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Creating new from that which is discarded

The collaborative San Francisco Tablecloth Repurposing Project

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In San Francisco, as in most municipalities, there is no regular collection system for pre-sorted, discarded textiles at the consumer or industry level as exists for paper products, plastic materials, glass and canned goods. Historically, textile products did not have the same resale value as aluminium cans, glass bottles and newspapers, and were not part of the initial solid waste recycling programmes of the 1980s (Domina and Koch 1997: 96). A complex textile recycling industry does exist (Hawley 2008: 213), consisting of large quantities of consumer and business textile products, termed post-consumer waste (Domina and Koch 1997: 101), discarded to landfill, or donated to local and national charities and non-profit organisations. These organisations market and sell the products to consumers; any products not sold through their retail channels are sold off to rag sorters and brokers, or discarded to landfill. In the US an estimated 60% of the product purchased from the non-profit organisations by the recyclers is exported (SMART 2012) for sale in developing countries, for example to Kenya in Africa or Bolivia in South America. As these countries develop, the desire and need for these used textile products diminishes, replaced with the desire for new products (Hawley 2008: 229). In 2009, discarded textile products were estimated at 12.7 million tons, or 5.2% of all municipal solid

waste collected by garbage services in the United States (USEPA 2009). Less than 15% of all textile waste placed in the garbage was recovered (re-used or exported) (USEPA 2009); the remaining 85% goes to landfill (SMART 2012). For every ton of textile products diverted from landfill and re-used, an estimated 20 tons of CO₂ is saved (Hunt 2011: 14).

While there is much documentation regarding the textile waste generated by consumers, the documentation of textile waste created by the hospitality and tourism industries is lacking. More than 16 million people visited the city of San Francisco in 2011, spending \$8.5 billion, with business and leisure travel on the rise (Finz 2012: D 1). In these industries textiles are replenished for bedding, drapery, furniture and carpets because of excess use or updated design concepts. Restaurants and banquet tables require clean tablecloths and napkins for each sitting of customers, creating textile waste when stains, holes and other damages are created from continual use. As landfill space becomes scarce, the City and County of San Francisco has pledged to reduce solid waste deposited into landfills to zero by 2020 (City and County of San Francisco 2002). New models must be considered that explore methods to extend the life of discarded hospitality industry textile products, diverting them from the traditional textile recycling industry and landfill.

This case study investigates a collaborative effort in the city of San Francisco among government, business and a local trade organisation for the purpose of converting textile waste into a manufacturing resource. The ultimate goal of the study is to understand what usable discarded textiles from the waste stream of the hospitality industry can be diverted as a consistent supply for repurposing into new products. An additional component of this study is the heightened consumer interest and demand in purchasing products with a perceived environmental impact that correlates with its true impact (Chen and Burns 2006). In this chapter, the term 'repurpose(d)' is used to define the collecting and sorting of discarded materials as the resource for new products designed and manufactured in the location of discard. As the rise and influence of LOHAS (lifestyle of health and sustainability) consumers grow, so will the demand for and growth of repurposed products (Blossom 2011).

10.1 Synopsis of two textile supply chains

Exploring methods to reduce dependence on new or primary fibre and textile product supply chains and shift to usage of the discarded or secondary fibre and textile product supply chain is paramount. The international non-profit trade association, the Secondary Materials and Recycled Textiles Association or SMART, has as a goal, 'to promote the interdependence of all industry segments...as they use and convert recycled secondary materials from used clothing, commercial laundries' (SMART 2012). Its ultimate goal is to divert these products from ending up in landfill and further to explore how to extend the textile product life-cycle.

The Sustainable Apparel Coalition, founded in 2011 and representative of global apparel and footwear companies, created as one of their desired outcomes to, 'develop effective uses for textile waste, creating a second life for materials' (Sustainable Apparel Coalition 2012).

10.1.1 Primary fibre/textile supply chain

The textile, clothing and sewn products industry was built on the model of a one-way, cradle to grave system (McDonough and Braungart 2002) with resources grown or manufactured for singular use followed by disposal (see Fig. 10.1). This linear model is due in part to product innovations marketed to and supported by changing consumer demands, requiring the continual availability of new goods in the marketplace (Guide *et al.* 2008). Designers and manufacturers create products based on the false premise that production of new yardage from virgin fibre will be continuously available. In 2010 and 2011, product sourcing managers faced the reality of cotton fibre in short supply with prices rising, while escalating oil prices were putting pressure on the cost of polyester fibre (D'Altorio 2010). Fibre supply became a finite quantity, instead of increasing, to meet the growing demand for textiles and textile products. Retailers' strategies to expand their businesses depended on access to plentiful, well-priced fibre and textile products. The 2010/2011 fibre shortages and price escalations proved it to be difficult to maintain expected profit margins for global retailers and support the challenges of the traditional primary fibre/textile supply chain.

10.1.2 Secondary fibre/textile supply chain

As the traditional fibre/textile supply chain has its own life-cycle, so, too, does the secondary fibre/textile supply chain. Supported by Japanese fibre innovations, developing textile waste removal efforts and the emerging interest from particular consumer market segments seeking products made from recycled or repurposed materials, a secondary supply chain of discarded textile products collected for re-use has emerged (Owen 2011). This supply of textile products is a complex mix of blended fibres, combined fabrics, specialised fabric finishes and intricately sewn products. These discarded textiles were originally designed or produced using the primary fibre/textile supply chain without re-use in mind. The evaluation of discarded textile products for manufacturing new products provides a new secondary supply chain resource.

Figure 10.1 Cradle to grave fibre/textile production and consumption model



Industry efforts to date concentrate on temporary diversion of textile waste, such as reselling the same product as in the traditional textile recycling industry, or repurposing into a new product. An example of repurposing would be Martex Fiber (Martex Fiber Southern Corp 2011), a global importer and exporter of textile waste, which offers waste removal services for fibre, fabric and product manufacturers for the purpose of new yarn and fabric production (Bloomberg Business Week 2012). A new West Virginia, US, apparel manufacturer, SustainU, makes clothing from 100% recycled materials for its knitted tops sold to colleges and universities (Laporte 2012). Technological advances in fibre and yarn manufacturing, utilising existing fibre and fabrics for new fibre manufacturing, now make it possible to conserve fibre resources for new production.

Teijin Fibers, a Japan-based fibre mill, has invented a procedure to chemically recycle (depolymerise and repolymerise) existing polyester fibre products into new, high-quality polyester fibre (Eco Circle 2008). The process uses fewer chemicals, produces lower emissions and uses less energy than virgin polyester fibre manufacturing. Toray Fiber, another Japan-based fibre mill has also developed similar fibre recycling in nylon and polyester fibres (Toray 2011). Teijin Fibers and Toray Fiber collect only their own textile products for producing new fibre. They contract with their customers, such as Patagonia or Nike, to collect their post-consumer products, shipping them back to the fibre mill for chemical recycling into new fibre, manufacturing into new products and purchase by Patagonia or Nike (Eco Circle 2008).

Manufacturing previously used fabric into new products provides an opportunity to keep fabric out of the waste stream and remain in a new secondary fibre/textile supply chain, a cradle-to-cradle model (McDonough and Braungart 2002). The collection of discarded textile products for manufacturing of category specific new products provides the spark to invent new manufacturing models and perhaps a new industry. The intent of this study is an exploration of a new collection, sorting and manufacturing system for the repurposing of hospitality and tourism textile waste.

10.2 San Francisco's 'zero waste' by 2020

The City and County of San Francisco (2002) has pledged to reduce solid waste deposited into landfills to zero by 2020. San Francisco had achieved 72+% total solid waste diversion by 2009, the highest large city waste diversion programme in the United States (Green 2009). However, 3.8% of solid waste collected annually in San Francisco is textile waste that goes to landfill (E.S. Associates 2006). To date, there has been no focus by either the SF Department of the Environment or the city-contracted waste collection agency, Recology, to study the issue of textile waste.¹ San

¹ Personal interviews with Jack Macy, San Francisco Department of the Environment, and Bob Besso, District Waste Management Director, Recology, 15 November 2009.

San Francisco Department of the Environment advises consumers to send unwanted clothing to various non-profit or for-profit used clothing retailers (Eco-findeRRR 2012), yet lacks alternative options that will remove discarded textiles from the landfill. San Francisco cannot fulfill its zero waste pledge unless it addresses textile waste.

10.2.1 Collaborative working model

San Francisco is one of the top global destinations for tourism and conventions, both industries using and creating categories of wasted materials discarded to landfill. The San Francisco Department of the Environment (SFDOE) identified for potential diversion a large category of textiles used daily by the tourism and convention industries: tablecloths. Industrial tablecloths are sheets of flat, woven fabric, in standardised round, square and rectangular sizes manufactured in singular or blended fibre combinations of cotton and polyester. Polyester, when discarded to landfill, creates environmental problems through the slow degradation and waste of a polymer derived from non-renewable petroleum resources (Zou *et al.* 2011: 769). Hilary Near of the SFDOE reached out to the San Francisco/Bay Area sewn products trade association, PeopleWearSF, to explore potential methods to divert and re-use this textile tablecloth waste. PeopleWearSF (PWSF) is a collaborative network of industry professionals whose mission is to use their knowledge and skills in designing, manufacturing and marketing products that have a positive impact on the planet, people and the local economy. The organisation accepted the challenge and opportunity to investigate how this discarded textile waste could create a secondary supply chain for the sewn products industry.

10.3 Premise of the case study

In 2011, a core group of PWSF board members launched the San Francisco Tablecloth Repurposing Project. Their challenge was to collaboratively work with the City of San Francisco and the Hotel Council of San Francisco to develop a plan for repurposing discarded hotel linens while supporting the citywide goal of zero waste by 2020 (City and County of San Francisco 2002), and locally manufacturing a new product for consumer purchase.

10.3.1 San Francisco hotel industry waste management

The Hotel Council of San Francisco is a non-profit organisation representing all segments of the San Francisco lodging industry. One of its philanthropic missions is to divert usable discarded materials (including sheets and towels), both new and partly used amenities (including shampoo, soaps, tissues, toothpaste and other toiletry items), furniture and kitchen equipment from landfill and into the hands of

community-based charitable organisations (Hotel Council of San Francisco 2012). To reach these organisations, the Hotel Council works through the San Francisco Hotel/Non-Profit Collaborative. Jo Licata, Community Projects Manager, Hilton San Francisco Union Square, is a founding member of the San Francisco Hotel/Non-Profit Collaborative. Under her leadership, the Collaborative works with the Hotel Council to focus donations where they can best be utilised. Over 4,500 kg of materials per month, including soaps, shampoo and toothpaste, are donated to the Collaborative for distribution (Hotel Council of San Francisco 2012). Discarded tablecloths are not a requested item for this method of diversion, making them a perfect source of waste stream diversion for repurposing.

10.3.2 Quantity of tablecloths

Data obtained from three multinational San Francisco hotels (each with over 500 guest rooms) revealed that on average 15–100 tablecloths, of varying sizes, are discarded each month. The supplier of tablecloths to restaurants discards up to 5,000 tablecloths (2 tons) per month.² The criterion for tablecloth discard is consistent: permanent stains, holes, tears or other damages. The expected lifespan of the tablecloths ranges from 2 to 5 years depending on the type of use, fibre content, construction and finishes that affect the soil release and general appearance of the products. Some of the discards are re-used as rags for cleaning and others are discarded to landfill.

10.3.3 Tablecloth characteristics

The tablecloths are 100% polyester or a blend of 50% polyester and 50% cotton fibre content, utilising several weaves (balanced plain, oxford or sateen), all approximately 8 oz/sq yd (300 g/m²), some treated with a stain-resistant finish. Tablecloth fabrics are laundered frequently, often after a single use, and are manufactured with a polyester fibre content to enhance washing, drying, pressing and cost efficiencies, not possible using 100% cotton fibre content. Sizes range from 152 to 335 cm round, 114 to 229 cm square, and 152–229 cm to 229–396 cm oblong or oval, mostly with rolled hems (Fig. 10.2).

10.4 Creating a new manufacturing and consumption model

With the identification of the discarded tablecloths as the material for transformation, an investigation into their properties ensued. Basic manufacturing

² Personal interview with Hilary Near, SF Department of the Environment, 9 February 2010.

Figure 10.2 Discarded tablecloths



questions as to the consistency of fibre content, size, colour and quantity needed to be clarified to transition the old and make new. Two manufacturing models were reviewed for potential usage with this textile waste. The existing remanufacturing model of recuperating particular components or parts of products and reprocessing or renewing for reassembly (Pialot *et al.* 2012) was not chosen,

as the reason for discarding the tablecloths was because of stains or holes that could not be renewed. As the tablecloths were not being disassembled, processed and sold, a traditional recycling model was also deemed inappropriate (Beamon 1999). The profitability of repurposing these goods ultimately depended on the quality and quantity of this product and the product for which it would be repurposed (Attasu *et al.* 2008). The question of what products consumers require, their demand for 'environmental stewardship', and their willingness to pay for such a product (Rodie 2010), were an integral component of potential product review and consideration.

10.4.1 Product design using discarded tablecloths

The parameters of product design required attention to the limitations of the tablecloths including variations in tablecloth size, fibre content, fabric colour and irregular positioning of stains or holes. A major qualification for design was a product where the 'used' nature of the materials created new value through the transformation into something new (Norris 2010). Consideration was given to a product that could be sold in and promoted by a San Francisco Hotel gift shop, further supporting the Hotel Council mission of environmental stewardship. Product consideration was also supported by San Francisco's recent ban on the use of plastic bags at grocery stores (Sabatini 2012), supporting the investigation into the production of re-usable bags. Market research highlighted a multitude of shopping bags promoting varying details of sustainable materials positioned for the LOHAS consumer (Howard 2007). Bringing re-usable bags to grocery or other stores is a practice that has tripled in the past six years (LOHAS 2010), supporting the usage and consumer acceptance of this product category. A collaborative decision was made to prototype several bag silhouettes manufactured from the secondary supply chain of discarded hotel tablecloths.

The PWSF team worked with local patternmakers and sample makers, developing prototypes and ultimately deciding on three styles of basic shopping bags, each with an external pocket. The external pocket was designed as a place for digitally printing a customer name, logo or other personalised graphics to brand the bags, creating a unique motivation for purchase and a 'desire-by-association' for the consumer (Arieff 2011). Intrinsically there is a social value (LOHAS 2010) in using these repurposed bags, a representative product of a lifestyle that supports waste reduction and the local manufacturing industry.

Decisions on graphic images included the typeset words 'Made in San Francisco from locally discarded tablecloths', or 'My first life was as a tablecloth'. After careful review, a decision was made to design a recognisable logo that communicated the geographic location (Remade in San Francisco) of manufacture. Other logos and images for inclusion would be determined by and representative of the organisation purchasing or promoting the bags: hotel names, company names or conference names.

10.5 Production realities of a secondary supply chain

The reality of production planning from a secondary fibre/textile supply chain differs extensively from a primary fibre/textile supply chain. Because of the continuous cycle of using, laundering and pressing, variation in fibre content and design, these polyester or polyester/cotton blend tablecloths are available for repurposing in varying quantities at various times over their lifespan. As the tablecloths are laundered an indeterminate number of times, the label bearing the fibre content and quantity is often faded and illegible, a lack of information worth noting, but one that does not impinge on their re-use into bags where the fibre content is currently not a Federal Trade Commission (FTC) requirement (Federal Trade Commission 2010).

While the San Francisco Hotel/Non Profit Collaborative embraced the concept of repurposing tablecloths, they lacked a monitoring system for documenting where and when, during the process of using to cleaning, the decision for discard was made. It appears that some hotels make this determination when the tablecloth is inspected during the cleaning process, while others when the tablecloth is spread on the table for use. At no time is there a separation by size, colour or damage. This project brings to light the need for a systemic approach to sorting discarded tablecloths by size and colour, while documenting the quantity and quality of damages; an inventory before entry into the new secondary supply chain is mandatory.

10.5.1 Manufacturing process: Digital printing

Digital printing techniques provide flexibility in image design, minimising energy use, wastewater and use of dye. The digital printing process does not use colour separation (no screens required), and the use of disperse dye in the heat transfer process means the printed images are colourfast, particularly important for the tablecloths with a polyester fibre content in excess of 50% (Cohen and Johnson 2010). Digitally printing the image on the tablecloth, using an inkjet large-format printer, allows for more complex images than traditional screen printing and additionally creates opportunities for customisation in small print quantities. Creating a digital file, rather than burning colour-separated screens, insures less waste generated and more efficient printing on the fabric and economic use of the fabric printed (Seiren 2012).

For this project a pocket piece was not cut before printing; rather the graphics were printed on the tablecloth and then cut. The width of the tablecloth determined the placement of the pockets that were first plotted out on the computer screen, with 20–30 pockets fitting on each cloth. The digitised pocket graphics were digitally printed, using disperse dyes, onto 122-cm heat transfer paper before being transferred on to a tablecloth. Several prototypes of pockets were required because of the lack of knowledge of fibre content and variations in weave structure and

Figure 10.3 Digital printing process



hand, depending on how frequently the tablecloth was laundered and pressed. The quality of the heat-transferred images depended on a perfect calibration of three variables of temperature, pressure and speed requirements for transferring the graphic design from the paper to the fabric (Fig. 10.3). The fibre content, possible finishing and density of the tablecloth weave influenced the image quality. The person assisting with the printing required confidence building and retraining regarding the acceptability and desirability of printing on small stains, flaws or holes. For final production, six tablecloths were printed and moved on to the cutting stage.

10.5.2 Manufacturing process: Cutting and sewing

The manufacturing process traditionally begins with an approved prototype and final product spec sheet ensuring that all products produced are the same, meeting the approved standards. Using fabrics from the secondary supply chain, it was challenging to create an approved prototype and spec sheet because of the colour, stain and other damage variations of the approved, upcycled piece goods. The anticipation was that the final products would actually be individualised and enhanced by the use of damage variations, and product value would be increased by their usage. A spec sheet highlighting this information was created.

The cutting process for this secondary textile supply chain was slow as the width and length of each tablecloth varied, and all hemmed edges of the repurposed tablecloths required removal. The efficiency of continual stacking of fabric layers was not possible; multiple or single layer cutting was performed. The cutters required retraining to understand that flaws, small holes and stains were usable yardage and the bundling together of different shades of fabrics was permissible. The sewing process was quite similar to that of goods from the primary textile supply chain, with a retraining that varying shades of fabric, binding and pocket pieces

Figure 10.4 Large shopping bag manufactured from repurposed tablecloths



were permissible to sew together. The latitude and acceptance of slight colour shading and fabric weave variations was great.

After 6 months of design development, a collaborative decision was made to produce a small production lot of bags for initial marketing and sales response. Forty-eight pieces of each of three bag styles (Figs. 10.4–10.6) were manufactured at a local sewing factory, totalling 144 finished bags. Twenty-five of the initial 140 discarded tablecloths were repurposed throughout the initial sample making phase and manufacturing process.

Figure 10.5 Computer bag manufactured from repurposed tablecloths



Figure 10.6 Small shopping bag manufactured from repurposed tablecloths



10.5.3 Product distribution

The project required more time than initially planned because of a number of factors: re-sorting collected tablecloths for fibre content, size and colour, and sewing factory scheduling. Hence, it is too early for solid product distribution information.

What is evident from the initial responses by those individuals involved in the manufacturing process is that the pocket branding idea is easy to understand and the repurposing of tablecloths from San Francisco is a favourable idea. The Tablecloth Repurposing Project was previewed to a group of over 50 garment industry professionals at a PeopleWear SF general meeting with the following response: seven bags were purchased, one client asked to sell them in his sewing supply shop, and another in her patternmaking studio. The bags are also under review by major clients of the San Francisco Hotel industry for use as totes for conventions in San Francisco.

10.6 Discussion and conclusions

This case study was undertaken to contextualise how usable discarded textiles from the waste stream of the San Francisco hospitality industry could be diverted and become a consistent supply for repurposing into new product. Traditionally, products are designed, produced and purchased with the understanding or assumption of eventually being discarded, so that new products can be consumed. The hospitality industry always requires clean table service, inspecting tablecloths during the laundering process or when preparing for an event, using criteria that when tablecloths are damaged, they are discarded without repair and replaced with new cloths. As noted by the San Francisco Department of the Environment (SFDOE), tablecloths are discarded with small imperfections; holes and stains are not acceptable for meeting the restaurants' or hospitality industry's standards. To organise a supply of textile products, such as the tablecloths, intended as the resource for new manufactured product such as the shopping bags, required a rethinking of the textile product supply chain. The new model considered how products are designed, manufactured, distributed and collected for sorting as repurposed materials for newly designed and manufactured products, on a more continual or directed basis.

To provide manufacturing efficiency, the carefully orchestrated collection and sorting by product size, fibre content, colour and quality according to design concept is important to creating effective production models utilising existing textile products. For the San Francisco Tablecloth Repurposing Project to be viable, the current tablecloth discarding process must be revamped and elevated in importance, as the tablecloths have a value as repurposed material, rather than landfill material. The need to facilitate textile sorting is gaining momentum as a global awareness of the importance of re-use of post-consumer textiles increases (Deschamps 2012).

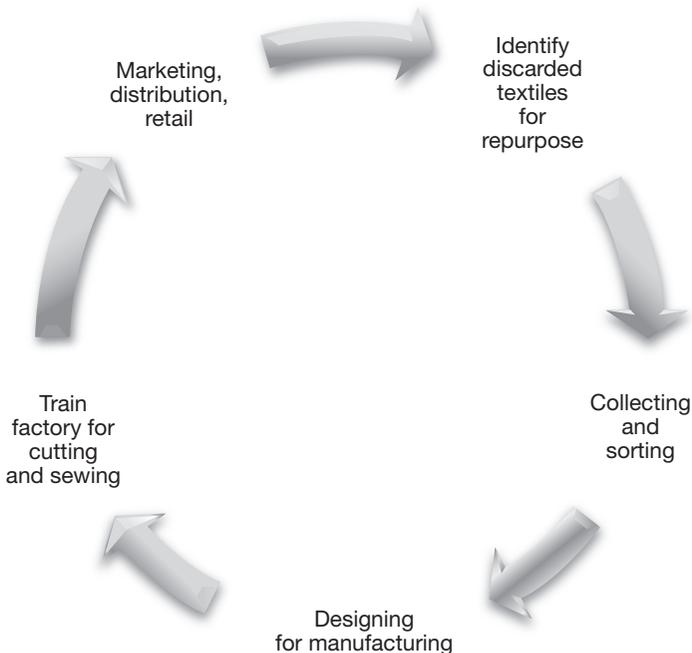
The first step in creating this secondary supply source of existing textile products requires a collaboration of government agencies (such as the SF Department of the Environment, in partnership with its contracted waste collector, Recology) to identify potential sources of usable textile waste, experienced textile product designers and merchandisers to develop the new products, and a factory with a flexible

manufacturing plant to accommodate a variety of experiments in production. The second step is to organise a consistent supply of identified discarded textile products to scale up the manufacturing model to large volume. The third step is to train the factory management to learn how to cut and sew from a different type of fabric source that is not new fabric yardage. The implementation of these three steps will lead to a systemic beginning for the secondary fibre/textile supply chain.

10.7 Opportunities

New industry can be established, founded on the opportunity to effectively learn how to use large amounts of discarded textile products, employing a trained workforce that collects, sorts by design, transports, cuts, sews, distributes and markets new products that would otherwise lie dormant in a landfill (Fig. 10.7). This new industry has an added benefit in that it addresses the market demand for living lightly on the Earth, reducing the consumption of not-so-easily-renewable resources, and giving new life to discarded products.

Figure 10.7 Secondary fibre/textile supply chain model for design, manufacturing and retail of new product



Further, there is an inherent need to consciously define and disseminate industry terms and definitions in a manner and method that embraces their importance and ends the confusion for the consumer over the environmental claims being stated about products (Niinimäki and Hassi 2011). As designers, manufacturers, marketers and retailers use the same terminology, or 'environmental product declarations' (EPDs) to communicate to consumers the true value of the products they purchase, confusion will dissipate (Anderson and Tukker 2006). The goal is to change the traditional linear pattern that consumers go through in consuming products: acquisition, usage and disposition (Shim 1995: 39). It is the combination of the historical, social and environmental components of the new products made from repurposed materials that will create value for customers. As the numbers of LOHAS consumers grow, because products are clearly labelled and branded with consistent definitions of the secondary supply chain, the market value of the products they purchase will rise (Howard 2007: 58). This repurposed tablecloth to shopping bag product is timely, for consumers have an interest in what they consider sustainable, and they make more product purchase decisions based on environmental impact (cKinetics 2010).

What once was non-valued waste, these discarded tablecloths have become a value-added product for repurposing. As this study has shown, new secondary textile supply chains can be realised when business and community organisations collaborate to support innovative strategies. With the promotion of the productive use of textile waste as its mission, the findings from this study are transferable to other locations. The San Francisco Tablecloth Repurposing Project is now in progress, reaching the initial goal of supporting the citywide goal of zero waste by 2020. Sincere congratulations to all who have contributed time, energy, frustration and product to this project. We have only just begun!

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