BEYOND BED AND BATH: BUILDING A CIRCULAR ECONOMY FOR LINENS DISCARDED BY THE HOSPITALITY INDUSTRY

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Abstract

The clothing and textile industry has many detrimental environmental impacts and is a major contributor to greenhouse gas emissions, pollution, and water and pesticide use. In addition, currently 85% of all textile waste winds up in landfills. Worldwide, 1.5 million tons of textile waste annually is comprised of just sheets, pillowcases, and towels (linens), with hotels being a significant contributor to this waste stream. We convened a multi-disciplinary academic team to tackle this global issue on a regional scale in Washington State, by investigating a circular economy model in which textile waste generated by the hospitality industry is reused and then recycled to develop new textiles. Within the hospitality industry, we focused on linens discarded by hotels. The linens are optimal for secondary use because many are discarded in new or nearly new condition. The hotel linens have a high percentage of high-quality cotton and are also optimal for recycling because they lack the zippers, buttons, and other accessories common in apparel. Our team is working in partnership with Washington State's hospitality industry and the Washington State Department of Commerce.

Our textile circular economy model included a survey to determine information on how, why, and the quantity of linens discarded by Washington State hotels. We completed an economic analysis and an investigation of potential secondary markets for discarded linens. With linens donated by hotels, we held a design hack-a-thon with students from Washington State University's Apparel, Merchandising, Design, and Textile Department. Our research estimated the quantity of discarded linens available for secondary use and eventual recycling. Next steps include further investigating secondary markets and working with linen manufacturers to develop take-back programs. We believe a circular textile economy fed by linens from the hospitality industry has the potential to create innovative secondary markets and be a reliable resource for textile recycling to radically transform the industry.

Introduction and Motivation

Every day, over nine billion people worldwide wear and use clothing and textiles. This includes pajamas, cozy sheets, blankets and comforters, towels, underwear, and clothing. These textiles are a human need and provide protection by keeping us warm or cool and preventing injury or disease. Many of us take this necessary resource for granted, purchase more than is needed, and casually discard clothing and textiles when they become worn, stained or out of fashion.

The scale of the clothing and textile industry produces a range of harmful environmental and human impacts. Currently, 87% of all textile waste is destined for a landfill (Moazzem et al., 2021). Much like the petroleum and agriculture industries, the clothing and textile industry produces a lot of pollution to our atmosphere and water by contributing 8% to global carbon budgets and 20% to industrial water pollution, which occurs throughout the supply chain (Wagaw and Babu, 2023; CDP Worldwide, 2020).

We need solutions to make this industry more environmentally responsible and build a sustainable circular textile economy. Innovations are happening in inventive reuse, creative upcycling, and fiber recycling. Our team chose to focus our research on developing a sustainable circular economy around cotton fibers because one of our members, Hang Liu, is developing the technology to recycle cotton into new fibers (Liu et al., 2019). Only a small fraction of cotton is currently recycled (Moazzem et al., 2021). Our initial research on textiles that were primarily cotton led us to focus on sheets, pillowcases, and towels otherwise known as linens. In 2018, 1.5 million tons of linens were estimated to be discarded in the US and 1 million tons of these linens were sent to the landfill (EPA, 2024). This large quantity of material, with likely a high cotton content, creates an opportunity for reuse and upcycling prior to recycling.

Linens have additional advantages in that they are a consistent material and they lack the zippers, buttons, rivets, and other accessories that can interfere with the upcycling and recycling process.

We believe that, within the hospitality industry, hotels are a significant contributor to textile waste and provide an opportunity to be an essential key in building a circular textile economy. By working with the hospitality industry, we are able to address a small piece of creating a global textile circular economy. In Washington State, we conducted a pilot study in spring 2023 on the possibilities and potential to model a new textile economy with waste linens from the hospitality industry.

Review of Related Work

Awareness and progress on the need to create circular economies in the clothing and textile industry have recently made great strides. There are examples of creative upcycling and secondary markets within the industry (Zhi, 2022). These need to be scaled up and replicated to additional applications.

Textile reuse and upcycling

The huge volume of discarded clothing and textiles is flooding markets worldwide. In general, Europe is more progressive in policies, innovation, and technology for reusing and upcycling clothing and textiles. Recently, through the Waste Framework Directive, Europe imposed the separate collection of textile waste to enhance the opportunities of reusing and recycling, starting from January 2025 (European Environment Agency, 2024).

Zhi (2022) reviews the role of reconstructing textiles through dyeing, printing, and combining fabrics and the reconstruction of garments through upcycling into refashioned clothing and other items. Current companies that use these techniques include Beyond Retro, Re/Done, Fanfare, and Joslyn West Designs. Another solution is to make unwanted clothing into emergency aid blankets for communities in need (Norris, 2012).

Hospitality industry

The hospitality industry is increasingly embracing sustainability through various initiatives. These include eco-premiums (Kang et al., 2012), energy conservation, waste reduction, and downcycling partnerships. Hotels are working on reducing carbon emissions and improving air quality, energy efficiency, water conservation, and waste management (Prakash et al., 2023). The hospitality industry in Europe is also making strides in using linens that are not chemically bleached and in their natural color (AccorHotels, 2018). Sustainable and green practices benefit not only the environment but also the hotels, their staff, and their guests (Green Hotels, 2023). These initiatives demonstrate the industry's commitment to sustainability, even without regulatory mandates.

In the United States, significant accomplishments include the California Recycling Commission listing Hospitality Textiles as a top ten policy proposal (Bill Text - SB-707 Responsible Textile Recovery Act of 2024). Hotels have also achieved specific milestones, such as reducing laundry by changing linens as needed instead of daily. Many hotels have introduced the "Towel Reuse Program," which encourages guests to reuse towels by displaying signs in bathrooms including, "Save our planet. A towel hanging up means I will use it again" (Nisa, 2017). Research shows that this policy shift has significantly reduced the overall environmental footprint of hotels (CBRE, 2023).

There is growing awareness that hotels should work to reduce and reuse their unwanted linens (Botelho, 2021). A think tank meeting on Textile Innovation in Hospitality (Green Hospitality, 2022) concluded that the hospitality industry consumes a lot of textiles and generates a large volume of waste. This positions the industry to have significant impact in creating sustainable textile solutions. Most relevant and exciting to our project are Dutch designers who are upcycling unwanted sheets to make a line of shirts (Corbley, 2020), and a British designer making pajamas and nightdresses (Rice, 2022).

Even more relevant is the San Francisco Tablecloth Repurposing Project to remanufacture tablecloths discarded from the hospitality industry into a variety of reusable totes and shopping bags (Ulasewicz and Baugh, 2013). The authors noted that the textile supply chain needs to be rethought and that discarding of textiles needs to be done in a way to elevate their value. They also discuss the obstacles of acquiring a consistent and steady supply of materials.

The findings of Ulasewicz and Baugh (2013) are directly related to our project; however, it appears that their project is not currently operational.

Technology Approach

From the start, our end goal has been to extend the lifespan of cotton textiles and preserve embodied greenhouse gas emissions, minimize the massive production of virgin cotton fibers, and reduce the volume of cotton textile waste ending up in landfills. To address this global problem on a regional scale in Washington State, we assembled a multi-disciplinary academic team to create new opportunities for upcycling and recycling textiles. Our previous research suggested that opportunities to reuse, upcycle, and recycle copious quantities of linens may exist within the hotel and hospitality industry. Our focus was to determine if linens discarded by hotels could be reused, upcycled, and then recycled into new textiles. We thought that the linens could be ideal for reuse because we assumed that many are discarded in new or slightly used condition. There are also thousands of hotels in Washington and many more around the world, which make a standard and easily accessible textile resource.

Early in our project, we learned about periodic renovation cycles that many hotels undergo every five to seven years. During this process, all the linens in the hotel are commonly discarded regardless of their condition and whether or not they have ever been used. For example, one hotel in downtown Seattle, WA started a renovation in late 2023 and had 2,673 sets of sheets and towels to dispose of. The hotel expressed the desire to dispose of a tractor truck load of linens in a sustainable way.

Our pilot project had four components to determine the feasibility of a circular textile economy based on discarded linens. The first step was to investigate the state of linens within the hospitality industry, which included an estimate of the volume of linens discarded by hotels in Washington. We next wanted to test our assumption that the discarded linens were still in reasonable condition for second use. Then we evaluated and explored the potential for linens to be used in secondary markets including reuse and upcycling. Finally, we hosted a design competition or hack-a-thon for WSU students to design apparel, accessories, and other items from discarded hotel linens. All this work included preliminary feasibility assessments to begin drafting a model for a circular linen textile economy.

Hotel linens

In Washington State, the Washington Hospitality Association (WHA) calculates there are 118,996 hotel rooms. When the linens in use by these hotels are combined, we estimate there are over 8.3 million pounds (about 3,764,813.6 kg) of total linens, which creates a dependable and sustainable source of textiles for the circular economy.

To start, we collaborated with the WHA to create and issue an online Qualtrics survey for hotels to find out the how, why, and the quantity of linens discarded by Washington hotels. We collected data over three months in spring 2023 on hotel linen disposal (costs and quantity disposed of). We structured the survey around questions about a respondent's current quantity of linen use and standards for linen purchasing and questions about one's current process for linen disposal and quantity disposed of. The survey was distributed by WHA via their list-serves and contacts with hotels across Washington.

In total, the survey data provided information from 37 hotels of various locations and quality levels across Washington. On average there are 20 pieces of linen in each hotel room including sheets, pillowcases, duvet covers, towels, and wash cloths. Of the survey respondents, 81% reported that they discard linens with their garbage. The most common reasons for discarding linens are because of small stains and tears according to 90% of the respondents. From our survey findings, we estimate 539,773.59 pounds of hotel linens are discarded per year in Washington (Table 1). We believe the number of discarded commercial linens is large enough to create an opportunity for secondary use and recycling with materials sourced from hotels.

Table 1. Estimated individual, market discarded linen quantities and discard site data.

Total Surveyed Quantity of Discarded Linens Per Hotel	Average Linen Inventory Par	Total Estimated Quantity of Discarded Linens in Market	Share of Hotels that Discard to Landfill	Share of Hotels that Discard to Shelters, Charities
890.71 lbs.	3.02 par	539,773.59 lbs. (6.5% of market)	81%	78%

Linen testing

We conducted an analysis of the properties of discarded linens compared to new hotel linens to help gauge the suitability of discarded linens for secondary uses. Linens for our testing were collected from hotels that indicated, in our survey, a willingness to donate them to our researchers. The linens included both flat sheets and towels from hotels with a range of quality levels, in addition to newly purchased flat sheets and towels (Figure 1). Our lab evaluated the linens for thickness, weight, fabric density, tensile strength, and elongation, tearing strength, abrasion resistance, flexibility, and water absorption. Multiple samples were taken from each flat sheet or towel for the testing.

Figure 1-- Examples of types of damage in linens discarded by hotels in Washington.

We found that the discarded flat sheets and towels displayed a wide range of results in all the properties assessed. Given the limited number of samples evaluated, there was no conclusion related to the correlation between the quality of the discarded linen and the quality level of the hotel. However, the results showed the flat sheets and towels still had strong tensile strength (Tables 2 and 3). Most of the discarded towels and flat sheets were strong with tensile strength higher than 200 N, which means they can withstand the pulling force that occurs on everyday products. ASTM D5431-09 (Standard Performance Specification for Woven and Knitted Sheeting Products for Institutional and Household Use) specifies that the minimum tensile strength of 100% cotton woven sheets for both institutional and household use is 178 N. For towels, all of them had a tensile strength that still could meet the ASTM D5433-12 (Standard Performance Specification for Towel Products for Institutional and Household Use). The minimum requirements based on this specification are 178 N and 133 N for the length and width directions, respectively, on bath, hand, washcloths, and bath sheets. The towels were soft and had good water absorption. Although some sheets had lower tearing strength than that required in the American Society for Testing Materials (ASTM) standard specification for sheets, they were still in excellent condition for other uses, further supporting the potential for a secondary market for these linens.

Table 2. Physical and mechanical properties of discarded flat sheets (numbers 1-8) compared to a new sheet (9).

	Thickness (mm)	Weight (g/m^2)	Tensile Breaking Force – Length Direction (N)	Tensile Breaking Force – Width Direction (N)	Tearing Strength – Length Direction (N)	Tearing Strength – Width Direction (N)
Sheet #1	0.14 ± 0.00	93.82	326.7 ± 40.0	166.9 ± 9.2	6.92 ± 0.61	8.15 ± 1.15
Sheet #2	0.22 ± 0.00	122.67	173.6 ± 18.6	171.9 ± 5.1	6.57 ± 0.55	10.24 ± 0.70
Sheet #3	0.21 ± 0.01	130.70	357.5 ± 43.7	219.8 ± 26.1	8.9 ± 0.60	5.52 ± 0.48
Sheet #4	0.23 ± 0.01	123.36	375.2 ± 5.8	210.4 ± 23.6	11.13 ± 1.06	7.55 ± 0.63
Sheet #5	0.28 ± 0.02	115.61	245.7 ± 22.4	116.3 ± 19.9	5.68 ± 0.75	3.66 ± 1.30
Sheet #6	0.33 ± 0.01	142.23	345.1 ± 4.6	184.9 ± 9.2	7.93 ± 1.45	5.42 ± 0.65
Sheet #7	0.28 ± 0.01	123.90	229.1 ± 34.9	439.0 ± 41.7	10.85 ± 0.77	20.73 ± 1.23
Sheet #8	0.25 ± 0.01	133.83	280.6 ± 21.7	599.9 ± 65.3	9.02 ± 1.05	26.69 ± 5.05
Sheet #9 (New)	0.38 ± 0.01	124.81	208.3 ± 6.6	324.5 ± 50.8	12.44 ± 0.69	15.79 ± 4.40

Table 3: Physical and mechanical properties of discarded towels (numbers 1-3) compared to a new towel (4).

	Thickness (mm)	Weight (g/m^2)	Tensile Breaking Force – Length Direction (N)	Tensile Breaking Force – Width Direction (N)
Towel #1	4.33 ± 0.90	784.70	398.7 ± 46.7	282.7 ± 29.2
Towel #2	3.43 ± 0.45	563.69	366.1 ± 139.8	214.6 ± 109.2
Towel #3	3.41 ± 0.32	622.97	730.3 ± 145.2	172.3 ± 11.2
Towel #4 (new)	7.24 ± 1.40	776.62	215.9 ± 23.1	191.9 ± 14.7

Second-use markets

To create a more sustainable circular economy, we need to find ways to maximize the use of valuable fibers including cotton *before* they are recycled into new fibers and fabric. Better quality hotels implement periodic renovation cycles when old furnishings and linens are completely replaced by new ones without regard to their condition. It does not make sense either economically or environmentally to recycle linens when they are still of fair to high quality. We refer to the second-use markets for discarded hotel linens as secondary markets, which include linens that are reused, remade, and remanufactured, upcycled, and downcycled. There is much to be done in this area. At present, our work is in the preliminary stages as there are enormous logistical issues that need to be resolved including sourcing secondary markets, balancing supply, and demand (especially when vast amounts of linens are discarded during renovation cycles), storage, transportation, tracking, and economic sustainability. We have begun to explore whether using existing infrastructure is feasible, such as having current laundry contractors with established contracts and routes collect discarded linens. We are not aware if this is currently being done.

Linens in good condition can be reused in their current form by another organization or entity. The sheets can be remade into pillowcases or smaller twin, or crib sheets, and bath towels can be remade into hand towels. The linens can also be upcycled and made into shirts, quilts, or other desirable items. The downcycling options include using the linens as rags, shredding them to make into insulation or donating them to fashion design schools to be used for test garments. However, our focus is on reuse, remade, remanufactured, and upcycled linens as we believe there is more feasibility for secondary use and then recollection before entering the recycling stream (Figure 2).

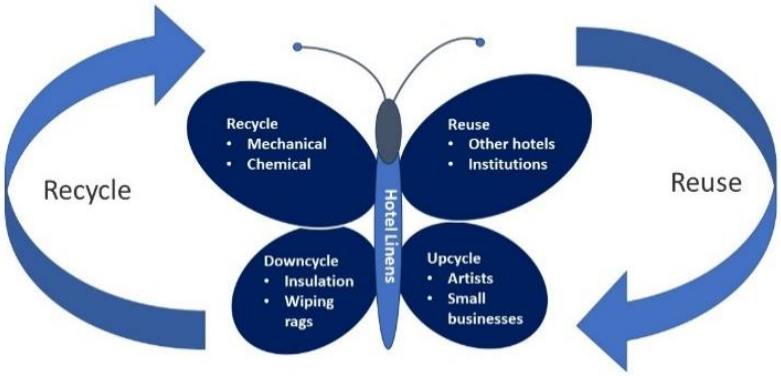

Figure 2: Diagram for a double loop circular economy with discarded linens.

Our preliminary research indicates that hotels do donate their linens. From our 2023 survey in Washington State, 78% of hotel respondents donate a portion of their linens to a shelter, charity, or other organization (Table 1). However, we do not yet know how the shelters and charities use and then discard the linens. Instead of donating them to other organizations, hotels could potentially remanufacture their discarded linens into aprons, dish towels, and lap towels for use in their food service areas. Hotels could also downcycle their discarded linens by cutting them to be cleaning rags. This could save them money on not needing to purchase cleaning cloth. We are aware anecdotally that some hotels use discarded towels to absorb water spills and as cleaning rags. However, we know of at least one non-profit organization that downcycles a hospital's linens into cleaning cloths and mop covers to be reused at the adjacent Ronald McDonald House.

We have found two organizations in Washington State that upcycle discarded linens into quilts and other items. Our most promising discovery was from an interview with the Washington Department of Corrections. They have a Sustainable Practices Lab where inmates make quilts and teddy bears from donated linens and other materials. These items are then donated. A discarded flat sheet, for example, can be used as the backing for a quilt. A small start-up organization, Rebundance, collaborates with hotels to take their discarded linens and dye the materials for use in craft kits for quilts, upcycled pillowcase shopping bags, and other items. More research is needed to investigate the potential and economic costs and benefits of secondary markets for discarded hotel linens.

Linen hack-a-thon

To explore creative second uses for discarded linens we conducted a design competition or hack-a-thon, which encouraged WSU students to compete in a design competition to promote creative upcycling options for discarded hotel linens. To incentivize participation, we offered $3,200 in cash prizes for the winners, donated by the Pullman Marriott Hotel. Linens used by the students as raw materials for their designs were contributed by the Pullman Marriott and the Pullman Holiday Inn.

The students' entries ranged from tote bags and aprons to pool cover-ups, slippers, and pet accessories (Figure 3). A team of ten judges, comprised of members of our project team, staff from WSU's Office of Commercialization, and Marriott executive staff reviewed the entries for utility, originality, quantity of linens used, potential for mass production, and recyclability of the designed item. Six winning designers were selected and recognized at an award ceremony held at the Courtyard by Marriott in Pullman, WA. Marriott is exploring the possibility of repeating and sponsoring the hack-a-thon in the future and is also planning to donate discarded sheets to WSU's Department of Apparel, Merchandising, Design, and Textiles to use in place of new fabrics purchased by the department and students for class projects.

Figure 3: Items made from discarded linens by WSU students for the Hack-a-thon.

Discussion

Based on our research, we are confident that a new circular textile economy with linens from the hospitality industry has potential to create novel and large-scale secondary markets and be a reliable resource for cotton textile recycling to fundamentally transform the industry. However, creating these secondary markets will require addressing numerous logistical challenges, each with associated costs. These challenges include sorting, volume, storage, transportation, and recapturing linens, all of which need to be fully explored and understood to successfully build this new market. In addition, we do not know the market demand for upcycled and reused linens.

Secondary market challenges

- Sorting: The discarded linens will need to be sorted by condition, the type of damage, sheet or towel, and fiber content. We will assume that all the linens coming from the same hotel will have an identical fiber content. It will thus be important to keep linens from different hotels separate as they are collected.
- Volume: Hotels discard individual linens on a day-to-day basis as they are deemed unusable due to stains and tears. They also discard huge quantities during renovation cycles, making the supply very inconsistent. We found that hotels are willing to send their linens to a secondary market or recycling if doing so does not interfere with their established operations. The secondary markets we have explored would find this inconsistency a challenge, and most would be unable to handle the extreme volume of linens from a renovation cycle.
- Storage: One way to negotiate the challenge of an inconsistent supply with a consistent demand would be storage. However, storing textiles of any kind requires a space that is climate controlled and sealed to avoid mold, mildew, and pests rendering them unusable. The linens from the renovation cycle of just one large downtown Seattle, WA hotel would require storage space equivalent to a shipping container.
- Transportation: As mentioned previously, transporting either large or small quantities of linens from the hotel to storage and then to a secondary market would require coordination. The larger the geographical area across which the linens are distributed, the greater cost and complexity of this coordination and the transportation itself.
- Recapturing: The environmental and financial costs of producing textiles are high, so it makes sense to fully utilize them in a secondary market before they are recycled. However, ensuring that hotel linens go from their second use to recycling requires additional coordination, tracking, and transportation across potentially greater distances to a cotton recycling site.

In addition to logistical challenges, we learned that there are potential social challenges to implementing the secondary market. Hotels are extremely brand conscious and may want to market their practice of repurposing and recycling their linens to demonstrate their concern for environmental sustainability. They may also have brand-related concerns about where their linens find a second use. For example, while the hotel may approve of their discarded linens supporting homeless shelters or being used as raw materials for a refugee women's collective, it may object to their linens going to the Department of Corrections and benefiting prisoners. There are also ethical concerns with prisoners making upcycled items that are sold for commercial profit. These are all issues to be discussed and worked out.

Research implications

Around the globe there are millions of hotel rooms stocked with linens. When discarded, these linens should and can be a valuable resource to increase sustainability in the clothing and textile industry. The linen consistency in color, fiber, and fabric and their high volumes make them a prime candidate for creating a circular textile economy. Textile production is a global industry, and its economic and environmental impacts are felt around the world. We have intentionally partnered with a colleague in Switzerland to help expand our work to different continents. As we begin to find solutions to build a circular textile economy in Washington, we believe this can be a foundation for other locations.

Conclusions and Recommendations

This project was a pilot investigation into the status of linens discarded by hotels in Washington and the potential for secondary textile markets. Due to close ties between WSU and the Washington Hospitality Association, previously inaccessible survey data was gathered for critical analysis. Not only has our project heightened hotel interest in the sustainability and cost-savings of the circular textile market, it has also generated interest in immediate circular market participation from significant secondary market consumers previously detached from the downcycling textile stream. We believe that each of this project's aspects deserve further study on their own, and that future research should strive to organize and connect market actors to physically implement the framework our research has developed.

Secondary markets

The issues surrounding secondary markets warrant more investigation because of their extreme complexity. There is no single path that discarded linens will, or should, take to a secondary market. We believe that a portfolio of secondary markets can provide multi-faceted solutions to help build a circular textile economy. Both studying and addressing secondary markets fully was beyond what could be accomplished during this project. Indeed, trying to address this issue within the brief time of this project was our team's greatest challenge. As next steps in this area we recommend:

- To determine the best secondary market options for discarded linens, we recommend expanding the size and scope of the textile testing of discarded linens.
- There needs to be continuing collaboration with the Washington Department of Corrections regarding their ability to potentially transport, store, and use quantities of linens too large for other entities.
- There should be an exploration of other opportunities for how discarded linens can be redistributed to smaller organizations and other second uses.

Policy recommendations

Although some hotels may be in favor of repurposing and recycling their linens, getting them to change their current practices to make textile reuse and recycling an established norm will take effort. We believe this is more likely to occur with incentives rather than penalties. We endorse the development of policies that reward or encourage the donation or sale of linens before discarding to a landfill. We recommend further study in the following areas:

- A more detailed exploration of the cost of purchasing and discarding hotel linens.
- Municipal policies to support reuse and recycling and discourage discarding.
- Meaningful incentives, financial or otherwise, which motivate hotels to practice and promote linen reuse and recycling.
- An assessment of key market forces to encourage policies for sustainable linen manufacturing, use, reuse, and then recycling.

Next steps

Within the hospitality industry, we believe there is potential for linens to be discarded and then remanufactured for secondary use in a hotel or restaurant. This could begin to build the circular textile market within the hospitality industry itself. Our student hack-a-thon included designs in this realm. For this to be accomplished, we need to collaborate with linen manufacturers to develop linen take-back programs and interest them in remanufacturing and making linens from recycled cotton. Part of this work should include drafting feasibility studies, breakeven analysis, and business plans. This process needs to include building awareness of the immense problem of linen waste and gathering partners to begin to build a textile circular economy.

Our goal to extend the lifespan of linens, minimize the massive production of virgin cotton fibers, and reduce the volume of textile waste ending up in landfills, has made positive strides through this project. Through heightening awareness of the circular textile market, our team has laid initial groundwork for future textile waste prevention and for fostering a community of engaged market stakeholders ready to manifest the theoretical benefits we outlined. However, we have only scratched the surface of an immense topic. Success will require building new relationships, creating new networks, and designing workable systems. Multiple actors, dizzying coordination, and key market forces will all need to work in concert to create a sustainable circular textile economy. We do believe the current system can be improved, but it will take more time and additional resources.

Acknowledgements

We would like to extend our gratitude to the Washington State Department of Commerce and the Washington State Department of Ecology for allowing us to take these next critical steps in our work. We wish to acknowledge the following entities whose partnership, participation, and support were instrumental in the successful implementation of this project: College of Agriculture, Human and Natural Resource Sciences (WSU), Department of Apparel, Merchandising, Textile and Design (WSU), School of Hospitality Business Management (WSU), Washington Hospitality Association, Pullman Marriott Hotels owned and operated by Stonebridge Companies, Pullman Holiday Inn Express, Washington State Department of Corrections, Walla Walla State Penitentiary, Seattle Marriott Bellevue, and Courtyard by Marriott Seattle. This project was possible with funding from Washington State Department of Commerce and the College of Agriculture, Human and Natural Resource Sciences (WSU).

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Martha Aitken is the Assistant Director for WSU's Metropolitan Center for Applied Research and Extension where she manages a diverse portfolio of projects for urban stakeholders. She has a long interest in textiles and now often uses repurposed textiles.

Dr. Mark Beattie is a Scholarly Assistant Professor in the School of Hospitality Business Management and serves as the Academic Director for Carson College of Business on the Everett campus.

Dr. Hang Liu is an associate professor in the Department of Apparel, Merchandising, Design & Textiles. She has a polymer science and textile engineering background and extensive expertise in various fiber production techniques.

Dr. Giuseppina Menconi is an Associate Professor at César Ritz Colleges Switzerland where she teaches several scientific and quantitative courses. Her research interests include the role of sustainability in our lives and in hospitality and tourism.

Kolby Ross graduated with a B.S. in Economics, Policy & Law from WSU in 2023, and contributed to the economics findings of this project with guidance from WSU professor Mark Gibson. Kolby is a current law student at the University of Arizona.