From the Ground Up:

How Small Firms Are Weaving Circularity into the U.S. Textiles Sector

A thesis submitted by

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Abstract

As the environmental and social costs of the global textile industry grow increasingly oppressive, circularity has emerged as a promising alternative model. While much attention has focused on corporate commitments and technological innovation, this thesis centers the role of small and micro-scale firms in advancing textile circularity in the United States, using qualitative methods to explore motivations, practices, and challenges. Findings show that these firms are implementing a wide range of circular strategies, often driven by deeply held values and local needs rather than market incentives. Participants emphasized community-based models, consumer education, and peer collaboration as key tools for shifting industry norms, while also identifying persistent barriers including lack of funding, regulatory fragmentation, and infrastructure limitations. Rather than aiming for mass scalability, small, values-driven firms seek to demonstrate replicable, place-based models that align with ecological and social priorities. This study underscores the critical but under-recognized leadership of small firms in shaping circular futures and calls for greater investment in networks, shared infrastructure, and policy frameworks that reflect and support their work.

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Chapter One: Introduction

The Linear Crisis in Textiles

The global textile industry is expanding at an unprecedented rate, contributing to environmental and social crises. Production volumes have more than quadrupled since 1970, with synthetic materials now making up the majority of textiles produced (Schumacher and Forster 2022). Consumption patterns are shifting as well, with consumers buying more per capita, using textiles for shorter amounts of time, and discarding them more readily (Shirvanimoghaddam et al. 2020). Together, these trends create an ever-increasing amount of post-production and post-consumer material waste. In the United States alone, textile waste grew by 868% between 1960 and 2020, far outstripping all other categories of solid waste produced (Schumacher and Forster 2022).

From research extraction and environmental pollution, to labor exploitation and waste generation, the current linear system of "take, make, use, dispose" is hugely detrimental to people and the planet. The textile industry is one of the most resource-intensive and polluting sectors globally; it remains second only to oil and gas in terms of greenhouse gas emissions and is projected to take up as much as 25% of the global greenhouse gas budget by 2050 if current trends continue (Chen et al. 2020). Textile production also demands huge amounts of water, petroleum, and chemical inputs, depleting natural resources and contributing to persistent pollution (Shirvanimoghaddam et al. 2020; Boström and Micheletti 2016). At the end of their useful lives, textile products are dumped in landfills, where they accumulate to unsustainable heights and continue releasing pollution into surrounding environments (EPA 2017). The rapid

growth of the textile industry combined with the huge detrimental impacts of the textile lifecycle are creating an unsustainable system and a looming crisis.

Circularity as Imperative

In response to growing acknowledgement of the current system's precarity, the concept of a circular economy has gained popularity as a sustainable alternative to the linear model. In a circular economy, resources circulate and transform throughout the value chain rather than terminating as waste. Circularity in textiles aims to reduce resource inputs in production, extend product lifespans, and return "waste" materials to useful lives (Schumacher and Forster 2022; Shirvanimoghaddam et al. 2020). The Ellen MacArthur Foundation's Butterfly Diagram has become a key framework for understanding circularity strategies, distinguishing between the biological cycle – which has the goal of returning materials safely to the earth – and the technical cycle, which outlines steps needed to keep materials in use and includes familiar strategies like repair, reuse, remanufacture, and recycling. Many of the interventions included have the potential to recapture much of an item's value and minimize negative externalities.

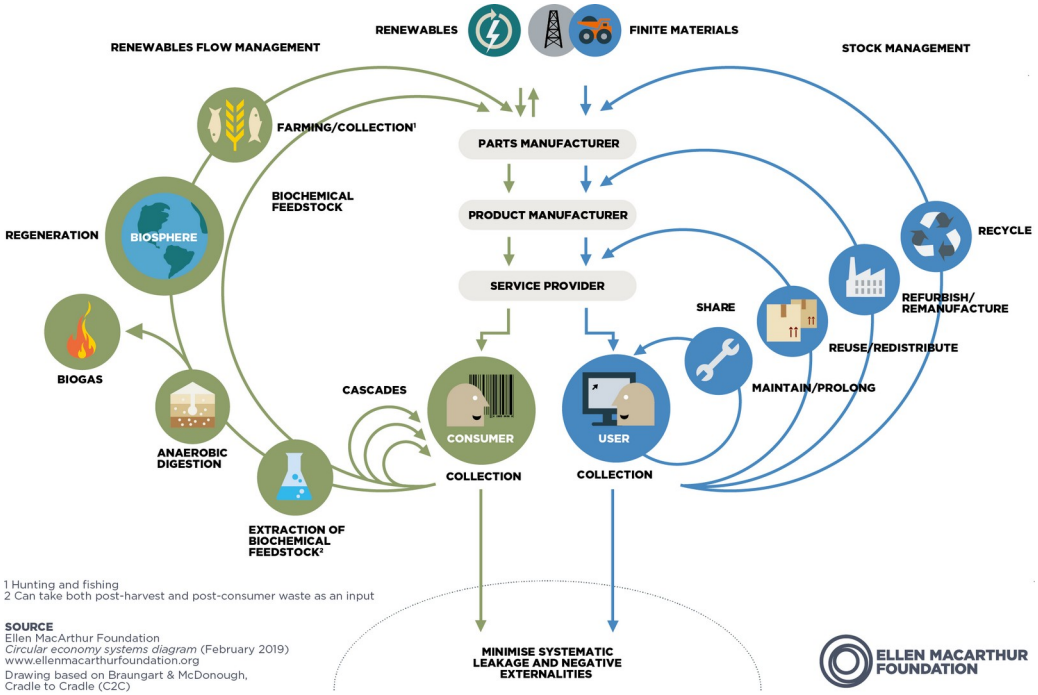

Figure 1: The butterfly diagram: visualizing the circular economy from the Ellen MacArthur Foundation, 2021

However, shifting to a circular system requires a complete redesign of existing linear supply chains and a deep change in production and consumption habits. In addition to the need for a perspective shift, widespread adoption of circular interventions remains limited due to technical and organizational obstacles—such as fiber blends that resist easy recycling, insufficient collection infrastructure, and consumer unwillingness to pay higher costs for circular products (Sandin & Peters 2018; Jia et al. 2020). Due to a lack of widespread deployment and data collection, systematic reviews of textile circularity strategies show gaps in identifying empirically the economic, social, and environmental impacts of circularity strategies (Ramírez-Escamilla et al. 2024).

Beyond Industry Giants: The Role of Small and Micro Firms

As discussed above, the transition to circularity is a challenging one and can be difficult for individual producers to undertake. Implementing circularity is particularly demanding for small- and micro-scale firms, as they often lack market power, economies of scale, financial resources, and technical capacity (Abdullahi et al. 2016; Brown et al. 2019). However, smaller firms also benefit from agility, close consumer relationships, and the ability to innovate through experimentation. Further, small firms are more likely to be driven by a commitment to sustainability or circularity and thus be more dedicated to such outcomes, as opposed to large producers that must meet specific financial obligations.

Little empirical research has explored how these smaller actors are shaping circularity within the U.S. textile sector. While European case studies and industry reviews provide foundational insights (Franco 2017; Ramírez-Escamilla et al. 2024), there is a critical need to examine how U.S.-based firms navigate the unique challenges of implementing circularity within a deregulated, import-heavy, and consumer-driven economy. This thesis aims to fill that gap by turning attention to the people and organizations on the ground—those running small-batch circular apparel production, building textile reuse infrastructure, and advocating for regenerative practices. The lessons learned from these examples suggest that small-scale firms can catalyze change through localized, values-driven models even without mainstream infrastructure or large market shares.

Research Questions and Purpose

This thesis aims to address key gaps in our understanding of textile circularity by centering small and micro-scale firms in the United States that explicitly pursue circular economy practices. It attempts to answer the following research questions:

- How are small and micro-scale firms focused on circularity impacting the U.S. textile industry?
    - What drives such firms to enter the industry? How do small-scale circularity practitioners define their major goals and concerns as related to environmental, sustainability, and economic responsibility?
    - How do small and micro-scale firms interact with and influence the wider textile industry?
- How can their efforts be supported or scaled up to increase impact?
    - Through what avenues do small and micro-scale firms primarily see their work making an impact?
    - What external enabling factors – including infrastructure, policy, financial support, and more – are needed to support and scale up the efforts of such firms?
    - What role can advocates and other invested stakeholders play in supporting the development of grassroots circularity practice in the US textiles industry?

By drawing on the experiences and insights of circularity practitioners across the US, this study aims to explore not only the strategies these firms employ, but also the structural constraints they face and the policy and cultural shifts that are needed to support their growth. In doing so, it highlights the often-overlooked role of small actors in building a more just, sustainable textile future.

Chapter Two: Literature Review

Introduction: Toward a Circular Textile Economy

Adopting circular economy principles has emerged as a promising path forward to building a more environmentally, socially, and economically sustainable textiles sector, though trailblazers are often hampered by significant challenges. This chapter reviews the existing literature on circular economy principles in the textile industry, focusing on its potential to mitigate negative impacts, the existing strategies for circularity, and current barriers to wide-scale implementation. The literature review will focus primarily on research with a global perspective and describe the U.S. context, but given the importance of context in the textiles industry, will not include studies conducted in non-U.S. settings.

Defining the Circular Economy in Textiles

The circular model is an alternative to the traditional linear model of "take, make, use, dispose" that aims to keep resources in a closed loop (Schumacher and Forster 2022). The circular model focuses on keeping materials in use for as long as possible, extracting maximum value from them while in use, and recovering and regenerating products and materials at the end of their life cycle (Shirvanimoghaddam et al. 2020; Schumacher and Forster 2022).

A circular economy in textiles entails systemic redesign across the entire value chain—from raw material sourcing to post-consumer waste management. Supply chains, manufacturing procedures, and products must be redesigned to reduce waste within the system (Jia et al. 2020). Products must be created to be durable, reusable, and repairable so their lifespans can be maximized and they can provide the greatest value while in use (Shirvanimoghaddam et al. 2020;

Schumacher and Forster 2022). Finally, end-of-life procedures must include recovery and repurposing mechanisms that will allow textiles to be reutilized. Circularity is a waste reduction framework that can increase both environmental and economic performance in the textile industry (Jia et al. 2020).

The Urgent Need for Circularity

Waste and Consumption Trends

Due to population growth, increased standards of living in Global South countries, and changes in consumer practices – including the rise of fast fashion – the global textile industry is expanding monstrously (Shirvanimoghaddam et al. 2020). In the last two decades, the average global annual consumption of textiles has risen from 7kg per person to 13kg per person. Almost 100 million metric tons of textiles were produced in 2020, which is nearly double the amount produced in 2020 and quadruple the amount produced in 1970 (Schumacher and Forster 2022). Most of this growth has been in synthetic textiles, which now make up 60% of clothing and 70% of household textiles. People are also using their textiles for shorter amounts of time, reducing the lifespan of the textiles being produced. Over half of fast fashion products are thrown away in under a year, and worldwide, the average number of times a piece of clothing is worn before disposal has decreased by 36% over the last 15 years (Ellen MacArthur Foundation 2017).

This high production volume and shortened lifespan results in huge amounts of textile waste, with Americans sitting firmly as the world's number one producer of textile waste. Between 1960 and 2020, US textile waste generation increased 868% while total municipal solid waste increased only 232% (Schumacher and Forster 2022). Each American discarded an average of 104 lbs of textiles in 2018, adding up to roughly 15.5 million metric tons total. The

vast majority of this waste is going into landfills. It is estimated that 2-20% of all textiles produced are discarded as manufacturing waste before even making it to consumer markets. Data from the US EPA American Apparel and Footwear Association looking at post-consumer textile waste in 2015 showed that only 15.28% of total textile waste was recycled; 19.03% was incinerated for energy recovery and the remaining 65.69%was discarded into landfills (U.S. EPA 2017).

Environmental Impacts

The production, use, and disposal of textiles has huge environmental impacts. Textile production is resource-intensive and environmentally degrading. Natural fibers demand substantial land, water, and agrochemical inputs – producing just 1 kg of cotton requires between 7,000 and 29,000 liters of water (Schumacher and Forster 2022; Shirvanimoghaddam et al. 2020). Synthetic fibers, which make up 63-69% of fibers produced globally, are made from petroleum and are thus associated with high carbon dioxide emissions. The production of synthetic polymers is estimated to consume 98 million tons of oil annually (Chen et al. 2020). Further manufacturing processes such as weaving/knitting and wet processing require petrochemical inputs in the form of lubricants, accelerators, solvents, and more (Schumacher and Forster 2022). The textile industry globally contributes approximately 1.2 billion tons of CO2 annually, second only to the oil industry in scale of emissions (Chen et al. 2020). Researchers estimate that the textiles sector will use up to a quarter of the world's carbon budget by 2050.

Additionally, textile manufacturing involves multiple pollution-heavy stages, particularly during dyeing and finishing. These processes use hazardous substances including bleaches, dyes, flame retardants, and stain and water repellents, which pose risks to workers, local communities,

and ecosystems (Schumacher and Forster 2022, Leal Filho et al. 2019). It is estimated that 20% of global industrial water pollution results from textile dyeing and finishing alone.

The environmental burden continues during the consumer use phase. Synthetic textiles release microplastics during routine washing. Every PET fleece garment is estimated to release 110,000 microfibers into wastewater streams each time it is washed (Leal Filho et al. 2019). These micron-long plastics are especially harmful because of their small size, as they are too small to easily track or to be filtered out by wastewater treatment plants (Chen et al. 2020). They end up in oceans and waterways, harming ecosystems, polluting water, and taking an as of yet unknown toll on human health.

The widespread use of non-biodegradable synthetic fibers also means that garments persist in the environment long after their useful life ends. At the disposal stage, garments laden with chemical finishes and synthetic components do not biodegrade readily, leading to long-term soil and water pollution. Furthermore, global inequalities in textile waste disposal exacerbate environmental injustices, as discarded clothing is often exported to low-income countries where it overwhelms local waste management systems and damages informal economies (Leal Filho et al. 2019).

Together, these production, usage, and disposal impacts underscore the urgency of transitioning toward circular systems that minimize environmental harm across the textile lifecycle. By lessening the raw material demands of textile production and decreasing the production of waste, circularity has the potential to greatly lessen the impact of the textile industry.

Labor and Social Concerns

Labor exploitation and community-level environmental injustice are prevalent in textile production. Many workers face hazardous chemicals, fiber dust, and repetitive strain injuries (Shirvanimoghaddam et al. 2020). Low wages, child labor, and lack of occupational safety standards persist, particularly in the Global South (Shirvanimoghaddam et al. 2020; Ellen MacArthur Foundation 2017). Because textile supply chains are so wide-reaching and fragmented, individual stakeholders have little control over other pieces of the chain. The increasing demand for fast, cheap products is also putting increasing pressure on supply chains and, ultimately, on workers, who are forced to work longer hours in worse conditions for little pay. Local communities also suffer from pollution, such as untreated wastewater contaminating rivers. If designed intentionally, a circular textile economy has the potential to revolutionize supply chains. Circularity could also help recover lost value in traditional textile supply chains, including the uncompensated labor and expertise of workers and the $400 billion in clothing estimated to be wasted every year (Shirvanimoghaddam et al. 2020). Though circularity has been theoretically discussed as an antidote to socioeconomic harms in the linear model, further research is needed to determine whether and how these impacts are realized (Leah Filho et al. 2019).

Circular Strategies in Practice

The Ellen MacArthur Foundation's Butterfly Diagram serves as a foundational visual for understanding circular economy strategies, distinguishing between two main cycles: the biological cycle (where materials return safely to nature) and the technical cycle (where products are maintained, reused, refurbished, or recycled). We will use this diagram as a guiding

framework for understanding different parts of a circular textiles economy moving forward. As our research will be exploring the actions small-scale domestic enterprises can take, we will focus on the technical cycle. This section re-organizes the literature on circular textile practices according to the diagram's hierarchy of preferred interventions: maintain/prolong, reuse/redistribute, refurbish/remanufacture, recycle, and cascading.

Maintain/Prolong: Extending Product Use

Maintaining and prolonging the useful life of textile products is the most resource-efficient circular strategy and requires less infrastructure to achieve. Though underutilized, repair can significantly extend product lifespans and reduce demand for new production. Ramírez-Escamilla et al. (2024) conducted a systemic review to identify and evaluate circular textile strategies covered by the literature published in the past decade (2014-2024); they identify repair as making up only 7% of circular strategies, limited by cost, accessibility, and lack of consumer knowledge. Many of the skills required to repair and maintain textiles are no longer commonly learned or readily available as services. The cheap, low-quality clothing common today with the rise of fast fashion also disincentivizes maintenance – it may cost more to repair a piece than to buy a new one, and flimsy materials do not lend themselves to long lives. Still, initiatives that revive artisan skills and promote craftsmanship can revitalize local economies while supporting circularity (Shirvanimoghaddam et al. 2020).

Durability and modularity in garment design also contribute to maintenance and prolongation. The Ellen MacArthur Foundation (2017) emphasizes the need to redesign clothes for durability, ease of care, and disassembly, thereby enabling future maintenance and recycling.

Reuse/Redistribute: Keeping Products in Circulation

Reuse—through resale, rental, donation, inheritance, or swapping—is the second most common strategy after recycling, accounting for 35% of the circular strategies analyzed by Ramírez-Escamilla et al. (2024). It allows textiles to be directly reintegrated into use cycles, reducing environmental impacts of raw materials and waste. Reuse is generally more economically viable than recycling because it does not require as much investment in infrastructure and technology and often makes use of existing production and distribution chains. Reusing a piece of clothing rather than purchasing a new garment is estimated to reduce the environmental footprint of clothing by 20–30% (Shirvanimoghaddam et al. 2020).

Barriers to reuse include consumer preferences for new products, concerns over hygiene, brand exclusivity, and the undervaluing of second-hand items. To overcome these, some brands offer take-back schemes or reward consumers for returning products at the end of use (Ramírez-Escamilla et al. 2024). However, the effectiveness of reuse is also constrained by market demand and logistical capacity to sort, clean, and redistribute used textiles.

Refurbish/Remanufacture: Transforming Products

Though less documented in the textile sector than in electronics or furniture, remanufacture can apply to textiles through creative repair and upcycling. Leal Filho et al. (2019) documented several brands in Brazil and Europe focused on upcycled fashion, which aim to add value, empower workers and consumers, and reduce waste by using both post-industrial and post-consumer textiles as feedstock. However, the scale remains small, largely due to labor costs, inconsistent material quality, and integration challenges with existing supply chains. Scaling upcycling may require close partnerships with factories and creative waste management practices on the part of producers.

Recycle: Recovering Materials

Mechanical recycling involves shredding textiles into fibers but reduces quality, limiting their use to downcycled applications. Chemical recycling can restore polymers to near-virgin quality but requires clean, mono-material inputs, which are rare due to blends, added elastane, finishes and treatment (Shirvanimoghaddam et al. 2020; Schumacher and Forster 2022). Textile recyclers generally utilize a combination of mechanical and chemical recycling, since most products consist of mixed and treated materials that require multi-step processing.

Recycling is the most technologically challenging of the core circularity strategies due to necessary energy inputs, fiber degradation, and infrastructure demands. However, it remains popular because it allows discarded textiles to be transformed into raw materials that can then be fed into production cycles for new products, meaning it has a wider variety of applications than reuse or remanufacture. Ramírez-Escamilla et al. (2024) found that recycling comprised 45% of circular textile strategies studied in existing literature. They identified two primary challenges in textile recycling. First, since most textile products consist of mixed materials and components, recycling requires technology or labor and infrastructure to support sorting and separating materials. The second barrier is collection, as textile recycling services are not always widely available or promoted, limiting the amount of material that is collected. Scaling recycling demands investment in infrastructure, better product labeling and design for disassembly, and wide-scale education and collaboration. Ramírez-Escamilla et al. (2024) present policy and regulation as a solution to scaling challenges, as these mechanisms can incentivize companies to invest in recycling.

Cascading and Downcycling: Secondary Applications

When textiles can no longer be reused or recycled into new clothing, cascading routes offer value recovery through conversion into lower-grade products such as insulation, industrial wipes, and mattress stuffing (Ellen MacArthur Foundation 2017). This is particularly common for recycled materials, as the recycling process results in shorter and lower-quality fibers. However, these markets are limited and risk saturation, and cascading is not seen as a desirable option because it typically represents a loss of material quality and economic value (Ramírez-Escamilla et al. 2024).

Barriers to Implementation

Despite the value of circular interventions and growing momentum supporting adoption, widespread implementation remains limited due to a number of challenges. A comprehensive 2020 literature review by Jia et al. identified a number of barriers, which they classified into the categories of organizational barriers, financial barriers, and policy barriers. While other studies have used slightly differing or more granular categories – see Kazancoglu et al. (2020) and McCauley and Jestratijevic (2023) for alternative groupings – we will use Jia's categories for broad discussion in this section. Each of these categories encompasses numerous and interrelated challenges that undermine the effectiveness and scalability of circular economy (CE) strategies in the textile industry.

Organizational Barriers

Organization barriers refer to challenges arising from within firms and include limitations related to strategy, planning, personnel, and operations (Jia et al. 2020). Traditional companies may lack the structures needed to implement circularity; for example, circularity may be an add-

on rather than a strong commitment built in to guiding principles, or companies may not have the tracking and reporting systems needed to evaluate circularity. Kazancoglu et al. (2020) further identify issues such as a lack of trained intermediate staff, poor internal communication, and resistance to cross-sector collaboration. In many cases, companies are hesitant to share information with suppliers or competitors, leading to disjointed supply chains and limited innovation. Operational fragmentation across sourcing, manufacturing, and distribution further complicates traceability, compliance monitoring, and systemic coordination (Schumacher and Forster 2022). This limitation is particularly prevalent in the textile industry, which is heavily fragmented and globalized.

The nature of circular practice also challenges the limits of organizations' abilities. Franco (2017) found that even among cradle-to-cradle certified firms in the EU, firms struggled with product redesign due to the material and use specifications required to create circular products. Recyclers and re-manufacturers face the challenge of making use of mixed feedstock, limited quantities, and inconsistent inputs. Finally, many companies are organized around existing partnerships and supply chains, creating organizational inertia when it comes to transitioning away from traditional production models (McCauley and Jestratijevic 2023).

Financial Barriers

Circular practices often demand significant upfront investment, which presents an insurmountable barrier for many firms, especially small and medium-sized enterprises (SMEs). According to Jia et al. (2020), financial constraints include the high costs of infrastructure development, talent acquisition, research and development, and expenditures related to transitioning to circular materials and processes. These costs are exacerbated by market dynamics that favor cheap, linear models of production and consumption. In their analysis of the

future of textile recycling, Leal Filho et al. (2019) emphasize that the cost of recycling often outweighs its returns, especially in contexts where downcycling dominates and high-value outputs are limited. High transportation costs, inconsistent feedstock, and limited demand for recycled fibers make recycling commercially unattractive. Schumacher and Forster (2022) note that the current linear model also incentivizes waste because taxes are levied on labor, an input that is expensive for the company, and not on waste, an output that is expensive for global communities. As long as it is cheaper to manufacture a new product than it is to create a circular product, companies will choose the traditional model.

Consumers are also often unwilling to pay more for circular products, a challenge referred to as the "circular premium" (Schumacher and Forster 2022). This consumer reluctance hinders market growth for resale, rental, and recycled apparel. Some firms are reluctant to make strong commitments to circularity because of the high investment cost and uncertain profitability; others are willing to invest in innovation but cannot sustain circular work without sufficient consumer demand (Kazancoglu et al. 2020, Franco 2017). Retailers and recyclers face additional barriers when there is no clear business case for take-back programs or resale strategies, particularly when logistics costs exceed the residual value of returned items. McCauley and Jestratijevic (2023) identify negative process economics, inconsistent material supply, and commercialization struggles—including feedstock specifications, off-take agreements, and limited market demand—as critical challenges. These financial barriers prevent many firms from maintaining and scaling circular operations.

Policy Barriers

A lack of coherent, enforceable regulation remains one of the most significant obstacles to circular textile systems. Jia et al. (2020) argue that a circular economy requires comprehensive

policies that guide firms across all stages of the supply chain—not only focusing on waste management but encompassing eco-design standards, traceability protocols, and more. In many regions, such frameworks are either missing or too fragmented to be effective. McCauley and Jestratijevic (2023) note that regulation also plays an importance role in establishing accountability and encouraging action from responsible parties.

The European Union currently has the most robust textile circularity policy, leading both in comprehensiveness and in assignment of responsibility. The European Commission adopted the EU Circular Economy Action Plan in March 2020, prioritizing the transition of high-impact sectors from linear to circular models (Textiles Strategy – European Commission, Joint Action Plan for Circular Economy in Textiles). The EU strategy for sustainable and circular textiles, promulgated in 2022, includes the following key actions: binding and product-specific ecodesign requirements, transparency obligation for large companies to disclose numbers of discarded and destroyed textile products, microplastic pollution mitigation measures, a Digital Product Passport with new labeling requirements, and Extended Producer Responsibility. These comprehensive measures are intended to transform the textiles sector to reduce waste, pollution, and greenhouse gas emissions at every point in the supply chain.

In the US, firms lack any policy nearly as comprehensive as the EU's. No existing laws support circularity on the national level, and only a couple of proposed policies present a potential movement. One proposed federal bill that does touch on textile circularity is the Americas Trade and Investment Act, introduced in 2023. The Act, which is designed to stimulate private sector growth in the Western Hemisphere, includes a chapter on textiles and apparel that proposes over $14 billion in tax incentives, grants, and R&D funding to support domestic infrastructure for recycling, resale, repair, and circular innovation (U.S. Congress 2023). Another

federal policy is the Fashioning Accountability and Building Real Institutional Change Act, or the FABRIC Act. Introduced by Senator Kirsten Gillibrand in 2022, the FABRIC Act would amend the Fair Labor Standards Act to eliminate piece-rate pay, establish a national garment manufacturers registry with the Department of Labor, and create a Domestic Garment Manufacturing Support Program to fund domestic firms (U.S. Congress 2022). These bills focus on economic partnerships and labor rights, respectively, and include circularity only as a fringe benefit. They lack the comprehensive systems transformation perspective needed to successfully implement circularity, and neither has become law as of yet.

State-level policy shows more promise. California led the adoption of textile Extended Producer Responsibility (EPR) policy with a carpet-specific EPR law passed in 2010; by 2021, the state reported a carpet recycling rate of 28%, over three times the national rate of 9% (Resource-Recycling 2021). In 2024, California expanded EPR requirements to all textiles with the passage of the Responsible Textile Recovery Act (SB 707) requiring that textile producers establish systems for collection, reuse, repair, and recycling by 2026, with full implementation by 2030 (California Legislature 2024). California also addressed labor issues in textile manufacturing with SB 62, which eliminates the piece-rate pay system for garment workers in California and holds fashion brands jointly liable for wage violations occurring in their supply chains (California Legislature 2021). New York followed California's example with a 2022 carpet EPR law mandating a 30% recycling rate within 5 years and banning the use of PFAS in new carpet (Resource-Recycling 2021). A comprehensive textiles policy was also proposed in 2022; the New York Fashion Sustainability and Social Accountability Act, or "Fashion Act," would require that large apparel companies map and disclose their supply chains, then mitigate climate, pollution, and labor impacts throughout the supply chain with a binding Mandatory Due

Diligence Framework (Fashionact.org). The act is currently under consideration in the New York State Congress.

As described, the US lacks any federal, nation-wide regulatory framework that mandates circular practices across the textile supply chain. In the absence of comprehensive federal regulation, state-level efforts have begun to fill the gap, most notably in California and New York. Though these initiatives signal growing momentum, they remain piecemeal and jurisdictionally constrained. State-level guidance cannot provide the national consistency or market-wide incentives needed to drive systemic transformation across the country. Without uniform policies on design standards, take-back systems, labeling, or producer responsibility, firms—especially small and mid-sized enterprises—face a fragmented regulatory landscape that complicates planning, discourages investment in innovation, and allows unsustainable practices to persist unchallenged in less-regulated regions.

Lack of information-sharing and collaboration among stakeholders further complicates the design and implementation of effective circular textiles regulations. Regulatory fragmentation and industry competition results in a lack of standardized definitions and certifications, making circularity difficult to evaluate and scale (Kazancoglu et al. 2020). Additionally, without standardized information systems, it is difficult for governments to collect data on textile flows and implement targeted interventions (De Felice et al. 2025). Lack of publicly available information also hampers policy effectiveness; Leal Filho et al. (2019) point out that low public awareness surrounding textile recycling limits the effectiveness of recycling policies, even in areas that have them. Citizens must have the knowledge and motivation to participate in textile recycling programs.

Gap Analysis

This literature review has examined the environmental, economic, and social impacts driving circularity; provided an overview of circularity strategies using the framework of the Ellen MacArthur Foundation's Butterfly Diagram; and analyzed barriers to implementation across organizational, financial, and policy dimensions.

Past research has provided a useful high-level understanding of the challenges that must be overcome in order to implement a circular textiles economy. However, there is a significant gap in research centering the perspectives and experiences of the small and independent enterprises that are often at the leading edge of adoption, particularly in the U.S. context. Franco (2017) offers the only micro-scale analysis that looks at individual firms, examining five cradle-to-cradle certified companies in the European Union. Her work reveals that even firms with a commitment to circular practices struggle to face the challenges of product design, materials sources, and supply chain coordination, emphasizing how the embeddedness of the current linear system creates barriers for circular firms. However, her analysis is limited to a European context, which differs substantially from the regulatory and market landscape of the United States. Policy support for circularity and labeling requirements in textiles are far more advanced than in the U.S., meaning U.S. based firms likely face an additional dimension of difficulty.

In the U.S. context, the body of literature focusing on firm-level barriers remains thin. McCauley and Jestratijevic (2023) conducted a qualitative study assessing the structural and cultural challenges facing textile recyclers. They highlighted issues such as inconsistent feedstock, limited end markets, and inadequate investment in domestic recycling infrastructure. While informative, their work focuses primarily on downstream waste management actors and does not include producers or other stakeholders engaged in the full cycle of circular production.

Similarly, a 2017 study by Bye and Erickson explored the experiences of small, independent textile producers in Minnesota, emphasizing localism, maker identities, and sustainability-oriented design as key factors leading to success. Their study provides valuable insight into the motivations and challenges for small domestic manufacturers, but does not engage directly with circularity frameworks or assess how circularity goals might complicate the work of such firms.

Taken together, these studies suggest a need for research that bridges the current gap: examining small-scale, independently operated textile firms that are explicitly committed to circular economy practices. Existing studies either analyze circularity from a macro or policy level, or focus on actors other than firms driven by circularity (such as recyclers or producers). This research aims to fill that gap by providing a grounded analysis of the motivations, challenges, and opportunities facing small U.S.-based firms that are actively implementing circular textile models. By doing so, it brings needed attention to a set of actors whose innovations and constraints are poorly represented in the current literature, despite their potential to lead the tide in the movement for a circular textiles industry.

Chapter Three: Methodology

Partner Organization: Mechanism

This research aims to analyze the actions and attitudes of a number of small and micro-scale US-based enterprises whose work focuses on circular textiles. Stakeholders of interest were identified through existing relationships with Mechanism, until recently known as the Urban Manufacturing Alliance. This national nonprofit organization is focused on supporting environmentally responsible and community-sustaining domestic manufacturing. Their webpage states: “Our collective goal is to create pathways to middle-class jobs, spark homegrown innovation and ensure that cities and towns continue to be the places where we make things” (urbanmfg.org). Mechanism conducts original research to produce policy recommendations and convenes Communities of Practice for stakeholders in the manufacturing space to come together. One of these Communities of Practice is the Flexible Products Fabrication Community of Practice (FPFCOP), which consists of 80+ small and micro textile manufacturers across the US. The FPFCOP began around 2018 through organic and snowballing connections Mechanism staff made in the textile industry. During the COVID-19 pandemic, the work of the Community of Practice focused on protecting their workers and building local supply chains. This resulted in the publication of a policy report, “Sewn Trades Manufacturing in the United States: From pre-COVID state of the industry to the frontline responses to PPE demands” (Urban Manufacturing Alliance 2020).

Discussions among Community of Practice members around sustainability and circularity prompted Mechanism to put together a 6-part Circular Solutions for Flexible Product Fabrication Showcase Series. Sessions took place from November 2024 to April 2025. Each Showcase

spotlighted two organizations working in an aspect of textile circularity, from product stewardship and producer responsibility to regional fiber ecosystems to reuse of post-consumer material. This research was conceived as a complementary exploration, building on the momentum of the Showcase Series to assess lessons learned and paths forward for circularity practitioners. Andrew Dahlgren, the Community of Practice Coordinator, worked with me to develop a qualitative research project, which we agreed would serve as the basis for both this master's thesis and a report to be published by Mechanism. Having worked as a Policy Fellow for Mechanism the summer immediately prior to this research, I continued to draw on Mechanism's fellowship funding to support this work.

Interviews

This research uses qualitative methods to evaluate the experiences of small and micro-scale firms engaged in circular textile production in the United States. Since we wanted to gain a firsthand perspective on the motivations, strategies, and challenges of such practitioners, we decided qualitative methods would be the best way to collect these insights. Other studies with similar motivations – including Franco (2017) in the EU context, or Bye and Erickson (2017) and McCauley and Jestratijevic (2023) in the U.S., as discussed in the gap analysis – all used qualitative methods to capture the perspectives of practitioners. These studies demonstrated the value of rich, descriptive data in exploring the emerging field of textile circularity, especially when focusing on smaller firms.

The primary data collection method used was semi-structured interviews. The use of interviews allowed us to dive deeply into the complexities of small enterprises, which are often shaped by local contexts, individual leadership decisions, and resource constraints that are not

easily captured through other methods. Further, because of the small scale of many circular firms – several organizations we contacted only consisted of one individual – the practitioners themselves represented the greatest source of data. Unlike larger companies, many of the stakeholders of interest did not publish corporate sustainability reports or other documentation that could be used for content analysis; the experiences of the individuals involved were the most valuable source.

Steiner Kvale's 2007 book *Doing Interviews* provided instruction on the interview design. His work guided the development of a semi-structured interview guide, which would provide a consistent framework and make sure all topics of interest were covered in each interview, while allowing flexibility to explore emerging themes or focus on subjects most relevant to each interviewee. Kvale also provides a discussion of ethical considerations of interview practice. We chose to de-identify all data to minimize any potential harms. Since we would be asking about details of the participants' business practices, including potentially sensitive subjects like financial struggles and personal motivations, we were also careful to word queries in a way that made clear the intent of such questions and encouraged interviewees to share to their comfort level.

Candidate Selection

An interview recruitment form was sent out via email to all members of the FPFCOP and all participants who had registered to attend the Showcase Series. (See Appendix A for the email language and form). Recipients were asked to respond if they were interested in participating in this related research initiative and were either: 1. owners or managers at small-batch, US-based textile manufacturers, 2. representatives from organizations engaged in textile circularity practices, preferably individuals who have firsthand experience managing such initiatives, or 3.

stakeholders involved in textile circularity research or policy work. The initial outreach email was sent out on January 28th and received six responses. Follow-up outreach emails were sent after two weeks and four weeks, resulting in a total of seventeen responses. Fourteen of these individuals were the founders or leaders of firms involved in circular textile production; the remaining three were researchers and academics. Because of the high level of response from practitioners, we decided to focus our efforts on these stakeholders. These interviewees were chosen because they would be able to speak in depth not only about circularity strategies but also about the business case for textile circularity – given their experiences with establishing and maintaining firms focused on such work. One practitioner withdrew from consideration and one did not respond during the recruitment phase, leaving us with twelve interviewees. The final list of interviewees represented both for-profit businesses and non-profit organizations of various sizes located throughout the continental United States.

Interview Protocol

Interviews took place virtually over the video conferencing platform Zoom in the spring of 2025. The interviewer explained the goals of the project, stated that data would be de-identified prior to publication, and emphasized the voluntary nature of participation. The interviewer asked for consent to record the interviews using Zoom's in-build recording function, which was given in all cases. The protocol and consent procedures were reviewed and approved by the Tufts University Graduate School of Arts and Sciences Institutional Review Board (IRB) prior to beginning of data collection.

Through individual semi-structured interviews, stakeholders were asked to discuss their experiences building or running circularity initiatives, their perspectives on attitudes towards circularity in the wider textile industry, and particular challenges facing their organizations and

others engaged in textile circularity work. The interviews were conversational in tone, with the interviewee utilizing rephrasing, prompts, and follow-up questions to ensure accurate understanding and encourage elaboration. Questions were tailored as necessary to account for variations in individual experiences. See Appendix B for the interview protocol.

Content Analysis

The Zoom transcripts were cleaned and then analyzed using thematic analysis (Naeem et al. 2023). We reviewed transcripts and notes to identify keywords and develop codes corresponding to major concepts and through lines that came up during interviews. Transcripts were then analyzed in detail, with sections assigned to relevant codes. Related codes were organized and grouped into overarching themes corresponding to the primary interview topics. The interview content under each code was then interpreted in narrative form, drawing connections between statements made by different interviewees. Finally, we created some conceptual diagrams to help analyze and visualize the results. These conversations illuminated several common threads in organizations' experiences and pointed towards paths forward for both circularity practitioners and advocate organizations like Mechanism.

Chapter Four: Additional Survey Data

In addition to participating in individual interviews, participants were also asked to fill out a brief follow-up survey to provide descriptive data on their organizations. The full survey can be found in Appendix C.

The organizations this study surveyed were all based in the continental United States. About half are located in Rust Belt areas, including the Great Lakes region and upstate New York. A few interviewees made this connection explicit, talking about bringing production back to cities considered post-industrial to revitalize local economies and retain talent in the area.

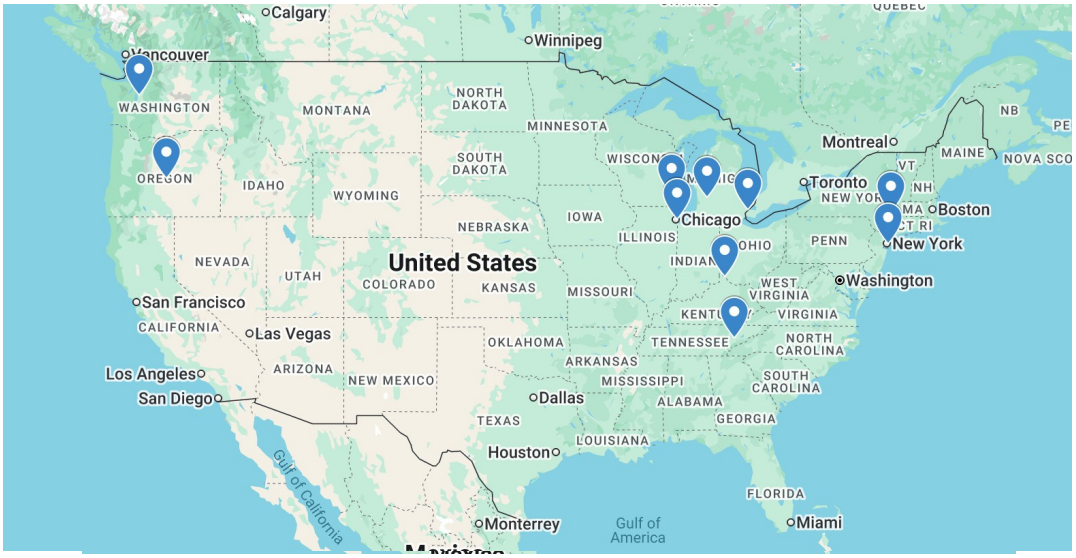

Figure 2: Locations of interviewee organizations

The survey also asked respondents to self-report the size, model, and focus of their firms. Out of our 12 interviewees, one individual had sold the production company they had founded and was no longer involved in circularity work. Another did not respond during the time the survey was open. The following figures show results from the remaining 10 respondents.

The organizations surveyed were all small and micro-scale firms with circularity as a central focus of their work. 4 of these organizations only reported one employee – these were generally independent designers who were producing their own independent, circular lines. A couple of remanufacture and upcycling producers also had 1-3 employees. Only 3 of the respondents reported 10 or more employees, with the largest organization surveyed employing 26 people supporting a variety of innovation and workforce initiatives.

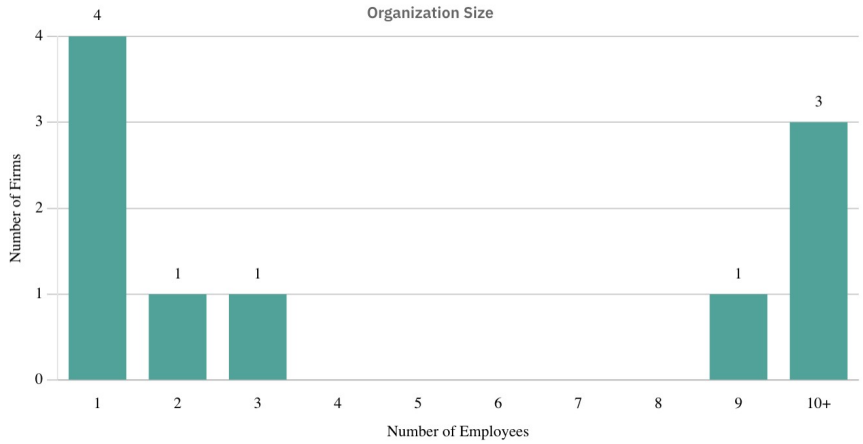

Figure 3: Size (in employment numbers) of surveyed organizations

Half of the respondents represented non-profit organizations; these mission-driven organizations run on grants and private funding sources. Producers who relied on profits from product sales made up 4 of the 10 respondents. 1 identified as a for-profit enterprise with a non-profit fiscally sponsored program for grant applications.

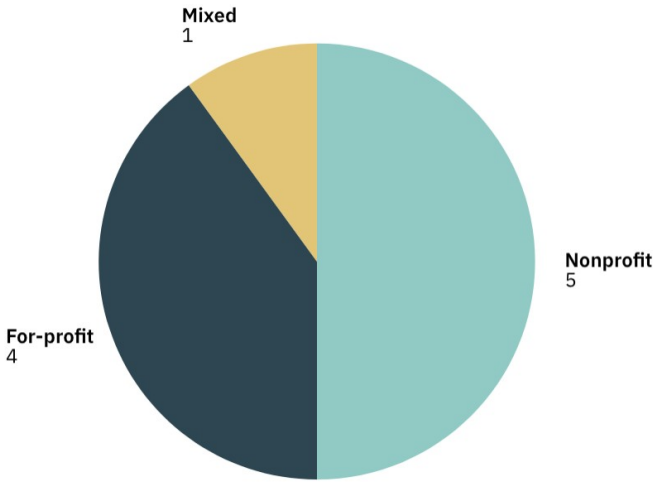

Figure 4: Business models of organizations

Respondents were asked to use the Ellen MacArthur Foundation's Butterfly Diagram to self-identify which area(s) of the textile circular economy they primary worked in. Responses shown below.

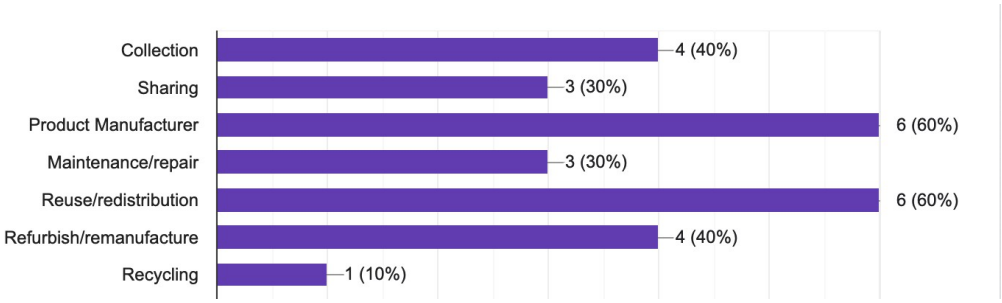

Figure 5: Areas of work, based on Ellen MacArthur Foundation Butterfly Diagram

Most of the respondents worked in manufacturing or in reuse/redistribution, though we had representatives from all areas of the diagram. In addition to their roles within the circular supply chain, many of the interviewees discussed other work their organizations undertook to support circularity goals. Based on analysis of the interviews, we identified five common areas of additional work, including: workforce development, consumer education/outreach, manufacturer engagement, industry partnerships, and policy advocacy. The survey asked respondents to select or describe any additional areas of work.

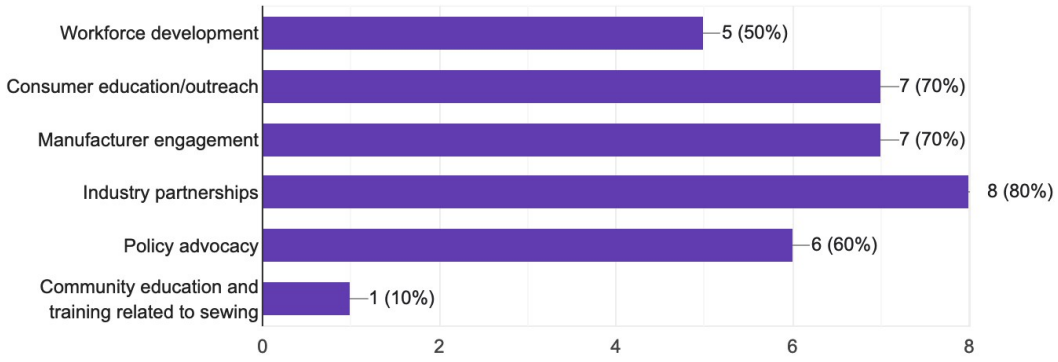

Figure 6: Additional areas of work

Industry partnerships were key for the majority of respondents; a couple of interviewees noted that circularity-focused coalitions and networks were indispensable in facilitating their entries into the space. Most respondents also undertook education and advocacy work, whether with producers, consumers, or policymakers. Further discussion of the role of education will follow in the analysis of interview content. One respondent also added that community education and training related to sewing was a major area of addition work for their organization.

Finally, respondents were polled about the effectiveness of different interventions, including: funding, legislation, education, and collaboration. The survey asked which

intervention would be most necessary to support their organization's work, then which intervention would be more necessary to support the development of a circular textile economy. Responses differed between the questions. The majority of respondents identified funding as most essential for their organizations. All interviewees expressed troubles securing sufficient financing for their firms; both nonprofit organizations and for-profit producers struggled to fund and grow their work because of financial limitations. However, when asked about the textile industry as a whole, the majority of respondents selected legislation as the most needed intervention. This was seen as necessary to push large retailers and stakeholders not motivated by circularity to adopt the appropriate measures. Interviewees discussed the need to rectify perverse incentives in textiles manufacturing and prevent a "race to the bottom" scenario; more details on the need for legislation will follow in the interview analysis section.

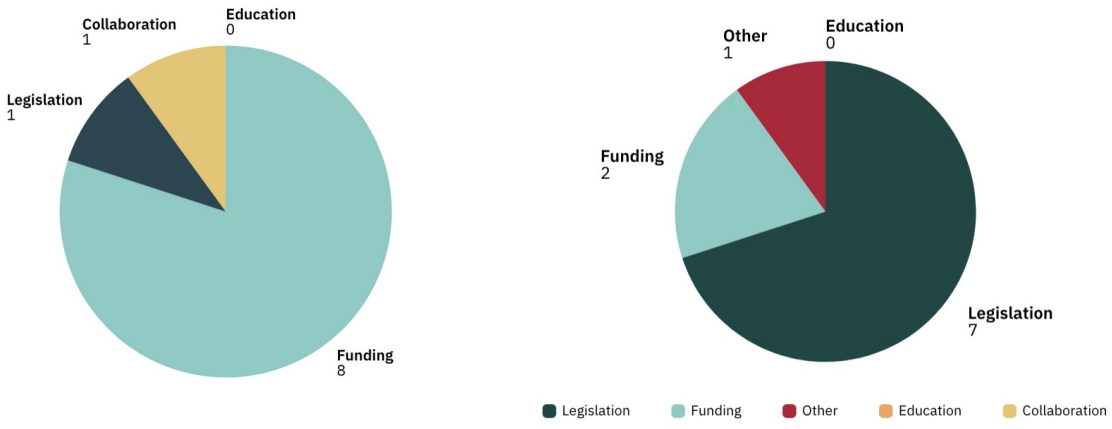

Figure 7: Interventions most needed to support: respondents' work (left) and the development of a circular economy in the textiles sector (right)

As shown, the interviewees represent a diverse collection of organizations, varying in size, structure, and geographical location, in addition to engaging in work across the circular supply chain. However, many shared common experiences and insights related to circularity work.

Chapter Five: Interview Results

The following sections will delve into key findings from interviews, organized under five main themes: motivations and goals, industry trends, major challenges, necessary interventions, and opportunities for transformation.

Motivations and Goals

Somewhat surprisingly, only about half of the circularity practitioners interviewed entered the space because of interest in sustainability. The remainder were motivated initially by local needs that they saw going unmet in their communities, and came to circular models as they explored the best ways to meet those needs. As their work evolved, interviewees' organizations came to be motivated by a mix of factors, but community and sustainability remained core.

Local Needs

A powerful and recurring theme across the interviews was a motivation to respond to local gaps and economic needs. Interviewees often entered the circular textiles sector because they saw gaps in their local ecosystems and felt compelled to address them — both as a means to stimulate local economies and to create greater community ownership and access to production. Rather than viewing circular fashion as solely a global or environmental issue, participants emphasized the urgency of building localized infrastructure that could meet the demands of residents, small brands, and supporting businesses.

Every practitioner primarily motivated by local needs saw their work as filling in an infrastructure gap of some sort. Entrepreneurs in the manufacturing space identified a lack of accessible, small-batch manufacturing options that could serve independent designers, startups,

and small brands. This shortage was especially acute in regions with high demand for such incubator opportunities, such as around the traditional fashion hub of New York City or near design schools producing young talent. Others involved in upcycling or remanufacture noted a similar lack of infrastructure supporting textile waste collection and reuse; several described a realization that the abundance of textile "waste" produced locally could serve as a valuable resource for other users, but that no infrastructure or systems existed to connect the two.

By providing missing infrastructure, interviewees also saw themselves as economic actors, helping to recover material value and retain human capital locally. Building local textile economies was viewed as a strategy to generate sustainable employment opportunities and revitalize local economies. Several respondents positioned circular textile ventures as economic drivers that could re-anchor fashion production in local communities, speaking about the number of people they were able to employ over the years and describing workforce development programming.

Beyond economic growth, many interviewees also spoke of a broader cultural mission to bring production back to local communities and to reinforce the connection between products and place. This often included explicitly responding to the needs of local businesses and entrepreneurs or addressing community interest in local waste solutions and circular practices.

> A small manufacturer and incubator said: *"It's putting the hands that are making things back into your local places... We're creating ecosystems within our region, within our state. and ultimately within our country and reinforcing community again. It all comes back to community"*

Interviewees involved in reuse and remanufacture emphasized the local sources used for their feedstock and the importance "locally made" marketing held for customers. A number also took

pursued community partnerships, contributing materials and knowledge to local organizations. Interviewees involved in circular manufacturing spoke of opening up the "black box" of textile production to educate and empower small designers, producers, and innovators.

> A small batch producer said: *"[A traditional factory's] whole model is based on efficiency, and most people don't have the technical training to even have a conversation with a factory. so they would not entertain pretty much any conversation unless you're a known company... This kind of part of the industry is very closed off. We communicate and develop products for people that have no background in manufacture. We let everybody participate in the system where that has not been the case in the past, or currently honestly."*

Practitioners saw that local communities had the desire to be involved in circularity, whether motivated by waste reduction or economic goals, and positioned themselves to empower their communities.

Sustainability Concerns

The other major motivator interviewees expressed was a deep-rooted commitment to sustainability and concern about the environmental impact of the fashion industry. For many, this was not just an operational focus but a core ethical commitment that motivated their entry into the circular textiles field.

Several of the interviewees had worked for years in the fashion and textiles industry, but had become disillusioned with their work due to the amount of overproduction they witnessed. Their personal ethics made them uncomfortable with the wastefulness, pollution, labor exploitation, and other issues common in mainstream manufacturing. Interviewees expressed a desire to be a part of the solution rather than contributing to the problem, leading to a shift into

circular production work. For a couple of our respondents, this meant leaving careers with large fashion companies to start their own brands, ensuring they could design every part of the supply chain to align with their personal ethics.

A former designer with a large apparel company said: *"I realized I was just contributing to a global problem. And I couldn't live with myself anymore if I kept designing for these mass market labels."*

A number of interviewees positioned themselves as triple bottom line enterprises, emphasizing that they were not motivated by profit, but by their overall environmental, social, and economic impact. This was not an afterthought, but a core piece of how each conceived and operated their businesses.

An important note is that interviewees expressed very broad definitions of sustainability that often encapsulated multiple dimensions of impact. One practitioner tied living wages for garment workers back to sustainability: "To me, if you want to have a product that is sustainable, but it's made by a person that's not afforded to live a sustainable lifestyle – then that's not a sustainable product. Another made the connection to human health, pointing out that the impacts of microplastics and synthetic fabrics held close to the skin are still unknown; even products that may be considered "circular," like garments made from recycled PET bottles, cannot be called sustainable if they have long-term impacts on health. Through such comments, it was clear that sustainability was a core motivator for practitioners, who used it as a lens to broadly consider their impacts.

A small-batch manufacturer said: *"Sustainability has always been a big value and at the forefront of our ethics here, due to the problematic side of the apparel industry. So we*

aim to prove that sustainable and ethical apparel manufacturing can be done in our backyards, and how we do that is by walking the walk."

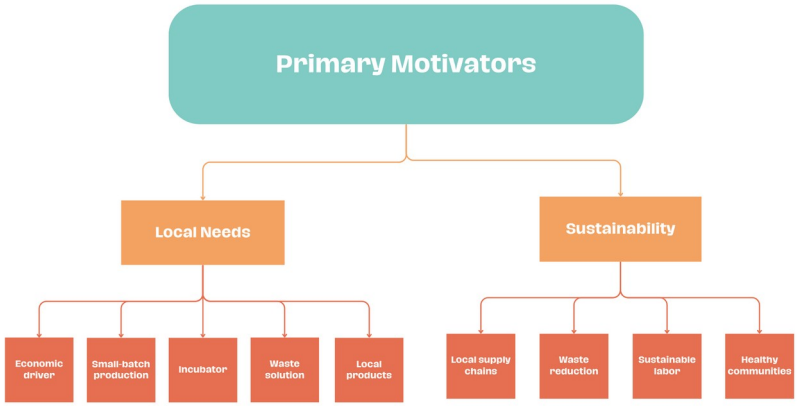

Figure 8: Primary motivations of circularity practitioners

Education

All interviewees saw themselves as circularity educators, whether through intentional educational programming or simply through having conversations with customers and suppliers. They considered education an important piece of their mission, as it can help empower and motivate others to join efforts for circularity.

Several featured organizations offer avenues for individuals to become involved in the textile cycle, whether through hosting training programs, staging public classes on mending and sewing, or providing resources. These learning opportunities were cited as a way to build practical skills, reduce waste, and reintroduce people to the value of textiles, thus encouraging more thoughtful consumption patterns and extending the valuable life of products. Other

interviewees educated others their work with stakeholders throughout the textile supply chain. Small-batch factories worked with entrepreneurs to create designs that created less waste and lent themselves to repair or remanufacture; upcycling studios spoke with their sourcing partners about the value of waste and alternative uses for material; independent designers provided their customers with information on the sustainability metrics and reuse opportunities for their pieces; and more. Upstream industry education, paired with consumer awareness, was seen as critical for building more sustainable and values-driven textile system.

Participants noted that most consumers and even industry newcomers have little understanding of the textiles supply chain. They consistently underestimate or simply do not think about how products are made, the labor involved, or the waste produced. Education is seen as essential to fostering thoughtful production and consumption, which are foundation to creating a circular economy.

> A local manufacturer and education provider said: *"We're a consuming country. We don't make stuff here anymore. . . all we Americans do is we just consume. And so nobody thinks about it. They just want the thing, and when they don't want it anymore, they throw it away."*

Industry Trends

Across all interviews, participants consistently emphasized that the textiles and apparel sector is undergoing a significant cultural and structural shift. Many noted that they see vast differences in how sustainability and circularity are discussed within the industry, even within the past 10 years. Some are also hopeful about changes in cultural norms surrounding consumption and the advent of innovative technologies. While barriers remain, particularly around systemic

inertia and economic misalignment, interviewees expressed measured optimism around these emerging trends.

Industry Interest in Sustainability

Nearly every participant noted that language and attitudes around sustainability have evolved dramatically over their time working in textiles. Concepts like "circularity," once marginal or unfamiliar in fashion spaces, have become mainstream talking points, both in industry discourse and consumer culture.

> A designer with experience in the apparel industry said: *"Circularity probably wasn't even a word used in the fashion industry 10 years ago. These days, if you're not talking about sustainability, I don't think you're relevant."*

Still, interviewees warned that not all sustainability rhetoric is equal. While awareness has increased, this moment is also marked by greenwashing, inexact or varying definitions, and technological limitations that constrain meaningful adoption. Some participants described this as a learning phase, where sustainability is becoming a new norm — albeit unevenly implemented.

> A practitioner with an organization supporting circularity innovators said: *"It's now gone from being a movement to a new norm. We're not going backwards now. It's impossible to go backwards. We may not be moving forward fast enough, but there's no way we're [going to] go backwards."*

Consumer and Cultural Shifts

A second key trend was the growing environmental and justice consciousness among consumers, especially younger generations. Interviewees pointed out increasing attention to issues prevalent in the fashion industry, including: overconsumption and the rise of fast fashion, exploitative labor practices, and microplastics and other pollution stemming from the textile and

apparel sector. Participants also noted increased traditional and social media discourse around popular brands and retailers, suggesting a deeper interrogation around fashion and apparel production. This disillusionment with traditional supply chains and retail models has translated into greater support for small, independent brands and sustainable products.

Policy and Advocacy Momentum

Many interviewees also credited advocacy work and policy change for recent shifts in the textile circularity landscape. Legislative pressure around labor conditions, domestic manufacturing, and waste responsibility are creating new expectations for textile producers. Interviewees noted that such efforts were coming from advocates and small, values-driven players; large manufacturers remain slow to adopt or even hostile to such regulatory efforts.

Growing Pressure on Waste Systems

One of the most visible signs of the unsustainability of the existing linear system is the sharp increase in demand for waste collection and repurposing services. Interviewees involved in upcycling work who offer waste removal services as part of their materials sourcing practice reported being overwhelmed by supply, with everything from grain bags to showroom textiles being redirected their way. While this reflects a rising awareness of the impacts of waste and a growing desire to redirect waste, it also poses significant burdens for circularity practitioners. Interviewees struggled with the cost and logistical complications of picking up, sorting, and storing textile waste. They were also overwhelmed by volume; many small- and micro-scale circular firms cannot realistically make use of all the waste they receive.

> An upcycler who partners with local businesses said: *"Once you start taking it, you have to take a lot. Otherwise you're not a real solution for them, because they need to offload thousands of pounds a week."*

Businesses sending their waste to some interviewees expected disposal to be a free service or even wanted compensation for the material, even though they would have paid a waste management company for the same service. Participants attributed this to biases and gatekeeping that persist within donation and waste diversion systems, where repurposing materials for commercial use is met with suspicion — especially when compared to charitable redistribution. It was clear from interviewees' experiences that the increasing demand for waste services represents a growing pressure that existing systems are unable to meet; however, due to the limited scale of and lack of understanding around circular options, the amount of waste redirected into circular systems is greatly limited.

Systemic Contradictions and Tensions

Despite growing attention around circularity and its potential to ameliorate many negative externalities of the linear system, the traditional model remains entrenched because of economic structures and motivations that disincentivize change. Interviewees described an industry in which the bottom line rules, even at the cost of the environment or communities: domestic manufacturing has fallen victim to offshoring, planned obsolescence drives unsustainable rates of resource extraction, and industry competition leads to overproduction and overconsumption. Several interviewees expressed doubt that large manufacturers would ever take action on circularity, as the purpose of their existence is simply to make profits and generate value for shareholders.

> A circularity innovator said: *"The fashion industry is a low-margin, deflationary category. While other products have gone up in value over the last 30 years, apparel has gone down, and it's diminished in quality."*

Interviewees also found it challenging to make a business case for circularity to profit-driven stakeholders. One interviewee described presenting on circularity to sustainability or ESG-focused company representatives and getting positive feedback, only to later hear that the proposals were rejected by higher-level executives because of cost concerns: "[They would say] great, great idea, we love this! And then it would go to die in committee because of discussions around the value chain." Another struggled to convince larger producers to invest in recycling infrastructure that would not bring them any financial benefits. Others described the current system as incentivizing waste, since it is free or very cheap to throw material away, but expensive and challenging to find alternative disposal methods. The environmental and social impacts of waste are externalities, not accounted for in current understandings of value. Overall, traditional manufacturers were seen as reluctant to invest any resources in long-term, systemic transformation that would not have immediate impacts; they feared falling victim to a 'trend' and could not justify expenses without returns. Even though circularity has wide-ranging and long-term benefits, these do not outweigh the profit motive for traditional players.

Challenges

Interviewees described a number of challenges facing the circular textile economy, drawn from their own experiences implementing circularity, their perspective on industry conversations, and their attempts to scale and replicate their models. Primary challenges include financial constraints, market pressures, and supply chain limitations.

Financial Barriers

A recurring theme among interviewees was the difficulty of making circular production financially viable — both for producers and consumers. All of our interviewees described

iterating on business models and funding structures before finding a model that was viable for their organization. Several participants described transitioning or splitting between for-profit and non-profit models, as neither was completely able to support their work.

Circular producers inherently face much higher per-unit costs than mass, linear production, from the extra time needed to design low-waste and reusable products to the finances of sourcing sustainable materials. Choosing to make garments in small batches and pay living wages to workers limits the manufacturing partners available and prevents circular firms from benefitting from economies of scale. These costs are prohibitive for many, throughout the value chain; interviewees offering production services had brands unable to afford their services, while others struggled to price their products appropriately given consumers' reluctance to pay a "circular premium."

Organizations that relied on outside funding in addition to or instead of production profits also faced obstacles. Several interviewees described a dearth of public grant funding for circularity or manufacturing; opportunities were difficult to find and limited. Venture capitalists and private investors also overlooked circular textile firms. A few interviewees found that these types of funders were more attracted to technology firms or software as a service, since such products could quickly scale and return profits. Circular production – which demands space, specialized equipment, and human expertise – did not offer the same types of returns. However, circularity practitioners found ways to secure funding. One mentioned patient capital investors, while another organization had success with private philanthropy. Those interviewees who did pursue grant funding aligned their work with larger goals – including community development, workforce programs, environmental goals, or even tech and innovation – to position themselves for opportunities.

Challenges accessing financing was attributed not only to profit motives, but also to biases within funding systems. Two interviewees expressed the belief that sexism may play a role in investor decisions; one discussed the historical devaluation of women's labor and the women- and immigrant-dominated nature of the textiles industry, while another pointed to female founders of apparel companies who were poorly treated by investors when compared to male giants in fields like technology. Another interviewee found that funders were primarily interested in new, groundbreaking innovations and overlooked intermediate technologies that could still have a significant impact: "All the funding goes to next-gen materials and tech and chemical recycling and whatnot, and we don't actually need it. It's the at the expense of funding for textiles and systems and farmers that already exist. Brands like mine are already doing the work and don't need new tech added to the mix."

Market Saturation

The booming textiles sector means that small producers are fighting to compete in a market already saturated with cheap, readily-available mass produced products. Though circular products offer sustainability and quality, practitioners struggle to market their goods and services in a crowded market. This challenge is compounded by greenwashing on the part of bigger brands; when consumers feel they are getting comparable sustainability benefits from mainstream retailers, there is less incentive to switch to circular products.

Circular and small-batch products cannot match the speed, price, or novelty of mass-market brands, especially in the fast fashion space. People may not be willing or able to pay the "circular premium" when traditionally manufactured products are cheaper and more readily available. The nature of some circular practices, such as upcycling existing material, also limits

the types of product that can be produced. Upcyclers often struggle to find or reach the right customer for the very specific product they can offer.

> A small upcycling business said: *"I worked with a procurement company and – because they upsell everything and they try and get everything for as cheaply as possible – they tried to pit me against Target. Even though I offer these sustainability and social and US-made benefits, those were not reasons to buy."*

Many interviewees stressed the importance of brand storytelling as a way to differentiate themselves from mass retailers and communicate values core to their practice. Success often depends on marketing sustainability alongside style, aesthetics, and cultural relevance, especially given the higher cost of sustainably produced products. Interviewees found that sustainability is not a strong enough selling point on its own, so running circular textile businesses requires significant attention to messaging.

> A circular clothing designer said: *"We're all fighting for people's attention. I'm fighting against Shein to get people to buy my garments, and you really can't compete with those prices. So I'm really trying to think about it as: I want people to buy into this circular brand . . . It's about people wanting to show off your brand because of the values that you stand for, not only sustainability, but the vibe and the lifestyle."*

This marketing challenge did not apply only to direct-to-consumer sales; interviewees also needed to pitch their brand to production partners and material sources.

> Another designer said: *"In order to integrate sustainability you need to solve the puzzle of how to make the product sell on its own, and rely as little as possible on sustainability as a selling point. You need to figure out what is important to consumers, what is important to the suppliers of the of the textiles."*

Supply Chain Limitations

Circular production often requires entirely new supply chains, creating logistical complexity that add an additional burden for practitioners. Current systems are not designed for circularity, forcing circular producers to adapt existing resources or create their own from scratch. Many interviewees stated that building robust supply chains to support their work was a challenge. Those involved in upcycling and remanufacture face a unique difficulty, since they depend on irregular, often unpredictable material streams. The type and amount of material they are able to sources affects everything from design to production planning and scalability, limiting what they are able to produce. Other interviewees sought out domestic or sustainable production partners to help build out their supply chains, but found that infrastructure aligning with their goals did not exist.

The fragmented nature of existing supply chains also poses difficulties for stakeholders invested in circularity. They cannot guarantee true, full circularity because they cannot see or control what happens in other phases of the chain. One manufacturer talked about struggling to find solutions for the inevitable textile waste created during production – they started by donating fabric scraps, but had no way of knowing whether recipients were simply disposing of them later, leading to a switch to an in-house scrapping system when financing was secured. A designer of sustainable garments wanted to ensure labor fairness, but had to trust the information they were receiving from their factory partner. Small, independent firms can only control their own practices; the opaque and fragmented nature of the broader supply chain makes true circularity difficult to achieve, even for dedicated practitioners.

Finally, several interviewees spoke about workforce challenges. It is difficult to find workers for circular production because the textile industry has been offshored for so long that

few have the skills needed to produce high-quality, domestically manufactured products. Recruitment to training programs is challenging because sewing and textile work is not widely seen as a desirable or stable job. The U.S. lacks robust workforce development programs, particularly those comparable to European apprenticeship models. One interviewee noted that the workforce development which does exist in pocket in the US is not holistic and sustainable; programs focus on filling classes rather than preparing individuals for rewarding careers. Further, a couple of interviewees noted closures of small factories and the displacement of immigrant labor, which has long sustained textile manufacturing.

Interventions

Interviewees emphasized the need for multiple, systemic interventions to support the growth of a viable circular textiles economy. Many interviewees supported the push for legislation requiring better labor, waste, and production practices in the textile industry. They saw legislation as essential to ensure that companies did not continue to "race to the bottom," producing greater quantities of low-cost, low-quality products to outcompete others: "If it's not regulated, then people are going to see what they can get away with to try to increase their bottom line." A few noted that textile waste was already putting pressure on existing waste management systems, signaling the need for new measures to be taken. Legislation could remedy waste problems by increasing the cost of disposal, implementing producer responsibility, or creating new management infrastructure. Several interviewees pointed to recent efforts in California and New York as models.

However, interviewees were cautious about the potential impacts of policy, emphasizing that legislation needs to be thoughtfully designed and implemented to support circularity goals. A

couple of interviewees saw textile-specific policy as overly narrow, lacking the systemic transformation needed to create a more sustainable, just economy; they pointed to the need to overhaul immigration policy if the United States wished to attract and retain a textile workforce, and the impact of property prices on economic outlooks for workers. Several interviewees stated that policy could do some things, but would not be successful without supporting infrastructure and resources, For example, one interviewee discussed the textile waste ban in Massachusetts – the policy forbids residents from disposing of textiles in household waste, but was not deployed with any comprehensive collection or recycling infrastructure for textiles. The policy may be doing what it is meant to do – preventing people from throwing away textiles – but without adequate infrastructure and planning, it is not a true circular solution. A couple of interviewees made similar points when discussing Trump's proposed tariffs on imported textiles – they may deter some from buying textile products from overseas, but without a robust domestic manufacturing industry, what is the alternative? Such measures are seen as inadequate and lacking in comprehensive understanding of the textile value chain.

> A practitioner supporting workforce and supply chain innovations said: *"Policy almost always comes with some sort of burden. When you're talking about an industry that's doing business with one foot on a banana peel has hardly any margins. It's very hard to enforce burdensome policy when the industry isn't healthy."*

In addition to policy advocacy, interviewees also expressed a need for greater consumer awareness and funding. Many interviewees were hopeful about the potential for consumers to use their purchasing power in support of circular, sustainable goods and called on practitioners to continue educating and empowering the public. Interviewees also wanted more avenues for public involvement in circularity; for example, by providing broadly accessible recycling

solutions or repair services. Finally, to scale impact, some interviewees advocated for funding and incentives — akin to those supporting electric vehicles — to reward sustainable practices, lower barriers for small producers, and support innovation in industrial textile reuse.

Opportunities

While the circular textiles sector faces significant challenges, interviewees also identified number of potential avenues for accelerating change. Notably, many focused on the importance of grassroots action and the work of small firms, highlighting community action, collaboration, and innovation rather than top-down transformation. Some particular areas of promise include:

Consumer Engagement and Value Shifts

Several participants emphasized the potential of individual and consumer action to create meaningful impact. Even in the face of affordability barriers, interviewees are working to make sustainability accessible — offering repair, knitting, and sewing classes, organizing clothing swaps, and reframing how textile products are treated in a throwaway culture.

> A circular designer said: *"It's definitely that value conversation – reevaluating what value means and not just placing monetary value on it. But thinking, how does it make you feel? Where did you get it? What does it mean to me? What will it mean to somebody else?"*

Others pointed to the importance of consumer behavior, especially considering the massive rise of textiles consumption and the controversy over fast fashion. They saw their work as playing a role in helping individuals make better, more value-driven choices, even when embedded in a consumer culture. Interviewees also felt hopeful about shifts in industry and public conversation that seem to indicate the public is taking sustainability and ethical concerns into greater account.

Another designer said: *"If I can get someone to buy my piece over a Shein piece, that to me is like a huge success because I know – it can save this amount of water and this amount of waste. People are still going to be buying things, so can those things and those garments that people are buying be good for the planet instead of destructive? So I think if if we can help shift our perspective into buying better clothing, that would be a success for any company."*

Local Models with Scalable Lessons

Rather than focusing on mass replication or scalability, many circular entrepreneurs see their role as community-based innovators, developing models that are locally rooted but globally relevant. While their operations may remain small-scale, they see value in demonstrating success and serving as proof-of-concept for others with similar goals in different regions. Several also rejected scalability as a goal and noted that they did not want to grow or move into other regions; instead, they wanted to empower people in those regions to do similar work in a way that is appropriate for their specific communities.

A small manufacturer said: *"The point of all this is to show that everybody can succeed if we're all working together and putting people first."*

This vision centers on community ownership, regional dynamics, and local ecosystems, rejecting the assumption that scale alone defines success.

Partnerships, Networks, and Sharing

Collaboration — not competition — was a recurring theme across interviews. Participants spoke of building regional and cross-industry partnerships, whether to redirect waste, share resources, or learn from other successful models. These networks help address systemic barriers by building collective capacity and reducing duplication of effort.

A nonprofit manufacturer, upcycler, and educator said: *"The ideal scenario is that we are actually a community resource for not only our community and region, but then ideally that we could help other communities learn how to do this same work in their community – whatever their industries are, whatever their people talent are, whatever their educational institutions. This is a systems response to a systems problem. But we're not looking at trying to solve the problem in Ohio, in Pennsylvania, down in Texas. We're looking to solve this for our community here, and then help others learn how to do it there."*

There is also momentum around knowledge-sharing platforms, such as podcasts, learning cohorts, and informal communities of practice focused on sustainability and circularity. Several interviewees first became interested and empowered to enter the space by being exposed to media on circularity and hearing from members of their networks.

Innovation in Materials and Manufacturing

Finally, several participants highlighted the opportunity for innovation across the value chain, particularly through new technologies and materials. Interviewees expressed optimism around the future of advanced textile recycling methods; smart supply chain technology that could help reduce waste and increase traceability; and innovations in materials science that allow garments to return to natural cycles. A couple of interviewees particularly emphasized this last point and work on returning materials to the bio-cycle, as they see this as the only fully circular solution.

Chapter Six: Discussion and Conclusion

The Future of Small Firms

This thesis set out to understand how small and micro-scale firms focused on circularity are impacting the U.S. textile industry. Our research found that small circular firms are driving change from the ground up, piloting circular innovations in their local communities and serving as model organizations for other interested stakeholders. While mainstream producers have a larger market share and may be able to dedicate more resources to circular systems, our interviewees were doubtful of their potential impact because of profit incentives and the embeddedness of existing linear supply chains. They saw their grassroots work as more impactful despite limited reach because they are mission-driven, remain connected to communities, and are able to pilot innovative strategies. Rather than directly challenging or competing with mainstream producers, firms like those represented by our interviewees are essential in building a new vision for the textiles sector – shifting consumer perspectives, creating new circular supply chains, and supporting emerging local economies. Their most important impact is in serving as model organizations, showing others how circularity can be implemented effectively and responsibly.

Our second research question sought to determine how the efforts of small circular firms can be supported or scaled to increase impact. Somewhat surprisingly, when asked about plans to expand, many of our interviewees outright rejected scalability as a goal. These practitioners had intentionally designed their work in response to needs they saw going unmet or resources going untapped in their local areas, and found success through local partnerships and outreach. They were not interested in expanding their work in a way that would divorce it from community；

the localized nature of their work was an asset, not a limitation. Rather than seeking to scale up their organizations, interviewees aimed to serve as models and resources for those designing circular solutions in their own communities. To facilitate and support these efforts, interviewees did identify a few key needs: improved infrastructure for collection and recycling, coherent policy frameworks that support comprehensive circularity, and increased access to capital.

The findings of this study highlight the unique role that small and micro-scale firms play in advancing circularity in the US textile industry. However, the study is limited by its small sample size and qualitative design, which do not allow for generalization across the entire US textile sector. Participants were self-selected and drawn from a limited pool of existing contacts; this may have biased the results by overstating the role of networks or the level of optimism among practitioners, for example. Future research could expand on these findings through larger-scale, mixed-methods studies that include quantitative data on firm performance, supply chain metrics, and consumer outcomes. Comparative studies across regions or between small and large firms would also deepen understanding of how structural factors shape circular practices and outcomes. Finally, this study focuses on micro-scale circularity practices on the scale of firms – companies or organizations. There are many individuals who take part in what we describe as circular practices because of tradition or economic need, both in their homes and in informal economies. Looking at the unique contexts driving individual and community-centered textile circularity could be an interesting avenue for additional research.

Opportunities for Other Stakeholders

While small firms are modeling important change, they face systemic obstacles that cannot be addressed individually. Partners like Mechanism and other invested stakeholders have

a role to play in facilitating the transition. Interviewees consistently emphasized the importance of collaborative networks, mentioning the need to share knowledge, look up to models, and build collective infrastructure. They also noted positive momentum coming from consumers demanding sustainable products and policy advocates pushing for circularity legislation. Participation from diverse stakeholder groups is essential in the push for a circular textile economy.

The main challenge all our interviewees discussed was financial – it was difficult to secure adequate funding for their type of work. Private investors demanded scalability and quick returns, which circularity practices are not designed to deliver. This sector may instead present a great opportunity for impact investors and mission-driven capital, who value long-term ecological and social benefits in additional to economic returns. These sources of patient capital can help small-scale circularity practitioners develop the circular infrastructure and community connections that make them successful, reaping their rewards once local circular economies have been established. Circularity-centered firms and impact investors should be more intentional about seeking each other out, and partner organizations like Mechanism that have connections across the industry can help facilitate bringing these groups to the table together. Public funding is also essential for non-profit organizations and companies hoping to reduce the 'circular premium.' Interviewees had limited success with local and state grant funding, and several called for incentives like those afforded to other 'sustainable' sectors like electric vehicles. In addition to creating programs specifically targeted to circular manufacturing or textile production, public funders can also provide financial support through grants or low-interest loans for circular infrastructure like collecting and recycling facilities; tax incentive programs that reward firms using circular practices or materials; or producer rebates, like those in California's EPR law, that

incentivize circular production. Such financial programs can help close the gap between circular and linear production and better reflect the actual costs/benefits of production.

In addition to creating funding opportunities, public officials – from the local to federal level – can significantly strengthen circularity through targeted policy design. For instance, Massachusetts's textile waste ban (effective November 2022) prohibits disposing of textiles in household trash and requires municipalities to partner with recyclers, leading communities to offer curbside pickup using local partnerships with organizations such as Helpsy (MassDEP 2022). Local governments can likewise adopt textile recovery mandates or support drop-off networks; state governments can offer producer responsibility laws, procurement standards, or grant programs; and federal policymakers can establish interagency coordination, industry registries, or uniform traceability requirements similar to proposals like the FABRIC Act. Ultimately, a comprehensive national policy—akin to California's Responsible Textile Recovery Act or the EU Circular Textiles Strategy—could provide consistency, scale markets, and reduce burdens on small firms by creating coherent national standards and infrastructure investment. Advocates are currently fighting for this type of legislation, backing bills like the Fashion Act in New York State and the proposed FABRIC Act. Supporting the work of advocacy groups and organizations like Mechanism that bridge the gap between circularity practitioners and policymakers is essential.

Finally, we can all support circular textiles in our small ways, whether that looks like taking a repair class and holding on to clothes for longer, choosing a sustainably produced garment from a local business rather than a mass manufactured one, or signing a petition to support the FABRIC Act. We can build a circular economy together, one action at a time.

Conclusion

This thesis has explored how small and micro-scale firms in the United States are advancing textile circularity from the ground up. Their work reflects a values-driven and community centered response to the environmental and social challenges of the global textile industry. Interviews revealed that circularity is not only technical goal, but a cultural and systemic shift—one that must be supported through collaborative infrastructure and coherent policy. As these firms continue to lead with creativity and care, the responsibility now lies with broader coalitions, institutions, and policymakers to support and amplify their impact.

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