by businesses which implement circular business models, will help inform what intervention strategies are needed from governments and their policies to advance the transition towards the circular economy (Kirchherr et al., 2018). Furthermore, research into organizations with business models, suited for a circular economy, could also uncover insights into how one successfully executes such a model or at least parts of it. This would help established businesses when incorporating this new way of thinking and break free from their linear approach to production and growth (Lüdeke-Freund et al., 2019)

This research explores how the identified barriers form challenges for, specifically, a business model pattern related to the reuse and redistribution of products (Lüdeke-Freund et al., 2019). Furthermore, reducing the scope even further, this research is concerned with the case of the

second hand camera market and its organizations facilitating the reuse and redistribution of cameras. These organizations all contribute to the preservation of cameras and their lifetimes.

To guide the academic and practical relevance of this research, a leading research question is constructed; *How do organizations, facilitating the reuse and redistribution of cameras, experience barriers to the circular economy?*

The following chapter will elaborate on the theoretical framework on which this research is based. Relevant concepts will be introduced to the reader to explain the current state of literature regarding the circular economy, reuse and redistribution business model patterns, and this transition's challenges. Then, the methods section will discuss the research process, present an argumentation for the used design and methods, and elaborate on the data collection and analysis. The results chapter will then present what the findings tell us with respect to the research question. Finally, the concluding chapter will discuss the results and its impact.

THEORY

To better understand this research and its approach, this chapter will elaborate on existing literature on the related concepts. First, the broad concept of the circular economy will be introduced with the help of established literature. Then, as a form of implementing this umbrella concept, the reuse and redistribution (circular economy) business model will be touched upon. Finally, an existing framework on the barriers to the circular economy, which this research builds on and contributes to, will be presented and discussed.

The circular economy

Boulding's (1966) work emphasized the fact that human activities on planet earth are dependent on natural resources with a limited availability, meaning we should pay attention to the inputs we need and the outputs we are creating. Furthermore, the Limits to Growth Report by the Club of Rome (Meadows et al., 1974) stressed the fact that the earth and its resources are 'finite' and further elaborated on the negative effects of waste and emissions from our exponentially growing production activities. From these works, among others, it became clear that our current view on, and striving for, economic growth leads to environmental degradation and increasing exploitation of natural resources, and is thus harming the biosphere and its ecosystems. These findings ignited and inspired the forming of a set of principles aiming to transform society towards a 'circular economy' (Merli et al., 2018). Broadly speaking, this concept of the circular economy stresses that our linear 'take-make-dispose' path of production and consumption should make way for a society in which economic growth is decoupled from natural resource depletion and environmental degradation (Geng and Doberstein, 2008). It implies a transition towards an economy in which its actors and processes don't have a negative effect on the environment

anymore. In such an economy, natural damage from gathering resources and the generation of waste is restored and/or minimized during production processes and the life cycle of a product or service (Murray et al., 2017).

The need for alternative business models

The concepts and approaches under the umbrella of the circular economy sound promising, but will require businesses to embrace and follow its principles (Bocken et al., 2016). As this entails the abandoning of the linear approach to growth, which is deeply rooted in ordinary businesses, new and innovative business models are needed to create value along the principles of the circular economy (Lüdeke-Freund et al., 2019).

Lüdeke-Freund et al. (2019) identified different categories of business model patterns embedded in the circular economy principles. Among others, the authors discussed the ‘repair and maintenance’ and ‘reuse and redistribution’ business models. The repair and maintenance business model could refer to parties providing a repairing service for products and creating value by extending product lifetime. Therefore, they would need technological expertise and the willingness from customers to engage in co-creation, as they might need to bring in the products (Lüdeke-Freund et al., 2019). The other model of interest, the reuse and redistribution business models, are related to the creation of access to used products for customers. Furthermore, these businesses are concerned with evaluating the market value of a product, enhancing or modifying them, and creating some sort of market place. Within this category, one could think of an organization which actively collects second hand products, curates them, and sells them through an online webshop (Lüdeke-Freund et al., 2019).

Product lifetime extension

The mentioned business model patterns are concerned with extending the utilization period of products, and thereby reducing the need for production and the extraction of new natural resources (Bocken, De Pauw, Bakker & Van Der Grinten, 2016). This approach is labeled as ‘product lifetime extension’ and refers to all activities aimed at extending and improving a product’s useful life, either through product design or maintenance and repair, to extend its usability for the main function it was originally built for (Ertz et al., 2019).

The barriers to the circular economy framework

For the mentioned business model patterns to be implemented, however, particular challenges exist (Bocken et al., 2016). To uncover aspects which hinder the societal transition from a business model or organization’s perspective, frameworks exist that help identify these ‘barriers to the circular economy’. These barriers refer to different categories of challenges, that are currently hindering the successful implementation of business models along the principles of the circular economy (de Jesus & Mendonça, 2018). This research adopts a categorization presented in Figure 1; a table theorizing the different categories of barriers (Kircherr et al., 2018).

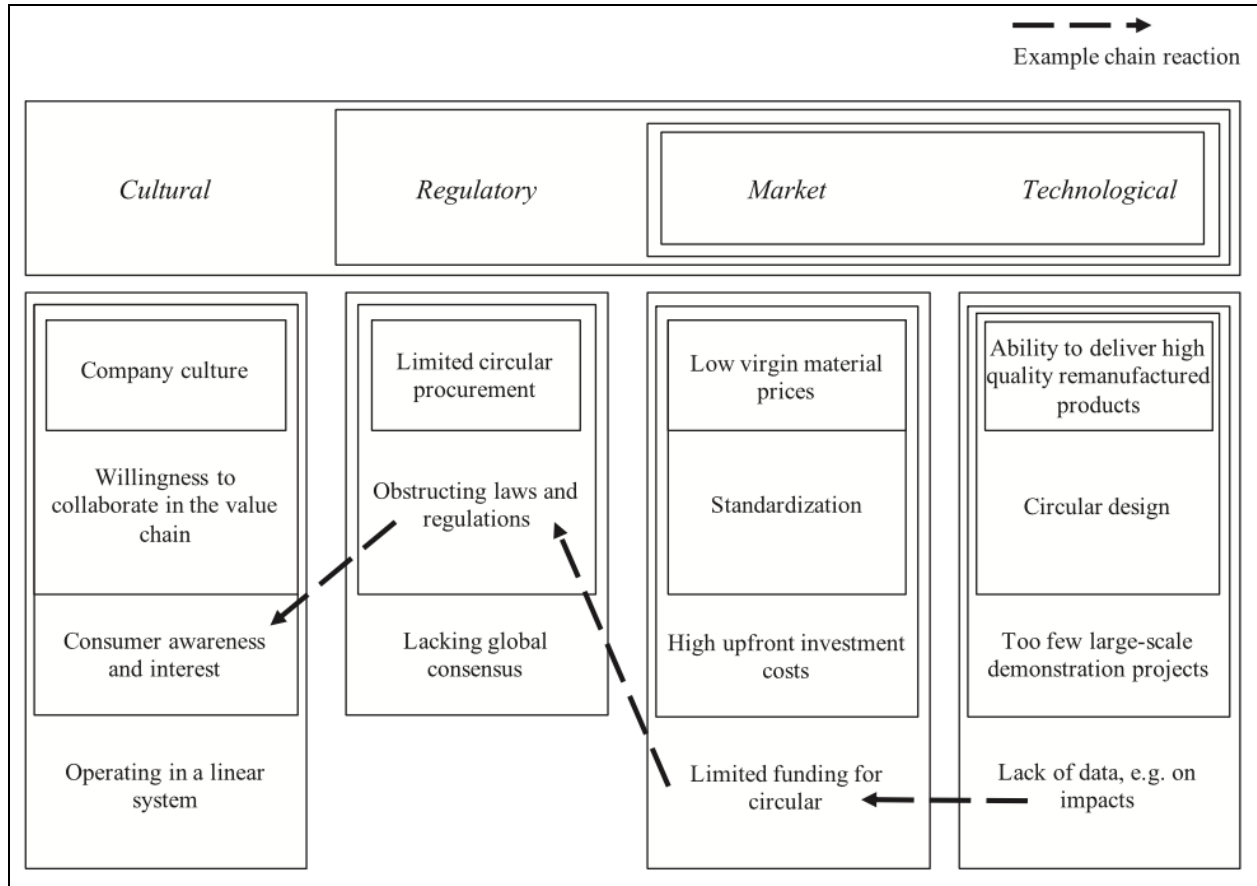


Figure 1: ‘Theorizing the CE Barriers’, as presented by Kirchher et al. (2018: 267)

Building on earlier categorization by (de Jesus & Mendonça, 2018), Kirchherr et al. (2018) defined different challenges, or barriers, for business models aiming to capture value along the circular economy principles. Cultural barriers refer to the lacking awareness or willingness to engage with the circular economy. This could either be from the company’s side due to a hesitant culture or value chain, or there could be a lacking interest and awareness from the consumers’ side. Regulatory barriers refer to a lack of supporting policies favouring the transition to the circular economy. This mainly concerns obstructing laws and regulations, a lack of global agreement and a main focus on costs, ignoring other things. Market barriers refer to the causes for a lacking economic viability of circular business models. Here, one could think of the low

prices of virgin materials, a lack of standards, high investment costs (in new processes) and limited funding options for circular business models. Lastly, the technological barriers refer to a lack of (proven) technologies to implement a circular economy. This could be due to difficulties in providing data on impacts, the lack of products designed for recycling or a lack of quality in recycled materials. Finally, as visualized in Figure 1, it is worth mentioning that these subcategories of barriers show interaction effects and could reinforce each other (de Jesus & Mendonça, 2018; Kirchherr et al., 2018).

While these challenges confirm that we're locked in a system which favours the linear model of production and consumption, we must now seek to better understand these matters from an organization's perspective in order to 'mainstream' the circular economy and bring it to scale (Ellen MacArthur Foundation, 2021).

METHODS

This chapter will present and justify the specifics of this qualitative research. The chosen strategy, as well as the reasons for a case study design will be elaborated on. After introducing the units of analysis, some paragraphs will explain why and how the qualitative interviews are conducted, ethical concerns to consider, and how the data is analyzed.

Approach & strategy

This thesis aims to explore and deepen our understanding of the barriers to the circular economy. Therefore, this study takes a constructivist approach, which assumes that reality is socially constructed, and individuals' actions and views thus create reality (Bryman, 2016). This approach is taken because to better understand the topic of barriers to the circular economy and how these are experienced, its perceptions and interpretations by individuals are of importance. This study applies a qualitative research strategy to conduct its research (Bryman, 2016). This strategy suits the research objective as an emphasis on words, rather than quantification, is needed to study perceptions of reality and *how* one (i.e. an organization) experiences challenges.

Research design

The following section will describe the used case study research design and the case and units of analysis this research is concerned with.

Single case study design

Regarding the structure and framework for the collection and analysis of data, this research makes use of a case study design (Bryman & Bell, 2011). The research's aim is to explore the

barriers to the circular economy in detail through the ‘case’ of the facilitation of the reuse and redistribution of cameras. Thus, the single case of interest for this study is the facilitation of the reuse and redistribution of cameras as a whole. To get a holistic understanding of this specific case (Yin, 2018) and intensively examine the setting (Bryman & Bell, 2011), insights were retrieved from different ‘embedded’ units of analysis (Yin, 2018). These units of analysis consist of different organizations concerned with the reuse and redistribution of cameras, and a repair expert with an in-depth understanding of the second hand camera market.

Although a case study design is often linked with longitudinal research, gathering data over a longer period of time (Yin, 2018), this case study gathered data in a single moment in time, during the months of April and May. This was due to deadlines for this particular study, set by the master’s program.

Units of analysis

This study researches and analyzes five different organizations, concerned with buying, trading, and selling second hand camera equipment, and one repair expert (see Appendix A) . While the initial idea was to incorporate more international organizations in this research, multiple cases of non-response or rejections resulted in a sample of mainly Dutch organizations and one Finnish. All of the organizations share a business model pattern related to the reuse and redistribution of cameras, but differ in the kind of cameras (analog or digital) they resell, their scale of business, and their geographical presence. This slight degree of heterogeneity within the set of units of analysis is needed to represent the different types of organizations concerned with the case of the reuse and redistribution of cameras. Furthermore, the repair expert is incorporated as involving

insights from experts within the field is an efficient and concentrated method of gathering data (Bogner, Littig & Menz, 2009) and repair expertise is essential to this sector.

Data collection

To answer the research question and gather data on experiences, this study makes use of qualitative semi-structured interviews. The reason for the use of this method and the processing of this data will be discussed in the following paragraphs.

Sampling

The interviewees were purposely sampled as they have been strategically chosen based on the relevance for the research topics (Bryman, 2016). Google searches revealed that the units of analysis within this study make up for the majority of the second hand camera market in the Dutch and European market, strengthening the generalizability of the study's results. While more organizations were initially approached to take part in this study, only 50% responded and agreed to take part in the study by doing an interview. However, after interviewing six different units of analysis, signs of data saturation were showing. This meant that the researcher felt assured that further data collection would not lead to the discovery of new information and the study can be replicated ((Fusch & Ness, 2015). As this signals to qualitative researchers that the collection of data may be stopped, no more last minute attempts to find new respondents were made.

Publicly available contact information made it possible to invite the participants to take part in the study through email contact. An email was sent to organizations asking whether they wanted to participate in this study by taking part in an in-depth interview. In most cases, the

interviewees are the founders of the organization which they represented. Only in the cases of Kamera Express (2021) and CameraNU (2021), the two larger organizations, the interview is held with the head of the second hand department.

Semi-structured interviews

This study collected data through qualitative semi-structured interviews. These interviews are guided by an interview guide (see Appendix B), which leads the conversation through a list of themes and broad open questions (Bryman & Bell, 2011). The theoretical framework on the different themes of barriers (Cultural, Regulatory, Market and Technological) (Kirchher et al., 2018) served as a guiding structure for the conversation, but left room for the organizations to give insights into what kind of challenges they experienced with regards to these broad topics. This method of data gathering is best suited for this study as this allowed for in-depth interviews in which the different barriers to the circular economy could all be discussed in a structural manner. However, it left room for elaboration on specific interpretations or the mentioning of new barriers. Furthermore, this method allowed the interviewer to ask further questions if the interviewee touched upon interesting insights.

Conducting the interviews

During the months of April and May 2021, the interviews were conducted, mostly in an online environment due to Covid-19 regulations at that time. At the start of the conversation, an informed consent document ([Informed consent document](#)) was read out to the interviewee, whereafter he/she could agree and state if full anonymity was desired. After this approval, I

started recording the conversation. The interviews lasted an average of 45 minutes and were recorded through a phone or laptop.

Ethics

Finally, some ethical considerations need to be discussed. When conducting social research, it's important to pay attention to ethical issues like; harm to participants, lack of informed consent, invasion of privacy, and deception (Bryman, 2016). To prevent these issues from occurring, the following measures are taken: The participants were in the position to stop the interviews at any moment. Additionally, an 'informed consent' document was presented to the participants, describing the content and goal of this study, which they could accept before participating. Finally, the participants' privacy and anonymity has been respected throughout the research, as interviewees were allowed to remain anonymous in this research and always in a position to not answer a question.

Data analysis

The following paragraphs will mention the transcribing and elaborate on the coding practices used to derive and analyze the results from the audio recordings of the interviews.

Transcripts

After conducting all six interviews, the recordings were transcribed in full. With the help of the website 'oTranscribe' (oTranscribe, 2021), the recordings were manually transcribed to accurately report everything being said during the conversations. The transcripts ([Transcripts](#)

[document](#)) were then imported into ‘ATLAS.ti’ (Atlas.ti, 2021), an application built for the analysis of large bodies of textual data.

Coding

Within the Atlas.ti (2021) program, codes were labeled to parts of the transcripts which were in valuable for answering the research questions. While the theory presented some components of what the barriers to the circular economy consisted of for industries in general (Kirchher et al., 2018), this study’s focus on the facilitation of the reuse and redistribution of cameras resulted in the mentioning of new and undiscussed challenges. Methodically this meant that during the coding, the grounded theory method was incorporated, as the specific coding and theory building took form after the data collection itself (Walker & Myrick, 2006). To elaborate, identified challenges within the transcripts were tagged with a descriptive code through the open coding method (Williams & Moser, 2019) as this left room for unexpected insights (Bryman, 2016). Later, these codes were grouped by color within the four different barrier themes from the theoretical framework (Kircherr et al., 2018). An example of the structure this resulted in is shown in Appendix C.

The codes and corresponding quotes were then used to analyze the data and discuss the results of this study in the results chapter. Within the results section, quotes are used to clarify and emphasize findings.

RESULTS

In this chapter, the results from the semi-structured interviews will be discussed. The chapter is structured by the different themes of barriers derived from theory, which were the main conversation topics. The leading research question sought to find out how these barriers are experienced by the researched organizations. The different challenges raised by the organizations will be explained with the help of quotes from the qualitative interviews. Then, this chapter will conclude this study's findings by presenting a table including the different challenges found.

The Cultural Theme

The results revealed a variety of difficulties that may be classified as cultural. These challenges are; a lack of awareness of the second hand market, the need to convince customers to trust your products and judgement, the possibility of dishonest suppliers, and a dominant consumption society. These challenges will be explained in the following sections.

Awareness of second hand market

One of the first important challenges mentioned, has less to do with organizational operations but more with a lack of awareness within society. CN among others, mentioned the obstacle of a lack of awareness of the second hand camera market. *“Not everyone is familiar with this. The older generation is, but the younger less so. That if they buy a camera on the internet, they can also sell it there if they want. You really have to make this possibility clear to your audience and activate it. ... People clearly imagine this for a car, but less so for a camera. (CN)”*

The fact that the thought of trading in your camera, as well as reselling your camera to a camera shop, is less common for a big group of people means that these organizations need to put in extra effort to activate and convince their customer groups to do so. While reselling and buying cars through the second hand market is a very common and normalized method, there's still a long way to go for a thriving second hand camera market.

Convincing customers to trust your product and judgement

Apart from generating awareness of your organization's ability to facilitate the reuse and redistribution of cameras, the organization also needs to actively convince their group of customers to trust them. All of the organisations discussed the importance and effort it takes to convince customers to trust their repair processes, their judgement on the state of a product, and the fact that a used camera could function as well as a new one.

“ Trust, it arrives by foot, but leaves on horseback. So if you screw it up a few times... (CO)”

In this light, CO further mentioned the threat of news articles about fishing and online scamming, and how it leads to reluctance from the consumers to even consider a second hand camera from an online webshop. Additionally, CN stressed that promises about the state of a camera need to be made true, as customers and their reviews could have a big impact if the word spreads about negative experiences.

KE illustrated different aspects of an organization which could help foster this feeling of trust for the customer. When talking about trust *“... then the well-known name is of great importance. ...*

and you have an official point of sale and offer warranty, then of course you already have several points that make a customer think earlier; okay I dare to go second-hand (KE)“

However, if this is taken care of and an organization is presented in a trustworthy manner, KE continued, it's in a position to be the 'better choice' compared to private resell platforms like 'Marktplaats.nl'.

The possibility of dishonest suppliers

Staying in the realm of trust mechanism; in addition to the necessity of trust between the customer and the organization selling second hand cameras, the organization itself also has to have a certain level of confidence in its suppliers of the second hand products. Raised as a challenge by both KE and CR, the possibility exists that the supplier, which sells or trades its used camera equipment to the organization, isn't completely honest or transparent about a product's state, its origin, or its own identity.

“There has been a lot of straight up lying actually. They claim that products have been fully serviced by a technician last month. We then buy it, open it, and see that the last service sticker is from 20 years ago and full of grease. So it's weird but it's actually still the case that people can truly lie and deceive other people, and look for stolen goods and stuff like that. (CR)”

KE added that they often perform identity checks to find out if someone is actually who they claim to be. Furthermore they mention the need for analyzing the repair history of the product before buying, as it's often difficult to read the true state of a product from the outside. While

these processes do work, it's a considerable amount of work to put in practice for each of the unique incoming products.

A society in which we always need the newest model, and throw away our old one

Finally, it's important to mention a bigger overarching cultural challenge, touched upon by all organizations, but explicitly discussed by ACR. As the interview conversation emphasized, our society is dominated by a culture in which marketers are continuously “... *talking and telling us that this stuff is better and you need this.. And if you don't have it you're not going to have the best images and your friends are gonna look at you and think 'are you poor'? And this is the fundamental change that needs to happen. (ACR)*”

In a culture in which people are taught to always need and save up for the newest product models with the newest features, the second hand and older option for a camera would initially always be the less appealing option. Additionally, and connected to the need for the newest models and upgrades for products we already own, the quick and easy disposal of functioning and repairable products is being normalized.

This consumption society in which we go for the newest models and throw away anything that's old or partly broken is a global problem, and affects the demand for and supply of second hand cameras. This obviously has an effect on the market for second hand cameras, which will be discussed later in the chapter within the 'Market-Related Theme' section.

The Regulatory Theme

The organizations elaborated on a few specific and challenging regulations within their trade, while a broader theme regarding policy was also mentioned. The VAT regulations, shipping policies, 'anti heling registration', and the bigger subject of camera market incumbents and their lobby power, will be discussed in the following paragraphs.

VAT regulation

When discussing the theme of regulation with the different organizations, an often raised topic of rules to adhere to was the VAT regulation they need to take into consideration. The Value Added Tax is calculated over the margin made by the organisation reselling the second hand camera (KE). While financial regulations are quite similar in European countries, CR raised the point that VAT regulations differ per country and could form contextual challenges in one, while creating an inviting environment in other countries. CO further mentioned that there are a lot of these kinds of 'rules of the game' in this second hand market which you have to get used to. This often needs some explanation for newcomers or customers who are not aware that they can not reclaim VAT for their second hand purchases for example. A disadvantage of these VAT arrangements is that businesses prefer to stay away from purchasing second hand cameras.

Shipping policies

While all organizations mentioned some occasional sales and shipping to other European countries, CR is the organization that's most concerned with global shipping regulations. While general shipping policies apply to cameras and its accessories, like the fact that batteries are only allowed onto an airplane if it's attached to a product (CR), shipping issues could occur when

international import regulations hinder the entry of second hand products into a country. *“Some countries do not allow anything used into their country, like India. They will only take new products, because the idea is that trash doesn't end up in the country. (CR)”* This is not only a practical inconvenience for international shipping; if this applies to more countries, it may also impede the international redistribution of used products in general.

Anti heling registration

CN, CO and KE raised the fact that an organization like theirs, which resells second hand products, is required to register all incoming products in a database. As demanded by both the municipalities and police intelligence departments, these organizations, which buy in used products, are required to register all purchased cameras and the identities of their previous owners. This ‘anti heling registration’ is to prevent and/or track the trading of stolen goods. These kinds of administrative procedures are of great importance for society of course, but *“... these are regulations that require you to do a lot of time consuming administrative work. (CN)”*

Camera market incumbents and their lobby power

Finally, when discussing the field's regulations, concerns were shared regarding the threat of market incumbents and their lobby power. One could argue that the second hand camera market is only a small one, and not doing any harm to the biggest camera brands. However, the fact is that camera brands don't make any money when used cameras are traded, and moreover, it could prevent the purchasing of newer models. Some conversations hinted towards this threat of big camera brands who are not amused with a growing second camera market. CO, for example,

referred to moments where employees from the bigger camera brands are often ‘negatively’ surprised by how well business is going in such a second hand camera store.

This is experienced as a stressing challenge for these organizations as big incumbents in any industry possess a large amount of lobbying power to influence policies in the field (ACR). Because “... *companies like Shell, one of the biggest problems out there, they have so much money and lobby invested in governments that they're 'impossible'. They will change at their own rate and they will take twenty years to change, and they will block all newcomers to the market with better and more efficient technologies, until they've had the opportunity to turn their big ship around and capitalize on it. (ACR)*”

The Market-Related Theme

The organizations brought up different challenges regarding the valuing, price setting, and supply of second hand cameras, which were all classified as market-related. How age, demand, and technological innovation rate determine value, the stressing need to adapt to prices set by competitors, and the absence of a steady supply of second hand cameras, will be elaborated on in the following sections.

Age, demand, and technological innovation rate determine value

Market related mechanisms, and its challenges and consequences, were extensively discussed topics in the interviews. All organizations argued that an in-depth understanding of the market mechanisms is of great importance for this sector in which cameras are resold. When

redistributing, in other words; reselling, cameras, the selling prices and the accompanying profit margins per camera depends on different variables (FD).

“Some cameras just have such a bad reputation, even if they're working they're not sellable. (FD)”

In the analog market in which FD operates, the demand for certain cameras depends on the reputation of the product. This reputation of a certain brand or model could be influenced by the creation of hype because of a certain artist or the use of a particular camera by an influential person. This means that the changing reputation of models over time could form challenges for organizations, as it's not a matter of improving advertisement or adjusting selling prices. Some models sell, while others just don't (FD, CR).

When focussing on the digital camera market, an influential variable for the value of a product is the age (CN). Not the amount of time a camera has been used, but the time that passed since the model was released to the public. Broadly speaking, the older the digital camera, the lower the reselling value, and the lower the possible margin. In the bigger picture, this means that the redistribution of 'older' digital cameras is not a viable option for organizations, as the costs would outweigh the benefits and financial security would thus not be achieved.

“A customer who trades in a camera that is a three-year-old model will also receive a prize for a camera that is three years old. Whether you bought it last week.. that doesn't matter, because you can't prove to the new owner that it was only bought a few weeks ago. As it has been on the

market for three years, you get it? ... The value is determined by the age of the camera and the demand for the camera. (CN)”

An overtime decrease of the market value of a product is due to the rapid development of technological innovation. KE explained that the rapid development of new innovations in digital cameras and their functionalities, mean that the ‘older’ models without the newest technologies (e.g. image quality, auto-focus speeds, mirrorless sensors) could become irrelevant to customers.

“Technology is becoming more affordable and you have to take into consideration whether cameras that don’t possess the latest features are still relevant in today's market. A camera that cost a thousand euros ten years ago is no longer as powerful as a camera that currently costs two or three hundred euros. That's simply because technology is moving quickly in all areas. (KE)”

Adapt to prices set by the competition

As the previous paragraphs discussed, the value of cameras is influenced by different variables on which these organizations don’t have a direct influence. Additionally, the prices for which they aim to sell their products needs to be adjusted to prices set by competing actors in the second hand market (CN).

Competing actors for the researched organizations consist of private resellers, who make informal resale deals between two persons in private or through a platform like Marktplaats.nl, and camera shops selling the actual new cameras. While private resale deals carry some risk,

they are often more beneficial for both the seller and buyer, as there are less costs involved (CN). Additionally, camera shops that offer products for a low price, through price reductions or VAT refunds, could also pose a threat to the willingness to choose the second hand option. While a market in which an organization needs to take into account competitors and their prices isn't a surprising challenge in itself, it does have some consequences for organizations reselling second hand cameras specifically. KE, for example, mentioned that people often show some comprehension when hearing about the trade-in value of their camera, or seeing for what prices second hand cameras are being sold for. The studied organizations carry the burden that people expect a certain cheaper price for a used camera, while the costs and effort it takes to trade cameras in a proper manner are often not acknowledged or understood by people (KE).

Finally, it's important to note that while all organizations mentioned the described challenges as difficulties in their specific market, there was an overarching view that *"... this only poses a problem if you're not aware of what's going on in the market. (KE)"* After all, for many of the studied organizations, the thrill of trading with their beloved cameras was the reason to get into this sector.

"Our philosophy is that everything can be sold if the prices and the product are right. ... It's a matter of knowing what you are talking about, and switching in time when something drops in price and being able to estimate in advance what the market is doing (innovation, reputation, etc.) and what influences each other. (KE)"

No steady supply of used cameras

Furthermore, conversations within the market related theme also raised a challenge regarding the supply of used cameras. The organizations have different methods of acquiring their stock of used cameras; FD, CR and CO actively buy used cameras from different types of sellers, while KE and CN allow customers to trade in their used camera when buying a new one. But one challenge applies to all of them; people must be willing to let go and sell their used camera (CN).

For an organization working in the analog field, in which there's no influx of newly produced units, the main challenge is to actually find and locate the cameras. Most of them are rusting away in attics or in possession of (older) people who are not aware of the value these cameras still possess (CR). For digital cameras, the supply of used cameras mainly depends on the willingness of people to put in the effort to sell or trade in their old camera. The researched organizations raised this supply insecurity as a challenge, and dependent on market developments.

“It's a fairly uncertain story because you are not dealing with a supplier who can simply supply you with items on demand. ... You cannot come up with a promotion with a large price drop for a second-hand product where you then arrange a larger quantity of the product from the supplier. ... You depend on developments on the market; the reason why people get rid of their cameras. This we can not control(CN)“

The Technological Theme

Within the technological theme, the data showed challenges surrounding the reliance on digital technology and knowledge, the labour intensive processes involved in the repair and redistribution of second hand cameras, and the threat of diminishing repair knowledge. Additionally, some difficulties with presenting environmental impact were touched upon. The following paragraphs will elaborate on these matters.

Reliance on digital technology and knowledge

When discussing the role of technology for the organization, two main stressing topics were brought up during the interviews. Firstly, CR and FD brought up the necessity of a digital database or system to process and keep track of all incoming cameras, their state, the repair work they need, and their value. As CR stressed, the handling of the cameras and their unique characteristics is only scalable if digital technologies are used to store and keep track of data regarding all of the different and uniquely treated cameras.

Secondly, his reliance on digital technology was further emphasized by CO, CR and FD, who all stressed the importance of their presence on the internet with a webshop. Being visible and findable through search engines like Google is what made it possible to connect to their group of customers and scale up their redistribution processes. CR explicitly mentioned that this upcycling practice, in which used cameras are connected to appreciating customers, is dependent on the connecting strength of the internet and webshops. As the following quote shows, without the reach of their webshop, they would not have been able to run their organization.

“ it would be technically impossible for us to be in Finland and sell this many cameras in a physical shop, even if we would be in the best possible location and with the best marketing. It's only through, basically, the AI / smartness of Google and the online algorithms that someone in Dubai can find us and a little accessory for his camera that he was looking for. ... I would say that has been the big change which made the CE scalable in this upcycling phase. (CR) “

R&D and labour intensive process needed for optimal grading and repair routines

Within the topic of technology, all organizations touched upon the fact that business in this field is carried by a labour intensive process of grading the state of unique products, performing repair activities, and determining their market value. Additionally, KE elaborated on the process by explaining that all unique cameras need to be photographed and put up for sale individually, often without original packaging. This illustrates that there are many additional processes involved, which aren't needed when selling a newly purchased stock of cameras.

“It is labour-intensive; it's not like a new camera that comes in from the factory, in a box, that you just need to scan in your inventory and put on your shelves. It is of course something else; items that come in must be reset, cleaned, personal data removed, everything must be checked... (KE)”

To smoothen this labour intensive process, CR took some years to actually research how to process and analyze their incoming supply as efficiently as possible. They *“... had clear meters for the condition of the cameras and clear checklists on what to check on the cameras, and clear lists of prioritizing of parts, processes, and what's good for use or for repair etc. (CR) ”* Without

creating an efficient method and process, the redistributing of used cameras and its parts is not scalable. These standardized checklists and processes are not only necessary to scale up the process, but also to control the costs.

Diminishing efficient repair knowledge and repairability

The mentioned processes, happening behind the scenes, are additionally hindered by a diminishing knowledge on efficient repair of cameras. For the digital cameras (KE, CN, CO), the repair cases are outsourced to other parties, designated by the respective camera brands. This outsourcing is necessary since the digital evolution of cameras entailed that for repair cases “... *the need for handy people was replaced by the need for smart people. (CN)*” The knowledge on how to work with these digital chips and digital technologies within cameras is now exclusively stored in a small number of specialized facilities. Regarding analog cameras, official repair facilities, appointed by camera brands, don't exist anymore. While there are still hobbyists and experts around, knowledge on specific repair routines is slowly diminishing (ACR).

“ Manufacturers don't design things to be prepared (by others) anymore. So there are less and less who can. I was trained for this stuff for over 30 years, and the guy I learned it from is dead now... (ACR)”

Furthermore CR, FD and ACR all expressed that “... *manufacturers don't design things to be prepared (by others) anymore. (ACR)*” As KE explains in the quote below, products are less and less manufactured in a way that supports a long lifespan and their repairability. This is mainly due to industry trends around cost saving in production and selling bigger quantities.

Additionally, referring back to one of the cultural challenges found, “... *the fact that these products or their batteries die after 5 years, that’s the way it is... this allows us to buy the newer models we think we need. ... It’s all a bit more replaceable these days. (KE)*”

Difficulties presenting environmental impact.

Most of the organizations didn’t discuss any difficulties presenting their environmental impact. This was mostly because they didn’t have to answer to investing or shareholder parties, and most didn’t consider subsidies applications. However, this topic is still worth mentioning because of frustrations experienced by CR. They often took part in competitions for national or European funding opportunities within the theme of the Circular Economy. What often happened is that they would lose to manufacturing facilities, working with recycled material or production methods on clean energy. These kinds of parties have the benefit that they can make more straightforward calculations on the amount of CO₂ used or saved per created product. For an organization which repairs and redistributes used cameras it’s incredibly difficult to realistically measure what the environmental impact is in terms of CO₂ emission prevention.

“If every camera that goes through us would need to be remanufactured, we’re talking about a huge amount, because every plastic bit and component would have needed to be produced, which is really energy consuming. (CR)”

The difficulty lies in the fact that, when repairing and redistributing products, you are not able to factually argue how much natural resources are saved and how much emissions are prevented “... *because we can not know if someone would be manufacturing it (if we wouldn't be doing it).*

*So it's actually incredibly difficult for us to calculate what we can possibly save by doing this.
(CR)”*

Overview of the results

The different types of challenges experienced by organizations, facilitating the reuse and redistribution of cameras, are summarized in Appendix D. The barriers in italic and within brackets refer to the proposed types of barriers found in the general Barriers To The Circular Economy Framework by Kirchherr et al. (2018). This means that in some cases the barriers addressed by this study's data, and which apply to this specific sector, can be linked to those addressed by the proposed framework.

DISCUSSION

This study builds on the Barriers To The Circular Economy Framework (Kircherr et al., 2018) by using its structure to gather insights into challenges experienced within a specific field; the second hand camera market. Theory proposed a framework consisting of four broad themes of barriers, ‘cultural’, ‘regulatory’, ‘market-related’, and ‘technological’, which were built through the classification of challenges found within a broad sample of organizations. This thesis however, reveals the challenges experienced specifically by organizations facilitating the reuse and redistribution of cameras.

Organizations within this second hand camera market experience a wide array of challenges along the proposed barrier themes (Appendix D). Examples of surprising insights into barriers to a circular economy are; the necessity of trust (between the consumer and organization, as well as the organization and supplier), the fact that used cameras can not be globally redistributed as long as some countries view it as unwanted waste, the fact that changing trends influence the demand and value of second hand cameras, and the diminishing repairability of cameras through design and knowledge loss.

The findings show that, while the themes of barriers are still applicable, the specific challenges experienced by the researched organizations do not all correspond to those outlined in the framework. Appendix D shows how some encountered challenges have been addressed in a broader sense in the general framework, while others are found for the first time. For example, ‘Awareness of second hand camera market’ is an identified barrier which is in line with the cultural barrier ‘Consumer awareness and interest’, found in Kircherr et al. (2018)’s framework.

However, ‘Convincing consumers to trust your product and judgement’ hasn’t been addressed before. The findings thus show that the highest layer of the framework is applicable, but the detailed level of barriers changes per context.

Practical recommendations

The created overview of categorized challenges (Appendix D) could function as a rundown of important considerations for organizations considering a reuse and redistribution business model. Furthermore, the described challenges under the regulatory theme propose debatable topics to consider for policy and regulation makers. For example; when is something classified as an upcycled product instead of waste? And; how to prevent big brands from preventing the second hand trade in their products?

Limitations and future research

When reviewing the research’s procedures, some limitations can be identified. While there’s only a small pool of organizations facilitating the reuse and redistribution of cameras, the possibility exists that a larger number of units of analysis would have provided undiscovered insights. One could think of adding local photography shops with a small second hand section, which have been ignored in this study. Furthermore, gathering insights into challenges in a single moment in time often means an interviewee needs to refer to experiences from the past. Quality of the gathered data then relies on the ability of the interviewee to recall feelings and events in a correct manner. Additionally, the fact that most interviews were performed through online calls (obligatory), could have influenced the quality of the conversations, as physical cues were harder to identify. Finally, while the interviews were semistructured and set up to identify all of the

organizations' challenges, the possibility remains that specific challenges were not discussed in the interviews.

Furthermore, different topics for future research can be proposed. The academic field concerned with the circular economy might benefit from qualitative research into the consumer side with regards to second hand markets. As many difficulties appear to stem from society and consumer behavior, it would be important to understand the reasons why consumers do(n't) choose second hand options. Additionally, as organizations often blamed manufacturing processes, future research into a more circular industry could focus on the role of design and manufacturing processes with regards to the repair- and reusability of products. Finally, as the findings show, more research is needed to expose the detailed level of barriers for different contexts. Luckily, this trend is growing at the time of the release of this thesis, as research regarding barriers within specific sectors, like the agriculture food supply chain (Mehmood et al., 2021) or the manufacturing sector (Badhotiya et al., 2021), is being published.

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APPENDIX A

Unit of analysis	Profile	Redistributing	Supply method	Interviewee
Camera Rescue (CR)	Committed to buying, repairing, and shipping analog cameras to enthusiasts around the world. Based in Finland.	Analog cameras	Buy in	Founder
Fotohandel Delfshaven (FD)	Specialized in the buying, repairing and reselling of analog cameras. Based in the Netherlands.	Analog cameras	Buy in	Founder
Kamera Express (KE)	One of the biggest distributeurs of cameras in the BeNeLux, selling both new and second hand camera equipment. Based in the Netherlands	Both digital and analog cameras	Trade-in	Head of secondhand department
CameraNU (CM)	One of the biggest distributeurs of cameras in the BeNeLux, selling both new and second hand camera equipment. Based in the Netherlands	Digital cameras	Trade-in	Head of secondhand department
Camera Occasion (CO)	Specialized in buying and reselling used digital cameras on a national scale. Based in the Netherlands.	Digital cameras	Buy-in	Founder
Amsterdam Camera Repairs (ACR)	Experienced analog camera repair specialist. Based in the Netherlands	Analog cameras	-	Founder

Table A1: Characteristics overview of units of analysis

APPENDIX B

Interview Guide

Introduction

- Could you introduce yourself and elaborate on your role within the organization?
- How does the business model of the organization work?
- How does the organization interpret- and what does it think of the circular economy concept?

Cultural Barriers

- How does the organization experience the customer's perception of second hand products.
- Of how much of an importance does the organization perceive its environmental and/or circular economy values?
- To what extent does your organization's supply and business partners share your environmental values?

Regulatory Barriers

- What kind of (inter)national regulations and laws are of particular concern to the organization.
- Would you say these are fostering- or obstructing your business activities and/or upscaling, and why?

Market-Related Barriers

- How does the low price of virgin materials and new products affect your business?
- How would you describe the setting up of the organization's business model, regarding costs and funding?

Technological Barriers

- How does technology play a role in the organization?
- To what extent are both technological and repair expertise essential to the organization?
- How does the organization perceive the measuring and presenting of (environmental) impact?
- To what extent does the used state of the camera's form challenges to the organization?

Closure

- Is there any stressing challenge for your organization which hasn't been addressed in our conversation so far?
- Is there anything you would like to add?

APPENDIX C

Theme / Codegroup	Code
Culture (orange)	<i>'Need to convince / create customer trust'</i>
	<i>'Lacking awareness of trade in / resell phenomenon'</i>
Regulatory (green)	<i>'VAT regulations'</i>
	<i>'Anti heling registration'</i>
Market-related (blue)	<i>'Decreasing value due to technological development'</i>
	<i>'Pressure to adapt to other prices in the market'</i>
Technological (pink)	<i>'Cameras not build to last'</i>
	<i>'Digitalization and Google knowledge needed to make upcycling scalable'</i>

Table C1: Example of code grouping

APPENDIX D

Cultural	Regulatory	Market-related	Technological
Awareness of second hand camera market <i>(Consumer awareness and interest)</i>	VAT regulation <i>(Obstructing laws and regulations)</i>	Age, demand, and technological innovation rate determine value <i>(Low virgin material prices)</i>	Reliance on digital technology and knowledge
Convincing customers to trust your product and judgement	Shipping policies <i>(Lacking global consensus)</i>	Adapt to prices set by the competition	R&D and labour intensive process needed for optimal grading and repair routines <i>(Ability to deliver high quality remanufactured products)</i>
The possibility of dishonest suppliers <i>(Willingness to collaborate in the value chain)</i>	Anti heling registration <i>(Obstructing laws and regulations)</i>	No steady supply of used cameras	Diminishing efficient repair knowledge and repairability
Consumption and throw away society <i>(Operating in a linear system)</i>	Camera market incumbents and their lobby power		Difficulties presenting environmental impact <i>(Lack of data e.g. on impacts)</i>

Table D1: Overview of barriers found per theme, accompanied by related sub categories of barriers (in *italic*) from the established framework.