CLOSING THE LOOP: AN EXPLORATION OF THE CHALLENGES AND OPPORTUNITIES IN CIRCULAR ECONOMY ADOPTION IN THE OUTDOOR APPAREL INDUSTRY

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CLOSING THE LOOP: AN EXPLORATION OF THE CHALLENGES AND OPPORTUNTIES IN CIRCULAR ECONOMY ADOPTION IN THE OUTDOOR APPAREL INDUSTRY

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Abstract

The outdoor apparel industry is at the forefront of sustainability efforts, driven by consumer demand and environmental necessity. This thesis examines the adoption of circular economy (CE) principles within U.S. based outdoor apparel companies. Through qualitative research, including archival data analysis and semi-structured interviews with industry professionals, this study identifies current CE implementation strategies, challenges, and future opportunities, as well as other sustainable practices being followed. Findings indicate that while brands have integrated circular practices such as repair, recommerce, recycling, and sustainable material sourcing, significant barriers remain. A lack of infrastructure, limited investment, and technological constraints hinder full-scale CE adoption. Additionally, product complexity, particularly in technical outerwear, presents challenges for recycling, repairability, resale, and sustainable material sourcing. Consumer awareness also plays a critical role, as education on sustainable purchasing and product lifecycle maintenance is limited. Despite these challenges, the industry is making progress in sustainability through material innovation, PFAS-free alternatives, carbon footprinting, and energy and other resource reduction. Collaboration of stakeholders, including brands, suppliers, policymakers, and consumers, is essential for overcoming barriers to circularity. This research highlights the need for further development of CE practices and investment in CE infrastructure to accelerate the transition toward a more sustainable outdoor apparel industry. By identifying key practices and barriers, this study provides insights that can inform industry players in circular development. This thesis contributes to the limited literature on circular economy adoption in the U.S. outdoor apparel industry and underscores the importance of systemic change to achieve circularity within the industry.

KEYWORDS: Circular economy, recycling, repair, recommerce, material, outdoor apparel industry, sustainability, consumer, infrastructure

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1. Introduction

Consider the last time you shopped for outdoor gear. Maybe you were looking for a new jacket, something durable and warm enough to bring with you hiking, skiing, or camping, and in any type of weather. As you looked through the options, what were your main points of attraction? Did a zipper here, or a pocket there influence your decision? Did you consider the product even if the price was much higher than a competitor? Was a tag reading "made with 100% recyclable materials" enough to get you to purchase the jacket? Did you ever consider if a 'green label' was just a marketing gimmick to influence you to choose one product over another? These are the questions that outdoor clothing brands must consider when designing their products. For many consumers, especially in the outdoor industry, purchasing gear isn't simply a decision of what looks the best, but also a result of other values, especially regarding performance and the environment.

Outdoor companies manufacture and provide apparel, equipment, accessories, and footwear to participants of outdoor recreation. In recent years, retailers have experienced a major uptick in demand, especially due to increased participation in a range of sports. Two 2023 reports, from the US. Department of Commerce and IBIS World, found that outdoor recreation participation has increased 6.7% year over year since 2018, contributing to $1.1 trillion in economic output in 2022 (Siler, 2023 & Bruton, 2023). Additionally, the industry is growing at 3.8%, compared to the US's total economy, which is growing at 2.8% (Woodbury, 2021). This equates to outdoor recreation participants making up over 57% of the American population (Outdoor Industry Association, 2024). With increased publicity and popularity of the industry comes greater

criticism of it, specifically considering environmental impact. The consumer goods that support this massive industry are part of global supply chains that utilize harsh chemicals to uphold performance standards. For example, outerwear has historically used polyfluoroalkyl substances (PFAS) to maintain long term waterproofing. Use of harmful materials, along with gear being produced unethically, has led to consumer pressures for outdoor brands to change their ways, especially because "if we don't carve a new, bold path for our industry and others to follow, we will ultimately fail to protect the outdoor experience upon which we all depend" (MacDonell, 2023). Thus, the restructuring of outdoor companies to become more sustainable is crucial for their success into the future.

This thesis will examine the impact that sustainable practices have had on the outdoor apparel industry (OAI), specifically addressing the concept of the circular economy (CE), and how outdoor apparel companies' technical products have evolved with the introduction of circular economy principles. This is important as it is a relatively new and emerging theory that has the potential to shape the industry, and others.

Thus, this thesis seeks to answer the question: **What are the major barriers being experienced by U.S. based companies in the outdoor apparel industry in their transition towards the circular economy?**

This topic is important today for a multitude of reasons. Firstly, brands need guidance on how to implement circular principles effectively, and by researching circularity in two brands, I was able to analyze which tactics are most effective for the industry as well as where the major challenges lie. Additionally, understanding the impacts of clothing manufacturing on the environment can allow companies to frame their operations in a way that meets sustainability goals, along with stakeholder demands

which can lead to competitive advantages in the market. Major stakeholder groups impacted by sustainability issues in the outdoor apparel industry include brands, consumers, suppliers, shareholders, policy makers, and the environment.

Research of the circular economy in the outdoor clothing industry is quite limited. While there is plenty of literature regarding the circular economy and fashion, this idea hasn't been explored deeply specifically within outdoor apparel, especially technical apparel. Furthering this, there is little literature focused on U.S. based companies which motivated my research in this area. Also, the inherent nature of the industry has put the OAI in the lead for sustainable practices. Through this study, I have outlined some of the key forces driving circular practices in the industry that have potential to be implemented in other industries.

My paper will be structured as follows: First, I provide a literature review, analyzing existing literature on the circular economy, focusing on the fashion industry as well as the outdoor industry so that key definitions, themes, trends, and limitations can be addressed. Next, I detail the methodology I used to collect qualitative data on the implementation of the circular economy in the outdoor apparel industry. I will then present my findings and discuss the trends that were highlighted. The paper concludes by summarizing my research, pointing out key findings and limitations, and suggesting directions for future research.

2. Literature Review

2.1 Introduction

In recent years, the fashion industry has transformed from providing quality, long lasting goods to being a form of daily consumption for many consumers. This activity has

been enabled by supply chain innovation, digitization, and the rise of e-commerce (Brydges, 2021). The fashion industry, along with most others, follows the take, make, waste idea of supply known as the linear supply model where products and materials live one life before being disposed of (Ellen MacArthur Foundation, 2024). The immense amount of waste has resulted in the industry contributing significantly to the environmental sustainability crisis (Brydges, 2021). As a result, much literature has been written examining how apparel companies have impacted the environment. These studies range from discussing impacts of fashion on water quality, to drivers, barriers, practices, and indicators of sustainable performance, to consumer motivation for purchasing sustainable products (Kirchherr et al., 2017). Throughout this literature review, I aim to analyze the outdoor apparel industry's approach to sustainability, focusing on the circular economy theory and its implementation within this context. I will also highlight gaps in current research that helped drive my own research.

2.2 Defining the Circular Economy Concept

Before diving into research on the circular economy in the apparel industry, it is important to define the circular economy (CE). Human consumption has proved to have significant contributions to the degradation of the environment with the traditional supply chain model known as a linear economy. The linear model takes, makes, and disposes of the raw resources used in a product (Millar et al., 2019, p. 13). On the other hand, the circular economy model values sustainability by utilizing a closed loop lifecycle for a product, aiming to "maximize resource efficiency and minimize waste production" (Ghunmi et al., 2016). This is an emerging idea that has gained traction over the last decade. In 2016, 100 articles were published related to CE, compared to only 30 in 2014

(Kirchherr et al., 2017). While there is much traction around this concept, the definition of the circular economy is blurry, causing misinformation and general lack of reliability due to no widely agreed upon definition. Between 2018-2023, discussion on the CE concept has tripled. Despite this, the share of secondary materials consumed by the globe has decreased from 9.1% in 2018 to 7.2% in 2023. This has happened all while global consumption equated to 500 gigatons in the same five-year period. For reference, that is 28% of material consumption since 1900, just in the past five years (Circularity Gap Report, 2024). The rate of consumption is nowhere near sustainable going into the future, hence the need for a change in our supply chain system towards the circular economy. A study done by Kirchherr et. al (2017), gathered 114 definitions of circular economy and analyzed themes in the definitions to come up with a more coherent and concrete definition. Through their research, it was found that the circular economy is most often defined using a combination of reduce, reuse, and recycling activities, otherwise known as the 3R's framework (Kirchherr et al., 2017). While this is oversimplified to the point where you may have been taught this idea in elementary school, it is the basis of the circular economy.

The Ellen MacArthur Foundation is paving the way in the circular space. What differentiates circularity from sustainability? While sustainability is the long-term goal, the circular economy is a promising strategy that can enable sustainability within industries and brands. According to the MacArthur Foundation, the circular economy is "a system where materials never become waste and nature is regenerated… products are kept in circulation through processes like maintenance, reuse, refurbishment, remanufacture, recycling, and composting" (Ellen MacArthur Foundation, 2024).

Additionally, this definition is based on three principles, being eliminate waste and pollution, circulate products and materials, and regenerate nature. (Ellen MacArthur Foundation, 2024). MacArthur argues that waste is a design flaw and can be eliminated by ensuring materials re-enter the economy at the end of their use. Materials can be circulated by working to keep finite materials in the economy while returning biodegradable materials to the earth. The regeneration of nature comes from the idea that when shifting from linear to circular, focus can be turned from extraction to regeneration. Instead of degradation of natural environments, natural capital can be built, and practices can be implemented to rebuild nature rather than take from it (Ellen MacArthur Foundation, 2024). Therefore, we can combine the 3R's with MacArthur's definition to define the circular economy as **a system that replaces the end-of-life linear system with a cyclical product lifecycle, meaning products and materials live multiple lives to minimize raw material extraction while maximizing product lifetime and maintaining materials at their highest possible quality** (Millar et al., 2019, p. 13). In other words, "the circular economy tackles climate change by decoupling economic activity from the consumption of finite resources" (Ellen MacArthur Foundation, 2024).

2.3 State of Circular Economy Adoption the Fashion Industry Broadly

The global textile industry was valued at $1,837 billion in 2023 and continues to grow due to massive increases in demand and the growth of e-commerce (Grand View Research, 2023). Clothing makes up 60% of the total textiles used, however, clothing use has declined by almost 40% due to shifts in the fashion industry, for example a new wave called fast fashion (Ellen MacArthur Foundation, 2024). Trends in the industry used to be

characterized by the four seasons, but now fast fashion companies such as H&M and Zara see up to 52 ‘trend cycles’ per year (Ross, 2023, p.6).

This has led to $460 billion worth of clothing being underutilized in the U.S., meaning that clothing is worn too little before being disposed of. Along with this, the industry relies heavily on non-renewable resources for its production. Continuing its current path, by 2050 the fashion industry has the potential to use more than 26% of the carbon budget associated with a 2°C global warming limit (Ellen MacArthur Foundation, 2024). With the global fashion industry valued at a $1.3 trillion, behavior needs to change. Hence, the idea circularity is crucial for clothing manufacturers to change their practices.

Despite these alarming statistics, changes are being seen within the industry. Even H&M has entertained circularity by focusing on upcycling, recycling, and green manufacturing (Beyer & Arnold, 2022, p.30). Additionally, the company has vowed to follow the Ellen MacArthur Foundations’ vision for a circular fashion industry, designing products that can be “used more, made to be made again, and are made from safe, recycled or renewable inputs” (Designing for Circularity, 2024). These changes have proven to be beneficial. New jobs are being created especially within product design and development. Additionally, adoption of the CE model has increased consumer comfort and brand reputation, inherently leading to more success (Beyer & Arnold, 2022, p.32-33). While it is imperative that the entire fashion industry progresses towards more sustainable operations and manufacturing going into the future, the outdoor apparel industry has shifted this way more than anyone else. This is because the industry is driven

by consumers who prefer to support companies whose values are aligned with their own, namely protecting the natural environment that outdoor activities occur in.

2.4 Circular Economy Practices in Outdoor Apparel

In 2019, the outdoor recreation industry contributed to 2.1% of the U.S. GDP. Additionally, the industry is growing at 3.8%, compared to the economy growing at 2.8% (Woodbury, 2021). This industry is consumer driven, with consumers spending more on recreation than they do on fuel and pharmaceuticals combined, supporting 7.6 million U.S. jobs last year (Outdoor Industry Association, 2024). These statistics emphasize the immense weight that the outdoor industry has on the economy, and the importance of maintaining this economy in the future.

The outdoor apparel industry is characterized by its high quality and long-lasting products that consumers rely on in all types of conditions. These factors are of course exchanged for a premium price (Fuchs & Hovemann, 2022, p.7). Thus, companies within the industry need to utilize circular principles to dictate their strategies and balance performance with price. Fuchs & Hovemann (2022), emphasized the fact that many companies are focusing on resource reduction in manufacturing as well as durable product design which shows more of a focus on narrowing the supply chain rather than ‘closing the loop’. However, more circular practices are a long-term goal. For example, many outdoor companies are focusing on resource conservation, waste reduction, and product longevity (Taylor, 2023). Maintenance and repair are large facets in the CE area, with companies highlighting the importance of product longevity. Furthering this, by buying and selling second-hand gear, consumers are actively contributing to sustainability in the industry through resource conservation and lengthening product

lifecycles. This, coupled with innovation in fabrics and materials, for example biodegradable and recycled materials, allows firms to minimize the environmental impact of their products both in the long term and in the production process. Combined with regenerative technologies that reduce waste and extend product and material lifespan, outdoor companies are poised to embrace the circular economy to make a more sustainable future. The outdoor industry is a large market with many facets which has led me to narrow my focus on outdoor apparel, specifically technical apparel.

With rapidly developing evidence on harmful chemicals along with the increased need for sustainable development in our apparel, many outdoor apparel companies have looked to the circular economy. The fashion industry has become increasingly wasteful throughout the years, but the circular framework has provided a way to transition to a more sustainable and less wasteful industry. Charles Ross, a specialist in performance sportswear design & sustainability states, "I almost see the outdoor industry as being the early adopter of this (circular economy in fashion)" (Weetman, 2022). With this, there is a significant amount of literature regarding Scandinavian countries, as brands based in these countries as well as the rest of the EU are the early adopters of the CE principles.

One such study investigates 19 Swedish fashion brands by interviewing employees whose responsibilities revolved around sustainable initiatives (Brydges, 2021, p.1). The study found that specifically for outerwear, focus was directed on engineering specialized technical fabrics that "meet both performance standards and expectations for a long garment life" (Brydges, 2021, p.3). This is because technology isn't at the point to allow other circular principles into the development process of outdoor apparel, so focus is specialized on durability. Additionally, implementation of sustainable practices

requires large investments. This has allowed more mature firms with higher revenue to achieve more circular operations than less mature firms (Heggelund et al., 2023). With limited resources, smaller more niche outdoor brands may struggle to implement circular practices. Consumer preferences may also discourage smaller firms from focusing efforts on sustainability, as "they won't choose the more sustainable garment before a better looking one" (Brydges, 2021, p.4).

Overall, CE principles are being implemented with outdoor brands, but not to their full potential. One reason for this is that firms are implementing circular practices in some areas, but not innovating their business model to wholly adopt these principles (Heggelund et al., 2023). A common trend among Scandinavian brands is the selective implementation of CE practices. Many brands have been seen to implement practices in the waste stage of the 'take, make, waste', linear concept, but not across the entire supply chain (Brydges, 2021, p.7). This shows that the OAI still operates very linearly, and full circularity hasn't been achieved in the industry yet. It is necessary for companies to address the current structure of the industry that is inhibiting circularity so that a ground up approach can be taken to restructure the industry in a circular and sustainable way (Brydges, 2021, p.7). That said, the industry is taking steps towards circularity. With the help of policy and regulation, acceptance and implementation of CE practices will grow.

To further existing knowledge in this area, I will examine the outdoor apparel industry by focusing specifically on circular economies within technical outdoor apparel. A technical textile is defined as "products which have higher performance qualities as compared to traditional textiles" (Technical Textile Market, 2021). For the outdoor industry, this comes in the form of outerwear. Materials for technical products are

oftentimes made up of synthetic or natural fibers. The technical textile market has grown at a compound annual growth rate (CAGR) of 6.2%, estimating that in 2025, the market will be valued at $222.4 billion. Higher performance qualities associated with technical textiles are ideal for outdoor apparel as consumers rely on these pieces in all outdoor conditions.

Technical textiles rely on chemicals to achieve their properties. For example, toxic polyfluoroalkyl substances (PFAS) are the main chemical giving water repellant properties to outdoor apparel (Hill et al., 2017). PFAS is known as a forever chemical, meaning that it is extremely difficult to break down and stays in natural systems forever. Higher concentrations of this chemical have been found to lead to health complications. However, the replacement of this chemical is proving difficult, as PFAS and other fluorinated compounds provide oil repellency, something that non-fluorinated substances cannot do (Brunn et al., 2023). That said, a consumer survey in 2017 concluded that outdoor apparel consumers value water repellency over other factors, which showed that non-fluorinated alternatives can be accepted by consumers as products containing PFAS are over-engineered for most consumer's needs (Hill et al., 2017). This, along with the rapidly developing technology in textile markets gives hope that non-toxic PFAS alternatives can be utilized into the future. Circular practices that have been employed by outdoor brands have been influenced by many stakeholder groups, and companies must balance the demands of these groups when making decisions regarding their sustainable practices.

2.5 The Role of Stakeholders

Consumers

Consumers are the ultimate driving force in the OAI as they dictate market trends and company reputation. According to Wang et al., (2022), price is still the most important factor contributing to consumer purchasing decisions. That said, the next two factors were traceable sustainability and eco labels (p. 666). Furthering this, Patagonia's eco-labels were extremely beneficial both in driving consumers to purchase sustainable products and to increase awareness of sustainable purchasing behavior, as well as to educate consumers on how to care for products (Wang & Shen, 2017, p. 4). This shows that consumers are worried about product environmental influence and are willing to make other tradeoffs, for example, with material quality. That said, while consumers are conscientious of sustainable goals in the fashion industry, they are unaware of the negative impact that the industry has on the environment, creating a "sustainability bias" (Colasante et al., 2021, p.9). Along with this, a survey showed that consumers were willing to pay more for bio-based clothing, and willing to pay less for second-hand clothing due to worries about quality (Colasante et al., 2021, p.1). This emphasizes consumers misconceptions on clothing developed with circularity in mind, as secondhand clothing shouldn't have worse quality because it is designed to be worn for a long period of time. Additionally, Brosdahl and Carpenter (2010) found that education of consumers is the greatest factor for encouraging more sustainable purchasing. Ultimately, increased consumer awareness is imperative to help drive the outdoor apparel and fashion industry towards a more circular framework.

Brands and Suppliers, Shareholders, and the Environment

Brands are impacted by sustainability issues because it has forced them to change their practices to meet sustainable goals and regulations while upholding product quality.

Additionally, they must adhere to consumer demands. Suppliers will be forced to utilize more sustainable materials to keep up with brand and consumer needs. The American Apparel and Footwear Association (2014), suggests that policies be set so that suppliers must uphold these standards. Shareholders are also an important stakeholder regarding the environment. Businesses must balance sustainability with profit, which makes sustainable transitions a challenge as sustainable practices are often costly. The environment is a key stakeholder in the industry as well. Implementation of circular practices within the outdoor apparel industry will reduce waste and minimize environmental impact into the future to maintain the environment.

Policy and Regulation

The textile industry produces approximately 1.2 billion tons of CO2 per year and contributes to 20% of industrial water pollution (Srisawaskraisorn, 2022, p.15). Generally, the regulation surrounding sustainability in the outdoor apparel industry is loose as there is a lack of political and legal guidelines regarding implementation of sustainable supply chain practices (Fuchs and Hovemann, 2022, p. 3). Thus, focus on new public policies and regulations are crucial to change corporate practices and allow for the full implementation of the CE in this sector. The EU is seen as the leader in public regulation, with at least eight policies in place that directly relate to regulating the textile industry to turn it more circular. This also comes with the aim of making the EU carbon neutral (Srisawaskraisorn, 2022, p.29). Increased pressure on the textile industry will help to drive systematic change throughout the industry. Textile related policies are slowly being introduced in the U.S. as well. For example, Massachusetts recently passed a law that involves textile waste reduction and New York announced the Fashion Sustainability

and Social Accountability Act, which would be the first law directly related to sustainability in the apparel industry, if passed (Ross, 2022, p. 16). By focusing on sustainability in product design, development, production, and distribution, as well as post-consumer, outdoor clothing companies will be able to gain more support from stakeholders, increase innovation, and follow policies revolving around the space. Additionally, regulation can educate consumers about sustainable behavior, which is currently lacking in the consumer-based society (Fuchs and Hovemann, 2022, p. 3).

2.6 Conclusion

Throughout this literature review, I have discussed the fashion industry and current trends regarding sustainability within the industry. I then moved to the implementation of circular economy principles in the fashion industry and narrowed further into the outdoor apparel and technical wear industry. Through my research, I discovered that while there is plenty of research on the circular economy in the fashion industry, there are some gaps in the research.

While the current literature provides valuable insights into the general concept of the circular economy, as well as implementation in the outdoor industry in Europe, research is limited around application the CE specifically in the outdoor apparel industry, and there is limited research in the United States. No studies have specifically investigated U.S. based outdoor apparel companies and their utilization of circular principles. This is important because research must be done in the U.S. to give companies and stakeholders an insight into the state of the industry, which can then be compared to other nations. Additionally, the U.S. is behind the EU in environmental policy, and research in the U.S. will highlight the effects of a lack of policy in the country. My

research addresses these gaps by focusing specifically on the implementation of the circular economy within the outdoor apparel industry in the United States.

3. Theory and Methodology

3.1 Introduction

To address my research question, **what are the major barriers being experienced by U.S. based companies in the outdoor apparel industry in their transition towards the circular economy**, I performed a case study of two outdoor apparel companies (Stio and Outdoor Research) as it would best capture how companies are applying principles and practices that align with circular economy theory. The criteria I used to select Stio and Outdoor Research (OR) included being outerwear focused brands, that are U.S. based, have a focus on sustainability, utilize circularity language in their website and company reports, and engage in circular activities. My chosen companies are comparable because they are of different sizes and different backgrounds. Stio is less than 20 years old, and OR was born in 1981. Additionally, OR is owned by a larger corporation called Youngone Corporation, while Stio is privately owned. These differences allow for a unique comparison of brands with similar goals but different structures. A case study is a valuable method when considering how or why questions, especially when they involve explaining the impact or outcomes of a contemporary phenomenon (Yin, 2009). Because I am studying the circular economy and its impacts on the outdoor apparel industry, this case-based method was ideal for this project. To carry out my research, I first investigated archival data that was publicly available from my two companies. This included sustainability and impact reports. I then conducted semi-structured interviews with representatives in the company who contribute to the brands

circular practices. This included individuals on sustainability teams, materials teams, and founders and CEO's. Additionally, I interviewed the CEO of Tersus, a textile reclamation & resale logistics service, to gain perspective about the post-consumer logistics of the circular economy.

3.2 Theory

Studying a complex and loosely defined theory such as the circular economy points to an interpretive research process, as interpretive research can help answer the questions, "why does the phenomenon come about" and "how does it unfold over time?" (Elliott et al., 2005). In this case, I studied how the circular economy has unfolded over time in the outdoor apparel industry, as well as what brought it about in the first place. My literature review allowed me to get a look into how principles surrounding the circular economy idea have been introduced in the industry, highlighting the goal of sustainable production which has been driven by many stakeholders. Additionally, an interpretive process aligned well with a qualitative case study.

3.3 Methodology

To familiarize myself with the industry further and to gain background information on the specific brands that I studied, I first started by looking at sustainability and impact reports that were publicly available from Outdoor Research and Stio. Archival data consisted of two years of impact or sustainability reports. OR released their first report in 2022 and skipped 2023 but plans to release one in 2024. Stio started releasing reports in 2020. Because of the limited availability of reports, and because sustainability reporting wasn't required by the SEC until 2024, I decided to utilize available reports starting in 2022, meaning the sole report published by OR, and the 2022

and 2023 report published by Stio (S&P Global, 2024). This allowed me to compare metrics and practices between companies within the same timeframe.

Source (Number)	Type of Data (Number)	Use in analysis
Outdoor Apparel Brand (2): Stio & Outdoor Research Company positions: sustainability director, sustainability specialist, materials manager, founder & CEO	Semi-structured interviews (4)	Detailed information about the industry, information about specific circular and other sustainable practices, attitudes of industry professionals, outlook on challenges, solutions, and future of the industry
Textile Reclamation & Resale Logistics Service (1): Tersus Company position: CEO	Semi-structured interviews (1)	Supplemental information beyond what was available from brand interviews, detail about reverse logistics in the industry, perspective about the industry from a new stakeholder
Archival Data (3)	Company reports (3)	Background information to help aid interviews, indication of themes, especially for marketing purposes

Table 1. Data sources and details

I used these sources because it allowed me to highlight industry wide themes, as well as compare the selected companies so that similarities and differences between their strategies regarding the circular economy could be extracted. I was also able to gain insight into metrics that each company reports, and changes to those metrics over time. Additionally, it led me to conclusions about what types of information companies want to market and report to public stakeholders. Furthermore, the in-depth analysis of key points made in publicly available documents from Stio and OR aided my interviews by providing background and context and helped tailor my questions to relevant topics and trends within the OAI.

I chose to utilize semi-structured interviews as my second source of data because they highlight in-depth information and personal perspectives on circularity within each company. Interviews are beneficial in tracing how present situations resulted from prior events. Additionally, they help "produce very rich data" (Sociology in Everyday Life). The archival data analysis allowed me to gain an understanding of the basics of circular economy practices within the OAI, while interviewing representatives within these firms was extremely beneficial in gaining understanding on a deeper level. By hearing perspectives from within the business, I was able to present the specific reasons for adopting circular economy principles more accurately, as well as highlight the benefits and challenges with implementation. Additionally, I assessed perspectives from industry professionals about circularity and sustainability to understand current beliefs about the topic along with attitudes about the future of circularity. I was also able to learn about topics that may not be written about publicly, helping further my understanding of circularity within these companies.

Often in a qualitative study, sample sizes may be "too large to permit the deep, case-oriented analysis that is the raison-d'être of qualitative inquiry" (Sandelowski, 1995). Along with this, the sample size determination in qualitative research largely involves judgement and experience in evaluation of the information that is collected (Sandelowski, 1995). Using this reasoning, I decided that it was acceptable to utilize a small sample of five interviews to go along with my archival data. This allowed for deeper comparisons and connections to be made between outdoor apparel companies. Additionally, because of the time-consuming nature of conducting interviews, smaller samples are common as they are designed to provide depth and detail rather than

represent a large group (Sociology in Everyday Life). That said, my sample size provided sufficient information, and conducting more interviews may not have contributed further to the insightful and detailed information that strengthened my findings.

Because I was seeking information from within companies for my interviews, I decided to select interviewees from different departments in each company. I made sure to select individuals who would be directly involved with circular economy principles throughout the product lifecycle to target depth an accuracy of knowledge. This first led me to target individuals who were on the sustainability team at each company. Sustainability teams were rare until recently, and in 2021, more chief sustainability officers (CSO) were hired than in the previous five years combined (Farri et al., 2024). The responsibilities of these individuals and others on their teams is growing ever more important. These roles involve tasks such as ensuring regulatory compliance, overseeing sustainability projects, looking for new technologies, and changing culture surrounding sustainability within the organization (Farri et al., 2024). Because of these pertinent tasks, speaking to someone on a sustainability team was crucial for me in discovering much of the information I hoped to gain through the interview process.

Because many current circularity practices involve product development and materials sourcing, I also targeted individuals involved in the supply chain such as development and materials teams. 80% of a products environmental impact is influenced by decisions made at the design stage (Ellen MacArthur Foundation, 2022). Individuals directly involved with this process have information regarding the companies processes and have seen the evolution of design throughout time. With regards to the circular economy, product design and materials teams “have the power to redesign everything –

in order to eliminate waste and pollution, circulate products and material, and regenerate nature" (Ellen MacArthur Foundation, 2022). Additionally, excessive materials sourcing has been seen to contribute to over ~20% of total greenhouse gas emissions worldwide, and the supply chain at consumer goods companies contribute to 80% of their emissions (Ramakrishna et al., 2022 & Ellen MacArthur Foundation, 2023). By focusing on these areas, I was able to paint a better picture as to what the significance of the early product life is on its lifecycle. Adjustments to the currently linear supply chain are crucial for implementation of a fully circular economy as they will need to be managed to be less dependent on finite resources in the future. Additionally, utilization of more circular materials will lead to smaller environmental footprints and social costs (Ramakrishna, 2022). Furthering this, circularity within the supply chain and materials sourcing will enable businesses to "become more resilient by decoupling operations from the extraction of natural resources, thereby increasing material security and reducing exposure to price volatility" (Ellen MacArthur Foundation, 2023). Because of the importance of material sourcing, supply chain management, and product design for the full implementation of a circular economy within a consumer goods company, I found that an individual directly involved with these processes would be of high value to speak with.

I integrated the different ideas from my interviewees to help analyze my results. All interviewees displayed very similar perspectives, with individually unique angles on them related to the position they held in the company. This uniformity within the industry allowed my results to point in a very clear direction and lead my conclusions to be relatively straightforward.

3.4 Ethical Considerations

To carry out a research study involving human participants, I had to get my interview process approved by Colorado College's Institutional Review Board (IRB), as well as remain in compliance with the IRB's guidelines regarding human subject studies. The IRB exists to protect the well-being of participants in human subject's research (Colorado College, 2024). By staying in compliance with the IRB, I have ensured that participants in my interview will be protected in their identities, personal information, and responses. The board has seven main concerns, them being: confidentiality, conflicts of interest, consent, deception, harm, data security, vulnerable participants.

My study had no issues regarding vulnerable participants, deception, or harm. This is because my interviewees were not subjected to any activity or verbiage that would inflict any form of harm because my discussions with them did not make them vulnerable in any of these scenarios. Deception is also not an issue. Deception involves misleading a participant about the research, but this is unnecessary for my research, as I am looking for straightforward responses directly related to my research from my participants. I foresaw no issues with vulnerability as well, as all my participants were able to freely consent to the interview process. I also did not expect any conflicts of interest in my interviews as participation in this interview didn't lead to anything for them nor did it affect any relationships.

In terms of consent, I provided all participants with a consent form. Additionally, I have maintained privacy and confidentiality by discussing what I plan to do with the participants data and information and ensured that I have permission from them to utilize the information that I have received. I have refrained from utilizing the participants

names, and rather refer to them based on their position within the company. I have also ensured protection of transcript versions of the interviews as to protect the individual from potential data breaches. This involves data security. To ensure no breaches here, I have made the interviewee unidentifiable by the transcript, and have stored all digital data privately.

3.5 Data Analysis Techniques

In this study, I collected data from two primary sources, being archival data made up of sustainability and impact reports, and semi-structured interviews. The analysis of my data involved many steps and strategies to effectively evaluate gathered data and organize findings to conclude about themes, practices, and industry norms regarding implementation of circular economy principles.

Within archival reports, I looked for key indicators related to circular economy practices, for example metrics on waste and waste reduction, emissions and energy reduction, CO2 and water usage, material usage, product lifespan, etc. I also considered explanations of procedures, policies, and company operations and cultural shifts. I focused on keywords such as ‘sustainability’, ‘circular economy’, ‘waste’, ‘design’, ‘development’, ‘supply’, ‘consumer’, ‘materials’, ‘recycling’, ‘reuse’, ‘resale’, ‘repair’, and others to track patterns between these words and connect them to the overarching theme of adoption of circular economy principles. Within my semi-structured interviews, the guide consisted of open-ended questions that targeted topics such as circular practices in all life-stages of a product, challenges with circularity, stakeholders, policies, and impacts of circular economy principles on the business and its operations. **A copy of my interview guide is attached in Appendix A**.

Carrying out my analysis through a case study allowed for in-depth examination of how the principles and practices of the circular economy theory have been integrated into product development in different companies throughout the outdoor apparel industry. My qualitative data was comprised of the responses received from the interviews, as I considered common themes within business practices between firms. I used a qualitative data coding tool called NVivo to help sort and organize information collected from my interviews and archival data into themes for easier analysis. In total, I had 68 unique codes that I sorted data into. These codes allowed me to determine themes and discrepancies between my sources, and between companies. Additionally, the range and depth of codes allowed for strong connections between topics, which benefited in establishing main focuses, successes, challenges, and opportunities in the industry.

After creating my 68 codes, I sorted codes into 14 main groups. These groups included, for example, 'CE challenges', 'CE implementation', 'Stakeholders', 'Metrics', 'Future', 'Business functions', and were created with the purpose of drawing connections between codes to synthesize my findings. Connections between codes were made 1) by grouping them in the same group to determine similarities, and 2) by copying the same code into multiple categories. For example, both 'zippers' and 'RDS' were put into the 'materials selection' code, and I listed 'legislation' in my 'challenges' and 'future of CE' groups. These types of groupings were beneficial in drawing connections between themes to shape my results and conclusions.

To ensure reliability in my data analysis, I first minimized interviewer bias. This was done by utilizing a semi-structured format, as well as open ended questions to allow the interviewee to freely express their thoughts. I also used triangulation, which involves

studying one research question/topic through multiple data sources to increase validity of the data (Flick, 2004). This study triangulated between sustainability reports and interviews, which allowed me to confirm trends and themes within the industry. By corroborating interviewees statements with publicly released data, I was able to ensure validity in all data sources. Additionally, interviews built on information within archival data sources, further developing my understanding of the subject. No bias was found in the process of triangulation. That said, there were some potential limitations that triangulation couldn't minimize.

For example, because I was relying on self-reported data from company reports, and because my interviewees were representatives of the companies and therefore work in the company's best interest, there may have been some bias towards these companies and their sustainable practices. This may have included slightly inflated statistics or response bias as interviewees want to highlight the best practices followed by a company. However, because of the coherence throughout every interview, and their consistency with reports, as well as the passion of the individuals I spoke to and their desire to simply make change and educate people, I believe there was very little bias, if any, in this study.

4. Results and Analysis

4.1 Introduction

The 14 codes identified in the data analysis of my interview transcripts and archival data guided the major themes and topics to focus on in my results. Throughout this process, I have highlighted key findings.

Firstly, there are some circular practices that are being implemented in the industry, including recycling, repair, and recommence, as well as conscious decisions

being made towards sustainable materials. Secondly, the industry has had significant challenges with fully implementing circular ideas. For example, there is a large lack of investment in recycling, repairing, and recommerce infrastructure, as well as limited technology with material innovation, which limits firms' ability to employ these practices. Additionally, there is a lack of consumer awareness and legislation that further limits adoption of CE practices. Thirdly, there are other sustainable practices being put in place, such as a large focus on minimizing carbon footprint, and reporting metrics with sustainability in mind. While circularity in the outdoor apparel industry isn't possible unless there is a full restructuring of the industry from the ground up, there are opportunities for future success, and there are actions being taken to make the industry more sustainable with its current structure. The following findings present the results of my analysis.

4.2 Current CE Implementation in the Outdoor Apparel Industry

Introduction

The circular economy is a relatively new idea in the retail world. However, the outdoor industry is seen to be the leader in adoption of circularity (Fuchs & Hovemann, 2022). After interviewing representatives from two outdoor apparel companies leading the industry in their practices, Stio and Outdoor Research, some key practices were realized.

The Role of Recommerce in Circularity

Reusability, especially through the form of recommerce is one of the most promising avenues brands can take to achieve circularity. Recommerce is the idea of selling previously used products that have been cleaned, refurbished, and put back into

essentially new quality. Many brands in the OAI have adopted a form of resale, where customers with old gear are able to return it for a store credit that allows them to purchase a new piece of gear for a significant discount. “Stio Second Turn is where a customer is done with a jacket, but it still has some use in it… we’ll give them a shipping label to send it back and give them a credit for new goods.” Stio Second Turn is now in its fourth year and has been growing well. Not only does the program repurpose products to live a second life, but it also “provides a more accessible value offering for budget-conscious customers.” This strategy has proved to be beneficial for the business because it increases product value and allows the brand to reach a new market. The most difficult piece of recommerce is the reselling of product. Products on recommerce cites are limited in variety of color and sizes which limits customer choice, resulting in low demand. Stio recognized this and pivoted the majority of their used gear sales to retail store events which increased success. A Stio representative stated that they have “had a tremendous amount of success selling the product through our retail store… somewhere between $300,000 and $500,000 in revenue out of circular product last year.” This is significant, as circular product is in its first decade of growth and brands are still discovering the best ways to make it profitable. Similarly, OR has implemented “a mini recommerce arm of our business.” That said, for them, focus is more on the repair side of the business.

Repairability: Extending the Lifecycle of Apparel

Repair is one of the most popular and successful forms of circularity. Most brands have some form of repair guarantee, as with OR, “we have a limited repair service that we offer on our infinite guarantee.” This allows customers to send in their products to be fixed versus spending money on a new product and throwing theirs out. For many

garments, it is a viable path towards circularity. Additionally, the sustainability director for OR stated, “that’s an easy way to do it with a relatively low amount of work and cost.” Repairing goods is efficient and low cost for both the customer and brand, making it a valuable practice. The repairability adds value and lifetime to each product. For example, with ski pants, “those are blocked out in a way that it’s easy for our partners to repair.” Pants are easily ripped around the cuff, so to build a pant that is easily repairable adds value and confidence that the customer will be able to keep the pant for a long time.

That said, the technicality of products limits repairability in some places. Outdoor Research highlighted three main places of failure in a technical shell jacket, being “seam taping, or a water leak along a seam, or the zipper.” These failure points are difficult to repair because of the fabrication process. That said, all three of the failure points are “relatively simplistic changes and fixes to make.” Thus, with slight changes in the design of products, there is potential to “get another 10 years out of the jacket.” Repairability is also a focus with other forms of consumer products and their drive for sustainability. For example, the OR sustainability director emphasized, “now you can walk into any Apple store and get your battery in your cell phone replaced for $65 or something like that. That’s a huge deal.” With increased attention on the idea of repairability, not just throughout the OAI, resources and infrastructure will continue to be invested in, increasing efficiency and efficacy of practices across industries.

While there are always improvements to be made with the repairability of products, OR isn’t dedicating excess resources towards repair because compared to other facets of the fashion industry “if you look at the durability of garments, we’re probably at the high end of that spectrum” and “we do make more durable products and higher end

quality products that are meant to be used and abused, and so that has always been kind of core to the ethos of outdoor apparel." Outdoor products are built with durability in mind, as consumers rely on products in harsh conditions and can't have failure when in outdoor conditions. Durability lengthens lifecycle in the first place, making it a key focus for OAI brands, especially with it being a very tangible target for increasing circularity.

Sustainable Materials Selection: Innovating for a Circular Industry

Figure 1. The components of a 3-layer shell jacket that challenges circularity

Arguably the most important aspect of implementation of the CE in the industry is material selection. With companies sourcing material from around the world, material choices are the key driver to what can and can't be done with a product in terms of components of a product, as well as the lifetime. Two sides to the puzzle are manufacturing and the post-consumer. While rental, repair, recycling and upcycling, and recommerce allows products to continue to live post-consumer, the manufacturing side is

just as important, as it supports the ability for products to have a post-consumer life. Companies are working to make products in a way that maintains durability and performance, while lowering impact. One example of this is with the Responsible Down Standard (RDS). RDS will be discussed further in the *Sustainable Standards* section of this paper.

The second promising material advancement is the ability to utilize monomaterial. Creating a monomaterial styled product would allow these products to be broken down and recycled into new products and materials, something that isn't currently possible with most companies. This means products that are for example, 100% cotton, nylon, or polyester. Brands have utilized this to make simple products such as a sun hoodie. However, outdoor apparel is particularly complex, with jackets having multiple layers and materials, as well as chemicals to ensure water proofing and properly sealed seams. This is seen in **Figure 1** above. Companies are doing research into how to make products such as ski jackets easier to breakdown, for example at Stio, the materials team is "looking at making any of our two-layer non-Gore-Tex fabrics with a polyester face with a polyester membrane, or a nylon face with a nylon membrane." Additionally, The North Face has recently released a three-layer monomaterial shell jacket made from recycled polyester, which is a huge step in the right direction, as it is the first product of its type that is fully recyclable post-consumer (Wengenmeir, 2024). Additionally, complex outerwear pieces have waterproof zippers, which are an entirely new challenge.

The theme of the complexity of breakdown of a zippered product was highlighted with every individual I spoke to. An OR representative mentioned that "when you make a durable jacket, you want to have a waterproof zipper. And a waterproof zipper has to be

bonded by heat into a jacket. It can't be sewn. There's not that many sewn bits on an outerwear jacket, because the more seams you have, the more chance it's going to leak." The zipper is one of the most common points of failure on an article, and it is difficult to remove because it has been bonded chemically to the jacket, rather than being sewn. Because of this, the breakdown of technical products is difficult. There is work being done to increase repairability of the zipper, with little implementation. A Stio materials manager spoke about how, "there's a removable zipper slider. The reason we haven't implemented it is, most of our zipper failures are not the slider failure, but the teeth on the zipper. So it requires you to cut out the zipper and replace it." To help with the development of circular materials in the industry, a company called bluesign® is working to make change from the first stages of the supply chain. I will focus on bluesign® in the *Sustainable Standards* section.

For the history of waterproof outerwear, PFAS has been the chemical keeping consumers dry. PFAS characterizes tens of thousands of chemicals known as forever chemicals, meaning that they will never break down in the environment. These toxic chemicals, however, have proved to bead water and other liquids extremely well, prompting many leading waterproofing technologies such as Gore-Tex to use PFAS in their DWR (durable water repellant) membranes. However, with increasing regulation, Gore started phasing out PFAS in 2022 (Stohler, 2022). Starting in 2025, many states have banned PFAS in textile sales and distribution (Rothman et al., 2024). This is a massive step forward for the industry as it will force manufacturers to use different technologies to maintain the waterproof qualities of PFAS. With Gore's move away from PFAS in 2022, and other companies removing PFAS from their waterproofing, product

containing PFAS free DWR is common. The only issue with them according to a Stio materials manager is that “they don't repel oil. Not like you think it's an issue, but a little ketchup, a little grease on your skin, anything like that, can contaminate it, and then once it's contaminated, it doesn't repel water.” This is a significant issue for outdoor apparel companies, as a loss of water repellency shortens a products lifecycle, limiting circular potential. Thus, a solution to this issue must be found. In my literature review, I referenced the idea that PFAS is overengineered for most applications, making acceptance of alternative materials easier, but the loss of water repellency in these new materials must be addressed. While the ban of forever chemicals is a step in the right direction, alternative materials that uphold the waterproof qualities of PFAS and increase durability and thus lengthen product life need to be innovated for a viable solution.

Recycling to ‘Close the Loop’ with Materials

Recycling is one of the most applicable options that outdoor apparel brands have started to use in their products. The 2022 OR Impact Report quoted, “using recycled materials displaces the use of new (virgin) raw materials, which helps reduce the environmental impacts of our material selection.” By utilizing these materials, less new material is extracted from the earth, allowing the circle to close further. Every company practices some form of recycling, and it is often advertised as a main source of sustainability. One reason for this is because recyclability is common across many industries and has proven to be more realistic with current technology and infrastructure. Outdoor Research is “at 50% recycled material across our offerings. Can we get it up to 55% in season ‘26.” Similarly, Stio “always opted for the recycled textiles or organic textiles… well over half of our collection is built out of that now.” That said, these

companies didn't start monitoring their use of recycled products up until recently. With increasing consumer demand for sustainability, companies can now track their material use down to the yard. The emphasis on recycling shows a hopeful future for circularity within the industry, but still comes with many challenges.

Along with resale, recycling in the post-consumer market is a great opportunity to minimize virgin material extraction and utilize and reutilize products and material that is already in existence. The Tersus CEO mentioned, "you have $10 billion worth of product in consumer's closets, much of it underutilized or not used at all." Relating back to my literature review, this underutilization of clothing is seen not only in fast fashion, but within the outdoor industry as well. By offering recycling services, products can stay in the marketplace and be used or turned into new products of equal quality, rather than companies continuing to, as a Tersus representative stated, make "a new (Patagonia) Nano Puff with six new colors."

A facet of recycling is called upcycling. Upcycling is the process of turning one product into another so that materials don't go to waste. For example, Stio has questioned, "can we take old ski jackets and turn them into baseball hats or shopping bags or things like that." While upcycling is common as its own business, it is less common within outdoor apparel companies. With more R&D, and technology that enables businesses to reprocess product when it comes back to them, the upcycling idea can be realized, increasing the potential of a circular industry.

Conclusion

Both Stio and Outdoor Research have demonstrated a push towards circularity. Firstly, both businesses have hired individuals to work in sustainability within the

companies. Stio has a sustainability focused materials team, while OR has a sustainability team that has direct input on materials and supply chain decisions, product development, and other functions. Both strategies have proved valuable, as these individuals directly influence decisions down to the material level that greatly impact the sustainability of the firm. Both companies have utilized the circular economy and are applying circular principles to all stages of the product lifecycle, where applicable.

CE Practice	Current Implementation	Challenges with Implementation
Resale & recommerce	• Recent startup of small resale branches in both companies • Retail store sale is more effective than online	• Collection, sorting, repair, washing, and breakdown of items, especially with small quantities of items coming back • Lack of consumer education • Lack of investment and resulting lack of internal infrastructure for this process • Profitability challenges
Repair	• Most firms have a repair center, especially as a warrantee guarantee • Repair is easy, cost efficient, and effective	• Collecting and sorting products that need repair versus washing or recycling • Lack of internal infrastructure • Complicated garments require high tech facilities to ensure post-consumer quality
Recycling	• Use of recycled materials over virgin materials to produce goods early in the supply chain • Research towards utilizing post-consumer recycled products to produce new products • Recent tracking of recycled material usage has been beneficial for firms	• Lack of investment and resulting internal infrastructure to recycle post-consumer goods • Lack of consumer education about product return programs • Complicated materials such as DWR, zippers, and multi-layer products are very difficult to break down to recyclable components • Downsides to both mechanical and chemical recycling such as toxic waste, cost, availability, energy usage
Material use	• Utilization of recycled materials • RDS certification • BCorp and bluesign® certification • Advancements in monomaterial • PFAS replacements that repel water as well or better	• Sustainable materials are expensive • Monomaterial can't replace other materials such as nylon/poly weaves yet • PFAS replacement in DWR doesn't repel oil • Use of chemicals to get demanded high quality • Materials cannot be separated once bound together • How to remove heat bound components such as zippers

Table 2. Circular economy practices, challenges, and implementation

4.3 Challenges with CE Implementation

Introduction

While it is evident that both Stio and Outdoor Research have made great progress on their efforts to implement the circular economy, there are many challenges with doing so. Every category of the CE mentioned above has its drawbacks, which I will address below. Additionally, the lack of infrastructure, investment, and innovation, as well as stakeholder challenges has proved to make the circular economy more of a future dream than a current reality. One representative from Outdoor Research stated, "is circularity key to our stakeholders… because there's a million other things in sustainability that we could be focusing on as well, right?" Additionally, she emphasized that, "there has to be a business case… it just has to make sense" and "we haven't been able to plug those two (CE & business case) together quite yet."

Infrastructure Challenges: Internal vs. Third-party Logistics

One of the key challenges to fully adopting the circular economy in the outdoor apparel industry is the lack of infrastructure. This issue is compounded by insufficient investment and innovation. As the OR sustainability director puts it, "we need three more I's: innovation, investment, and infrastructure." Companies such as Tersus, based in Denver, Colorado, are working to address this gap. They collaborate with brands such as Stio, Arc'teryx, REI, The North Face, Cotopaxi, and Lululemon, offering services that include liquid CO2 washing, a repair center, and down recycling. Tersus acts as an intermediary in the resale process, cleaning, repairing, or breaking down used items, which are then resold through recommerce programs or repurposed for manufacturing. Tersus's CEO notes, "we're as big as we need to be," pointing out that the infrastructure

problem isn't simply a matter of scale. In combination with other forms of capital such as innovation and investment, the industry is struggling. Without a solid business case or sufficient research, companies are hesitant to allocate the resources necessary for circularity.

The lack of infrastructure is more apparent internally. Instead of outsourcing recommerce logistics to a company like Tersus, many businesses want to handle it in-house, which exacerbates the infrastructure issue. Every company representative I spoke with acknowledged that the inability to scale circular practices internally is a major barrier to growth. Logistically, implementing circular principles requires significant resources, and many companies like Stio don't have the resources to carry out these practices internally. One Stio representative states, "until we're at the next level of scale, we will continue to use a third-party provider." In the absence of internal infrastructure, third-party specialists help companies advance their sustainable practices. That said, third parties do have drawbacks. For example, Stio avoids sending individual items to Tersus due to the cost inefficiency, and instead waits for larger quantities of items to send product, causing a backlog. Thus, in the long run, internal infrastructure will maximize efficiency and make recommerce fully scalable. Innovation and infrastructure hinge on investment and each "I" must grow together to ultimately support a more circular industry.

When speaking on designing for circularity, the materials manager from Stio stated that, "the infrastructure is not there yet, but that's not to say it won't be there in 15 or 20 years." Some other quotes from representatives from both companies that emphasized struggles with lack of infrastructure included, "it's a huge technical lift for a

company our size", "the technology literally does not exist", and "the biggest problem is that there's no money that is being guaranteed to help to solve the problem." Clearly, the lack of internal infrastructure, especially in smaller brands with limited resources, is a leading factor when it comes to inhibitors of circular implementation.

Barriers to Recycling: Infrastructure and Innovation

Recycling is arguably the biggest player in the challenges of circular economy adoption. Recycling is a large part of most brands sustainability efforts, especially on the manufacturing side. OR's 2022 impact report states that, "using recycled materials displaces the use of new (virgin) raw materials, which helps reduce the environmental impacts of our material selection." Both OR and Stio pride themselves on over 50% of their products being built with fully recycled or preferred materials, and Stio's best-selling shell is fully recycled.

However, utilizing recycled materials is expensive for companies and with the current market is difficult to make profitable. Stio states, "it's not a small number of what we're spending annually to use recycled or organic materials versus conventional." The use of recycled materials needs to make sense to shareholders but there has been difficulty making a business case for sustainable materials. That said, Stio materials manager highlighted that, "if there's enough critical buy in, it drives the cost down to be an easy decision for the big players." If companies can spend a similar or lesser amount on recycled materials as they would on traditional materials, they can kill two birds with one stone, appeasing shareholders while also contributing to their sustainable goals. Sustainable material costs will continue to decline as sustainability becomes more common, prompting more demand for materials and thus stabilizing costs. For example,

the Stio materials manager stated that for some recycled materials, costs have already dropped, “where you used to be paying a 30% surcharge on everything, now for some suppliers the recycled cost is the same as non-recycled.” This is significant, especially for smaller companies such as Stio and OR, that have limited resources.

Post-consumer recyclability is another major challenge. To break down a technical outerwear jacket to where it can be recycled takes a lot of work. For example, a three-layer shell jacket, designed to be durable, lightweight, and breathable, is made of several materials that are either laminated, sprayed, or woven into the fabric. Thus, the ease of recycling a monomaterial is gone, as separating these materials and fabrics back into individual materials is very difficult. For example, a hard-shell jacket will have polyester and nylon fibers that are woven together into one fabric. Once this fabric is woven, it isn’t possible to simply unweave it. Additionally, a sustainability specialist at Outdoor Research explained that, “sometimes the yarns themselves are twisted together with poly and nylon so a single yarn will have two materials in it. Unbreaking those chains down to that level to make new material, it's really difficult.” This leaves the recycling puzzle incomplete, as there is no clear way to break down these complicated products.

There are two forms of recycling being used with outdoor apparel companies currently: chemical recycling and mechanical recycling. Mechanical recycling is used to break down plastics into a new raw material without disrupting the polymer chains of the material. Mechanical recycling is widely used, however it uses a large amount of energy and results in a lower quality product than the original product, meaning that mechanical recycling isn’t sustainable in the long run as future recyclability is limited. Chemical

recycling, on the other hand, breaks down the polymer chains of plastics into monomers, so new plastics can be created. Additionally, chemical recycling can be done as many times as desired. However, it uses toxic chemicals in the process, and emits more waste. While both forms of recycling are promising, there is no full implementation of either process, as there are drawbacks, and because there is a lack of infrastructure. While the major problems inhibiting full circular adoption are on the firms' side, there are other stakeholders that contribute to the problem.

Overcoming Knowledge Gaps in Circular Economy Practices with Consumer Awareness

Consumers in the outdoor industry have always been more conscious of the environment as compared to other consumers, mainly because they interact with it in their activities. A representative at Stio commented, "consumers definitely drive the bus on sustainability." However, consumer education and awareness about many aspects of sustainability is low. Yes, consumers like to hear that they are purchasing a product that is sustainable, but in reality, the consumer isn't truly aware as an OR sustainability team member stated, "the challenge is that consumers are not educated."

Firstly, consumers aren't educated about what companies are doing in their sustainability efforts. The challenge becomes present when the company is deciding what to share with the consumer. A customer isn't going to understand the nitty gritty details of what a company is doing to be sustainable, and when they state that they save, 'two kilograms of CO2 per jacket', it is meaningless to the customer. Thus, what can a company present to the consumer about sustainability? Both OR and Stio sustainability reports utilize diagrams and images when presenting numbers in their reports, which makes them more easily digestible for the consumer.

Additionally, marketing materials that are sustainability focused have been seen to be beneficial. For example, OR's sustainability focused marketing emails had some of the best reading rates for the entire last year's marketing efforts. The sustainability specialist's perspective is "that customers are starved for authenticity, and I think that the more you can demonstrate hey, this stuff is hard and this is how we're approaching it, and we want it to be a conversation, I think that resonates." Similarly, Stio experienced positive results with sustainability focused marketing and product sales. "When we're able to take a product that wasn't recycled and make it recycled and tell a sustainability story, we do see a lift in sales for those products." That said, companies have been held back by green hushing. As stated by the OR director of sustainability, this is "essentially the fear of sharing some of these efforts out of the fear of being attacked or the fear that you don't have it perfectly figured out." Because of the apprehension of being accused of greenwashing, some environmental work across the industry is being concealed. Companies are therefore held back in the way that they share sustainability efforts, which is making consumer awareness and education difficult to navigate.

The second challenge with consumers is making them aware of what they can do to help companies in their circular efforts. For example, product return from customers is an integral part of both Stio and OR's recommerce business. However, when addressing this topic, the Tersus CEO said that "consumer awareness is just low across the board." Many consumers don't realize that you can trade your product in and get "a significant credit with the brand and upgrade to the new style." Businesses need to focus on making customers aware of the things they can do to help enable a circular future such as turning their jacket in for a credit. Additionally, brands have struggled with educating consumers

about product care and things they can do to upkeep the product while it is in their hands. With the banning of PFAS in durable water repellant, products now require more upkeep to maintain their performance. For example, an older jacket that utilized DWR containing PFAS still may bead water perfectly, and only needs to be washed when it gets dirty. Yet, a Stio materials manager stated, "it has a half-life of 500,000 years and it'll never break down in the environment." With newer jackets, a consumer will have to wash it multiple times per season and reapply waterproofing treatment to maintain its durability. While this can be explained on a tag or in the packaging of a product, it is still a challenge for companies as to how consumers can be made more aware of these things. Along with the challenge of how to educate consumers on their role in the sustainability story, businesses have struggled with different generations in the marketplace.

Within my data collection, there was talk about who a company can market to versus who is going to buy the product, and these things need to align. The sustainability specialist at OR emphasized that while Generation Z may have the appetite for sustainable apparel, "Gen Z doesn't have the money yet. They're not buying our products new." Younger generations generally support sustainable businesses more, however older generations are generally the ones who are in the marketplace to buy these expensive outdoor products. This presents an issue with balancing sustainability with maximizing revenue, as "there has to be a business case."

The Role of Regulation in Enabling Circularity

Another important stakeholder that has potentially limited sustainable development within outdoor apparel companies is policy makers. The outdoor industry, and textile industry has historically not been a regulated industry. This has been seen

especially with practices in the fast fashion industry. Additionally, there has been little focus on sustainable practices until recent years in the OAI. More policy will help further address this. An OR representative believes that legislation will, "provide a lot of pain and suffering moments and also give room for change to happen." For example, SB707, or the Responsible Textile Recovery Act, was recently passed in California. This law makes textile producers responsible for the collection, repair, and recycling of their products, with the goal of taking waste out of the landfills. An increase in policy is imperative to drive change within the industry by putting pressure on it from the outside. The OR sustainability team emphasized that policy makers and industry insiders will have to work together to ensure the law "actually helps to accomplish what the law set out to do" without squishing firms into a mold that "stifles innovation."

Many challenges and barriers have been highlighted that have made the application of the circular economy extremely difficult for Stio and Outdoor Research, and challenges have been echoed throughout the industry. Because of this, outdoor apparel companies have begun focusing on other sustainable principles to drive their sustainability efforts.

4.4 Current Sustainable Practices in the Industry

The circular economy faces many large hurdles that are preventing full implementation. There are also many opportunities that come along with these challenges, and businesses will continue to work towards circularity. However, circularity may be difficult to fully achieve in the future, so there are other practices that outdoor apparel companies have utilized to maximize their sustainability efforts.

Reducing Carbon Emissions & Energy Consumption

The outdoor apparel industry expends a massive amount of energy throughout a products lifecycle. From extraction of virgin materials, to manufacturing and production, to packaging and transport, to employee travel and more, outdoor apparel companies have many different areas that they can focus on to reduce energy and carbon emissions. Outdoor Research representatives use “our carbon footprint as our north star”, and Stio has similar ideas as “carbon is probably our biggest lever that we watch as a proxy”. This is because carbon is present everywhere, and is an indicator for both energy use, as well as material choice. By measuring carbon related metrics, firms can set realistic and visualizable goals that encompass multiple areas of the business, which maximizes sustainability across the board. Both Stio and OR are focused on carbon neutrality, with Stio being carbon neutral through a combination of carbon reduction and carbon offset purchases. Beyond working towards more carbon efficient travel and internal business operations, the biggest way to reduce carbon for these businesses is with their products. After speaking with Stio representatives, it was mentioned that around a third of the company’s impact comes from materials production. Thus, there has been a large focus on material impact and how the company can adapt its strategies to utilize materials with less impact. This also highlights the importance of having sustainability focused members on all teams within a company, including materials and production teams.

Both Stio and OR have sustainability focused positions directly involved with materials and supply chain activities, which is beneficial because these individuals can make decisions that contribute to the company’s sustainability while checking other necessary boxes for the business’s success. A materials team member at Stio described an example of their materials decisions as such; “when we're thinking about a new fleece

jacket, we might look at two different fleeces and from two different supply chains and be able to look at the carbon intensity of those two materials to help drive our decisions towards a lower carbon material." This heavy focus on the material side of the business has allowed Stio to reduce their carbon impact significantly. While a carbon footprint is going to grow with business growth, Stio's footprint is not growing proportionally to their business, and "a lot of that is from our material inputs." Similarly, OR has made efforts to reduce carbon impact within their products and materials. They recently released their first carbon neutral collection, which is a major step forward, and the first in the industry.

The Transition to Clean Energy Sources in Outdoor Apparel Manufacturing & Retail

Renewable energy is constantly evolving with technology and has become more widely used and accessible recently. The outdoor industry has begun to use renewable energy sources to reduce their impact. Outdoor Research is direct to consumer, meaning they do not operate any of their own retail stores, and only sell product through their online store. They do have product in stores such as REI, but not in stores they operate. Because of this, the company has a comparatively low energy usage than other brands that operate stores nationwide or internationally. Still, according to the sustainability team, OR purchases renewable energy credits for their North American operations to allow them to have zero emissions from a market-based standpoint. Stio tackles the renewables from a different side. They do operate retail stores around the US, and thus utilize a lot more energy to run the stores. Stio has worked to make sure their stores are run off wind powered energy, and they purchase wind credits to further offset energy impacts. With the fashion industry utilizing large percentages of the budgeted carbon for

global warming limits as seen in the literature review, it is imperative that brands continue to work towards renewable and more efficient energy sources.

Sustainable Standards: Industry Wide Certifications for Environmental Responsibility

While brands have worked hard to implement and maintain sustainable ideals at their core, credibility is occasionally questioned. This is due to a history of greenwashing in and around and industry, where companies have lied about what they are doing to make them appear more sustainable. There are a few certifications that are common among the industry which both improve credibility and help standardize practices throughout.

Firstly, there are B Corporations (B Corps). Being certified as a B corp ensures that companies follow high standards of social and environmental performance, transparency, and accountability (B Lab Europe, 2023). This is the most well-known form of social impact certification. Attaining B Corp status is quite difficult, especially as a smaller business, but Stio has gone through the baseline process to become a B Corp and use the guidelines as a benchmark to see their progress year to year.

Secondly, and possibly the most common certification is bluesign® certification. With outdoor apparel, application of certain chemicals is necessary to get the quality and performance that consumers demand. Bluesign® works with chemical manufacturers to ensure chemical safety for the consumer, worker, and environment. This is done through the removal of hazardous chemicals at the beginning of the supply chain. This way, environmentally and socially responsible chemicals are going into products. Additionally, this minimizes environmental impact. Not only are workers and consumers not exposed to chemicals, but there is no release into the environment either, as the harmful materials

are removed at the very beginning of the product lifecycle. Both Stio and OR work with bluesign®, “to provide the greatest assurance of chemical safety” (OR Impact Report 2022).

As stated in the *Sustainable Materials Selection* section above, the Responsible Down Standard (RDS) is in place as a form of social responsibility certification. RDS ensures that feathers for down products come from birds that were treated humanely, and that the down is traceable to the farm and sometimes even to the bird. This guarantees a sustainable supply chain, not just environmentally, but socially as well. Recycled down is also on the radar, but this form of down cannot be traced, and thus companies choose RDS over recycled down. However, the Stio founder emphasized that eventually, “the recycled down market will be big enough that you'll be able to get traceable recycled down and that's something we're super interested in.”

Tracking Sustainability: Metrics Utilized to Track Sustainable Practices

While sustainable practices have been explored for some time, companies have only recently begun tracking their efforts. This is seen through the recent requirement of companies to release an annual sustainability report. Many metrics pertaining to sustainability have been beneficial in enabling companies to report their progress towards environmental responsibility to the public.

Both firms that I spoke to utilize many key performance indicators (KPI’s) to track their environmental and social responsibility. These are highlighted in public reports as these more tangible and readable for consumers. The largest and most standardized performance metric is called the Higg Index. The Higg Index, which was developed by the Sustainable Apparel Coalition (SAC), is a suite of tools that allow

brands to measure their environmental and social impacts throughout the entire lifecycle of their products. This allows the SAC to generate standardized scores for businesses in the apparel, footwear, and home textile industries (SAC, 2024). These scores then allow companies within an industry to benchmark themselves against others. Both firms in my study utilize this metric and have seen positive returns from it. For example, OR sent blog style emails about their sustainability to educate consumers last year. They sent an email about the Higg Index, resulting in "the most click throughs and opens (out of the blog styled emails), and actually had a direct drive to revenue." This is significant because it shows that consumers are conscious of sustainability, and the ability to report progress in a standardized way contributes positively to businesses. While there aren't many other standardized KPI's yet, the industry continues to work towards a more standardized system, and the Higg Index is a major step in the right direction.

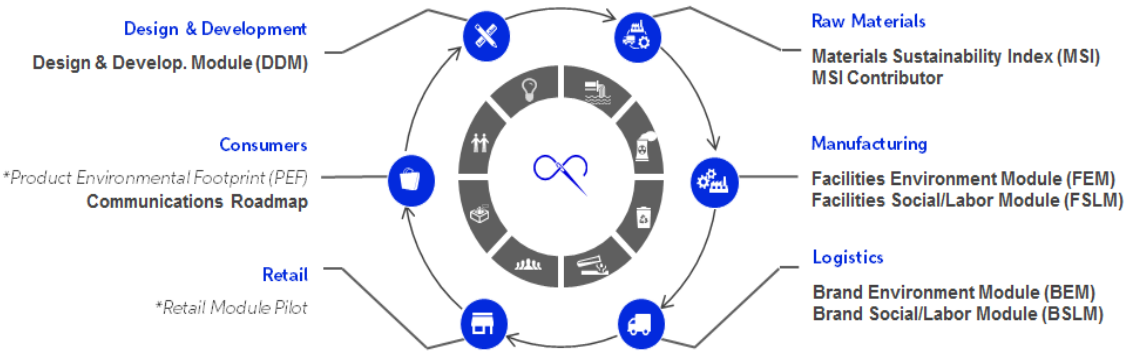

Figure 2. Higg Index Assessment Suite (SAC, 2024)

Both Stio and Outdoor Research have company specific KPI's that they use to quantify their sustainability and circularity efforts. For example, OR utilizes the Recycled Content Standard and the Global Recycled Standard to verifying their recycled content, and Stio uses similar metrics to maintain their recyclability. Additionally, firms may turn to less standardized metrics, such as tracking material usage to assess the general health,

efficiency, and sustainability of their business. Additionally, carbon metrics and other practices that have been spoken about earlier in the results section act as KPI's for firms. While these metrics are helpful, there is a need for well-known standardized KPI's to best aid the industry in a sustainable restructuring.

4.5 What is the future of the industry regarding circularity

Throughout the course of my research, I have been enlightened by the thoughts, stories, and ideas presented to me by industry professionals. However, I was also reminded of the reality of the world of business. The only way a business stays alive is by making money, and therefore, this must be a top priority, regardless of any other focuses such as sustainability. Reality as the OR sustainability director reiterated, is, "the most sustainable thing we can do for the environment is go out of business." There were other similar quotes out of every other interviewee in my study, some examples being, "anything you buy is bad for the environment, period. So, the big elephant in the room is, everybody needs to stop buying so much shit" and "it is near impossible to truly be circular from cradle to grave" and "do I think that we can go circular? I'm wrestling with that right now." While there are constant pessimistic attitudes about the sustainability issue, a balance can be found between making money and protecting the environment within the outdoor apparel industry. With regards to circularity specifically, a truly circular economy is not possible now, but a goal for the future. The OR sustainability director highlights that we need a reworking of the economy; "When we talk about sustainability, we talk about moving to a circular economy. We need to completely rewire our economy." Thus, a full systems change is required to make room for the advancements, policy, and action that will allow circular practices to be employed. Along

with this, we need “the investment in the infrastructure and innovation to actually figure out a way to do it.” Circularity will continue to be a focus into the future, but there are other practices that can be utilized to position companies in a sustainable position.

The ‘holy grail’ of these efforts is carbon reduction. Because carbon is present in virtually everything, focusing on carbon reduction is a good way to measure the overall efforts of a business. Both outdoor apparel companies that I interviewed underscored the importance of carbon footprints when it comes to building a more sustainable business. A Stio representative mentioned that “carbon is an awesome indicator to look at both for energy use, water consumption, and chemical use. If you're using less carbon intensive materials, chances are you're using less chemicals and less energy and hopefully less water as well.” Of course, there are metrics that can be used to measure carbon intensity of a firm or product so that firms can track their progress year to year, and between others. Outdoor Research holds similar values with their carbon reduction, as they stated, “if you keep carbon in the center, then all the other projects that you initiate should reduce that carbon footprint.” By focusing on more attainable climate related goals such as reducing carbon footprint, companies can maximize the balance between ‘making money and protecting the environment’. These carbon reducing activities will also lead to advancements in circular practices, for example with utilizing recycled materials. Pressure from external stakeholders such as consumers and policy makers are also going to push the industry to adapt their practices.

An increase in regulation of the textile industry is going to be necessary for outdoor apparel companies to fully implement sustainable ideals. To succeed in a systems change, legislation will have to be created in a fashion that doesn’t restrain innovation,

but rather guides the industry in the direction of circular applications through policies and regulations that affect what a company can and cannot do surrounding textile lifecycles. This also includes supporting people in government who will make positive changes for the environment and who will support policies that will push the country in the right direction.

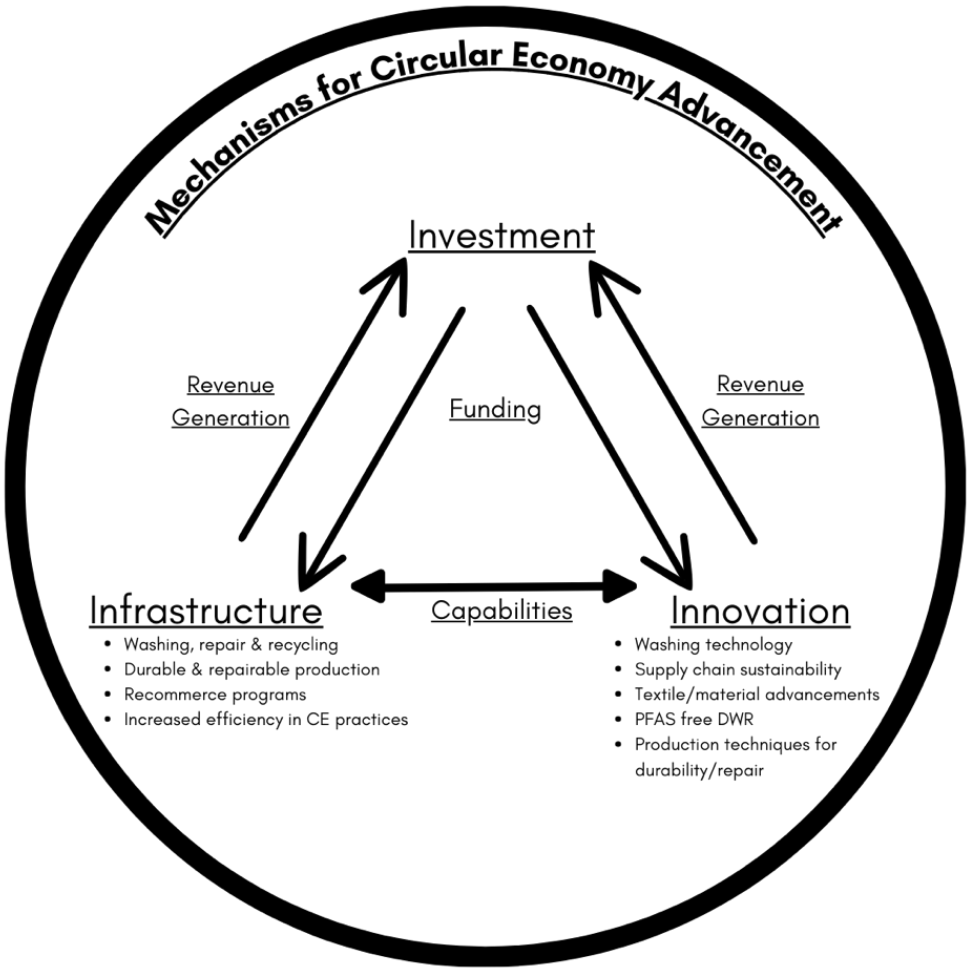

Figure 3. Mechanisms to advance the CE in the OAI

4.6 Discussion

Through qualitative research in the form of semi-structured interviews and archival data, my study found that the theoretical ideal of circularity is promising, however the actual implementation of practices is limited in the outdoor apparel industry.

While there are a multitude of circular practices being exhibited by multiple companies in the OAI, complete circularity is not currently possible but rather a goal for the future. Adding to this, I have deduced that there is a clear difference between extending product life and being circular. Extending product life is currently achievable by activities such as building durable products and offering repair but closing the loop to achieve circularity through methods such as recycling is not achievable yet. While product lifetime is a piece of circularity, it doesn't directly aid in 'closing the loop'. There are many opportunities for future success in a circular economy including greater investment in technology and infrastructure, material innovations that allow complex products to be broken down easier, and legislation that guides the industry in the direction of circularity rather than squishing everyone into a mold that obstructs innovation. Additionally, the circular model hasn't proven to be as profitable as a linear model, which needs to change for circularity to be realized. There are also other ways to tackle the sustainability problem, prompting OAI businesses to spread resources across many avenues. Companies are pursuing other sustainable practices such as carbon reduction and utilizing renewable energy and both strategies have proven to be successful and more attainable than circularity.

These results are consistent with what others have found. For example, German researchers Michael Fuchs and Gregor Hovemann have released two studies regarding circularity in the outdoor sporting goods industry (OSGI). One of them focused on the structure of the state of the CE in the OSGI, finding that many outdoor brands engage in CE practices, and that these practices are generally the same throughout. Additionally, they conclude that there will be developments in the CE within the OSGI into the future

to create best practices. The second study builds on their first by studying which CE practices are best suited for the industry by analyzing enablers and barriers to multiple practices such as reduce, circulate products and materials, and shift towards renewable resources. The study finds that the high complexity of certain products is a main barrier, while designing for durability and repairability were enablers. Thus, OSGI businesses should focus on building durable and repairable products. Much progress has been made since 2022 when both studies were released. My study builds on Fuchs and Hovemann (2022) by focusing on U.S. based companies. The EU has strong environmental policy which has driven sustainable innovation, whereas the U.S. is unregulated in its sustainability practices. Additionally, I focus specifically on apparel, whereas their studies focus on the outdoor industry as a whole. While we do have overlaps in our findings, for example the difficulty with implementing the CE in technical products, and low product return rates, my study focuses on the complicated aspects of apparel that make circularity difficult to realize for technical outerwear.

My findings about the challenges with circularity contribute to our understanding of circular economy adoption by giving an industry specific lens into why circularity is a challenge, highlighting the unique barriers such as supply chain and resource limitations, stakeholder demands, regulatory hurdles, and the need for a reshaping of business models to achieve circularity. These findings highlight implications for many audiences. For researchers, my findings about the barriers of circularity contributes to the theoretical understanding of sustainable transitions by highlighting that the industry isn't as developed in this area as it may seem to be. Strategies that practitioners could use to overcome these barriers include collaboration within the industry and supply chain,

standardizing sustainable materials and circular practices, investing in new resources and innovating business models, and increasing stakeholder awareness. Policymakers should focus on regulation that enables circularity rather than constraining innovation. This may include mandating sustainability reporting. Sustainable practices could be incentivized as well. Additionally, standards could be performance based and flexible in their action so that companies can adhere to the standard in the way that best suits them. Providing firms with different avenues to reach sustainability targets will enable innovation by allowing businesses to approach circularity in different ways rather than forcing brands into a policy that fits one company but not another.

My findings also highlight implications for other industries, especially because the OAI is a leader in sustainable business activity. For example, other industries will likely face barriers with supply chain sustainability, consumer education, and regulation. Businesses can utilize these findings to proactively design product with longevity and recyclability in mind, as well as innovate materials that aid in this. Other industries may also consider shifting their business models to better suit circularity. Additionally, the need for collaboration throughout the value chain, both within the industry, and between industries, has been highlighted and should be utilized to drive success with circular activities in the future.

While my research brought about thought-provoking results, there were some limitations that should be addressed and utilized to guide future research. Firstly, conversations were limited to a niche of the department that my interviewees worked in, so results may not have been indicative of perspectives throughout the organizational structure of the business. Going hand in hand with this, certain processes and business

functions were underrepresented. For example, I didn't interview anyone involved in company finances, so am limited in that perspective. I was also limited in the perspective of other companies. Both firms I studied are of relatively similar sizes and positions in the industry. Speaking to individuals from industry leading companies owned by corporations, such as The North Face would likely highlight a different outlook on circularity as they have more resources to experiment with practices. In the same light, studying a smaller company may bring about an entirely new perspective on the situation.

Considering my findings and limitations, there are many directions for future research. Future studies could examine more companies and select companies with variation. Cross-industry comparisons may also be beneficial as results could inform industries of similar practices to open areas for collaboration. Additionally, it is important that in the future, quantitative studies are done on the circular economy in the outdoor apparel industry. There is not enough qualitative research for this to be done yet, but quantitative research will give insights into the development of the industry, as well as financial viability of adopting sustainable practices going into the future. As metrics and reporting becomes more standardized, this will become realistic.

5. Conclusion

5.1 Conclusion

My project aimed to further current research in the outdoor apparel industry, focusing specifically on the implementation of the circular economy within the industry, and the challenges that companies have faced in circularity. I have also aimed to discover other sustainable activities that businesses participate in to further their environmental responsibility goals. Throughout my literature review, I discovered some gaps in current

research, especially a lack of research within U.S. based companies. The European market has a considerable amount of research as sustainable practices are more common there. Additionally, there is more environmental policy in the EU, promoting companies to work towards a more sustainable future. By studying U.S. companies, I was able to build from researchers in Europe such as Fuchs and Hovemann, but in a less developed sustainability market. Where the EU is in the 'walking' phase of sustainability, the U.S. is still in the 'crawling' phase. After conducting and analyzing five semi-structured interviews, and analyzing archival documents with the use of NVivo, multiple results were found.

Firstly, I discovered circular activities being practiced such as reuse, repair, recycling, and resale/recommerce. I discovered many challenges with them, being lack of infrastructure, innovation, technology, and investment, as well as many of these practices being expensive and not making money. This is coupled with a lack of regulation and lack of consumer education. These challenges led me to realization of why circularity isn't currently possible in the industry. Next, I found other sustainable practices that companies utilize to contribute to environmental responsibility, mainly being minimizing carbon footprint, reducing energy and other resource use, and utilizing renewable energy. Furthering this, metrics and certifications that boost credibility such as bluesign®, BCorp, RDS, and the Higg Index have become widely known in the industry. Finally, I learned about the future of the industry and what is needed to drive development and achieve circularity from cradle to grave, such as more legislation and changes in governing bodies, increased infrastructure, technology, and innovation, and continued

work on current practices, which will all lead to increased profitability to prove that the concept of circularity is achievable as a business case.

My findings suggest that CE adoption within the outdoor apparel industry is a significant challenge that the industry will have to overcome, although there are strong efforts being made already to implement such practices. My research shows individuals within and outside the industry what is needed to successfully restructure the OAI towards a circular future. Stakeholders will need to come together to change their behaviors, thoughts, and structures to continue to push for circularity and point towards sustainability. These findings bring about important implications regarding circularity in consumer goods and highlight the need for further research in this area, especially as circularity becomes a well-known topic. Along with my research, further qualitative research will lead to the context needed to conduct quantitative studies on the topic of circularity, which would provide further insight into the future of the industry and the current shortcomings of sustainability focuses.

The outdoor apparel industry has a great effect on populations throughout the world. From material sourcing for textiles, to producing and manufacturing garments, to the aftermarket effects of products, all stakeholders must be conscious of the impacts that their actions have on themselves and on far reaching communities, now and into the future. To drive the industry towards a circular economy, many changes must be made internally and externally to strengthen current practices and give rise to new practices and innovations. Collaboration and cooperation will allow the outdoor apparel industry to find success in their circular practices. As the Outdoor Research sustainability director put it, “the answer here is together.”

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Appendices

Appendix A – Semi-structured Interview Guide

Category	Question
Intro/Warmup	- Explain project & motivation, time allocation for interview, etc…
Background, professional history, etc.	- How did you become involved in the industry and in sustainability? - What drew you to the company? - Tell me about your role and responsibilities
Practices • Circular supply chain • Materials sourcing & innovation • Product lifecycle • Design & development • Manufacturing • Carbon reduction/efficient energy usage	- What specific circular principles do you focus on and why? Are there principles that are more difficult to utilize than others? - What prompted your company to adopt circular economy practices? Were there specific market or regulatory pressures that influenced this decision? - How has the company integrated circular economy principles into the design and development of your outdoor apparel products? - How does incorporating circular economy principles affect your product development and time-to-market compared to traditional methods? - Is there also focus on efficient energy/carbon reduction, and how does this fit into the CE picture?
Challenges & successes	- Do you have any stories/examples about challenges your team has encountered, and how you overcame them? - What challenges did the company encounter in weighing decisions about whether to adopt specific practices? - What challenges does the company face between departments with the development of sustainable practices? - What specific challenges does your team face when designing products with recyclability, reusability, or longevity in mind? - What has helped lead to success in implementation of circular practices? And what are some of the successes you've had?

	- What are your plans for circularity in the future?
Impact/measurement of practices	- Are there any tradeoffs that exist with CE implementation? How does your company manage the trade-offs between product durability and environmental impact, such as sourcing sustainable materials that may differ in durability from traditional ones? - How do you measure the success of specific practices (recycling, repair, resale), especially in terms of product performance and environmental impact? - Are there specific metrics you use?
Company structure	- What does the organizational structure of the business look like and how does this impact sustainable practices - How is sustainability focused on in the company culture, if at all?
Consumer impact	- What has been the impact on consumers in your changing practices - Has consumer loyalty changed? - What is the role of consumers in shaping your efforts?
Financial impact	- Has adopting circular economy principles impacted the cost structure of your product development process? If so, in what ways? - What is the profitability of CE implementation? - How do you believe circular economy principles will influence your company's competitive positioning within the outdoor industry in the coming years?
Industry as a whole	- Where do you see the industry going into the future? - What is driving this change, and are there any leaders?