

Corleone:

A Sustainable Dancewear Solution

ENGS 171: Industrial Ecology
Dartmouth College

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Setting the Stage

Based on a 1999 study^{1,2}, there are approximately **300,000** dancers in the U.S. who wear leotards regularly.

Dance students typically have between **1-20 leotards**, while professionals can have **100+**.

State of the Art



Image courtesy of: <https://us.blochworld.com>

Currently, the non-biodegradability of high-impact **petroleum-based leotards** renders most dance leotards unsustainable.

A leotard's negative environmental impact can be attributed to **material waste** from fabric and **energy** usage from washing.



PROBLEM STATEMENT

Current Sustainable Leotards

JAI ▲ DEE
DANCEWEAR

Expected launch fall 2019

Dedicated to sustainability for all dancers, as a creative, imperfect pursuit.

<https://jaideedancewear.com/>

 **SteelCore**[®]

Strength Comes From Within[®]

Organic line driven by the desire to create products that are local, organic and sustainable

Created their own organic cotton fabric

"Fiber to finish" made in America guarantee

<https://steelcorewear.com/>



Sustainably sourced, ethically produced
dance apparel and accessories.

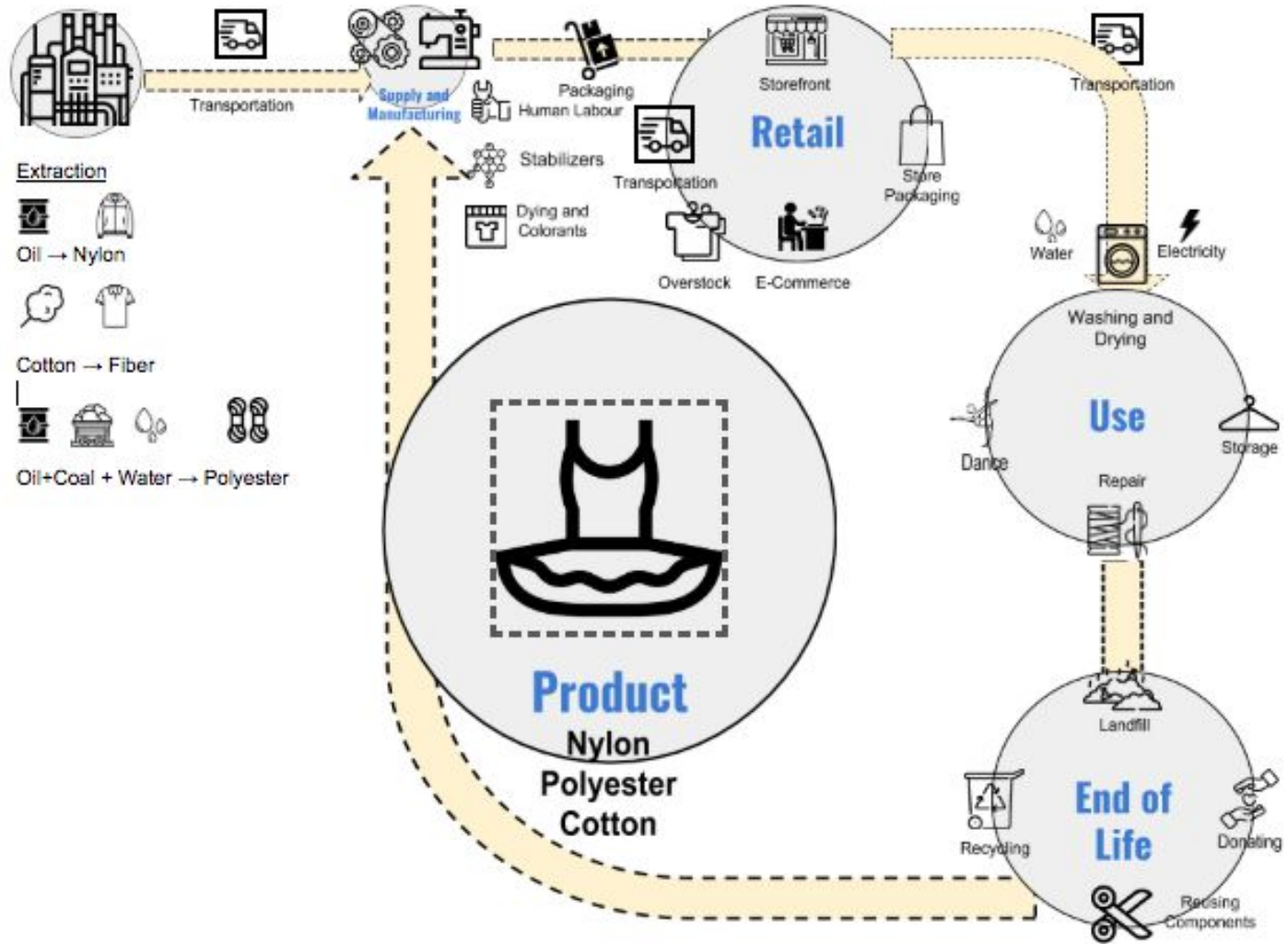
Boundary and Functional Unit



*impacts per hour
of use (dance)*

LCA boundary:
(Cradle to grave) - Inception
to “Death”

Whole System Map



Design priorities based on business and sustainability goals

Materials and End of Life

- Sustainable material was a design focus
- High recyclability is a key component to overall LCA
Client focus

LCA

“Wow Factor”

Customer Experience

- Heavy existing competition sets a high benchmark
- Nature of product

Client Preference

Material-focused solutions desired

Energy Reduction

Changes in product and system that reduced overall energy used

Price

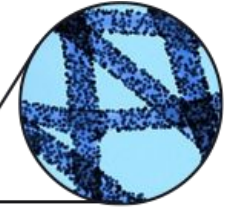
\$70 - 100



Mending Service



Energy-Capturing Dance Floors



GreenShield® Finish



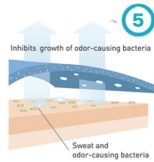
Finalists

Salad Spinner Washing



Worn Wear Website

REPREVE® + Antimicrobial Treatment



Cleansing Wipes



Finalist: REPREVE + Polygiene

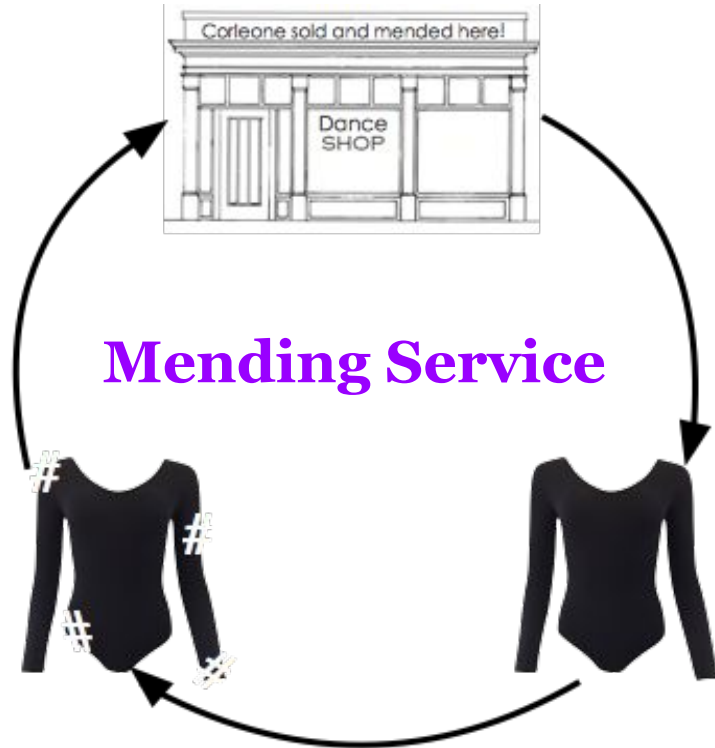
REPREVE® + Antimicrobial Treatment



Description:

1. REPREVE® is sustainably sourced, high-performance
2. Polygiene® reduces washes by 50-75%
3. Does not compromise user experience

Finalist: Mending Service



Description:

(Product related service)

1. Return and mending greatly reduces material wastage
2. Value from waste - circular economy
3. Complementary services for customers

Finalist: Cleansing Wipes

Description;

1. Cotton wipes with cleaning detergent can be used in place of washing
2. Completely eliminates washing in machines
3. Carbon footprint associated with use phase is zero

Cleansing Wipes



Finalist: Salad Spinner Washing Method

Salad Spinner Washing



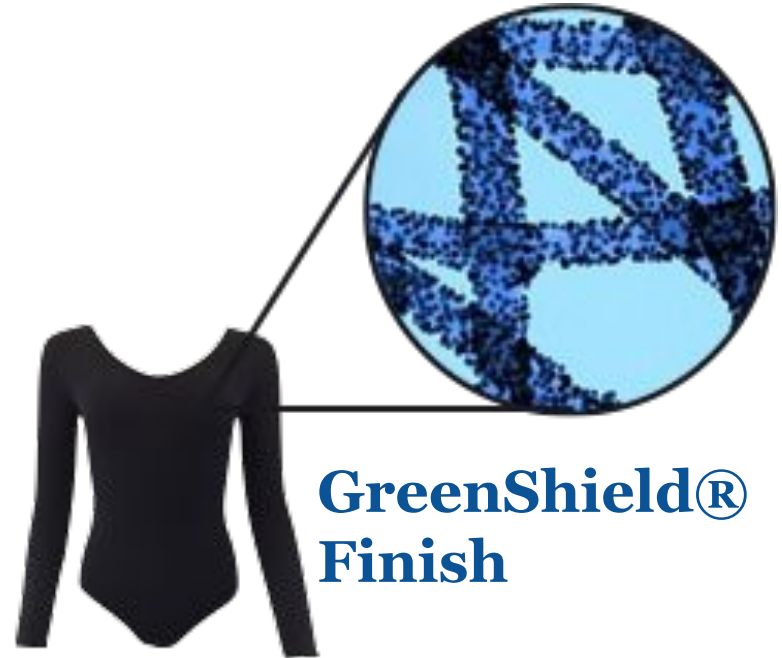
Description:

1. Use a salad spinner for washing leotard
2. Reduces water usage and electricity associated with washing in machines
3. Better care for leotard as it is equivalent to hand-wash

Finalist: GreenShield Finish

Description:

1. Water, oil and stain resistant coating on leotard
2. Reduces the need for washing leotard
3. Dancers may feel suffocated due to poor sweat absorption



**GreenShield®
Finish**

Finalist: Energy-Capturing Dance Floors



Description:

1. Leotard and dance studio floors embedded with sensors to capture and convert kinetic energy of dance into electricity
2. Reduces net energy consumed by ~96%
3. Unclear LCA impacts

Additional Service: Worn Wear Website*

Description:

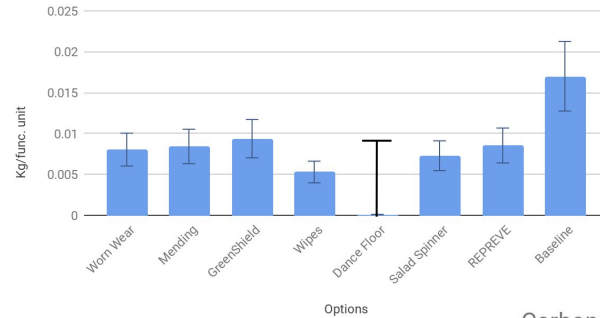
1. Space for users to exchange DIY ideas for used leotard
2. Enables circular economy
3. Uses social interaction to encourage sustainable choices



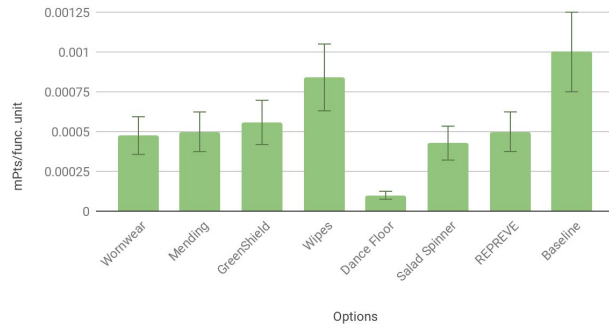
Worn Wear Website

Environmental performance of all finalist ideas were evaluated

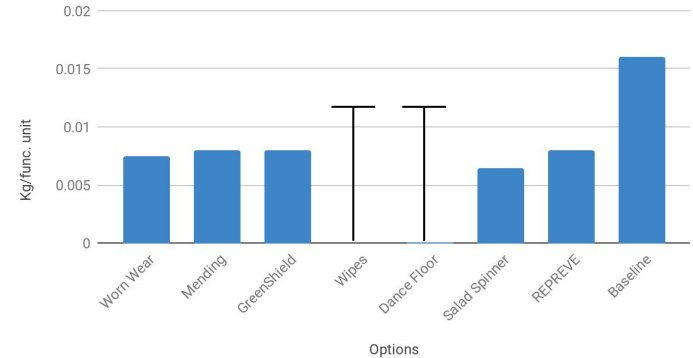
Carbon Impacts



TRACI Score



Carbon Impact for Use Phase



Impacts by Option

	Worn Wear	Mending	GreenShield	Wipes	Dance Floor	Salad Spinner	REPREVE
CO2 Total	0.00803619	0.008424971	0.00937585	0.0053	0.000099125	0.00728693	0.00854042626
CO2 Use Phase	0.007485	0.008014	0.008014	0.008014	0.0000564	0.0064938	0.008012
TRACI Points	0.0004739627	0.0004980347	0.000556763	0.00084	0.000099125	0.000426727	0.000498443744

Decision matrix used to evaluate finalist ideas based on design priorities

Priority	Weight	Worn Wear	Return and Mend	Repreve & anti-microbial	Salad Spinner	Leotard with cleaning wipes	Leotard with Green Shield	Dance Floor Energy Capture
LCA impacts	1	3	3	3	3	2	3	5
Energy reduction	3	3	3	5	4	5	4	5
EOL Treatment	5	5	5	3	3	3	2	4
User experience	5	4	4	4	2	4	2	4
Client preference	4	3	3	5	2	3	4	1
Price	4	3	3	2	3	2	2	1
Wow factor	4	3	3	5	3	3	5	5
Total		93	93	101	72	84	79	88

- Decision matrix evaluates performance of seven finalist ideas
- Performance evaluated on design priorities
- Weights assigned according to priorities of design parameters
- Top three - Return and mend, REPREVE + Anti-microbial, Leotard with cleaning wipes

While some ideas performed better than others, all met design brief requirements

Final recommendations given business and sustainability goals



Return and Mend (Product related service)

1. Return and mending greatly reduces material wastage
2. Value from waste - circular economy
3. Complementary services for customers



REPREVE and Polygiene

1. REPREVE made from recycled plastic bottles
2. Sweat-wicking, water repellency, adaptive warming and cooling
3. Anti-microbial coating polygiene prevents odor from bacteria growing in sweat



Cleaning Wipes

1. Cotton wipes with cleaning detergent can be used in place of washing
2. Completely eliminates washing in machines
3. Carbon footprint associated with use phase is 0

Sources

Title Photo: <https://www.houstonballet.org/seasontickets/2018-19-season/jubilee-of-dance/>

Repreve Graphic: <http://crazyeddiethemotie.blogspot.com/2016/08/repreve-student-sustainability-video.html>

Ending Slide Photo: <http://www.bdsdancestudios.uk/discover-dance/ballet/>

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2. Occupational Employment and Wages, May 2017 27-2031 Dancers. (2017). Bureau of Labor Statistics. <https://www.bls.gov/oes/2017/may/oes272031.htm>
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10. <https://www.bicycling.com/bikes-gear/a20047916/does-polygiene-work/>



Thank You