

Bridget  
Grace Upton

Portfolio

*Sustainable & Ethical  
Fashion Design (MA)*



The  
Sustainable  
Swimwear  
Guide



## Improving the sustainability and durability of performance swimwear through fabric innovation and consumer knowledge.

*How can we align a relationship between the purpose of swimwear and fashions contribution to environmental pollution?*

This paper evaluates the issues within the performance swimwear industry that led to its contribution to environmental pollution. Aiming to create possible solutions through a series of recommendations to industry. The research problems brought to light are, the reliance on synthetic fibres, the rapid deterioration of fabrics and the lack of knowledge from consumers on how to reduce the garments environmental impact. The three main issues that frame these issues are, fabric innovation and sustainable choices, durability and longevity and aftercare of garments.

The study begins using secondary research, in the form of a comprehensive literature review. This dissects the issues at hand and begins to deliberate possible solutions. Gaps in knowledge are identified within the review, in which interviews were conducted to address these gaps. Semi-structured interviews gain first-hand insight from consumers of performance swimwear. A brand analysis is then formulated to ascertain the movements already being made by brands and where they could improve. Finally, all primary and secondary data is analysed so that conclusions can be established.

The findings suggest that there is a lack of communication from brands around aftercare and consumer knowledge is lacking. This leads the researcher to believe that common areas of wear and lack of knowledge, result in premature disposal of swimwear. It is discovered that consumers would be open to a market of sustainable swimwear, that could utilise bio-designed innovation and other design methods. Through fabric innovation the solution of biomimicry and biodesign is explored, as well as recycled fabric alternatives. The suggestion of designing for emotional durability and/or design for disassembly creates a solution to the lack of durability. Finally, improvements in aftercare such as better communication and access to information is recommended.

The suggested audience for this paper concentrates on, brands within the performance swimwear industry, consumers of these products, such as swimmers at any level and researchers of this field.

**Key Words:** *Performance Swimwear, Sustainability, Biomimicry, Biodesign, Biofabrication, Durability, Longevity, Emotional Durability, Aftercare, Care Labels, Fabric Innovation.*

# Abstract

# The History of Swimwear

## All about Modesty

voluminous skirt of victorian era using tightly woven fabrics were hard to move in when water logged.

1800



1

## Invention of The Bikini

The invention of the first bikini. When Louis Reard first designed the bikini it was banned on most beaches. "a bikini isn't a bikini unless it can be pulled through a wedding ring."

1946



3

## Wool Knit

wool is one of the only fibres available to knit with but allows a more flexible fabric than weaving. 1927 the first line of knit swimwear is produced.



2

## Pin-up Curves

Nylon, elastic and jersey came into use, designs moved away from practicality and towards a pin-up girl aesthetic, using boning to accentuate curves.

1950

## CAUGHT FOR SPEEDING



5

## Setting Records

The thong is invented and string bikinis become popular. Speedo adds elastane to suits breaking records in 1972 Olympics. In 1973 German swimmers adopted "skinsuits" that became transparent when wet. Causing outrage, but setting 7 world records.



1960



6 For some reason, the best looking Speedo suits are often worn with accessories.

1970

## Invention of Monokini

The use of Lycra begins, suits became tighter and smaller and bikinis become mainstream. Rudi Genreich invents the monokini.

## The use of Nylon

The 1980s swimsuits can be termed the most athletically inclined in history. High leg and high neck swimsuits became popular. An influx in the use of Nylon, once again popularised by Speedo.

1980

## Invention of The Tankini

The Tankini is invented and popularised by Anne Cole capturing nearly a third of the swimsuit market. The TV show baywatch increases trend in high cut V shaped swimsuits.



7



FAST (body) SKIN

FAST (knee) SKIN

FAST (leg) SKIN

FAST (hydral) SKIN shorts

8

## Speedo's Fastkin

In 2000, Speedo launched the Fastskin suit series that mimicked shark skin. Those suits were approved for the 2000 Olympics, where they helped win 83% of the medals won.

1990

2000

# Framing the problem



### Swimming Bans High-Tech Suits, Ending an Era



Dara Torres wore a swimsuit made by Jaked, an Italian-based manufacturer, at the U.S. Nationals in July. Darron Cummings/Associated Press

By Karen Crouse  
July 24, 2009

ROME In an effort to clean up its sport, the international governing body of swimming will require its athletes to show more skin. By an overwhelming vote Friday at its general congress, FINA officials decided to ban the high-tech swimsuits that have been likened to doping on a hanger.

### Full Body Swimsuit Now Banned for Professional Swimmers

Ban comes after unprecedented number of swimmers set world records.

By KRISTINA WONG  
29 December 2009, 00:49 • 4 min read



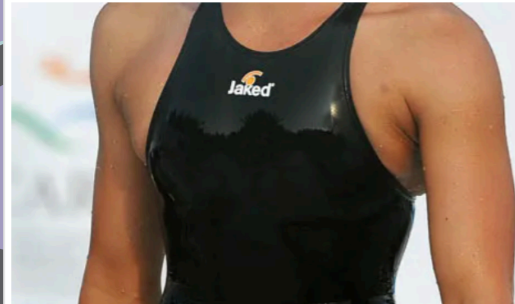
WASHINGTON, Jan. 4, 2010— -- The full body swimsuit made famous by Michael Phelps and other Beijing Olympians in 2008 won't be seen on anywhere on deck this year.

Beginning this year, swimmers are banned worldwide from wearing polyurethane and neoprene suits during competition.

10

### Fina agrees new rule to end swimsuit controversy

- Suits added to rule governing devices in swimming
- 'We felt like that was a good victory' says US coach



French swimmer Coralie Dobrai wears the Jaked swimsuit, which has caused great controversy in recent months. Photograph: Alberto Pizzoli/AFP/Getty Images

A proposal from USA Swimming to rein in swimsuit technology has been approved by Fina's technical congress.

New swimsuits have caused great controversy, with dozens of world records smashed by athletes wearing new designs that have undoubtedly improved performances by significant margins, and many in the sport object to their use. The introduction of the new rule could signal that the debate is moving on towards some sort of conclusion.

The new rule states: "No swimmer shall be permitted to use or wear any device or swimsuit that may aid his speed, buoyancy or endurance during a competition."

11

OUR WORLD

The big Change

## An opportunity to improve textile advancements through natural textiles

After FINA release new guidelines



12



13



14

What are they

# Training Suits



range of motion

durability

chlorine resistance

comfort

fewer sizing options

# Racing Suits



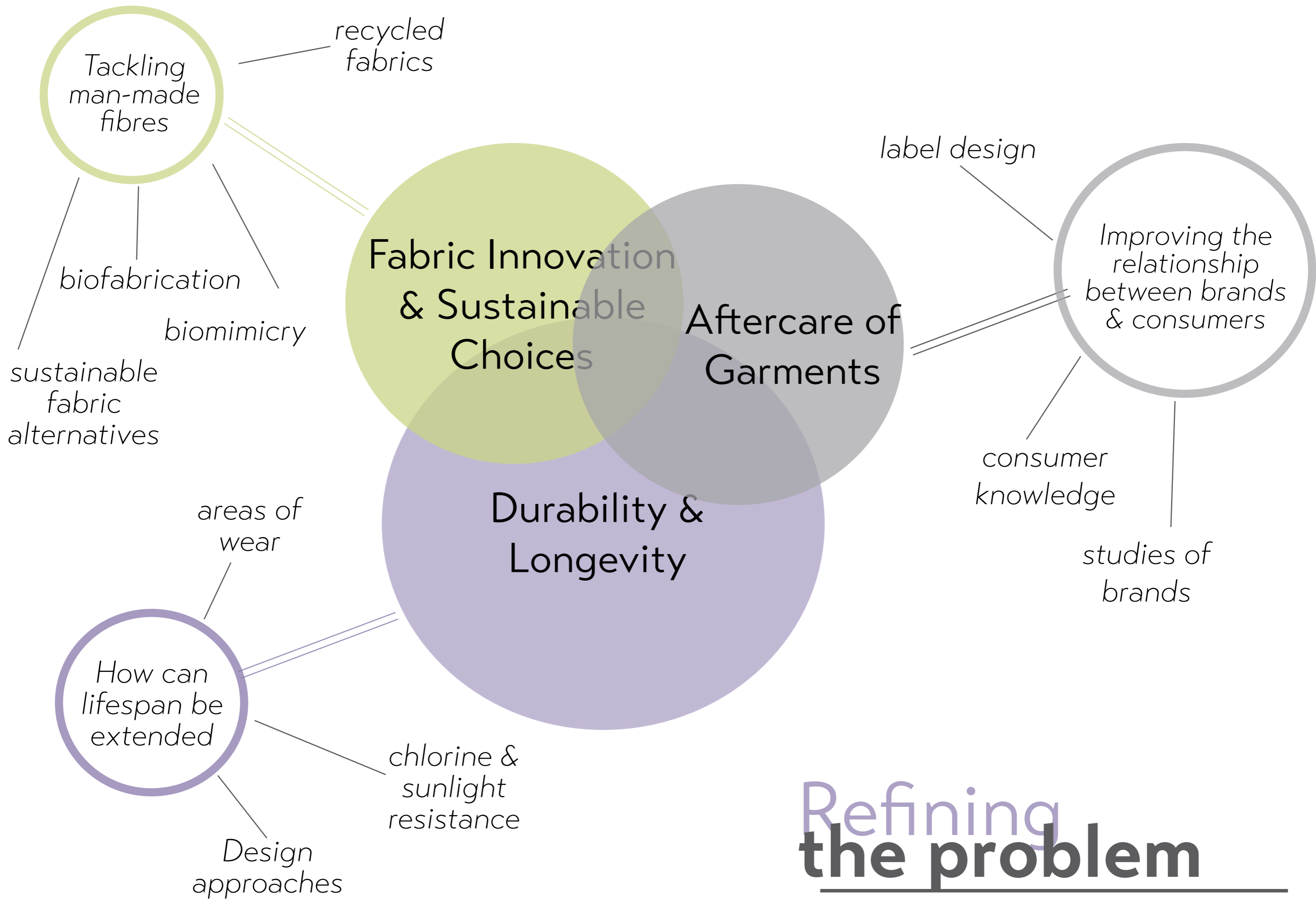
high compression

technology

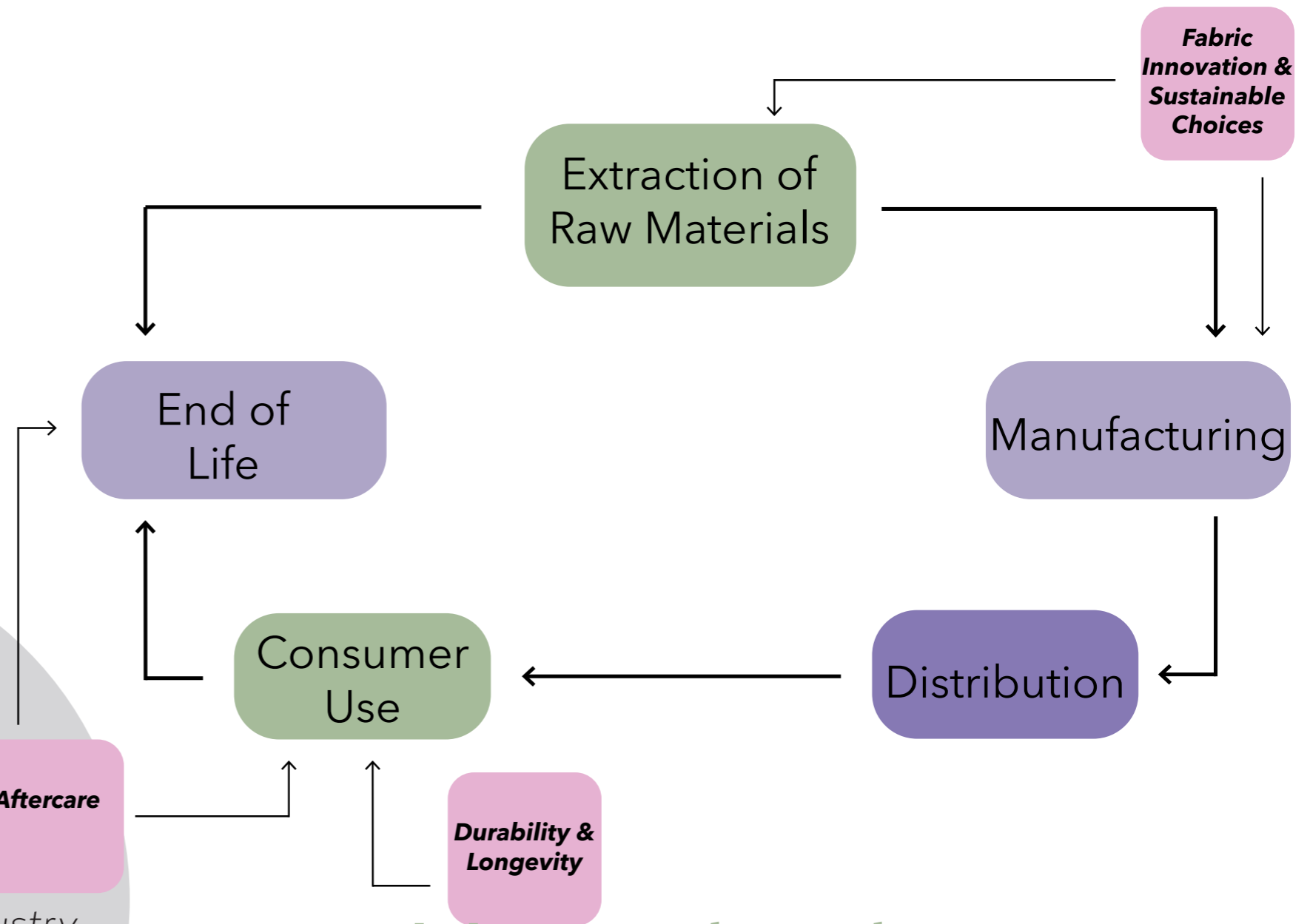
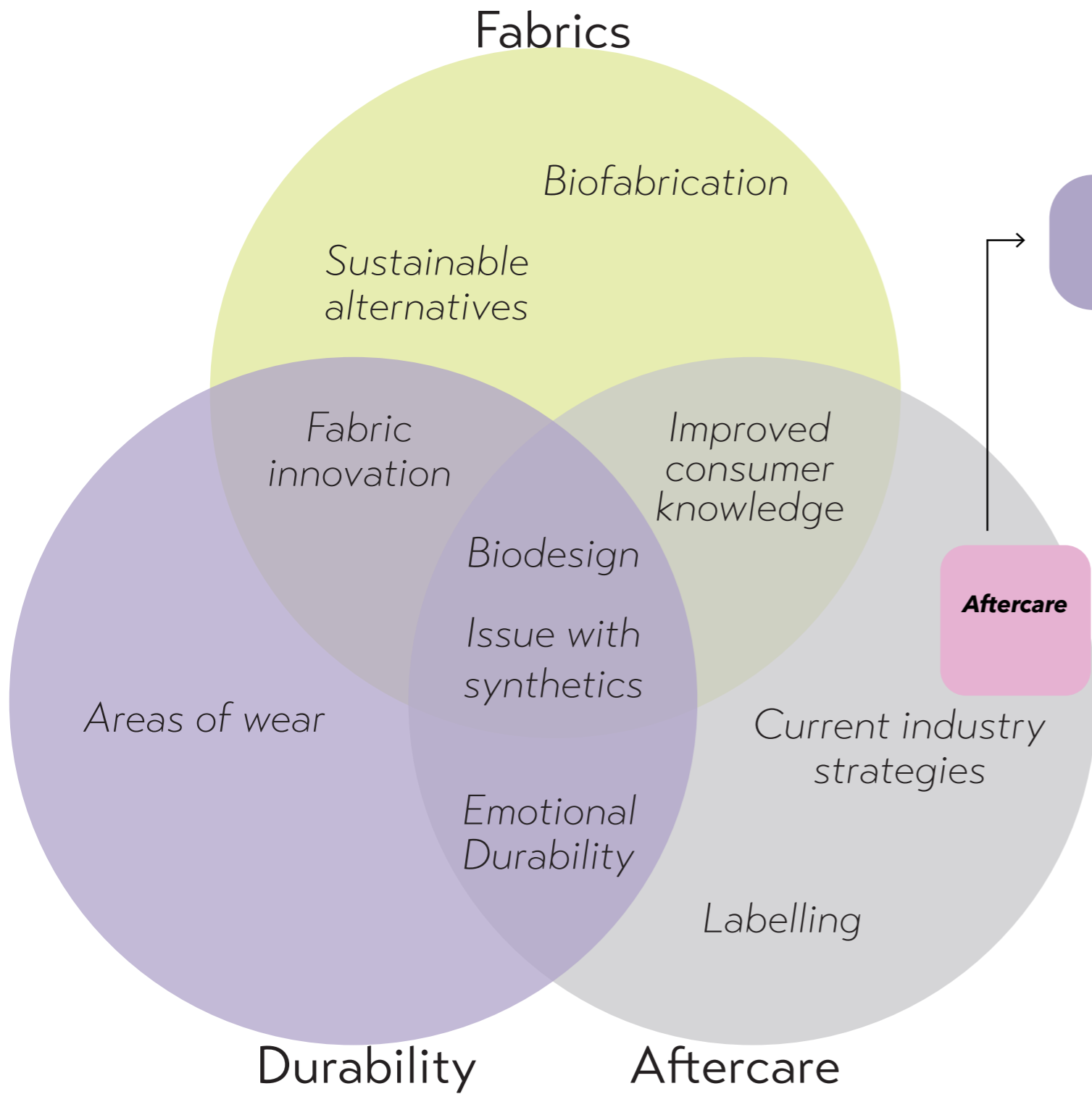
chemical coatings

drag reduction

water resistance



# How do these topics relate?



How do these topics fit into the product life-cycle?



# Why

## Why is Research Needed?

*Lack of knowledge on how to care for swimwear.  
Lack of sustainability in performance swimwear industry.  
Lack of responsibility or acknowledgement for sustainable swimwear.*

## Broader Discourse

*Influence brands to improve on fabric choices, chemical coatings and move towards using nature as a model.*

# Purpose

## Key Issue

*Sustainability & care of performance swimwear. - manufacturing pollution, sea pollution, micro fibre pollution.*

## Primary Purpose

*To reduce negative impact & improve sustainability of performance swimwear.*

## Aim to Achieve

*Inform & reduce use of synthetic fabrics.  
Improve consumer knowledge around after-care of swimwear.*

# Purpose

# Audience

## Outcome Audience

*Swimmers and swimwear manufacturers*

## Secondary Audience

*Swimwear brand & manufacturers*

## Primary Audience

*Swimmers - professional & amateur*

# Beneficiaries

## Overall Beneficiaries

*Swimmers, brands, sea life, natural world, garment workers, people living in developing countries.*

## Groups/Individuals

*improve the life of swimwear therefore benefitting swimmers.  
Improve lives of garment workers and people worst affected by climate crisis.*

# Bio-Inspired

## 1. Nature as a Model

- "where nature is imitated or used as a source of inspiration for designs and processes to solve human problems, e.g. a solar cell inspired by a leaf."

## 3. Nature as a Mentor

- "where nature is viewed and valued in a new way. It introduces an era based not on what we can extract from the natural world, but on what we can learn from it, e.g. developing solar technology that can be installed close to point of use, rather than developing desert wilderness areas into solar panel farms."

## 2. Nature as a Measure

- "where nature is used as an ecological standard to judge the 'rightness' of our innovation, e.g. considering how much energy (and what type) does the solar panel use in its production and whether the energy it saves during use justifies this investment."

'the only way to keep learning from nature and its wellspring of ideas is to safeguard its naturalness'

(Benyus, 2009)

Fabric Innovation  
& Sustainable Choices

# Fabric Innovation & Sustainable Choices

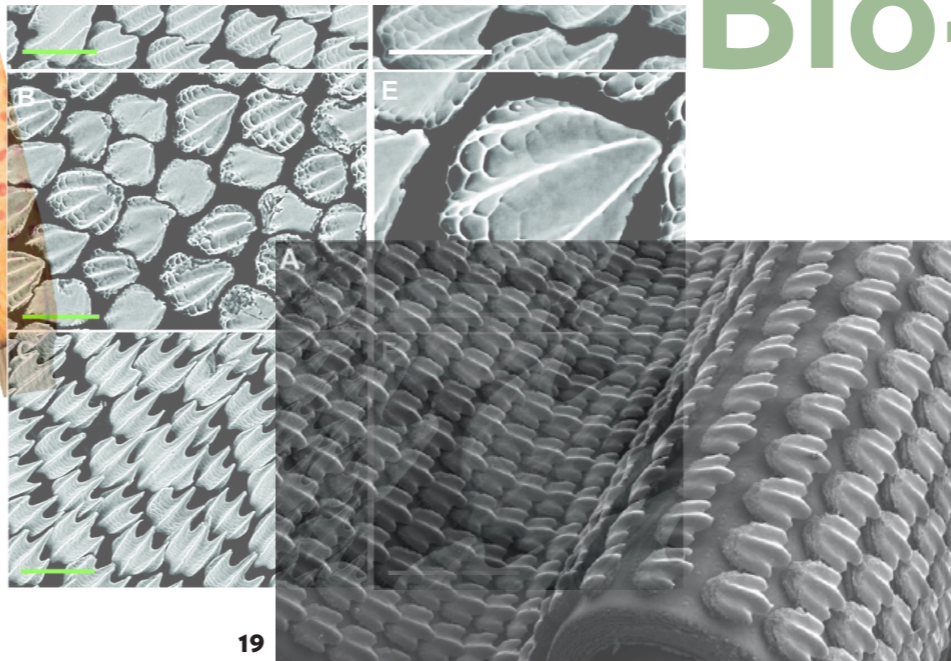
17



*"If we applied the same energy as we do suppressing life, towards cultivating life we'd turn the urban jungle into one that thrives and embodies the living world." (Lee, 2019)*



18



19

# Biofabrication

Bio-based  
Biomimicry

Biodesign

# Issues with Durability

## 1. Physical Durability

this can be choosing fabric that can handle wear and tear and is sturdy, but also enabling repair. Enabling repair could be allowing extra seam allowance, providing buttons and threads and clear label instructions

## 2. Style Durability

the garment should be carefully designed. The colours should be intentional and the shape and fit considered and precise, the garment cannot be designed to fit a fad, or trend of the moment, it should be timeless.

## 3. Emotional Durability

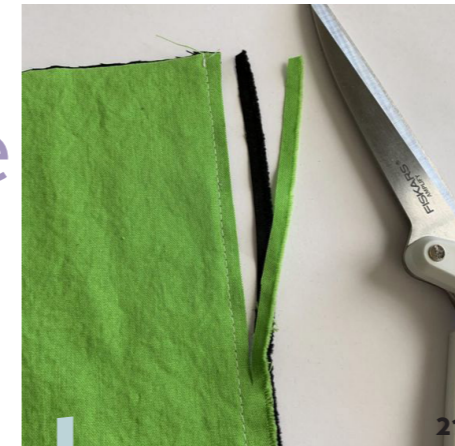
although not as easy to design for, it is designing with a user-centred approach to bring joy to the consumer

Physical Durability  
Timeless



20

Enabling Repair  
Shape



21

Colours  
User Centered  
Care Labels  
Considered



22

Emotional Durability  
Precise  
Durability

“Garments could represent an accomplishment and include the effort invested”

(Niinimäki & Armstrong, 2013)



“emotional durability: how to make everyday items both functional and emotionally compelling enough that people want to hold on to them longer.”  
(Spanne, 2015)



23

24

Emotional  
Durability




25



26

# Aftercare Of Garments



27


Words: Madeleine Hill  
Category: In the Know  
Published: 27 Aug 2021

## How to Take Care of Your Clothes: The Ultimate Guide to Clothing Maintenance

Share for change

We all know the fashion industry carries a hefty environmental footprint. From systemic and supply issues to the treatment of animals and people, much work is needed to clean up our clothing production. As individual citizens and purchasers of clothing, we are inherently woven into, and can't discount, our role in fashion's footprint on the planet. Thankfully, there are big and small actions we can take to help the situation: some obvious, some subtle. But one crucial part of the sustainability puzzle of our wardrobes is how to care for our clothes, since keeping them around for as long as possible is one of the best things we can do to reduce their impact!

Whether your clothes are new or second hand, caring for them requires understanding, consideration, and sometimes a little bit more time to ensure your clothing maintenance routine is the best it can be. This is crucial to maximising and expanding the life of our garments, which will save some pennies as well! Here is our go-to list for how you can win at clothing care.




## patagonia

Shop Activism Sports Stories


### Product Care 101

Laundry, stains and fabrics that are sometimes pains. These are all the nifty tricks that'll keep your gear in great shape—well into its vintage years.



How do I wash this?

Laundry

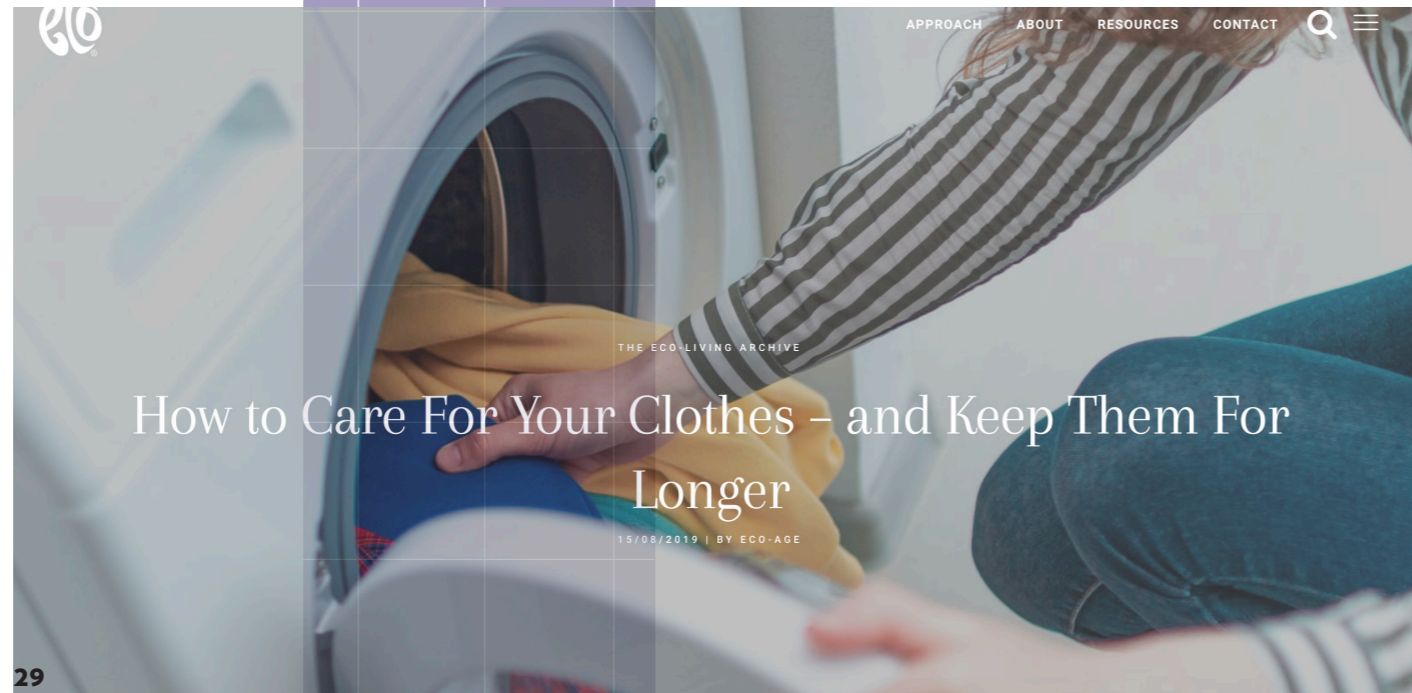
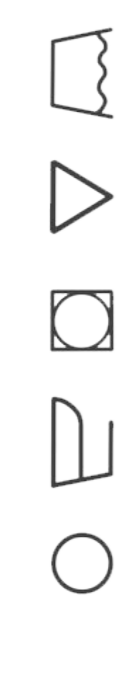


Help, this stain won't come out.

Stain Removal

28

Brands often use care labels as a form of protection of their brand, to reduce returns, rather than using it as an informative tool.



29

THE ECO-LIVING ARCHIVE

## How to Care For Your Clothes – and Keep Them For Longer

15/08/2019 | BY ECO-AGE

(Webb, 2020)

# Caring for your clothes guide

by birdsong

30

# Interview Themes

## Relationship with Swimwear

- 1** Factors of Choosing Swimwear
- 8** Emotional Attachment
- 6** Willing to change Attitudes

## Consumer Knowledge on Sustainability

- 2** Usage
- 4** End of Life

## Responsibility

- 5** Responsibility

- 7** Hierarchy of Influence

## Durability

- 3** Deterioration

Findings & Discussion

# Care Labels

## Washing Habits

End of Life

“all that my mom ever told me, you should get it out when you get home, wash it in the sink, hanging up to dry, don't leave it sitting in chlorine”

None of the participants had ever sought out information on caring for their swimwear

The Theme

The Code

Specific Responses

Consumer Knowledge on Sustainability

Usage

End of Life

Never looked at a care label

Doesn't understand care labels

Washing Habits

Doesn't know how to dispose of swimwear

Bin swimwear



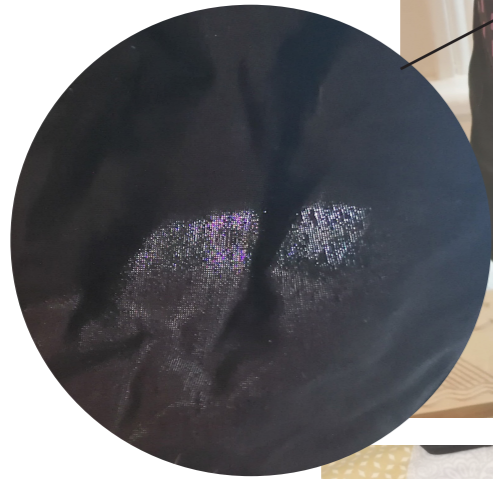
31

aftercare isn't easy to find.



# Are there any areas you find show deterioration first?

'the white starts to come through'



loss of elasticity



fabric pilling and wear on bum area



Comparison of very worn costume (left) and newer costume (right)



"it gets furry on the bum"



# Interview Findings

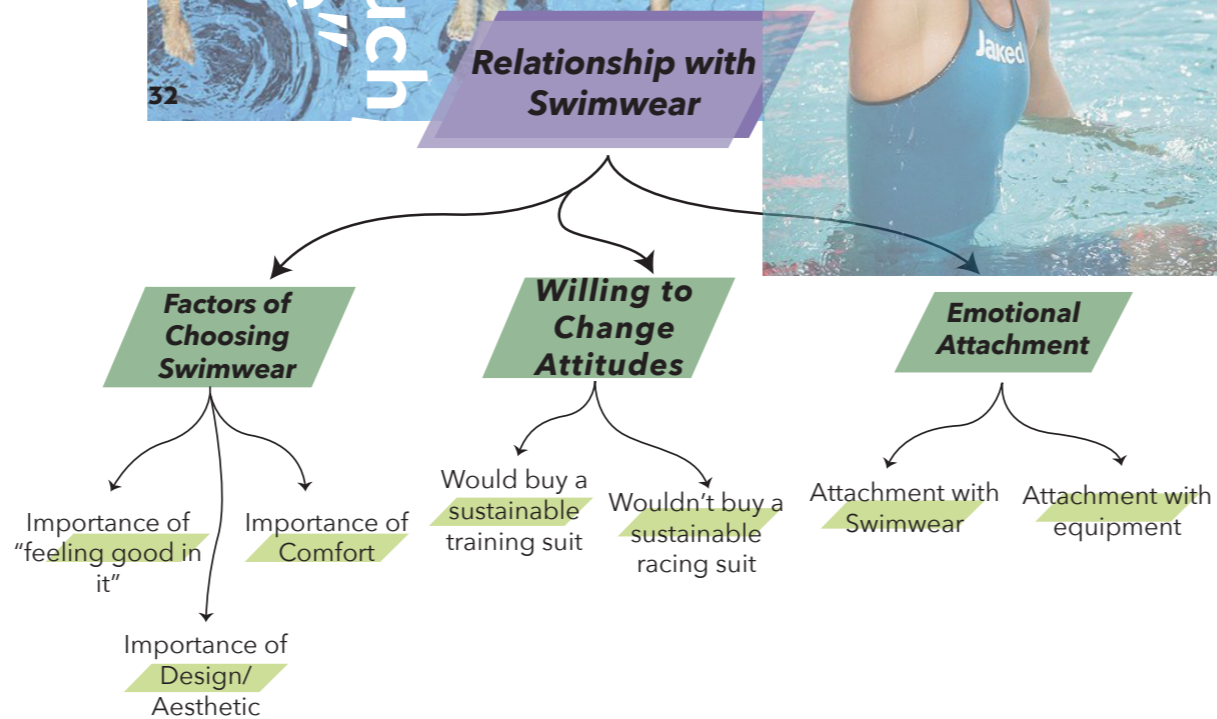
Comfort

Design/Aesthetic  
'Feel Good'

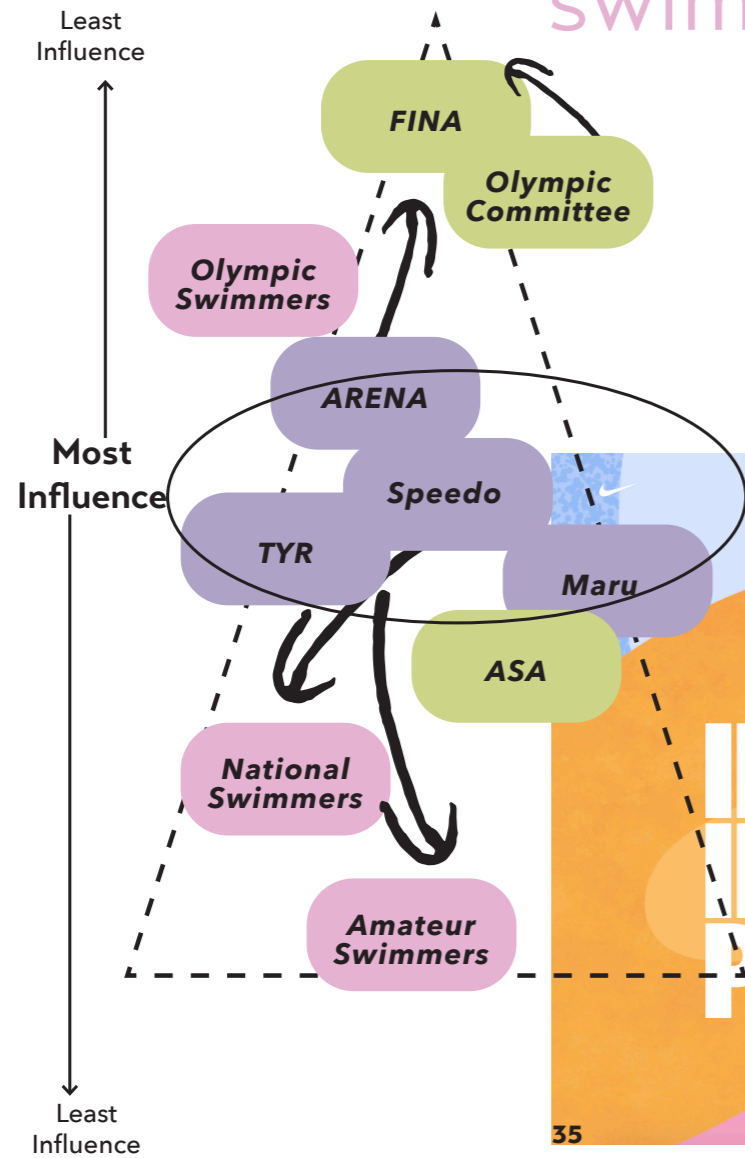
if you can't swim comfortably without exposing yourself it isn't fitting its purpose.



*"even if its maybe not in as good condition anymore, sometimes it doesn't matter how good the quality is, it's about how it makes you feel mentally"*



not only could well-known swimmers be advocates for sustainability, but so could any swimmer at any level.



# Responsibility

INVESTING  
IN OUR  
PLANET



brands held the most responsibility

# Analysis Of Brands

1  
Little to no information addressing issue, no transparency.

1

2

2  
Some information and transparency, little action.

3

3  
Some actions, some transparency.

4

4  
A lot of transparency and information, significant action.

5

5  
Complete transparency, taking action required to make change.

## Nike

	0	1	2	3	4	5
Use of recycled fabrics						
Use of other eco-friendly fabrics						
sustainability goals for the future						
water & chemical usage						
Labour Standards						
Supply chain transparency						
Carbon Footprint/Goals to reduce carbon footprint						
Accessible aftercare information						

## Arena

	0	1	2	3	4	5
Use of recycled fabrics						
Use of other eco-friendly fabrics						
sustainability goals for the future						
water & chemical usage						
Labour Standards						
Supply chain transparency						
Carbon Footprint/Goals to reduce carbon footprint						
Accessible aftercare information						

## TYR

	0	1	2	3	4	5
Use of recycled fabrics						
Use of other eco-friendly fabrics						
sustainability goals for the future						
water & chemical usage						
Labour Standards						
Supply chain transparency						
Carbon Footprint/Goals to reduce carbon footprint						
Accessible aftercare information						

## Speedo

	0	1	2	3	4	5
Use of recycled fabrics						
Use of other eco-friendly fabrics						
sustainability goals for the future						
water & chemical usage						
Labour Standards						
Supply chain transparency						
Carbon Footprint/Goals to reduce carbon footprint						
Accessible aftercare information						

## Funkita

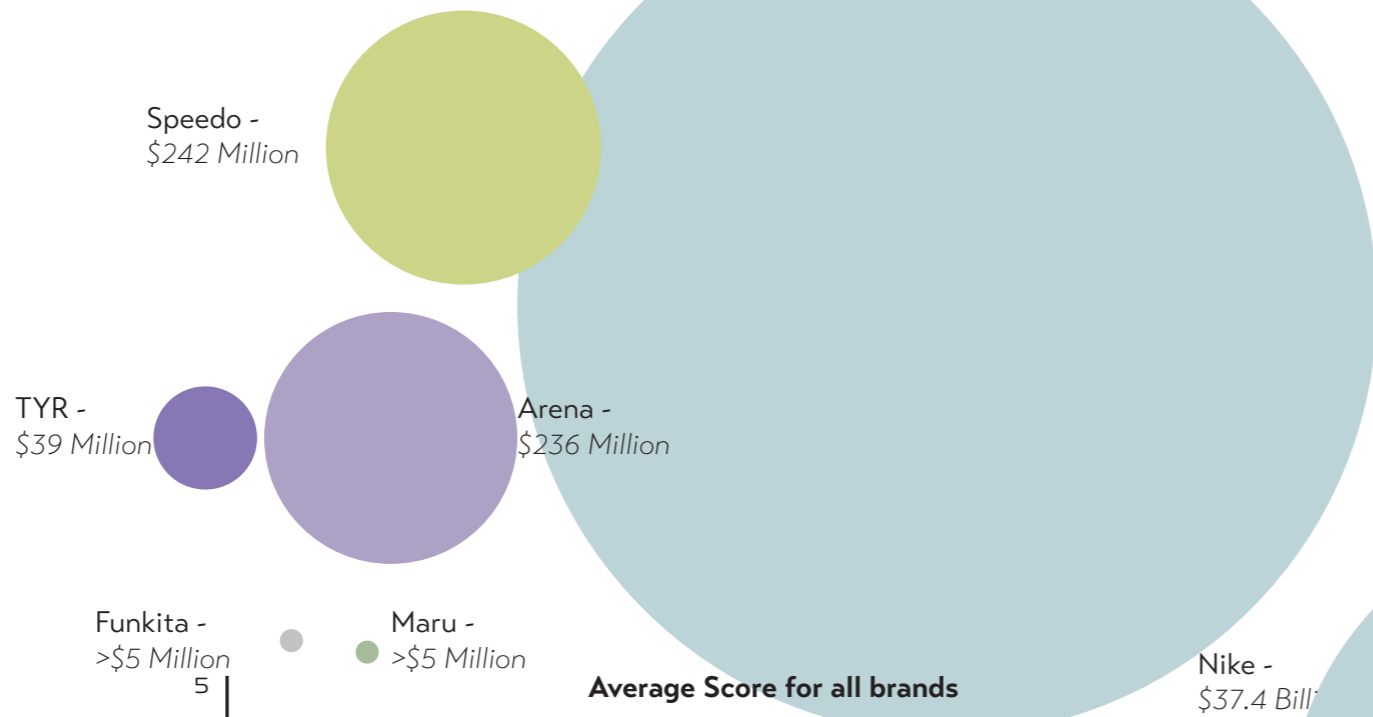
	0	1	2	3	4	5
Use of recycled fabrics						
Use of other eco-friendly fabrics						
sustainability goals for the future						
water & chemical usage						
Labour Standards						
Supply chain transparency						
Carbon Footprint/Goals to reduce carbon footprint						
Accessible aftercare information						

## Maru

	0	1	2	3	4	5
Use of recycled fabrics						
Use of other eco-friendly fabrics						
sustainability goals for the future						
water & chemical usage						
Labour Standards						
Supply chain transparency						
Carbon Footprint/Goals to reduce carbon footprint						
Accessible aftercare information						

# Analysis Of Brands

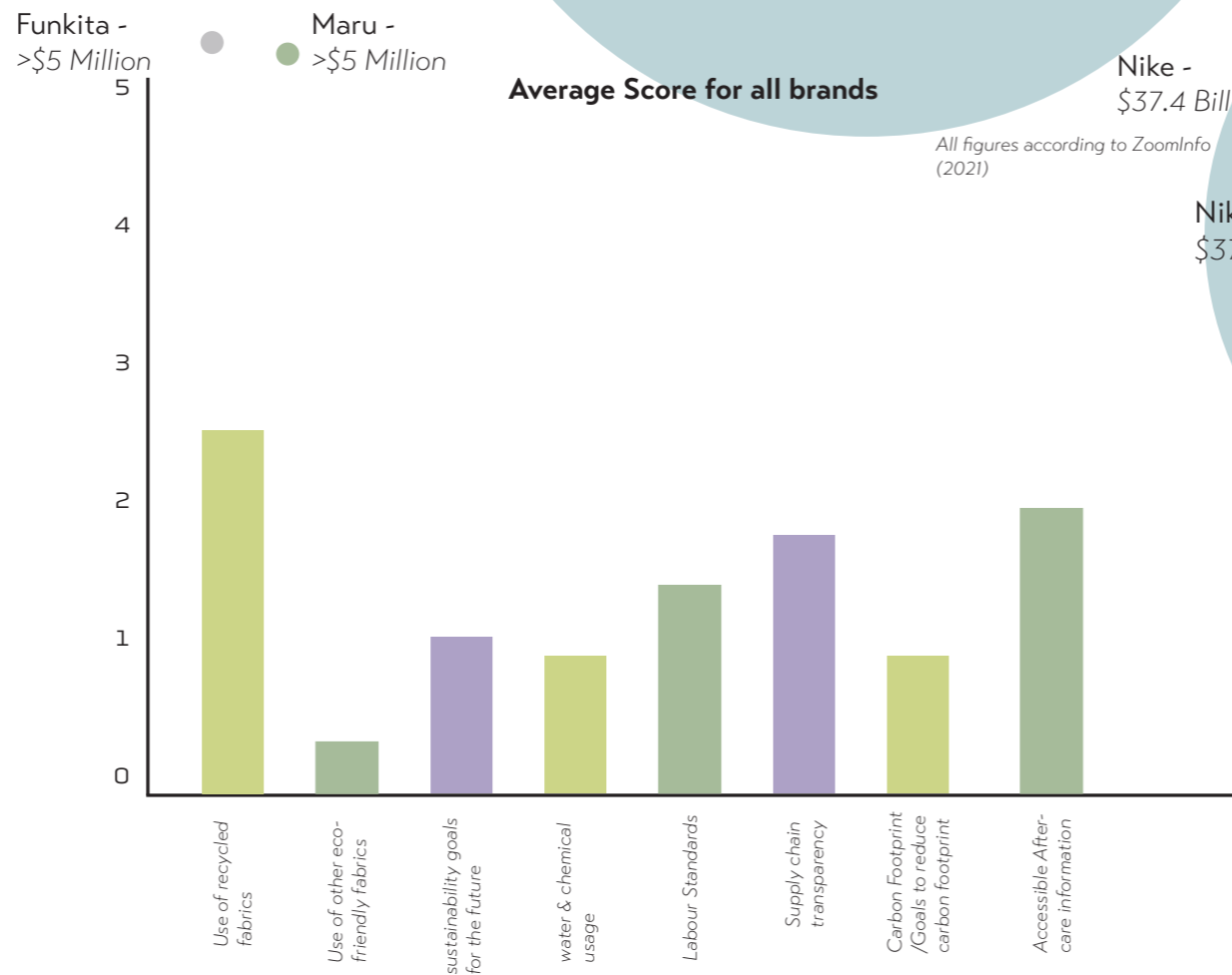
## Estimated Revenue of Brands



bigger brands proved to have more transparency, they didn't necessarily have sustainable solutions implemented

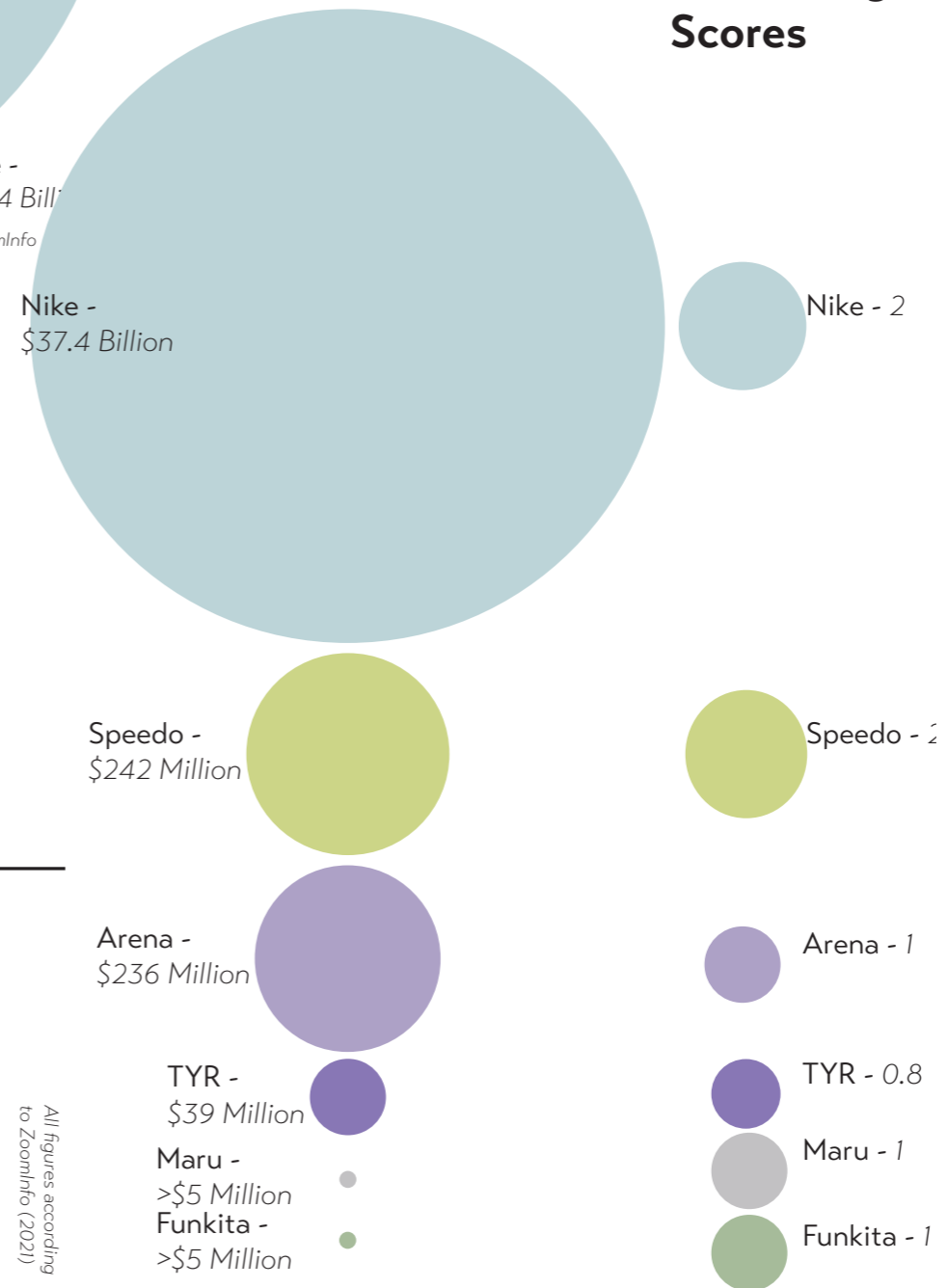
## Brands Revenues

## Brands Average Scores



All figures according to ZoomInfo (2021)

All figures according to ZoomInfo (2021)



low score for brands developing biodesigned or eco-friendly fabric options

# Recommendations for Industry

1.

Provide aftercare information that is specific to individual products and fabrics and is easily accessible to consumers.

2.

Improve the communication of aftercare from brands to consumer, specifically provide links between the physical garment and the information online.

3.

Implement upcycling and recycling schemes to reduce waste and increase awareness on how to dispose of swimwear in more sustainable way.

4.

Create a balance between designing for function, comfort and aesthetics. A bigger differentiation between the needs of a training costume and a racing costume could improve this.

6.

Invest in biodegradable and/or bio-based fabric innovation. Move away from the reliance on virgin synthetic fibres and revolutionise sustainable fabric solutions.

8.

Lead the way in change, take responsibility for action and devise strategies to encourage others to do the same.

5.

Implement different design strategies such as designing for disassembly, design through biomimicry and biodesign and designing for emotional durability.

7.

Be mindful within sponsorship deals, reduce the amount of free product sent out. Create a more meaningful relationships with athletes to promote sustainability, rather than capitalise on overconsumption.

Recommendations

# References

1 - Vintagedancer.com (2018) 1950s Bathing Suits, Swimsuits History. [online] Available at: <https://vintagedancer.com/1950s/1950s-bathing-suits/> (Accessed: 25 February 2021).

2 - HISTORY (2021) Bikini introduced. [online] Available at: <https://www.history.com/this-day-in-history/bikini-introduced#:~:text=Made%20out%20of%20a%20scant,named%20after%20the%20Bikini%20Atoll.> (Accessed: 25 February 2021).

3- Bohra, R. (2017) 1940's Swimwear. [online] Medium. Available at: <https://medium.com/@riabohra9196/1940s-swimwear-cca03eca4513> (Accessed: 25 February 2021).

4 - No Name (2018) rudi-gerreich-monokini-1964-60s. Available at: <https://www.mkcshop.com/p/?iid=239714157&pr=78.99> (Accessed: 6 January 2021).

5 - Wolfcale, H., (2014) The History of Swimwear. [online] SwimSwam. Available at: <https://swimswam.com/the-history-of-swimwear/> (Accessed: 25 February 2021).

6 - Michelle Persad (2014) Your Classic Speedo Started Off As Something Much More Risqué. Available at: [https://www.huffingtonpost.co.uk/entry/history-swimsuit-speedo\\_n\\_5717549](https://www.huffingtonpost.co.uk/entry/history-swimsuit-speedo_n_5717549) (Accessed: 6 January 2021).

7 - Rex (no date) Nicole Eggert Baywatch. Available at: <https://www.dailystar.co.uk/pics/pictures/gallery/baywatch-stars-then-now-18754757> (Accessed: 6 January 2021).

9 - Gamma Rapho (1946) Micheline Bernardini wearing the first bikini designed by Louis Réard. Available at: <https://en.bikiniartmuseum.com/news-presse/provokativ-so-feministisch-der-bikini-hat-geburtstag> (Accessed: 6 January 2021).

8- Oacas Innovations (no date) Speedo FastSkin LZR Racer. Available at: <https://oacasinovations.weebly.com/background.html> (Accessed: 6 January 2021).

9 - New York Times <https://www.nytimes.com/2009/07/25/sports/25swim.html>

10 - ABC - <https://abcnews.go.com/Politics/full-body-swimsuit-now-banned-professional-swimmers/story?id=9437780>

11 - The Guardian - <https://www.theguardian.com/sport/2009/jul/23/swimming-suits-rule-fina#:~:text=A%20proposal%20from%20USA%20Swimming,approved%20by%20Fina's%20technical%20congress.&text=The%20new%20rule%20states%3A%20%22No,or%20endurance%20during%20a%20competition.%22>

12 - Ptarmigan - Available at: <http://www.ptmgn.com/contact-3/> (Accessed: 8 January 2022).

13 - unknown

14 - Speedo team - Maher, M. (2019) 'The Impact of Invention on Sport' Lemelson Centre. Available at: <https://invention.si.edu/impact-invention-sport> (Accessed: 10 January 2022).

15 - Swimsuit red - <https://www.swimoutlet.com/pages/what-the-pros-wear>

16 - <https://www.swimoutlet.com/pages/what-the-pros-wear>

17 - Eco Fashion Talk - Available at: <http://www.ecofashiontalk.com/2016/05/biofabricate/> (Accessed: 16 January 2022).

18 - "biofabrication" - Available at: [https://www.ted.com/talks/suzanne\\_lee\\_why\\_biofabrication\\_is\\_the\\_next\\_industrial\\_revolution#t-680058](https://www.ted.com/talks/suzanne_lee_why_biofabrication_is_the_next_industrial_revolution#t-680058) (Accessed 15 July 2021).

19 - Biomimetic shark skin - Wen, L., Weaver, J. and Lauder, G. (2014) Biomimetic shark skin: design, fabrication and hydrodynamic function. *Journal of Experimental Biology*, 217(10), pp.1656-1666.

20 - Craft- <https://medium.com/@zady/the-lost-craft-of-care-aac6b243cd51>

21 - Seam Allowance - <https://www.peekaboopages.com/2020/03/reducing-bulk-how-to-trim-grade-notch-and-clip-seam-allowances.html>

Figure - Care Symbols - <https://theconceptwardrobe.com/care-label-symbols-what-do-they-mean>

22 - Patagonia Repair - <https://eu.patagonia.com/gb/en/stories/mending-life/story-113746.html>

24 - Team winning - <https://i.pinimg.com/originals/98/6f/2f/986f2ff6ad52bb2f8dfdf3c29b9eed0c.jpg>

25 - Team winning 2 - <https://i.pinimg.com/originals/9b/9c/9f/9b9c9f67769fdf1b7925058bda6a8232.jpg>

26 - Patagonia - X, C., (2021) Patagonia - Worn Wear Program | Circular X. [online] Circularx.eu. Available at: <https://www.circularx.eu/en/cases/34/patagonia-worn-wear-program> (Accessed 3 August 2021).

27 - Good on you - <https://goodonyou.eco/caring-for-your-clothes/>

29 - eco age - <https://eco-age.com/resources/how-care-your-clothes-and-keep-them-longer/>

30 - birdsong - [https://www.instagram.com/p/CEV8xI3Bzka/?utm\\_source=ig\\_embed](https://www.instagram.com/p/CEV8xI3Bzka/?utm_source=ig_embed)

31 - Clothing line - <https://www.swimoutlet.com/blogs/guides/how-to-care-for-your-swimwear>

32 - team mates [https://www.arenasport.com/en\\_row/](https://www.arenasport.com/en_row/)

33 - Athlete winning - <https://www.swimoutlet.com/pages/what-the-pros-wear>