WILL FASHION DYE ANOTHER DAY?

WATER-RELATED FINANCIAL RISKS IN THE TEXTILES SECTOR

TRACKER REPORT DECEMBER 2020

Planet Tracker

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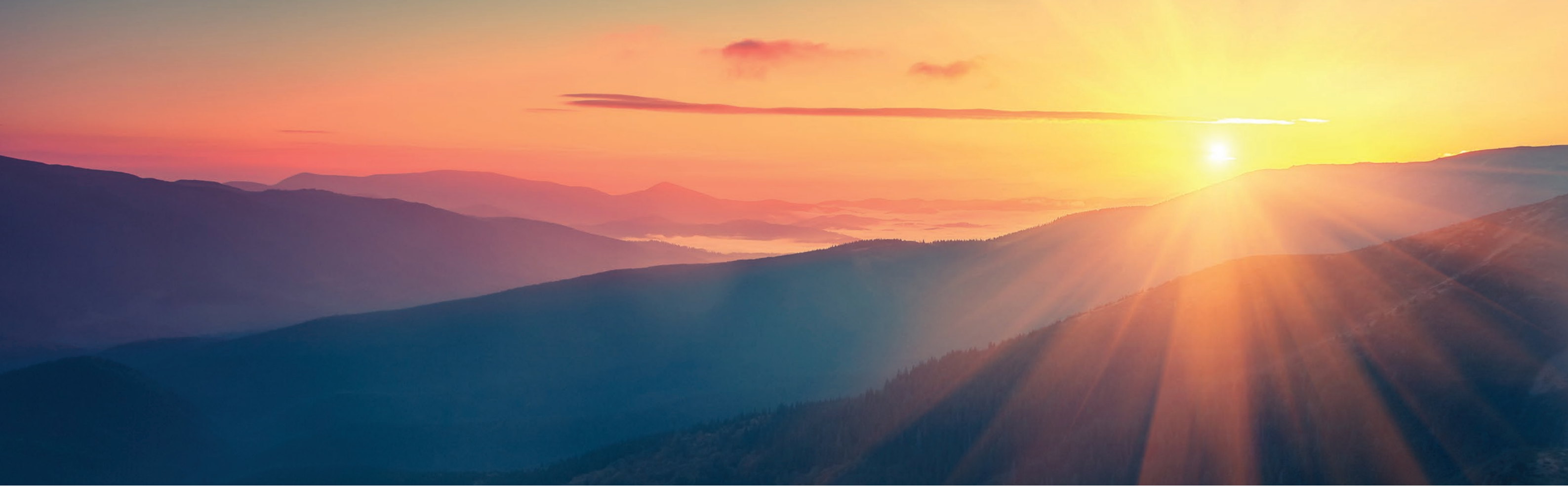

ABOUT PLANET TRACKER

Planet Tracker is a non-profit financial think tank aligning capital markets with planetary limits. It was created to investigate the risk of market failure related to environmental limits. This investigation is primarily for the investor community where environmental limits, other than climate change, are often not aligned with investor capital.

Planet Tracker generates breakthrough analytics to redefine how financial and environmental data interact with the aim of changing the practices of financial decision makers to help avoid both environmental and financial failure.

TEXTILES TRACKER

Textiles Tracker investigates the impact that financial institutions have in funding publicly listed companies across the Textiles, Apparel & Luxury Goods sector.

Fast Fashion has created cheap and abundant clothing globally, but the natural capital cost has been high, with toxic production practices, degradation of natural resources, massive and growing waste as well as labour injustice. By providing information and analysis on these problems, placing a value on them and quantifying the negative impact on profits and investor returns, Textiles Tracker will support and stimulate a transition to greater sustainability in the industry. Textiles Tracker will find the points in the textiles supply chain that are creating the greatest damage, analyse their financial value, provide transparency of ownership and, through owners and investors, seek to create pressure for change in industry practices.

This report focuses on the financial risks arising from the extensive use and misuse of water in the wet processing stage of clothing production, with much of the global production effort situated in areas where water stress and the associated risk is already high.

Textiles Tracker is a part of the wider Planet Tracker Group of Initiatives.

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Laudes Foundation H&M FOUNDATION

WATER as a **NATURAL CAPITAL ASSET** is fundamental to the production of **TEXTILES** and is increasingly becoming stressed as a result of climate change, inefficient use and untreated disposal.

EXECUTIVE SUMMARY

The fashion industry is gaining notoriety for the disproportionate harm it does to the environment. However, fashion brands and investors can exercise their significant influence to ensure that the industry transitions to more sustainable practices.

Water (a natural capital asset) is fundamental to the production of textiles and is increasingly becoming stressed as a result of climate change, inefficient use and untreated disposal. 'Wet processing' companies are impairing this natural capital resource (through dyeing, heating bleaching and use of toxic chemicals). Fashion brands motivate supplier behaviours through their buying practices, but opaque and complex supply chains make it hard to link the fashion brands driving the production process to the wet processing companies causing the harm.

In this report we discuss our methodology for linking the factory location water risk embedded in the wet processing companies to the investors standing behind them. We also highlight the fact that the wet processing companies may struggle to fund a transition to a more sustainable approach (in contrast to the fashion brands which are financially stronger). We question whether water risk is fully priced in by investors in wet processing companies. Our methodology can be used by investors to make their own assessment of water-related risks in their portfolios using freely available databases.

- In this report we focus on water and the risks to which wet processing companies (and those directly investing in them) are exposed. Water is one of the natural capital assets that is essential for the production of textiles (we estimate 430 litres of water are required to produce 1kg of textile fabric) and is particularly at risk of depletion as a result of the unsustainable methods currently in use. There are other issues to address with respect to textile production, consumption and disposal, such as GhG emissions, toxic chemical pollution and micro-plastics, which we will return to in future reports.
- Investors are also indirectly exposed to the risks we discuss in this report (and the other environmental harms being caused by the textiles supply chain) through their fashion brand investments, but the opaque and complex nature of textiles supply chains has prevented us from analysing the details of these links in this report.
- Planet Tracker has identified 740 publicly listed companies directly involved in wet processing activities. The majority of their factories are based in emerging markets (principally India, Pakistan and China). By layering wet processing factory geolocation data and water risk scores from WRI's Aqueduct 3.0 tool, we have assigned water risk scores to this basket of companies, highlighting the level of water related risks to which they are exposed.
- We have linked 230 of these wet processing companies with a combined market cap of USD 586 billion to investors. 51 companies worth USD 29 billion rank 'Extremely high' or 'High' on WRI's water risk scale, indicating the magnitude of the risks embedded in the fashion brands' supply chains.

- Individual investors and families are heavily exposed to water risk. 67% of those we identified in this category (with an aggregate investment of USD 8 billion in wet processing) are exposed to ‘extremely high’ or ‘high’ water risks.
- Asset managers hold wet processing investments worth USD 20 billion with medium-high investment risk (with Pzena, Diamond Hill, Wellington and Vanguard at the top of the list).
- Wet processing companies are financially weaker than the fashion brands at the end of the supply chain and may struggle to fund a transition to a more sustainable approach to textiles production. They have an average return on assets of 6.7%, an average EBIT margin of 7.7%, an average debt/equity ratio of 1.2x and a net debt to EBITDA ratio of 2.2x, compared to the fashion brands we reviewed where the figures were 9.4%, 10.2%, 1.0x and 1.3x respectively.
- Our analysis suggests that the average wet processing company will find it harder to withstand the costs that could arise if water and/or other environmental risks begin to crystallise in financial/regulatory terms than the fashion brands driving the production process.
- Fashion brands have an opportunity to prove their sustainability credentials by engaging with their supply chains and using their relative financial strength to support their suppliers’ efforts to transition to more sustainable techniques. As an illustration, we estimate that a 50bp (basis points) cut to average EBIT margins (while maintaining retail prices) could allow payments to the textiles supply chain to increase by approximately USD 220 million.
- Investors have a crucial role to play in encouraging the textiles industry to become more sustainable and to do so rapidly enough to meet the Paris climate goals by 2050.
- Many wet processing companies are controlled by entrepreneurs and families, reducing the extent to which other equity investors can influence their strategic direction. But with an aggregate of USD 55 billion of debt on their balance sheets there is a clear opportunity for lenders and debt investors to directly exercise their influence.
- Investors should demand higher quality data from all the companies involved in the industry, but particularly from the fashion brands, with respect to supply chain visibility, environmental accountability and product traceability, so that they can better quantify the risks to which they are exposed.

CALL TO ACTION

FASHION BRANDS

Supply chain transparency and verification

Fashion brands need to extend their supply chain disclosures beyond Tier 1 suppliers to ensure they are environmentally accountable and verifiable, so that investors, lenders and customers can fully understand the environmental costs and risks associated with producing textiles. Fashion brands need to take the lead in this since they direct the industry through their buying processes and contractual arrangements. Equally, wet processing companies can (and should) independently disclose the steps they themselves are taking to reduce their environmental footprint.

Actions speak louder than policies

Fashion brands need to take greater responsibility for their supply chains. Their buying behaviour and risk-based due diligence[1i] drives the behaviours throughout the supply chain. The share price reaction to the supply chain failings experienced by boohoo group plc in 2020 indicates that investors (and potentially customers) no longer regard the legal separation between the brand owners and their various suppliers as a sufficient excuse to absolve the brand owners from responsibility[2].

Fashion brands should align their buying with their sustainability policies and OECD guidelines, support their suppliers to provide verified environmental data disclosures and publish the results.

Brands should support a just transition in the supply chain

Fashion brands should devote some of their considerable financial resources[3] to supporting their suppliers' efforts to transition to more sustainable practices by investing in new equipment and innovative techniques, while ensuring jobs and communities are supported through the process. By way of illustration, a 50bp reduction in the average fashion brand EBIT margin (while maintaining retail prices) could theoretically allow payments to the supply chain to increase by approximately USD 220 million.

Financial support could also be provided by structuring longer contractual commitments throughout the supply chain with consistent payment terms, facilitating investment by the wet processors themselves.

ASSET MANAGERS, OWNERS AND LENDERS

Investors and lenders have a key role to play in encouraging fashion brands to take the actions set out above. Investors directly exposed to publicly listed textile companies engaged in wet processing have an opportunity to directly engage these companies to mitigate the multitude of water related risks we have outlined in this report.

[1] The OECD has published detailed Responsible Business Conduct guidelines for multi-national enterprises setting out the 'expectation that businesses – regardless of their legal status, size, ownership or sector – contribute to sustainable development, while avoiding and addressing adverse impacts of their operations including throughout their supply chains and business relationships.'

[2] We discuss the boohoo case in more detail later in the report. Their share price fell 46% in the 10 days following press reports that boohoo suppliers had been failing to pay their workers the required UK minimum wage.

[3] Our analysis in this report suggests that fashion brands are financially stronger than the wet processing companies (on average), but the range is obviously wide – some fashion brands will be less well-resourced than their peers

Similarly, investors in fashion brands can encourage them to develop transition strategies for their supply chains that protect jobs and communities as well as the environment.

Passive investors should also pressure index providers to take the natural capital impacts of the textile industry into account when constructing their indices. If this does not happen, they should consider developing their own natural capital benchmarks instead.

Investors should engage with intermediaries providing debt finance to the wet processing companies to influence them towards more sustainable practices.

Lenders have a significant role to play influencing textile supply chain companies to adopt more sustainable practices and working with fashion brands to fund this transition.

All investors have an opportunity to encourage regulators to mandate sustainability disclosures including water risks.

INVESTOR ENGAGEMENT

Potential questions investors can use in their engagement with fashion brands and wet processing companies to clarify water risks:

- How does the company assess water-related financial risks?
- What is the average cost of water per unit of raw material input for the company?
- What is the water footprint of each type of fabric produced by the company and how has this changed over the past 10 years?
- How does the company handle wastewater and the toxic chemicals it contains?
- What contingency plans does the company have in the event of water-related risks materialising?
- What investments has the company made to improve the efficiency of water usage, and the environmental footprint of wastewater treatment and removal?
- How often does the company perform a water audit and does the company make the results of such audits public?
- What regulatory/voluntary standards does the company adhere to? Have there been any breaches and if so, how were they dealt with?

TEXTILE SUPPLY CHAINS ARE COMPLEX AND OPAQUE

> "**FASHION** is the most distributed, opaque and difficult to understand **INDUSTRIAL SYSTEM** in the world"
>
> **Jason Kibbey, CEO, Higg Co [speaking at CFS+ October 2020]**

The textiles supply chain often consists of tens or even hundreds of independent companies in a complex network co-ordinated by textile orders from the brand owner or end retailer- see Figure 1.

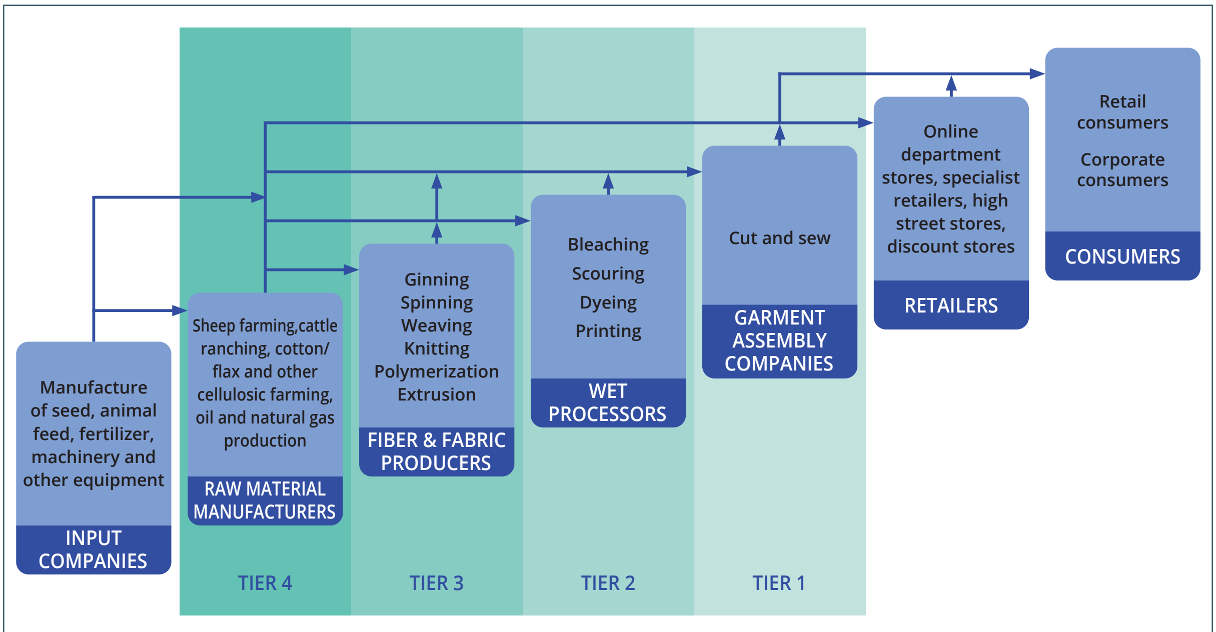

Figure 1: The Textile Supply Chain.[ii]

The outsourced nature of these relationships means that fashion brands can avoid being accountable for the environmental harms caused by textile production and do not disclose the natural capital costs to their investors.

This report focuses on identifying the scale of water-related risks of direct investments in publicly listed textile wet processors. Because of the opacity and complexity of the textiles supply chain, we have not been able to draw conclusions at this stage about the indirect exposure that investors will have to the wet processing companies through their investments in the fashion brands. We will return to this issue in later reports.

WET PROCESSING IS THE MOST POLLUTING STAGE OF THE SUPPLY CHAIN

Table 1 shows the impact of each stage of the textiles supply chain on a variety of environmental factors, highlighting the stages which have the greatest proportional impact. The Quantis study[iii] referenced in Table 1 covered the whole supply chain from fibre production through to disposal of textiles, but it excluded the environmental impact of micro-plastics (including oceanic pollution) so it is likely the table understates the negative impact of the disposal stage on ecosystem quality and (potentially) human health.

Table 1: Environmental Impact of the Textile Supply Chain (Rows may not sum to 100% due to rounding).

Impact category	Measurement unit	Total	Raw materials/ fibre production	Fibre and fabric producers		Wet processing	Garment assembly	Distribution and retail	Disposal
				Yarn preparation	Fabric production				
Climate change	Gigatons CO2eq	3.29	0.51	0.93	0.39	1.18	0.22	0.04	0.02
		100%	16%	28%	12%	36%	7%	1%	1%
Human health	10^6 DALY[4]	2.25	0.48	0.59	0.25	0.73	0.17	0.03	0
		100%	21%	26%	11%	32%	8%	1%	0%
Ecosystem quality	10^9 PDF.m2,[5]	1,020	309	211	90.2	304	94.2	8.81	2.79
		100%	30%	21%	9%	30%	9%	1%	0%
Resources consumption	10^9 MJ	40,900	7,250	10,300	4,280	15,700	2,800	624	-54
		100%	18%	25%	10%	38%	7%	2%	0%
Freshwater withdrawal	10^9 m3	215	67.7	49.2	23.1	58.4	16.2	0.25	0.15
		100%	31%	23%	11%	27%	8%	0%	0%

However, as Table 1 shows, when the textiles supply chain is considered as a whole, the wet processing stage is a significant driver of the majority of negative environmental impacts. Textile production requires an estimated 430 litres of water to produce 1kg of textile fabric (see Appendix A) and requires an estimated 8,000 toxic chemicals globally to turn raw materials into textiles, many of which will be released into freshwater sources.[iv] The dyeing and treatment of textiles is estimated to cause 20% of global industrial water pollution.[v]

The extensive use of heat at various stages in the wet process (both to heat the water and then to dry the wet material) consumes resources and generates greenhouse gas emissions (GhG).

Wet processing companies are exposed to water risk

Clean freshwater is an essential natural capital resource supporting the wet processing industry. However, in the majority of markets where wet processing factories are based (e.g. India, China, Pakistan, Vietnam and Bangladesh), water is a stressed resource and the industry is a major source of pollution, so risks relating to this natural capital asset are significant.

[4] DALY – Disability-Adjusted Life Years

[5] Potentially Disappeared Fraction (PDF) of land per square meter per year (PDF*m2*y) which relates to the likelihood of species loss.

This report concentrates on the negative environmental impacts on water arising from the techniques used in the wet processing stage. We will return to the other issues such as GhG emissions and toxic waste pollution in future reports.

Wet Processing is a significantly under-researched part of the supply chain (in contrast to raw materials production, such as cotton, where more work has been done on sustainability issues) and the brands that ultimately control the production of clothing generally do not disclose information about the environmental impact of their suppliers (though some are making efforts to change this).

WET PROCESSING STAGES

SINGEING: removal of fibres ('fuzz') from the surface of the fabric using gas flame, hot rollers or vibrating hot plates. **Environmental impacts include:** GhG emissions.

DESIZING: removal of starch and other chemicals previously added to the yarn to make it stronger during the weaving process. Sizing has the effect of making the yarn waterproof and this would prevent wet processing so the 'size' must be removed by washing the fabric in a hot solution containing enzymes or other chemicals. **Environmental impacts include:** water consumption, GhG emissions, toxic chemical pollution.

SCOURING: boiling the fabric in a soapy alkaline solution to remove other impurities that occur naturally in the raw material and/or have been introduced during the fabric production process. This stage also further increases the fabric's water-absorbing properties. **Environmental impacts include:** GhG emissions, water consumption and toxic chemical pollution.

BLEACHING: the fabric must be bleached to achieve a white colour in readiness for the dying stage. **Environmental impacts include:** water consumption and toxic chemical pollution.

MERCERIZING: the fabric is stretched and heated whilst being treated with chemicals to strengthen it and increase its lustre. **Environmental impacts include:** GhG emissions, water consumption and toxic chemical pollution.

DYEING: the fabric must be washed clean of chemicals and then dyed the desired base colour. **Environmental impacts include:** water consumption and toxic chemical pollution.

PRINTING: a variety of techniques and chemicals are used to print designs onto the fabric. **Environmental impacts include:** toxic chemical pollution.

FINISHING: the fabric is steamed to fix the dyes used and ensure the colours do not subsequently wash out. It then goes through a series of hot washes to remove chemical residues before being dried and packaged into rolls. **Environmental impacts include:** GhG emissions, water consumption, air pollution and toxic chemical pollution.

Refer to Appendix A for a discussion on water use in textile wet processing.
Refer to Appendix B for examples of chemicals used across each wet processing stage.

WATER-RELATED FINANCIAL RISKS TO THE TEXTILE WET PROCESSING SECTOR

Table 2 summarises the range of water-related risks to which wet processing companies are exposed. Appendix C shows the results of a complete natural capital dependency analysis of the textile wet processing sector, highlighting the sector's very high dependency on access to ground and surface water. But, as Table 2 summarises, risks extend beyond well beyond the physical risk to operations.

If water-related risks materialise in textile wet processing jurisdictions, fresh water will become scarcer with the potential to restrict supplies to wet processing companies. In such circumstances the cost of water to business is likely to rise. This will put pressure on those wet processing companies operating on thin financial margins giving rise to the risk of losses for investors exposed to those companies through their active and passive investment portfolios.

Table 2: Water Related Physical, Market, Regulatory and Legal Risks.[vi]

Type of water related risk	Impact	Description
Physical risk	**Disruption of operations**	• **Over abstraction** – This can lead to an exhaustion of local surface and groundwater resources. • **Wastewater** - The unregulated expulsion of toxic wastewater, sometimes containing banned chemicals, can render local water resources too toxic. This in turn can contaminate freshwater resources required by other wet processors restricting their supplies and/or raising their costs, as well as the obvious impact on human health. • **Rising water related costs** - As a result, a wet processing factory may need to have water physically delivered by water tankers at an unsustainable cost. • **Shut down** - In the worst-case scenario the textile mill may close operations and offload productive assets at heavily discounted rates.
Regulatory and legal risk	**Restricted access to land and resources**	• **Sensitive locations** If the factory is located in a biodiverse region, ecologically sensitive zone or a critical watershed area, there is the risk of the land on which it operates becoming subject to stricter environmental and conservation laws.
	Litigation	• **Water regulations** – Countries hosting the vast number of wet processing companies are likely to continue to introduce further legislation to protect stressed water resources (declining water quality and/or quantity). Fashion brands are at risk if new regulations implemented by organisations such as the EU extend to how they manage their supply chains. • **Fines and penalties** – As water resources face increasing stress in those regions the likelihood of increased enforcement of these laws and regulations is high. This could result in fines and penalties being levied on wet processing companies operating on thin financial margins.
	Pricing and compensation regimes	• **Under-pricing water** – Water is a severely under-priced raw material input, especially in emerging markets and jurisdictions where wet processing activities predominantly take place.[vii] • **The true price of water** – In the event of a true price of water being introduced through water taxes, fines and penalties as water resources dwindle, wet processors that have traditionally taken the resource for granted are likely to see their margins negatively impacted.

Type of water related risk	Impact	Description
Market & Transition Risk	**Changing consumer preferences and transition risk**	• **Conscious consumption** – There is increasing consumer pressure on brands to support sustainability and circularity principles. Fast fashion brands are increasingly scrutinized for their human rights and environmental records. • **Environmental lens** – On the environmental side the scrutiny is currently focused on raw material sustainability (GhG emissions from growing and processing cotton for example) and the lack of durability of produced garments. This is expanding to toxic chemicals and other processes.
	Purchaser requirements	• **Water disclosures** – As consumer awareness about water-related issues develops, brands that source textiles from wet processors will demand better water disclosures from those companies over time. • **Loss of contracts** – Wet processors that fail to comply with these demands could therefore lose out on lucrative contracts.
	Reputational risk	• **Dissociation** – Brands and investors associated with wet processors who are facing legal issues and related media scrutiny could directly face financial risks materialised through a decline of sales to conscious buyers. • **Avoiding controversy** – Brands and investors with strong supply chain sustainability governance may immediately cut ties with non-compliant wet processors which would result in short to medium term cash flow-related issues for the wet processor.
	Financing risk	• **TCFD, TNFD & nature related financial disclosures** – Investors and banks are increasingly incorporating environmental risks into decision making. • **Avoiding controversy** – Access to financial services - Wet processing companies that fail to innovate in water efficiency and disclose water-related information when requested could find it increasingly difficult / costly to raise finance.
	Systemic risk	• **Climate-related risks** – Climate change will lead to changing patterns of water availability and more extreme water events (droughts and floods), increasing the risk of material financial impacts on wet processors based in the worst affected regions.
	Social and supply chain risk	• **Community impacts** – Declining quality and quantity of local water resources can trigger social upheaval and conflict, thereby disrupting operations of wet processors. • **Loss of local support** – Affected communities could mobilise to disrupt wet processor operations or approach local authorities and pollution control boards to take action against wet processors.

[6] The average reported EBIT margin across our universe was 7.7% but the range is very wide – some companies would be better able to cope than others.

WATER RISK IMPLICATIONS – ANALYSIS OF COMPANIES INVOLVED IN WET PROCESSING

Investors are exposed to water risks from the wet processing companies in the textiles supply chain both through direct investment and indirectly through their investments in the downstream fashion brands.

As noted previously, this report focuses on identifying the scale of water-related risks of direct investments in publicly listed textile wet processors and does not analyse the indirect exposure that investors will have to the wet processing companies through their investments in the fashion brands. We have also had to restrict our research to listed companies that provide sufficient disclosures to support our analysis – the actual universe of companies involved in wet processing will be larger than our sample.

Companies operating the wet processing factories are mainly based in emerging markets and are therefore less well covered by financial researchers than the large fashion brands and retailers. We surveyed 1207 publicly listed companies and identified a universe of 740 directly involved in wet processing.

Within that universe, we were able to identify 1606 factory locations for 607 companies. Finally, we identified a subset of 230 publicly listed wet processing companies (with a combined market capitalisation of USD 586 billion) where we have factory location data and where we can link the companies to their owners.

The World Resources Institute has a methodology for assessing the water risks relating to specific geographical areas and converting those risks into a water risk score – see Figure 2.

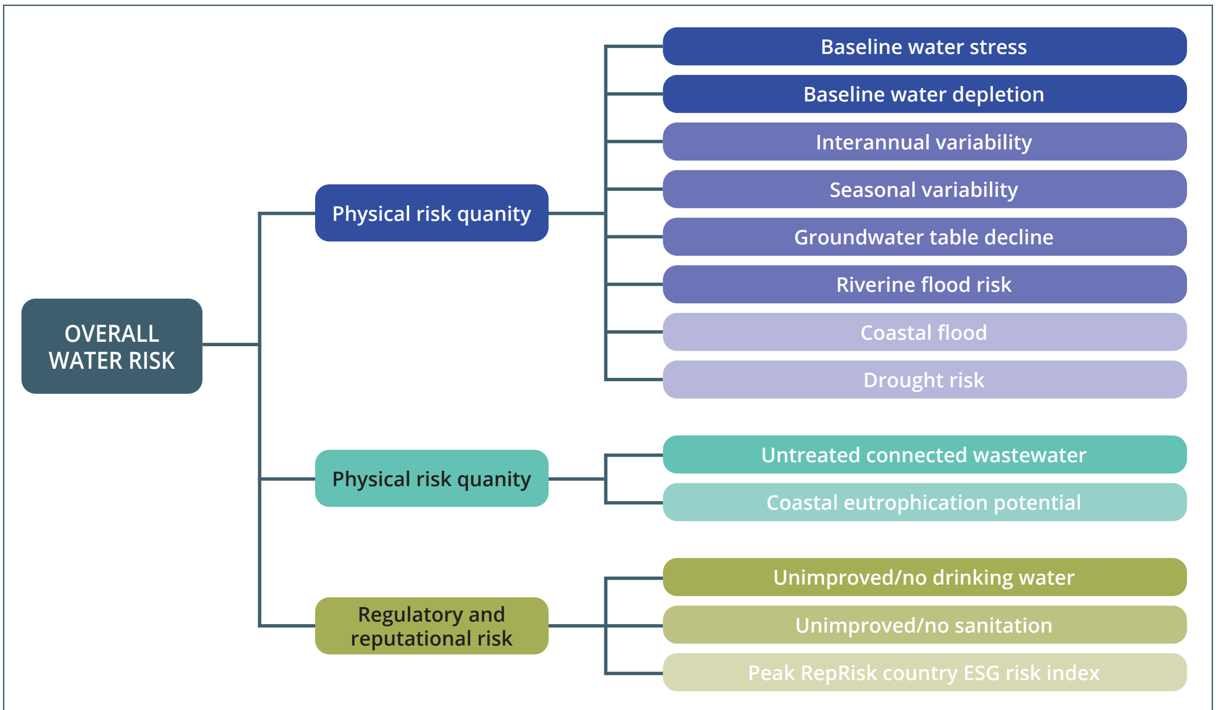

Figure 2: WRI's Overall Water Risk Indicators.[viii]

We used the water risk scores from the WRI's Aqueduct 3.0 tool[7] to assign a water risk score to each of the wet processing factories based on their locations and averaged those scores across the factories owned by a particular company to assign water risk scores to the basket of 740 publicly listed wet processing companies in our universe.[8]

The number of companies and factories covered in our research are summarised here - see Table 3.

Refer to Appendix D for the details of our methodology and Appendix E for a detailed discussion of WRI's water risk methodology.

Table 3: Refining Planet Tracker's Listed Textile Wet Processing Data Universe.[ix]

Total number of companies	**1207**
Number of companies matched to factories	**821**
Number of companies directly involved in wet processing	**740**
Number of companies directly involved in WP with factories	**607**
Number of companies with ownership details	**336**
Number of companies with ownership details & factories	**230**
Total number of factories identified	**1606**

India ranks first, with 25% of the wet processing factories we identified. Pakistan came second with only 7% - see Table 4.

The Open Apparel Registry captures location data for textile supply chain companies globally (including private companies). The OAR database does not specifically identify the activities of the companies concerned so we have not been able to use it in our analysis. The country rankings in Table 4 differ from the country rankings we derived from the OAR (see Appendix F for a detailed comparison).

[7] WRI's Aqueduct™ 3.0 water risk framework combines 13 water risk indicators - including quantity, quality, and reputational risk - into a composite overall water risk score. See Appendix E for details.

[8] Limited company disclosures have prevented us from adjusting the WRI scores to reflect the extent to which any particular company has taken steps to mitigate the water risks to which it is exposed.

Table 4: Geographic Distribution of Wet Processing Facilities owned by Listed Companies (Planet Tracker Universe) - Top 20 Countries by Number of Factories.[x]			
Rank	**Country**	**Number of factories involved in wet processing**	**% of total**
1	India	407	25%
2	Pakistan	118	7%
3	China	100	6%
4	Vietnam	68	4%
5	Bangladesh	64	4%
6	Taiwan	44	3%
7	Indonesia	37	2%
8	Japan	34	2%
9	US	31	2%
10	Thailand	26	2%
11	Republic of Korea	25	2%
12	Turkey	22	1%
13	Italy	18	1%
14	Egypt	14	1%
15	Mexico	13	1%
16	Cambodia	13	1%
17	Peru	12	1%
18	Brazil	11	1%
19	Sri Lanka	9	1%
20	Greece	9	1%
		1075	**67%**

As Table 4 shows, most of the wet processing factories we identified are located in emerging markets[9] (including Hong Kong). We identified a sample of 75 companies listed in emerging markets (including Hong Kong) that own wet processing factories and so are directly exposed to the associated water risks. These are listed below in Table 5, ranked by water risk.

[9]We use the terms 'Emerging' and 'Developed' markets as defined by MSCI for financial index purposes and not as a reflection of the state of development of any of the countries. We have grouped HK-based companies in emerging markets (instead of following the MSCI classification) in our analysis because they frequently have factories located in other emerging markets.

Table 5: Emerging Markets Companies with Direct Exposure to Wet Processing Water Risk (Ranked by Water Risk) Market Cap Priced at 27 October 2020.[xi]				
Entity Name	**Entity Country**	**Market Cap (USD million)**	**Number of WP factories**	**Avg. Water Risk score**
WRI WATER RISK – EXTREMELY HIGH				4 to 5
Arvind Limited	India	124	2	4.44
Jindal Worldwide Limited	India	127	1	4.44
Vishal Fabrics Ltd	India	207	1	4.44
Kama Holdings Limited	India	414	5	4.36
Trident Limited	India	537	2	4.32
Vardhman Textiles Limited	India	690	6	4.31
Nishat Mills Limited	Pakistan	216	3	4.30
Feroze1888 Mills Limited	Pakistan	242	2	4.28
Interloop Ltd.	Pakistan	368	2	4.26
Dollar Industries Ltd.	India	106	4	4.25
Sapphire Textile Mills Limited	Pakistan	113	5	4.25
Indo Count Industries Limited	India	288	1	4.23
Rupa & Co. Ltd.	India	203	4	4.23
Garware Technical Fibres Limited	India	661	2	4.23
Raymond Limited	India	262	3	4.22
Page Industries Limited	India	3175	7	4.21
Kewal Kiran Clothing Limited	India	125	3	4.19
PT Sri Rejeki Isman Tbk	Indonesia	278	2	4.19
Alok Industries Limited	India	749	2	4.19
K.P.R. Mill Limited	India	606	1	4.17
Ibrahim Fibres Limited	Pakistan	120	1	4.16
Himatsingka Seide Limited.	India	172	2	4.13
Paramount Textile Ltd.	Bangladesh	113	1	4.09
M.L. Dyeing Ltd.	Bangladesh	131	1	4.09
Hansae Co., Ltd	South Korea	649	11	4.00
Welspun India Limited	India	960	2	4.00
WRI WATER RISK – HIGH				3 to 4
Service Industries Ltd	Pakistan	104	2	3.93
Fountain Set (Holdings) Limited	Hong Kong	142	2	3.77
Regina Miracle International (Holdings) Limited	Hong Kong	332	3	3.70
Billion Industrial Holdings Ltd.	China	1355	3	3.66
Kingdom Holdings Limited	China	108	2	3.62
Formosa Taffeta Co., Ltd.	Taiwan	1873	4	3.60
Bros Eastern Co., Ltd. Class A	China	811	4	3.48
Tainan Spinning Co., Ltd.	Taiwan	679	3	3.46
Jiangsu Lianfa Textile Co.Ltd. Class A	China	470	1	3.4
Tex-Ray Industrial Co., Ltd.	Taiwan	149	2	3.39
Xinlong Holding (Group) Co., Ltd. Class A	China	671	1	3.35
Eclat Textile Co., Ltd.	Taiwan	3357	7	3.34
Pacific Textiles Holdings Limited	Hong Kong	650	2	3.30

Entity Name	Entity Country	Market Cap (USD million)	Number of WP factories	Avg. Water Risk score
Zhejiang Taihua New Material Co., Ltd. Class A	China	997	1	3.29
Nien Hsing Textile Co., Ltd.	Taiwan	115	5	3.29
Eagle Nice (International) Holdings Ltd.	Hong Kong	253	6	3.26
Huafu Fashion Co. Ltd. Class A	China	1361	2	3.25
Anhui Anli Material Technology Co., Ltd. Class A	China	385	1	3.25
Paiho Shih Holdings Corporation	Taiwan	318	2	3.15
Taiwan Paiho Co., Ltd.	Taiwan	709	2	3.15
Sanko Pazarlama Ithalat Ihracat Anonim Sirketi	Turkey	106	1	3.14
Thai Wacoal Public Co. Ltd.	Thailand	172	5	3.12
Jiangsu Sanfangxiang Industry Co., Ltd. Class A	China	1751	1	3.04
361 Degrees International Ltd.	China	264	1	3.02
Menderes Tekstil Sanayi ve Ticaret Anonim Sirketi	Turkey	104	1	3.00
WRI WATER RISK – MEDIUM-HIGH				**2 to 3**
Aksa Akrilik Kimya Sanayi A.S.	Turkey	334	1	2.96
Best Pacific International Holdings Ltd	China	169	1	2.95
Texwinca Holdings Limited	Hong Kong	187	1	2.95
Stella International Holdings Limited	Hong Kong	781	3	2.89
Vakko Tekstil ve Hazir Giyim Sanayi Isletmeleri A.S.	Turkey	125	1	2.81
Hongda High-Tech Holding Co., Ltd. Class A	China	288	2	2.8
Soenmez Pamuklu Sanayii Anonim Sirketi	Turkey	165	1	2.75
Everest Textile Co., Ltd.	Taiwan	174	6	2.74
ZheJiang Jasan Holding Group Co Ltd	China	558	4	2.47
Universal Incorporation	Taiwan	392	2	2.23
Xingye Leather Technology Co., Ltd. Class A	China	472	2	2.20
WRI WATER RISK – LOW-MEDIUM				**1 to 2**
HUVIS CORPORATION	South Korea	240	1	1.88
Hyosung TNC Corp.	South Korea	508	3	1.66
Taihan Textile Co., Ltd	South Korea	155	2	1.63
KOLON MATERIALS	South Korea	246	4	1.52
Ilshin Spinning Co., Ltd	South Korea	145	2	1.51
Lan Fa Textile Co., Ltd.	Taiwan	103	2	1.44
Fulltech Fiber Glass Corp.	Taiwan	151	2	1.44
Li-Cheng Enterprise Co., Ltd	Taiwan	167	2	1.44
Zig Sheng Ind. Co., Ltd	Taiwan	176	3	1.44
Li Peng Enterprise Co., Ltd.	Taiwan	224	2	1.44
De Licacy Industrial Co., Ltd.	Taiwan	241	1	1.44
LeaLea Enterprise Co., Ltd.	Taiwan	439	2	1.44
WRI WATER RISK – LOW				**Below1**
PFNonwovens a.s.	Czech Republic	292	2	0.95

Given that our analysis shows that 80% of the companies we investigated were registered in the same country as their factories and did not have any foreign operations, it is not surprising to find that the companies with the highest water risk are listed in India and Pakistan, since those countries ranked second and third in our country water-risk ranking (see Appendix D for the full list).

That said, it is also interesting to note that the companies at the top of the list have higher water risks than the peer group average for India and Pakistan because their factories are located in above average risk areas within those countries.

We identified a number of companies based in developed markets that are directly involved in wet processing and so have exposure to water risk (Medium-High or above) – see Table 6.

Table 6: Developed Market Companies with Direct Exposure to Wet Processing Water Risk (ranked by water risk) Market cap priced at 27 October 2020.[xii]

Entity Name	Entity Country	Market Cap (USD million)	Number of WP factories	Avg. Water Risk score
WRI WATER RISK – EXTREMELY HIGH				4 to 5
PVH Corp.	United States	4807	1	4.06
WRI WATER RISK – MEDIUM-HIGH				2 to 3
Seiren Co., Ltd.	Japan	981	10	2.95
Oxford Industries, Inc.	United States	768	1	2.88
Hanesbrands Inc.	United States	5908	3	2.80
TOD'S S.p.A.	Italy	944	6	2.72
Geox S.p.A.	Italy	190	1	2.67
Delta Apparel, Inc.	United States	104	6	2.57
Atsugi Co., Ltd.	Japan	93	2	2.55
Samsonite International S.A.	Luxembourg	1467	4	2.36
Salvatore Ferragamo S.p.A.	Italy	2647	1	2.32
Culp, Inc.	United States	171	5	2.02

INVESTORS ARE CARRYING WATER RISK AS A RESULT OF THEIR HOLDINGS

Calculating water risk scores for wet processing companies allows us to calculate the water risk to which investors in these companies are exposed.

Opaque supply chains hide the risk to brands

The bulk of financial value in the fashion industry measured by market capitalisation is concentrated in the downstream section of the supply chain, which is populated by large consumer brands/ retailers. As previously discussed, the supply chain supporting this multibillion-dollar industry is highly fragmented and populated by a multitude of small companies, the majority of which are based in emerging markets.

The water risks discussed in this report are largely hidden from view when the fashion brands are considered. In most cases the wet processing facilities are not directly owned by the brands and so often do not feature in the disclosures published by fashion brands[10], but this part of the supply chain carries the greatest water risk.

The risk for investors and lenders in relation to brands is that the hidden environmental and social risks embedded in the textiles supply chain are not fully priced in from an equity or credit perspective. We plan to return to this issue in subsequent reports.

Individuals and families are the most exposed

Individual entrepreneurs and families make up the most significant category of investors in companies directly involved in wet processing – see Table 7.

Table 7: Investor Categories Ranked by Aggregate Investment Value. Market Cap Priced at 27 October 2020.[xiii]

Investor category	Total value of investments (USD million)	Average water risk of investments	Number of investors in category	Average value of investments (USD million)
Individual	227,555	2.85	22	10,343
Investment Managers	65,700	1.80	28	2,346
Major Banks	15,337	1.67	16	959
Multi-Line Insurance	8,407	1.66	9	934
Sovereign	7,655	2.00	3	2,552
Regional Banks	7,222	1.73	6	1,204
Investment Banks/Brokers	5,111	1.82	7	730
Financial Conglomerates	5,587	2.07	8	698
Wholesale Distributors	1,379	1.39	3	460
Investment Trusts/Mutual Funds	1,213	2.03	1	1,213
Municipality	932	3.22	2	466
Chemicals: Major Diversified	693	3.60	1	693
Savings Banks	443	1.44	1	443
Province/State	435	2.37	1	435
Finance/Rental/Leasing	377	1.81	1	377

In market value terms, the analysis in Table 7 is skewed by the very material value (nearly USD 200 billion) of the investments in French fashion companies held by the Arnault family (Christian

[10] See Transparency discussion later in this report.

Dior and LVMH), the Hermes family (through their H51 SAS investment vehicle) and the Pinault François family (Kering S.A.). These companies are included because they directly own factories involved in wet processing (in contrast to the majority of their brand owning peers who outsource this function).

But even setting aside these significant family holdings, wealthy individuals and families are heavily invested in companies directly involved in wet processing in the fashion and textiles industry and thus exposed to the water risks arising from it.

Almost all of this category of individual investors and family businesses hold material stakes in 'domestic' companies (i.e. companies which are listed in their own countries) and, as previously discussed, most companies own wet processing factories in a single country. As a result, these holdings are very undiversified when it comes to water risk. 67% of these investors (with an aggregate investment value of USD 7.7 billion) are exposed to 'extremely high' or 'high' water risks based on the WRI classification system – see Table 8.

Table 8: Individual / Family Investors – Ranked by Water Risk – Medium High and above. Market cap priced at 27 October 2020.[xiv]

Investor name	Company name	Country of listing	Holding Market Value (USD million)	Individual Holding (% of Shares outstanding)	Company water risk score
WRI WATER RISK – EXTREMELY HIGH					4 to 5
RAM ASHISH BHARAT	Kama Holdings Limited	India	309.5	75.0	4.36
GENOMAL SUNDER ASHOK	Page Industries Limited	India	520.6	16.1	4.21
GENOMAL RAMESH	Page Industries Limited	India	520.6	16.1	4.21
GENOMAL NARI	Page Industries Limited	India	520.6	16.1	4.21
GOENKA BALKRISHAN GOPIRAM	Welspun India Limited	India	658.3	69.2	4.00
WRI WATER RISK – HIGH					3 to 4
SUN WEI TING FAMILY	Fountain Set (Holdings) Limited	Hong Kong	0.4	0.3	3.77
SZE TIN YAU	Billion Industrial Holdings Ltd.	China	411.1	30.3	3.66
YANG FAMILY /BROS EASTERN/	Bros Eastern Co., Ltd. Class A	China	258.1	31.9	3.48
YI YUAN INVESTMENT CO. LTD. / ECLAT TEXTILE/	Eclat Textile Co., Ltd.	Taiwan	318.5	9.4	3.34
SHI FAMILY /ZHEJIANG TAIHUA/	Zhejiang Taihua New Material Co., Ltd. Class A	China	366.3	36.4	3.29
SUN WEI TING FAMILY	Huafu Fashion Co. Ltd. Class A	China	638.3	47.0	3.25
TONGXIANG HENGJU INVESTMENT CO. LTD.	Xinfengming Group Co Ltd Class A	China	348.1	20.0	3.22
LIN CONG YING	Joeone Co., Ltd. Class A	China	548.1	53.7	3.22
ZHOU YAO TING FAMILY	Jiangsu Hongdou Industrial Co., Ltd. Class A	China	932.5	75.3	3.22
REN FAMILY /ROBAM/	HangZhou Nbond Nonwovens Co., Ltd. Class A	China	391.8	64.9	3.22
ZHUANG KUI LONG FAMILY	Xinfengming Group Co Ltd Class A	China	467.8	26.8	3.22
GRENDENE BARTELLE FAMILY	Grendene S.A.	Brazil	517.3	41.2	3.17
WRI WATER RISK – MEDIUM-HIGH					2 to 3
DELLA VALLE FAMILY	TOD'S S.p.A.	Italy	472.9	50.3	2.72
FERRAGAMO FAMILY	Salvatore Ferragamo S.p.A.	Italy	1393.2	54.3	2.32
PRADA FAMILY	Prada S.p.A.	Italy	8449.8	80.0	2.26

Asset managers are also exposed

Institutional investors are not immune to water-related risk either. Our analysis shows that asset managers and financial conglomerates have aggregate investments in publicly listed wet processing companies valued at approximately USD 66 billion. In many cases their investments are diversified across a number of countries and this has the consequence of reducing their exposure to concentrated water risks (even if the underlying risk models have not priced in this risk). This has the consequence of lowering the average water risk in their portfolios compared to the individuals and family offices discussed previously.

However, we identified 10 asset managers with Medium-High water risk in their portfolios as a result of their direct holdings in wet processing companies worth an aggregate of USD 20 billion – see Figure 3 and Table 9.

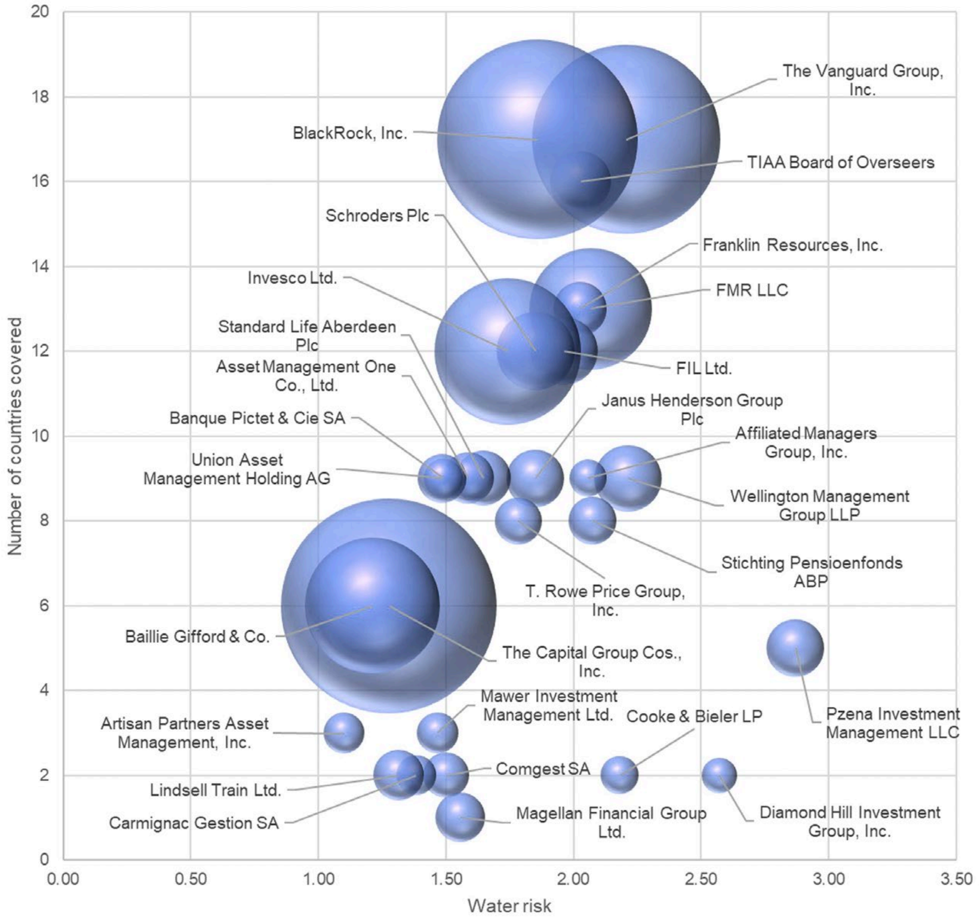

Figure 3: Asset managers – Water Risk and Country Coverage Compared to Aggregate Investment Value (Bubble Size Indicates Aggregate Value of Investments in Companies with Wet Processing Factories). [xv]

Pzena Investment Management stands out as the asset manager carrying the greatest water risk (2.87, close to the 'High' level) from its USD 0.9 billion investment in 6 companies across 5 countries, with Diamond Hill in second place (water risk of 2.57) from its USD 0.3 billion investment in two companies across two countries.

Wellington and Vanguard rank equal third with water risk scores of 2.21 – see Figure 3 and Table 9.

Table 9: Asset Managers – Ranked by Water Risk, Market Cap Priced at 27 October 2020.[xvi]

Investment manager	Investor - Avg. Water Risk	Individual Holding Market Value (USD mn)	Countries covered
WRI WATER RISK – MEDIUM-HIGH	**2 to 3**		
Pzena Investment Management LLC	2.87	923	5
Diamond Hill Investment Group, Inc.	2.57	338	2
Wellington Management Group LLP	2.21	1,248	9
The Vanguard Group, Inc.	2.21	9,956	17
Cooke & Bieler LP	2.18	393	2
Stichting Pensioenfonds ABP	2.07	634	8
FMR LLC	2.07	4,166	13
Affiliated Managers Group, Inc.	2.06	374	9
TIAA Board of Overseers	2.03	1,016	16
Franklin Resources, Inc.	2.03	790	13
WRI WATER RISK – LOW-MEDIUM	**1 to 2**		
FIL Ltd.	1.96	1,254	12
BlackRock, Inc.	1.86	11,269	2
Schroders Plc	1.85	1,713	12
Janus Henderson Group Plc	1.85	911	9
Peer group averages	**1.80**	**2,353**	**21**
T. Rowe Price Group, Inc.	1.78	603	8
Invesco Ltd.	1.74	6,015	12
Standard Life Aberdeen Plc	1.65	831	9
Asset Management One Co., Ltd.	1.59	728	9
Magellan Financial Group Ltd.	1.56	672	1
Comgest SA	1.50	575	2
Banque Pictet & Cie SA	1.49	421	9
Union Asset Management Holding AG	1.48	667	9
Mawer Investment Management Ltd.	1.47	465	3
Carmignac Gestion SA	1.38	422	2
Lindsell Train Ltd.	1.31	702	2
The Capital Group Cos., Inc.	1.28	13,006	6
Baillie Gifford & Co.	1.21	5,153	6
Artisan Partners Asset Management, Inc.	1.10	457	3

Of these 28 investment managers, eight have investments in textiles companies covering three or fewer countries, concentrating the water risk to which they are exposed. However, even these investment managers are less exposed to water risk through their holdings than many individual investors and family businesses.

The highest level of water risk for asset managers is 'Medium-high', 2 notches below the 'Extremely high' risk score that our analysis identifies for some individual investors, but the dispersion of water risk scores is still wide, with some asset managers achieving a risk score that is nearly in the 'High' band in WRI terms, while others are close to the 'Low' end of the spectrum.

Financial conglomerates

Most financial conglomerates are in the Low-Medium band or lower, but Dimensional Holdings stands out with a risk score of 2.34, putting it in the Medium-High category see Figure 4.

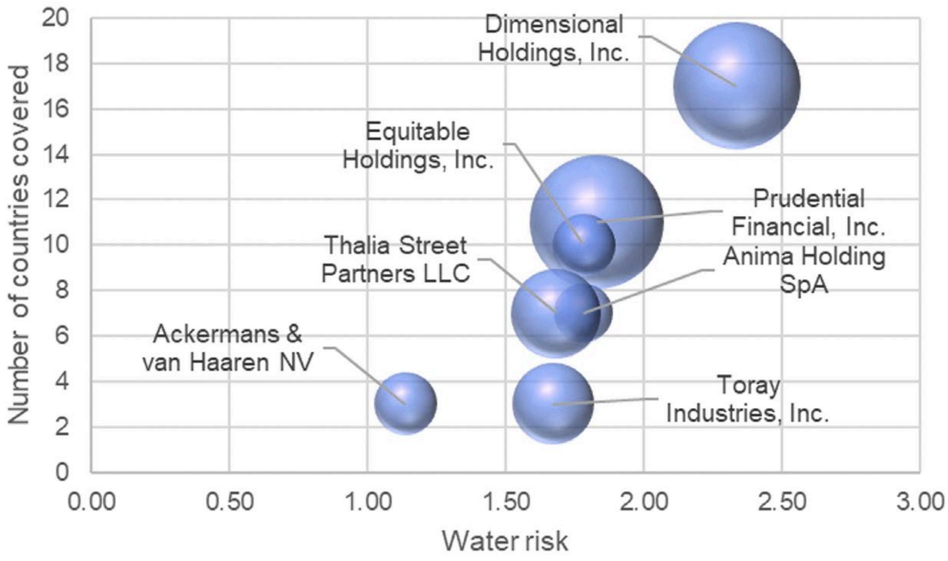

Figure 4: Financial conglomerates – Water Risk and Country Coverage Compared to Aggregate Investment Value (Bubble Size Indicates Aggregate Value of Investments in Companies with Wet Processing Factories). [xvii]

Major banks, insurers and other financial institutions

The majority of financial institutions have water risk scores that put them comfortably in the 'Low-Medium' risk category (or lower) but our analysis revealed 7 whose holdings had average water risk scores that put them in the 'Medium-High' category – see Figure 5.

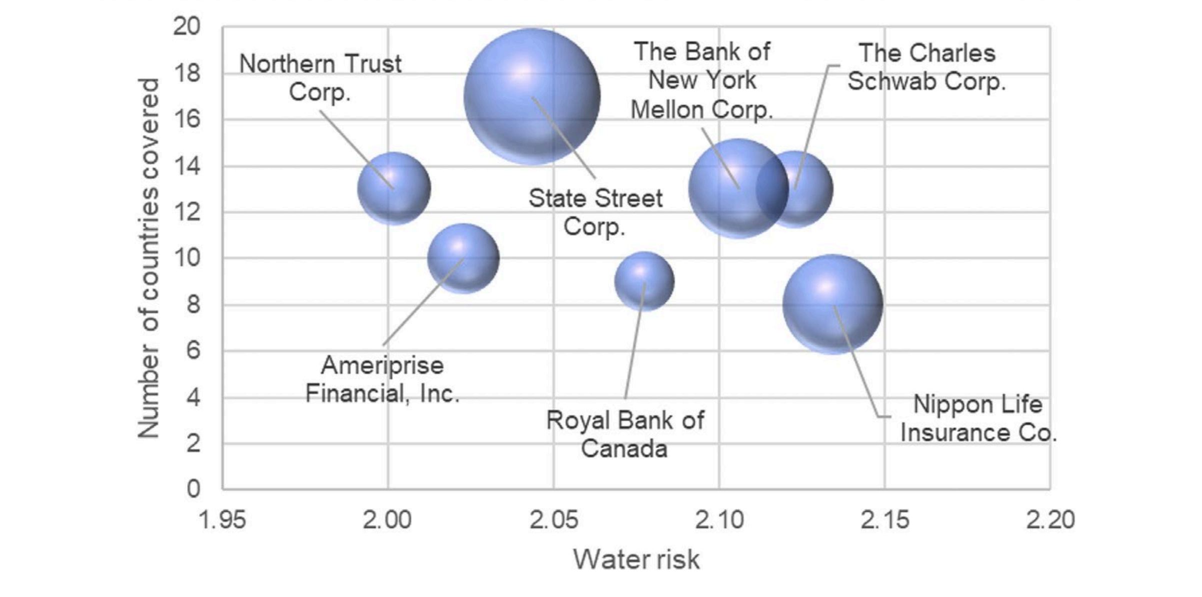

Figure 5: Financial institutions – Water Risk and Country Coverage Compared to Aggregate Investment Value (Bubble Size Indicates Aggregate Value of Investments in Companies with Wet Processing Factories). [xviii]

Active managers have more options to manage water risk

Asset managers, banks and financial conglomerates hold investments in companies involved in wet processing worth USD 114 billion, 73% (USD 82.9 billion) in active funds.

The Capital Group is the asset manager with the largest active exposure, with close to USD 13 billion actively invested in wet processors. Invesco is second placed at around USD 6 billion, followed by Fidelity, Sun Life and Baillie Gifford.

Vanguard is the most significant passive investor, with around USD 9.5 billion. BlackRock ranks second with USD 6.5 billion invested passively in wet processors – see Figure 6.

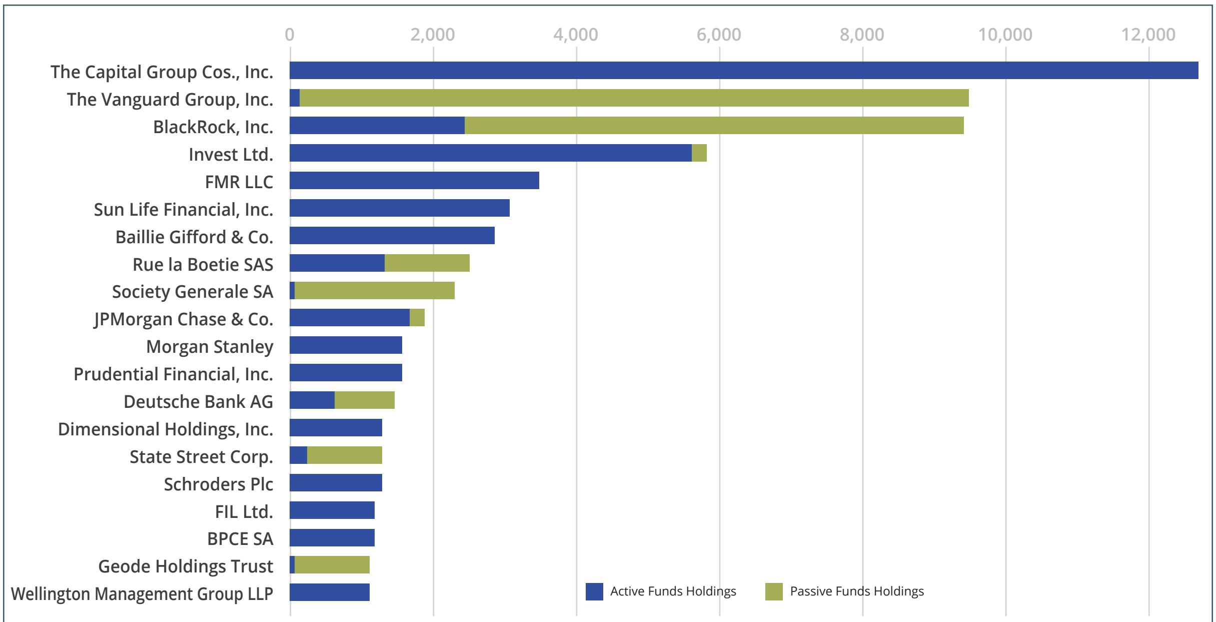

Figure 6: Active vs. Passive Investment Exposure of Financial Institutions to Publicly Listed Wet Processing Companies. [xix]

Given Vanguard's focus on passive index investing it may be hard for it to avoid much of the water risk to which it is exposed, suggesting that it should be incentivised to engage with the companies concerned to encourage a shift to more sustainable processes. In contrast, the active funds managed by Blackrock and Wellington have the option to avoid this risk if they so choose but assuming the stocks have been selected for their other merits, active funds have an opportunity to mitigate their risks (and improve their performance) by engaging with the wet processing companies they have picked.

Sovereign wealth funds

Our analysis revealed three governments with material water risk exposure from investments in the textile supply chain: China, Norway and Sweden. Norway's water risk is similar to China's, but Norway has by far the largest investment by value (USD 6.4 billion), the greatest number of companies (64) and the greatest geographical spread (22 countries covered) – see Figure 7.

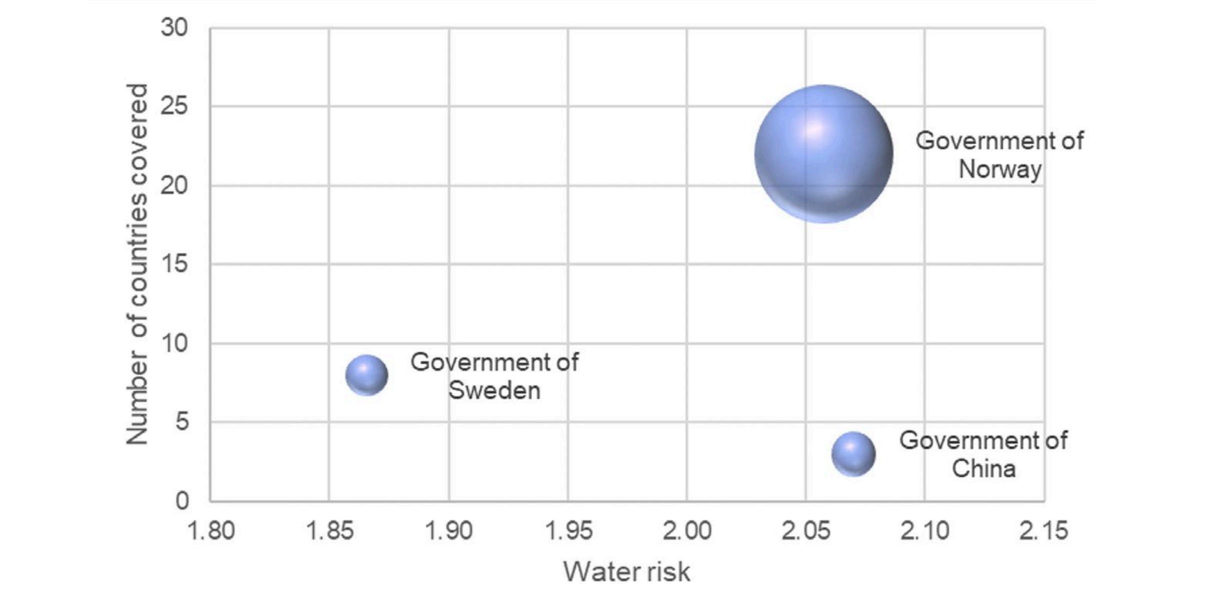

Figure 7: Sovereign Wealth Funds – Water Risk and Country Coverage Compared to Aggregate Investment Value (Bubble Size Indicates Aggregate Value of Investments in Companies with Wet Processing Factories). [xx]

COMPARING THE FINANCIAL STRENGTH OF WET PROCESSORS AND BRAND OWNERS

Wet processors are much smaller than fashion brands

We selected companies listed in emerging markets[11] from the 740 companies we identified as owning wet processing factories and compared them with companies listed in developed markets selected from the 200 most valuable companies in Factset's 'apparel' sector (as a proxy for fashion brands).

As one might expect, the average revenues of the fashion brands are significantly greater than the emerging market wet processing companies. Fashion brands with a market cap of over USD 2 billion have average revenues of nearly USD 10 billion compared to the wet processing companies which have average revenues of only USD 0.2 billion – see Figures 8 and 9.

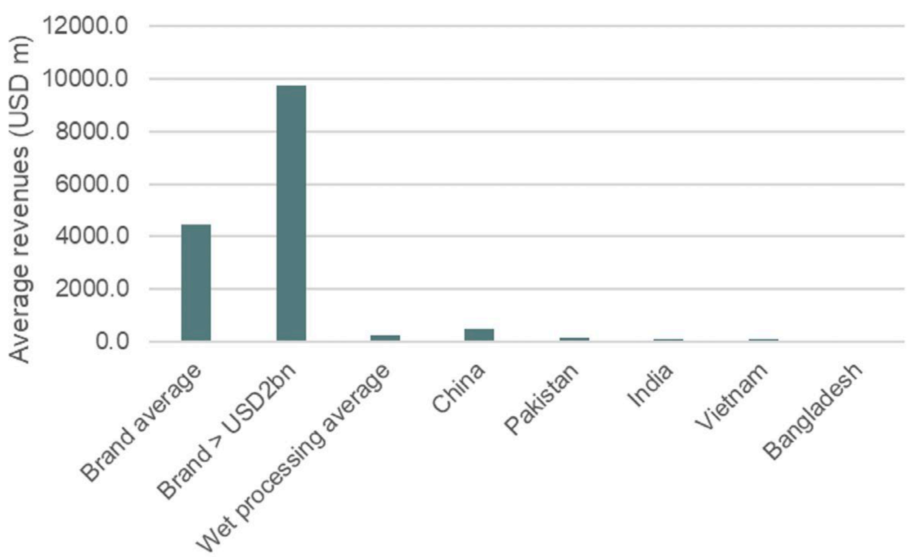

Figure 8: Average Revenues for DM 'Fashion Brands' (Market Cap > USD 2bn) Compared to EM Wet Processing Companies. Priced at 27 October 2020). [xxi]

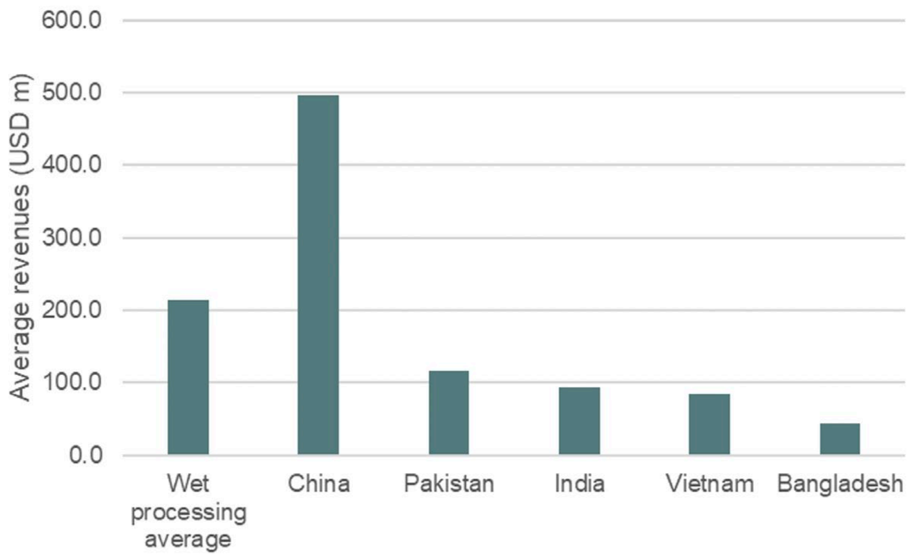

Figure 9: Average Revenues for Emerging Market Wet Processing Companies. Priced at 27 October 2020). [xxii]

[11] We include Hong Kong in this category since the factories owned by HK companies are generally based in mainland China or other emerging markets.

Ability to fund the costs of transition

A key question with respect to the wet processing companies is whether or not they could afford to transition to more sustainable production techniques. At this stage, we do not have sufficient data to be able answer that question in detail, however we compared EBIT margins and debt/equity levels for the wet processors and the fashion brands to provide an initial indication of financial strength – see Figure 10.

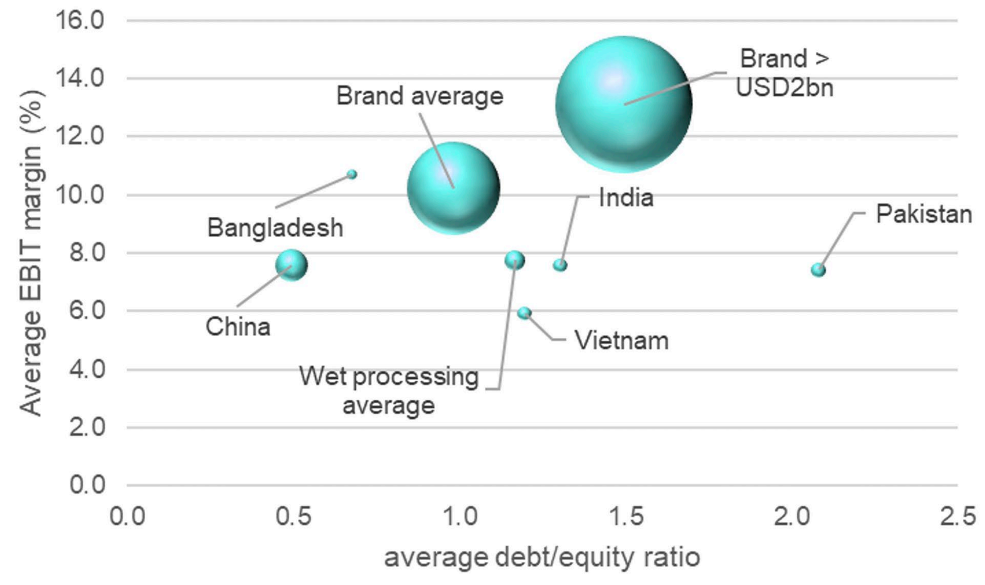

Figure 10: Average EBIT Margins Compared to Average Debt/Equity Ratios. Bubble Size Indicates Average Revenues. Priced at 27 October 2020). [xxiii]

Figure 10 shows that the picture is mixed. Wet processing companies based in Bangladesh have EBIT margins ahead of the peer group average, but much lower debt/equity ratios compared to wet processing companies based in Pakistan, India and Vietnam, suggesting that Bangladeshi wet processing companies might be better placed (on average) than their peers to increase their debt levels to help fund the costs of transitioning.

Figure 10 also shows the significant difference in the EBIT margins earned by the fashion brands (particularly the largest ones) compared to the wet processing companies further up the supply chain. This result is not surprising given that the brand owners rely on keeping their operating costs low to maintain their profitability while offering consumers low retail prices.

A comparison of the level of cash tied up in working capital also shows the extent to which the wet processing companies are in a weaker financial position than the fashion brands– see Figure 11.

Figure 11 shows that the wet processing companies have more cash tied up in working capital (equivalent to 153 days of sales on average) than the brand owners, putting further strain on their finances.

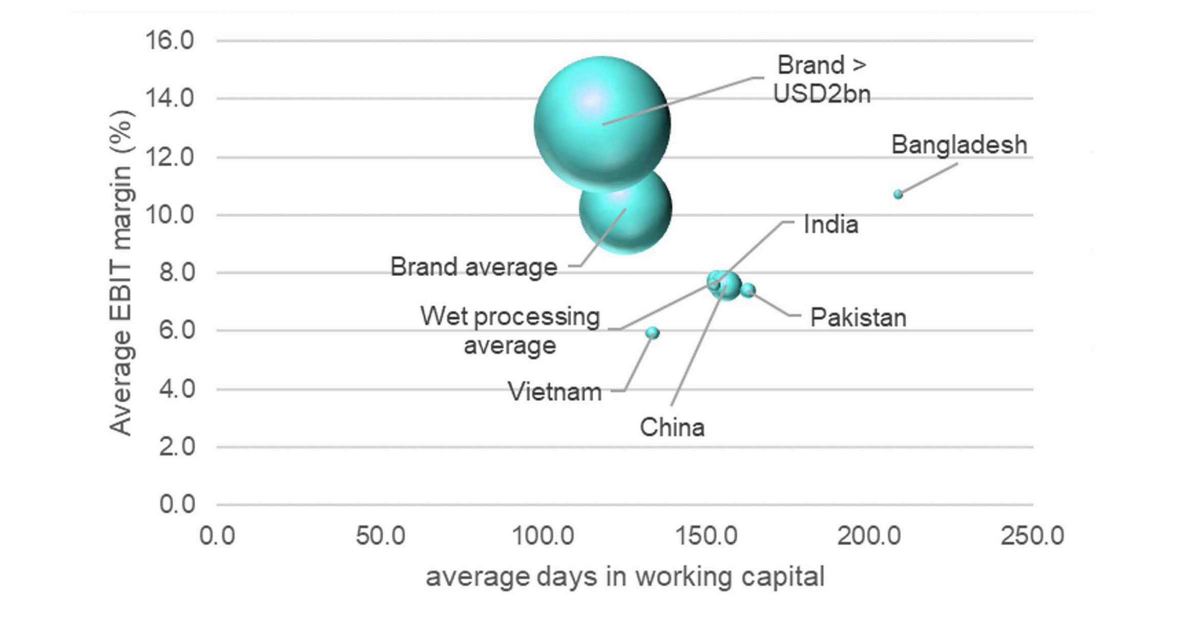

Figure 11: Average EBIT margins compared to average debt/equity ratios. Bubble size indicates average revenues. Priced at 27 October 2020). [xxiv]

Finally, we compared the returns that fashion brands were making on their assets with those generated by the wet processing companies – see Figure 12.

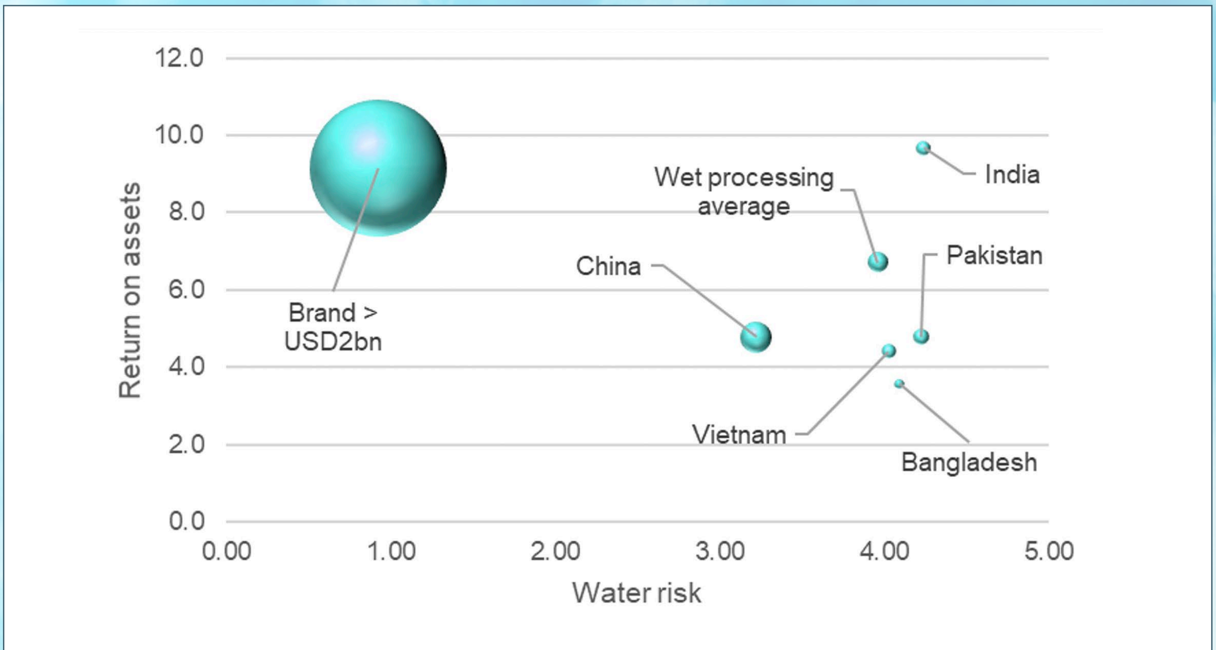

Figure 12: Average Return on Assets (Latest Reported) Compared to Average Water Risk. Bubble Size Indicates Average Revenues. Priced at 27 October 2020). [xxv]

Figure 12 clearly shows that fashion brands are generating much stronger returns (9.1% on average) than the wet processing companies (where the average is only 6.7%). Indian companies are the exception generating returns over 9%; if they are excluded from the wet processing average it falls to 4.4%.

Sharing the transition burden

When profitability and balance sheet strength are considered together it is clear that on average wet processing companies are less likely to be able to support potential transition costs than the fashion brands.

As a simplistic illustration, we estimate that a 50bp cut in the average fashion brand EBIT margin (from 13.1% to 12.6%) would provide c. USD 220 million of funding for the textile supply chain (assuming retail prices remained the same). Increasing payments to the supply chain to this extent would be equivalent to a 3% increase in EBIT for the wet processing companies.

The reality would be more complex (for example, the benefits from such a payment increase would not necessarily reach the wet processors) and there are alternative ways to direct the funding rather than simply increasing payments to Tier 1 suppliers and hoping this benefit will trickle down the supply chain, but this illustrates the extent to which fashion brands could help to fund a supply chain transition to more sustainable practices without suffering a material financial hit.

Analysing the costs of transitioning to more sustainable production methods and discussing how this process might be funded is beyond the scope of this report, but it is a topic we intend to explore further in subsequent reports.

Fashion brands have driven the negative impact of the textiles industry

To a great extent, fashion brands determine what textiles are produced, by whom, in what quantities and when, based on the designs they approve and the orders they place. Ultimately, they are the ones who have steered the industry down the high volume, low price path that has culminated in Fast Fashion and the environmental harms associated with it. They have the power to motivate a just transition to a sustainable future.

But analysing the environmental impact of the decisions made by fashion brands is extremely difficult because of the opaque and complex nature of the textiles supply chain.

Each year, Fashion Revolution assesses the efforts of fashion brands to become more transparent. The 2020 Fashion Transparency Index published by Fashion Revolution showed an overall score of 23% for the fashion industry, a 2pp (percentage points) improvement on 2019, but a clear indicator that much work remains to be done to provide better transparency of the complex supply chain that lies behind popular retail brands.[xxvi]

The Fashion Transparency Index covers five areas and weights the results to produce the final score: Policy & Commitments (18.8% weighting); Governance (4.8%); Traceability (31.6%); Know, show & fix (25.2%) and Spotlight issues (19.6%).

The average score for Traceability was only 16% in contrast to 'Policy and Commitments' where it was 52%, suggesting that there is a big gap between the traceability achieved to date and the industry's intentions – See Figure 13.

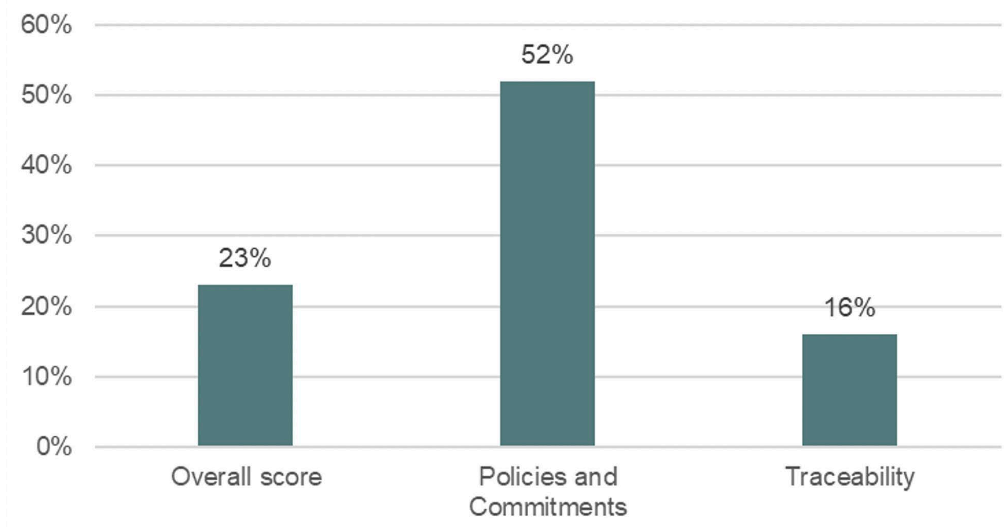

Figure 13: Fashion Transparency Index Scores 2020. [xxvii]

The poor traceability score is explained by the fact that less than half of the 250 brands surveyed disclose details of the companies in their supply chain. Only 40% (101 companies) publish lists of Tier 1 manufacturers and even fewer, 24% (60 companies), publish lists of their processing facilities which includes the wet processing factories. Only 7% disclose raw material suppliers.

That said, these figures represent a significant improvement on previous years (the score reported in 2017 was 8% compared to 23% in 2020 and only 100 brands were surveyed vs the 250 included in the 2020 report).

78% of major brands publish a policy on energy use and carbon emissions, but only 16% actually publish information about the carbon emissions produced within their supply chains (where most of the problem lies).

Water disclosures paint a similar picture. 52% publish a policy on water use (42% publish a water use policy for suppliers). However, only 31% publish their own water footprint and only 14% publish the annual water footprint at the manufacturing and/or processing facility level within the supply chain – see Figure 14.

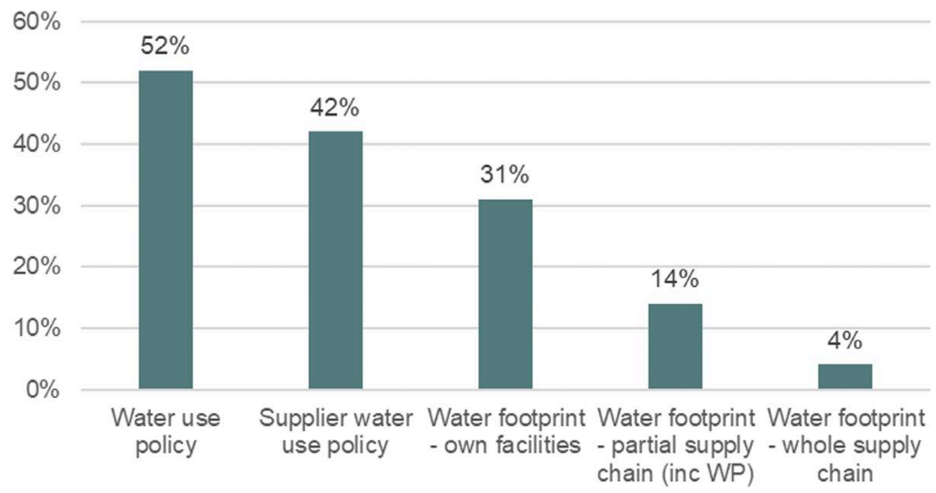

Figure 14: Survey of Brand Disclosures Regarding Water (Fashion Transparency Index report 2020. [xxviii]

Disclosure regarding waste generated during the production process is also very poor. Fashion Revolution only found 4% (11 brands) that disclosed data on this and only 3% (7 brands) that disclosed the volume of products deliberately destroyed. Given the estimated USD 500 billion of value lost per year due to overproduction and lack of recycling, this is a significant gap in the disclosures provided.[xxix]

In light of the action that a number of retailers were reported to have taken in response to Covid-19 (cancelling deliveries and refusing to pay their suppliers), it is interesting to note that only 6% publish a policy to pay suppliers within 60 days, only 11% explain how they ensure labour costs are ring-fenced (and non-negotiable) in price negotiations and only 23% disclose their approach to achieving a living wage for the workers in their supply chain.

FASHION INDUSTRY SUSTAINABILITY INITIATIVES

The textiles industry has spawned measurement tools, but change is slow

The fashion industry has spawned a number of initiatives designed to encourage moves towards a more sustainable approach to the design, production, consumption and disposal of textiles and clothing. We have highlighted five of the global initiatives in this section, including two of the most recent.[12]

The obvious criticism of the fashion industry's sustainability initiatives in the past is that their ambitions have been noble but the pace of change has been insufficient to prevent continued environmental harm (and has recently slowed, not accelerated.[xxx]

The Changing Markets Foundation published a paper entitled *'The false promise of certification'* in May 2018 which included a section reviewing the sustainability standards and certification processes in use across the textiles industry and referring to the 'more than 100 sustainability certification schemes in use in the textile industry'.[xxxi] The authors conclude that

> 'there is currently no single scheme or label that ensures transparent, traceable and reliably high standards at every stage of the supply chain.'[13]

Both of the recent initiatives discussed below have specific (measurable) environmental targets and funding provided by large fashion companies, which is encouraging, but it is too early to assess their effectiveness (particularly in relation to the supply chain issues we discuss in this report).

The Higg Index

The Higg Index was first developed by the Sustainable Apparel Coalition in 2012 and has been developed to *'accurately measure and score a company or product's sustainability performance'.* The concept underpinning the tool is that it will deliver

> 'a holistic overview that empowers businesses to make meaningful improvements that protect the well-being of factory workers, local communities and the environment.'

The Higg Facility Environmental Module (Higg FEM) includes an assessment of environmental performance relating to water use and wastewater outputs (alongside other environmental factors) by individual facilities.

In October 2020, the Higg Index and the Open Apparel Registry announced that they would be collaborating to streamline facility data records.

However, a paper published in August 2020[xxxii] based on an analysis of Higg Index data, surveys of 500 facilities and in-depth interviews with textile workers in Bangladesh and China, concluded that

> 'there is measurement (of environmental indicators), but not nearly enough action to drive real improvements.'

[12] This is not intended to be a comprehensive review

[13] Obviously, the textiles industry is not the only sector where this criticism could be made

ZDHC Foundation Roadmap to Zero[xxxiii]

The ZDHC Foundation was established in 2011 in response to the Greenpeace Detox campaign and oversees the Roadmap to Zero programme which aimed to achieve zero discharge of hazardous chemicals from the textiles production process by 2020.

The Foundation's initiatives have included producing a Manufacturing Restricted Substances List and tools allowing companies operating in the textiles supply chain to assess the products they use, identify safe alternatives and test the wastewater they produce against clear benchmarks.

Global Fashion Agenda

Founded in 2016 (formerly known as the Danish Fashion Institute). The GFA aims to encourage innovation towards a more circular approach to fashion. To support its efforts, it hosts the annual Copenhagen Fashion Summit and has published a number of regular reports assessing the industry's progress towards sustainability (including CEO agenda, Fashion on Climate and Pulse of the Fashion Industry).

The Fashion Industry Charter for Climate Action[xxxiv]

The Fashion Industry Charter was launched at COP24 in Katowice, Poland in December 2018. It includes a target of 30% GhG emission reductions by 2030 and a commitment to analyse and set a decarbonization pathway for the fashion industry drawing on methodologies from the Science-Based Targets Initiative.

The Fashion Pact[xxxv]

The Fashion Pact was launched a year ago in August 2019 at the G7 summit. It brings together CEOs from over 60 companies from across the fashion supply chain with the objectives to 'mitigate climate change, restore biodiversity and protect the oceans'.

The Fashion Pact is establishing 'mechanisms for larger brands to scale improvements pioneered by smaller innovators and ways for less-resourced companies to incorporate learnings from those who have been working in this area longer'. has a dedicated 'Task Force staff' and draws on external advisors to support this process.

SOLUTIONS AND RECOMMENDATIONS

A key component of moving the textiles and fashion industry towards a more sustainable future must be to reconfigure 'fast fashion' so that clothing is designed to be used for longer and disposed of without harming the environment (encouraging consumers to avoid treating items of clothing as akin to single-use plastic).

In this report, we have focused on the wet processing part of the textiles supply chain to highlight the level of water-related risks[14] faced by publicly listed wet processing companies. These water risks can only be mitigated by transitioning to a more sustainable approach to wet processing. Wet processing companies have an important role to play in this but a just transition is likely to require the guidance and support of the fashion brands, given their dominant influence over the textiles production process and their relative financial strength.

1 Brands

Supply chain transparency and verification

As we have discussed in this report, textile supply chains are very complex and the rewards are collected by the fashion brands and their investors, while the negative environmental impacts are generated by companies further up the supply chain and the immediate consequences are borne by people far removed from the end consumer.

A key step to resolving the negative impacts associated with textile production, and particularly wet processing, is to make the textile supply chain visible and verifiable.

One benefit of doing this is that it will enable the consumers who buy the clothes to link what they are buying to the production process and its environmental and social impacts.

The 2019 Pulse of Fashion report [xxxvi] noted that:

- 38% of consumers in Brazil, China, France, the UK and the US report actively switching from their preferred brand to another because it credibly stands for positive environmental and/or social practices.
- 75% of consumers in the five countries surveyed view sustainability as ***'extremely'*** or ***'very important'***.

This suggests that there is a clear opportunity for brands to gain market share by increasing their supply chain transparency.

There is also an opportunity for textile supply chain companies, including the wet processing companies Planet Tracker investigated, to use tools such as the Open Apparel Registry to declare their links to fashion brands and to provide clarity on the steps they are taking to move to more sustainable practices.

That could also represent a commercial opportunity for wet processors to market their sustainable qualities to brands seeking to improve the sustainability of their supply chains.

[14] As Table 1 shows, water risk is only one of the material nature-related risks that wet processing companies are exposed to – we will cover others in future reports.

Actions speak louder than policies

Brand owners need to take responsibility for changing behaviours in their supply chains.

The authors of 'Measurement Without Clear Incentives',[xxxvii] a detailed academic study into the impact on 'apparel factory practices and performance' of one of the Higg Index frameworks (the Higg Facility Environmental Module) noted that:

> 'There is need now to move from measurement and the good intentions of individual buyers, to a system with clear mechanisms and incentives to identify and drive solutions at scale. ... the industry needs to move to faster and broader systems of identifying problems, sharing solutions, and then incentivizing factories to make investments to improve.'

The share price reaction to the recent supply chain failings experienced by boohoo group plc[15] in 2020 (full explanation in footnote 5) suggests that investors (and therefore potentially customers and legislators) no longer regard the legal separation between the various suppliers en route from raw material to finished goods as a sufficient excuse to absolve the end retailer/brand owner from responsibility.

Fashion brands should align their buying with their sustainable policies and publish the results.

Again, to quote from 'Measurement Without Clear Incentives':

> 'Providing information that is detailed, granular, regular and standardized, as well as meaningful to consumers, will unlock incentives to buyers and suppliers. Top-performing producers could receive recognition in the market and encourage continuous improvement and differentiation. Helping top buyers receive the "halo effect" might encourage more brands to invest in data and environmental scientists like they have in social compliance specialists.'

Brands should finance sustainable processes

The old school - The wet processes used in manufacturing textiles have been in use for well over a hundred years (in the case of dyeing, probably thousands) and although automation has removed some of the labour involved, the basic processes and machinery designs have not changed dramatically over time.

Need for investment and innovation - To shift to more sustainable practices will require a significant investment in new techniques (to reduce or eliminate water use) and new machines, as well as improved access to sources of renewable power. Many of the wet processing factories may find this difficult, lacking the R&D facilities to develop new techniques and the financial strength to fund the capex required. Initiatives such as Fashion For Good aim to provide collaborative platforms for brands and suppliers to encourage innovation and the development of sustainable approaches.

[15] Boohoo's share price fell 46% in the 10 days following a Sunday Times report on July 5th 2020 that boohoo suppliers in Leicester had been failing to pay their workers the required UK minimum wage. The company subsequently initiated an independent investigation by Alison Levitt QC which was published on 24th September 2020 and concluded that 'Commercial concerns such as growth and profit were prioritised in a way which made substantial areas of [supply chain] risk all but invisible at the most senior level. I have concluded that in truth boohoo has not felt any real sense of responsibility for the factory workers in Leicester and the reason is a very human one: it is because they are largely invisible to them. It is hard for people to empathise with the plight of those of whom they know little.'

Financing a transition - Fashion brands already devote considerable resources to developing new fashions and marketing them around the world. They are likely to have the ability to develop new techniques and our analysis suggests they have the financial strength required to support the transition process.

Given the potential benefits of being seen to be taking practical steps to support the transition to a more sustainable future, it seems likely that investing in the supply chain to achieve this could be configured in such a way as to be profitable for the fashion brands in the medium term.

Accountability and proof of work - However, wet processors that would be beneficiaries of such financing will have to make verifiable improvements in water usage and treatment as 'proof of work'. Therefore, greater water accountability across the supply chain, especially among wet processing companies, is critical.

Commit to the supply chain - Implementing long-term contractual relationships would have the effect of providing financial support to companies in their supply chain with the added advantage of strengthening the control that fashion brands can exercise over the actions being taken. All too often the current approach is to rely on suppliers promising to adhere to brand policies without the promised adherence being audited – putting funding at the core of the relationship would encourage greater scrutiny, clearer compliance mechanisms, and a proper alignment of interests

2 Asset owners and lenders

Water-related financial risk is real - As our research shows, investors are exposed to water-related risks associated with the textiles supply chain, both through direct investment in suppliers and also indirectly through their investments in, and financial support of, the fashion brands and end retailers. In many cases, fashion brands and end retailers depend upon the financial markets for their equity and debt funding, or upon financial institutions which will in turn need to access the financial markets.

There is a clear opportunity for equity and debt investors to incentivise fashion brands and end retailers to take the actions we have outlined above, in line with the investors' own ESG policies. There is also a clear incentive. The nature of fashion is that the brand owners devote significant resources to reinforcing the strength of their brands in the minds of consumers, but this also increases the risk of a strong negative reaction if a brand is seen to be inauthentic, including regarding issues such as sustainability.

Consumers will question investors - As well as the obvious 'value at risk' argument, many investors are ultimately relying on the same consumers for their business growth and such negative consumer reactions can easily spread to investors and lenders who are seen as associated with the brand at fault. So, there is a more selfish business risk to consider as well.

Influencing the path followed by many of the suppliers, including the wet processing companies, will potentially be more difficult for global investors given that many of these companies are either privately owned (or at least majority controlled by families/individuals), based in emerging markets and/or too small to fit the institution's investment criteria.

Nonetheless, as our report shows, large investment firms are directly exposed to textile supply chain companies and the associated environmental risks and so have an incentive to encourage improvements or reduce their exposure.

Lenders - Lenders (including government agencies and development banks) are likely to have a bigger role to play in directly influencing textile supply chain companies since private as well as public companies will require debt funding and the entrepreneurs standing behind many of these companies will also seek debt finance from time to time. There is also a potential opportunity for lenders to provide finance to supply chain participants with the support of fashion brands, a strategy that could reduce lending risks while strengthening relationships with global clients.

Nature-related financial risk – This report provides a simple methodology for attributing water risk to investment portfolios that would be easy for investors to replicate. Our research and methodology of assigning water-related risk scores to a publicly listed company based on the geolocations of their productive assets (factories) by using publicly available datasets (WRI Aqueduct 3.0) would be conceptually simple to apply to investment portfolios in relation to other nature-related financial risks.

Engagement – disclosure – risk mitigation - We therefore encourage large investors to utilise and improve this methodology in order to identify the level of water-related risks embedded in their investment portfolios. The results of portfolio water risk screening will strengthen investor engagement with portfolio companies, inquiring how they are mitigating water and other nature-related material risks. Evidence-based engagement on water-related risks will lead to greater corporate water disclosures which in turn will ensure water-related financial risk is accurately taken into buy side consideration.

APPENDIX A WATER USE IN TEXTILE WET PROCESSING

Water is extensively used throughout textiles processing operations where almost all dyes, speciality chemicals and finishing chemicals are applied to textile substrates from water baths. Other processes, such as desizing, scouring, bleaching and mercerizing also use water baths or are generally very water intensive, as described earlier in this report.

Textiles therefore have a significant water footprint, i.e. they depend on a certain amount of water to produce and they require a certain amount of water to expel pollutants.

There are three water-related footprints.[xxxix]

- **Green water footprint** – Water from precipitation stored in the root zone of the soil and evaporated, transpired or incorporated by plants. A green water footprint is particularly relevant for agricultural, horticultural and forestry products.
- **Blue water footprint** – Water that has been sourced from surface or groundwater resources and is either evaporated, incorporated into a product, or taken from one body of water and returned to another, or returned at a different time. Irrigated agriculture, industry and domestic water use can each have a blue water footprint.
- **Grey water footprint** – The amount of fresh water required to assimilate pollutants to meet specific water quality standards. The grey water footprint considers point-source pollution discharged to a freshwater resource directly through a pipe or indirectly through runoff or leaching from the soil, impervious surfaces or other diffuse sources.

Textile factories involved in wet processing activities have blue and grey water footprints. Textile companies will only have green water footprints if they directly control their raw material supply or have rainwater harvesting facilities installed on site. Whilst ideal this is, however, a rarity.

Planet Tracker calculated the average water consumption per unit process in textile mills in a developed economy based on two separate studies. The difference in water usage differs slightly in each study, since they are derived from discrete sets of wet processing companies where selection bias skews the results.

An average value is derived from the two data sets to give an indication of the amount of water utilised by the wet processing sector to produce a tonne of synthetic or natural fabric - see Table 10. This is equivalent to an average of approx. 430 litres of water required in the wet processing of 1 kg of textile fabric

Table 10: Utilisation of Water Determined in Two Separate Studies for Wet Processes in Textile Manufacturing.[xl]

Process	Water usage in textile production (litres per tonne of production) - North Carolina Department of Environment and Natural Resources (2008) [xli]	Water usage in textile production (litres per tonne of production) - Shaikh (2009) [xlii]	Average water usage (litres/tonne of production)
Sizing	7,845	8,200	8,022
Desizing	20,029	21,000	20,514
Scouring	42,562	45,000	43,781
Bleaching	166,908	25,000	95,954
Mercerizing	1,001	32,000	16,501
Dyeing	150,217	300,000	225,109
Printing	25,036	16,000	20,518
Total	**413,598**	**447,200**	**430,399**

APPENDIX B CHEMICALS USED IN WET PROCESSING

Table 11 provides a short illustration of the types of chemicals typically used in the different stages of wet processing. Some studies estimate that it requires an estimated 8,000 toxic chemicals globally to turn raw materials into textiles, many of which will be released into freshwater sourcesThere are three water-related footprints.[xliii]

Table11: Conventional Wet Processing Chemicals.[xliv]

Purpose	Example chemical	Impact
Sizing	Starch	-
De-sizing	Hydrochloric acid	Corrosive [xlv]
Scouring (cotton)	Sodium hydroxide	Alkaline, corrosive [xlvi]
Bleaching	Hydrogen peroxide	Highly toxic to aquatic life [xlvii]
Oxidation, sulphur dyes	Potassium dichromate	Carcinogen, Mutagen [xlviii]
Thickener	Kerosene	Toxic [xlix]
Hydrotropic agent	Urea	-
Water repellent	C8 fluorocarbons	Persistent, toxic [l]
Wetting agent	Alkyl phenol ethoxylates	Persistent, oestrogenic [li]
Neutralization agent	Acetic acid	Toxic in high doses [lii]
Mercerization	Sodium hydroxide	Alkaline, corrosion
Reducing agent	Sodium sulphide	Corrosive, irritant [liii]
Dyeing	The powder form of sulphur dyes	Corrosive [liv]

In this report we focus on water because it is one of the natural capital assets that is essential for the production of textiles and particularly at risk of depletion as a result of the unsustainable methods currently in use.

Natural capital is another term for the stock of renewable and non-renewable resources, i.e. plants, animals, air, water, soils and minerals that combine to yield a flow of benefits to people.

To illustrate, ecosystems services (where service is defined as 'a system supplying a public need') can be regarded as the yield from healthy natural capital assets.

A degradation in natural capital assets will therefore lead to a decline in the quality and flow of ecosystems services. Ecosystems services can provide economic, social, environmental, cultural, spiritual or physical wellbeing. The value of these benefits can be understood in qualitative or quantitative (including economic) terms, depending on context.

Nature's value to industry and society is therefore derived from the consistent flow of ecosystems services from natural capital – see Figure 9.

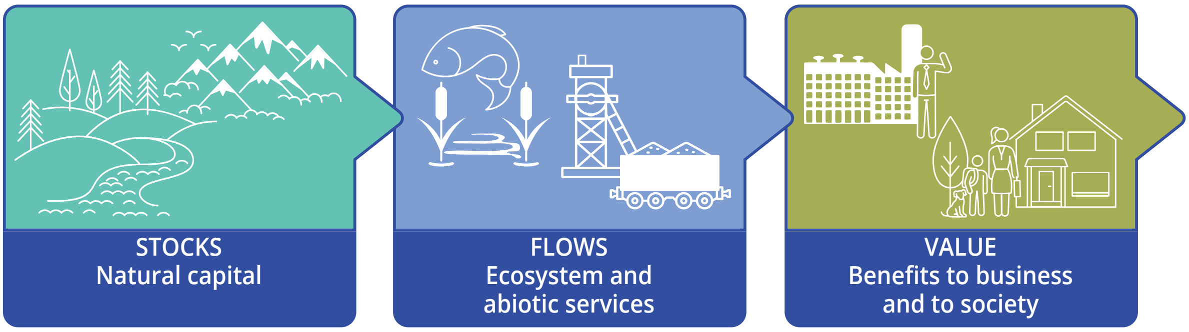

Figure 15: Biodiversity, Natural Capital and Ecosystems Services. [lvi]

Every industry sector depends on, and has an impact on, natural capital assets and their associated ecosystems services.

Using UNEP FI's Encore tool,[16] Planet Tracker has identified the natural capital assets and ecosystems services which the textile industry fundamentally depends upon to operate and to deliver shareholder returns – see Figure 16.

[16] The web-based tool, called ENCORE (Exploring Natural Capital Opportunities, Risks and Exposure), helps global banks, investors and insurance firms assess the risks that environmental degradation, such as the pollution of oceans or destruction of forests, cause for financial institutions.

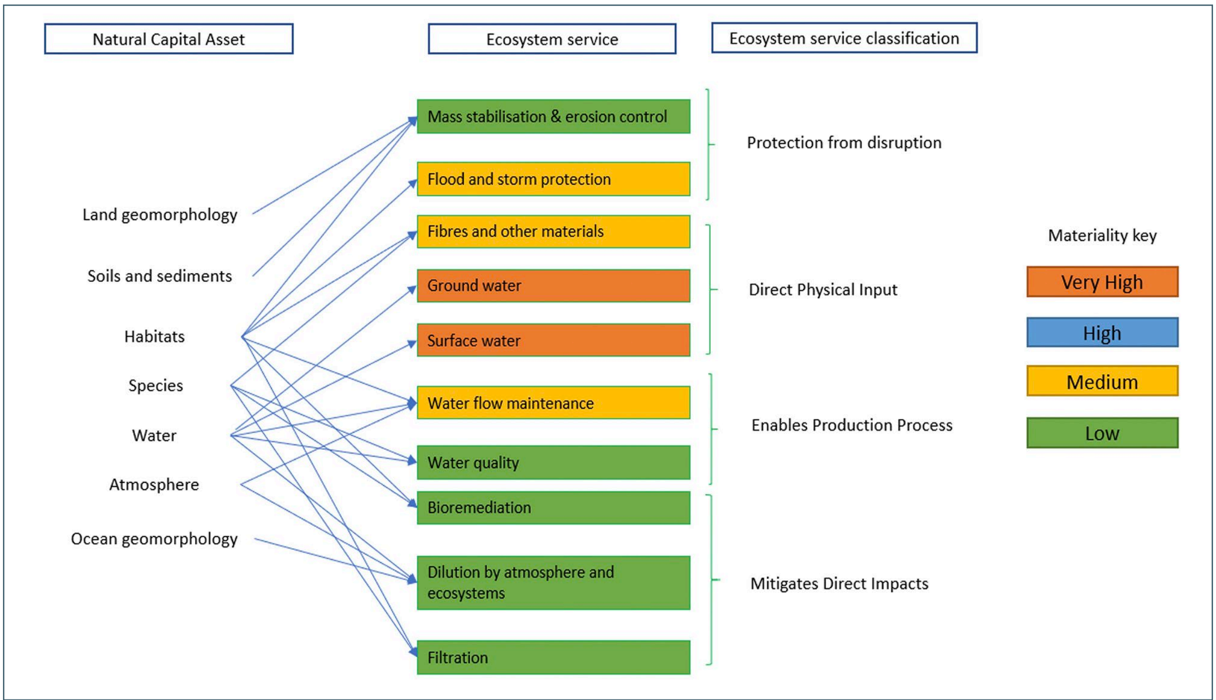

Figure 16: Natural Capital Dependencies of the Wet Processing Sector. [lvii]

From a natural capital perspective, water is the natural capital asset (stock) which contributes to the provision of ecosystem services such as ground water, surface water, water flow maintenance and water quality (potentially in combination with other natural capital assets, such as atmosphere, biodiversity (forests), geology and soils).

As illustrated by Figure 16, textile manufacturing is very highly dependent on ground water and surface water. The production of textiles results in a broad range of environmental externalities which, in turn, have an impact on the quality and flow of the ecosystems services on which the industry depends (i.e. there can be a potentially negative feedback loop as fresh water becomes scarce due to consumption and/or pollution by the textile industry).

APPENDIX D METHODOLOGY – WATER RELATED RISKS TO LISTED TEXTILE COMPANIES INVOLVED IN WET PROCESSING

Step 1 - Scoping the universe of companies involved in wet processing

The textiles, apparel and luxury goods (TAL) sector is dominated by multinational retailers, including many well-known fashion brands. FashionUnited estimates that the total value of the top 100 listed fashion brands exceeds USD 1 trillion. The economic footprint of the industry is even larger when general retailers such as Walmart, Amazon, etc, are taken into account with respect to their TAL sales.

However, as described previously, while a few multinational retailers directly own wet processing factories, the majority of companies involved in the wet processing stage of the textiles supply chain are independent operators that are much smaller than the multinational retailers they supply (although some are large in absolute terms and in the context of their local markets).

Step 2 - Planet Tracker's textile wet processing universe

We identified 1,200 companies involved in the textiles supply chain using the keywords 'dyeing', 'textiles' and 'wet processing' in Bloomberg and Factset.

On further investigation of those 1200 companies we found factory locations for 821 companies and identified 740 companies that were directly involved in wet processing.

We filtered out companies that did not disclose complete financial and ownership details, leaving us with a universe of 230 companies where we could link factory locations through to the investors owning the company.

Step 3 - Linking water risk to wet processing factories of listed companies

Once our sample set of companies and factories were identified, we then proceeded to assign a water risk score to each company based on the location of its factories and water risk scores provided by the World Resources Institute (WRI).

The WRI's Aqueduct 3.0 framework assesses water risk at a global scale by using 13 water risk indicators to calculate 'overall water risk'. To date, this is the most comprehensive water risk framework available in the public domain.

The WRI's water risk framework organises indicators into categories of risk which allow the creation of a composite index that brings together multiple dimensions of water-related risk into comprehensive aggregated scores. By providing consistent scores across the globe, the Aqueduct 3.0 tool enables rapid comparison across diverse aspects of water risk.

The WRI Aqueduct 3.0 tool goes further in providing industry-specific water risk profiles (including the textiles industry) by adjusting the water risk profile for specific geographies depending on how fundamentally important the water risk indicators are to the industry sector.

We have used the textiles industry tailored water risk scores from WRI's Aqueduct 3.0 tool in this report. The score ranges and their associated grades are summarised in Table 12.

Table 12: Labels applied by WRI to their textiles water risk scores.[lix]	
WRI label	**WRI textile overall water risk score**
Low	0 to 1
Low-Medium	1 to 2
Medium-High	2 to 3
High	3 to 4
Extremely high	4 to 5

For more details regarding WRI's Aqueduct tool's methodology and detailed descriptions of the 13 water risk indicators used to determine an overall water risk score, please refer to Appendix E – WRI's Water Risk Methodology.

Step 4 - Assigning water risk scores to companies

Planet Tracker identified factory locations of the companies in its wet processing listed equity universe by analysing company literature (company website, annual reports, sustainability reports etc.) and uploaded those locations onto the WRI Aqueduct website.

80% of the companies we investigated were located in the same country as their factories and did not have any foreign operations, so where we do not have factory data, we have used the water risk score for the country where the company is based as a reasonable proxy for the water risk arising from its operations (discussed below - see Table 13).

WRI's Aqueduct then produced baseline overall water risk profiles, based on historical output data (1990 – 2014), for each of the factory locations Planet Tracker identified for each company in its wet processing universe.

We then used a simple average of the water risk profiles of all the factories belonging to one company to provide a singular baseline overall water risk profile for that company.

The singular baseline water risk profiles of the companies were then used to present a water risk-related materiality assessment for the global wet processing equity universe and investors exposed to that universe.

Using factory locations to calculate country-level water risk

We investigated the geographical locations of the factories owned by the companies we identified. 821 companies provided information that enabled us to track down their factories and we identified 740 companies directly involved in wet processing with a total of 1606 separate facilities.

Based on the factory-level data we have calculated textile industry water risk scores on a country basis to be used when factory location data is not available – see Table 13.

Table 13: Country-Level Textile Industry Water Risk Scores – Countries with Extremely High or High risk. [lxi]

WRI Rank	Country (ranked by water risk)	WRI Water risk
1	Myanmar	4.27
2	India	4.24
3	Pakistan	4.23
4	Tanzania	4.16
5	Mongolia	4.13
6	Haiti	4.12
7	Cambodia	4.11
8	Madagascar	4.10
9	Lao People's Democratic Republic	4.10
10	Uzbekistan	4.10
11	Bangladesh	4.09
12	Ivory Coast	4.09
13	Ethiopia	4.08
14	Eswatini	4.07
15	Morocco	4.06
16	Lesotho	4.03
17	Vietnam	4.0
18	Philippines	3.99
19	Indonesia	3.99
20	Nicaragua	3.87
21	Dominican Republic	3.84
22	North Korea	3.61
23	Honduras	3.59
24	Guatemala	3.56
25	Albania	3.53
26	Moldova	3.51
27	Mauritius	3.50
28	Sri Lanka	3.49
29	Venezuela	3.34
30	Peru	3.32
31	Oman	3.28
32	China	3.22
33	Brazil	3.17
34	Thailand	3.08
35	Romania	3.06

Country (alphabetical)	WRI Rank	WRI Water risk
Albania	25	3.53
Bangladesh	11	4.09
Brazil	33	3.17
Cambodia	7	4.11
China	32	3.22
Dominican Republic	21	3.84
Eswatini	14	4.07
Ethiopia	13	4.08
Guatemala	24	3.56
Haiti	6	4.12
Honduras	23	3.59
India	2	4.24
Indonesia	19	3.99
Ivory Coast	12	4.09
Lao People's Democratic Republic	9	4.10
Lesotho	16	4.03
Madagascar	8	4.10
Mauritius	27	3.50
Moldova	26	3.51
Mongolia	5	4.13
Morocco	15	4.06
Myanmar	1	4.27
Nicaragua	20	3.87
North Korea	22	3.61
Oman	31	3.28
Pakistan	3	4.23
Peru	30	3.32
Philippines	18	3.99
Romania	35	3.06
Sri Lanka	28	3.49
Tanzania	4	4.16
Thailand	34	3.08
Uzbekistan	10	4.10
Venezuela	29	3.34
Vietnam	17	4.03

APPENDIX E WRI'S WATER RISK METHODOLOGY

A full description of the methodology and assumptions underpinning the WRI's Aqueduct tool is provided in the WRI Aqueduct 3.0 2020 technical note.[lxii] We provide a summary in Table 14.

WRI's hydrological model

The WRI has considered several global hydrological models and selected the PCRaster Global Water Balance (PCRGLOBWB 2) model.

The PCRGLOBWB 2 model contains historical output data (1990-2014) on water withdrawal,[lxiv] available water [lxv] and groundwater heads [lxvi]) that are used by WRI Aqueduct and further processed using spatial [lxvii] and temporal [lxviii] aggregation methods to present a 13 indicator water risk assessment of textile factory locations inputted into the Aqueduct 3.0 tool.

Table 14: Description and Calculation of WRI's Water Risk Indicators .

Water risk classification	Water Risk Indicator	Description Indicator	Raw measurement	Calculation
Physical Risks Quantity	Baseline Water Stress.	Baseline water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies. Water withdrawals include domestic, industrial, irrigation, and livestock consumptive and non-consumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate more competition among users.	Baseline water stress per month per sub basin in [location].	Baseline water stress is calculated using the postprocessed gross and net total withdrawal and available water per sub-basin time series from the default PCR-GLOBWB 2 run.
Physical Risks Quantity	Baseline Water Depletion	Baseline water depletion measures the ratio of total water consumption to available renewable water supplies. Total water consumption includes domestic, industrial, irrigation, and livestock consumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate larger impact on the local water supply and decreased water availability for downstream users. Baseline water depletion is similar to baseline water stress; however, instead of looking at total water withdrawal (consumptive plus non-consumptive), baseline water depletion is calculated using consumptive withdrawal only.	Water depletion per month, per year, per sub basin in [location].	Baseline water depletion is calculated using the processed net total withdrawal and available water per sub-basin time series from the default PCR-GLOBWB 2 run.
Physical Risks Quantity	Interannual Variability	Interannual variability measures the average between year variability of available water supply, including both renewable surface and groundwater supplies. Higher values indicate wider variations in available supply from year to year.	Interannual variability per month, per sub-basin, in [location].	Interannual variability is calculated using the available water time series from the default PCR-GLOBWB 2 aggregated in space but not in time. Interannual, or between year, variability is defined as the coefficient of variation (CV) of available water for each sub-basin. The CV is the standard deviation (SD) of the available water, divided by the mean. The CV per subbasin is determined for each individual month, as well as annually.

Water risk classification	Water Risk Indicator	Description Indicator	Raw measurement	Calculation
Physical Risks Quantity	Seasonal Variability	Seasonal variability measures the average within-year variability of available water supply, including both renewable surface and ground-water supplies. Higher values indicate wider variations of available supply within a year.	Seasonal variability per sub-basin in [location].	Seasonal variability is calculated using the available water time series from the default PCR-GLOBWB aggregated in space but not in time.
Physical Risks Quantity	Groundwater Table Decline	Groundwater table decline measures the average decline of the groundwater table as the average change for the period of study (1990–2014). The result is expressed in centimetres per year (cm/yr). Higher values indicate higher levels of unsustainable groundwater withdrawals.	Elevation of floodplain in meters for each 5 × 5 arc minute cell. If the difference between the floodplain elevation and the average elevation is greater than 50m, the cell is classified as mountainous.	Groundwater table decline is calculated using the groundwater heads time series from the PCR-GLOBWB 2 run coupled with MODFLOW to account for lateral groundwater flow processes. This indicator is based on the gridded monthly groundwater heads between January 1990 and December 2014. The groundwater aquifers contain several geomorphological features, which for practical reasons can be divided into sedimentary basins and mountain ranges. In mountainous areas, most materials are hard rock and eventually weathered. In the PCR-GLOBWB 2 model coupled with MODFLOW, very deep groundwater influences the averages in mountainous cells and is not representative. Mountainous areas are determined by comparing the height of the floodplain within a cell with the average elevation of that same cell. The elevation of the floodplain is derived from the 30 × 30 arc second digital elevation data from HydroSheds. The flood plain elevation is simply the minimum of the input.
Physical Risks Quantity	Riverine Flood	Riverine flood risk measures the percentage of population expected to be affected by Riverine flooding in an average year, accounting for existing flood-protection standards. Flood risk is assessed using hazard (inundation caused by river overflow), exposure (population in flood zone), and vulnerability. The existing level of flood protection is also incorporated into the risk calculation. It is important to note that this indicator represents flood risk not in terms of maximum possible impact but rather as average annual impact. The impacts from infrequent, extreme flood years are averaged with more common, less newsworthy flood years to produce the "expected annual affected population." Higher values indicate that a greater proportion of the population is expected to be impacted by Riverine floods on average.	The percentage of population expected to be affected annually by riverine floods per HydroBASIN 6.	Data on the population impacted by riverine floods are provided by Aqueduct Floods at the state /HydroBASIN 6 intersect scale. The data set estimates the average number of people to be impacted annually for several flood event magnitudes (2, 5, 10, 25, 50, 100, 250, 500 and 1,000 in return periods). The expected annual affected population is calculated using a risk curve. To create the curve, the return periods are first converted into probabilities (i.e., 1/ return period) and then plotted on the x axis against the impacted population. Next, flood protection is added to the graph. The current level of flood protection, given in return years, comes from the Flood Protection Standards (FLOPROS) model. All impacts that fall to the right of the flood protection line (i.e., impacted by smaller floods) are assumed to be protected against floods and are removed from the calculation. The expected annual affected population is calculated by integrating the area under the curve to the left of the flood protection line. The expected annual affected population is calculated for each state/ HydroBASIN 6 intersect, then aggregated up to the HydroBASIN 6 scale. The total population in each state/HydroBASIN 6 intersect is also summed to the HydroBASIN 6 scale.

Water risk classification	Water Risk Indicator	Description Indicator	Raw measurement	Calculation
Physical Risks Quantity	Coastal Flood Risk	Coastal flood risk measures the percentage of the population expected to be affected by coastal flooding in an average year, accounting for existing flood protection standards. Flood risk is assessed using hazard (inundation caused by storm surge), exposure (population in flood zone), and vulnerability. The existing level of flood protection is also incorporated into the risk calculation. It is important to note that this indicator represents flood risk not in terms of maximum possible impact but rather as average annual impact. The impacts from infrequent, extreme flood years are averaged with more common, less newsworthy flood years to produce the "expected annual affected population." Higher values indicate that a greater proportion of the population is expected to be impacted by coastal floods on average.	The percentage of population expected to be affected annually by coastal floods per HydroBASIN 6.	Data on the population impacted by coastal floods are provided by Aqueduct Floods at the state /HydroBASIN 6 intersect scale. The data set estimates the average number of people to be impacted annually for several flood event magnitudes (2, 5, 10, 25, 50, 100, 250, 500 and 1,000 in return periods). The expected annual affected population is calculated using a risk curve. To create the curve, the return periods are first converted into probabilities (i.e., 1/return period) and then plotted on the x axis against the impacted population. Next, vulnerability—or flood protection—is added to the graph as a vertical line. The current level of flood protection, given in return years, comes from the FLOPROS model. All impacts that fall to the right of the flood protection line (i.e., impacted by smaller floods) are assumed to be protected against floods and are removed from the calculation. The expected annual affected population is calculated by integrating the area under the curve to the left of the flood protection line. The expected annual affected population is calculated for each state/HydroBASIN 6 intersect and then aggregated up to the HydroBASIN 6 scale. The total population in each state /HydroBASIN 6 intersect is also summed to the HydroBASIN 6 scale.
Physical Risks Quantity	Drought Risk	Drought risk measures where droughts are likely to occur, the population and assets exposed, and the vulnerability of the population and assets to adverse effects. Higher values indicate higher risk of drought.	Drought risk per sub basin in [location]	Drought risk is assessed for the period 2000–2014 and is a combination of drought hazard, drought exposure, and drought vulnerability. Drought hazard is derived from a non-parametric analysis of historical precipitation deficits at the 0.5 [degree resolution]; drought exposure is based on a non-parametric aggregation of gridded indicators of population and livestock densities, crop cover and water stress; and drought vulnerability is computed as the arithmetic composite of high level factors of social, economic and infrastructural indicators, collected at both the national and sub-national levels.

Water risk classification	Water Risk Indicator	Description Indicator	Raw measurement	Calculation
Physical Risks Quantity	Untreated Connected Wastewater	Untreated connected wastewater measures the percentage of domestic wastewater that is connected through a sewerage system and not treated to at least a primary treatment level. Wastewater discharge without adequate treatment could expose water bodies, the general public and ecosystems to pollutants such as pathogens and nutrients. The indicator compounds two crucial elements of wastewater management: connection and treatment. Low connection rates reflect households' lack of access to public sewerage systems; the absence of at least primary treatment reflects a country's lack of capacity (infrastructure, institutional knowledge) to treat wastewater. Together these factors can indicate the level of a country's current capacity to manage its domestic wastewater through two main pathways: extremely low connection rates (below 1 percent), and high connection rates with little treatment. Higher values indicate higher percentages of point source wastewater discharged without treatment.	Unimproved/ connected wastewater raw value in [%].	Sewerage connection and wastewater treatment data come from a white paper published by the International Food Policy Research Institute (IFPRI) and Veolia. This aggregates three of the leading research papers on country-level connection and treatment rates into one data set through a hierarchical methodology. The data include the percentage of households connected to sewerage systems (percent connected), and the percentage of wastewater connected left untreated (i.e., not treated using primary, secondary, or tertiary treatments) (percent untreated). The calculation is based on the Environmental Performance Index's Wastewater Treatment (WWT) indicator. WWT examines the performance of wastewater treatment. The untreated, connected wastewater indicator reverses the WWT to instead examine the hazard.
Physical Risks Quantity	Coastal Eutrophi-cation Potential	Coastal eutrophication potential (CEP) measures the potential for riverine loadings of nitrogen (N), phosphorus (P), and silica (Si) to stimulate harmful algal blooms in coastal waters. The CEP indicator is a useful metric to map where anthropogenic activities produce enough point-source and nonpoint-source pollution to potentially degrade the environment. When N and P are discharged in excess over Si with respect to diatoms, a major type of algae, undesirable algal species often develop. The stimulation of algae leading to large blooms may in turn result in eutrophication and hypoxia (excessive biological growth and decomposition that reduces oxygen available to other organisms). It is therefore possible to assess the potential for coastal eutrophication from a river's N, P, and Si loading. Higher values indicate higher levels of excess nutrients with respect to silica, creating more favourable conditions for harmful algal growth and eutrophication in coastal waters downstream.	Coastal eutrophication potential [kg C-equivalent/km2/day].	The calculation described below is based on the Indicator of Coastal Eutrophication Potential (ICEP) methodology. The data are based on the Global NEWS 2 model and aligned to Simulated Topological Network basins. The NEWS 2 model uses biophysical, natural, and anthropogenic (both point and nonpoint) nutrient sources, along with in-watershed and in-river removal processes, to derive global nutrient yields. Total N and P fluxes are calculated by summing NEWS 2 nutrient yield data for dissolved organic, dissolved inorganic, and particulate nutrients. Si fluxes are simply the dissolved inorganic Si yields in the basin. The calculation is based on the Redfield molar ratio (C:N:P:Si = 106:16:1:20), which is a representation of the approximate nutrient requirement of marine diatoms.

Water risk classification	Water Risk Indicator	Description Indicator	Raw measurement	Calculation
Regulatory and Reputational Risk	Unimproved/ No Drinking Water	Unimproved/no drinking water reflects the percentage of the population collecting drinking water from an unprotected dug well or spring, or directly from a river, dam, lake, pond, stream, canal, or irrigation canal. Specifically, the indicator aligns with the unimproved and surface water categories of the Joint Monitoring Programme (JMP)—the lowest tiers of drinking water services. Higher values indicate areas where people have less access to safe drinking water supplies.	The rural and urban unimproved/no access rate is multiplied by the rural and urban populations, respectively, to find the number of people with unimproved/ no access to drinking water in each Aqueduct geometry. The rural and urban totals are then summed and aggregated to the HydroBASIN 6 scale, along with total population.	Data for this indicator come from the 2015 drinking water access rates published by JMP. The statistics from JMP's "at least basic" and "limited" fields are summed to represent the percentage of the population with access to improved drinking water. The improved rate is then inverted into the unimproved/no access rate by subtracting improved from 100 percent. This is done for the national, rural, and urban averages in each country. The national average is used to fill in any missing rural or urban averages. The unimproved/no access rate is matched to each Aqueduct geometry (intersect of states, HydroBASIN 6, and aquifers; using the International Organization for Standardization (ISO) codes provided by the Database of Global Administrative Areas (GADM) ("GADM Metadata" n.d.). Rural and urban populations are calculated for each Aqueduct geometry. Rural and urban populations come from a gridded 2010 population data set produced by the Netherlands Environmental Assessment Agency (PBL). The gridded population data set is parsed into rural and urban populations using a 2010 urban extent data layer and then summed by Aqueduct geometry.
Regulatory and Reputational Risk	Unimproved/ No Sanitation	Unimproved/no sanitation reflects the percentage of the population using pit latrines without a slab or platform, hanging/bucket latrines, or directly disposing human waste in fields, forests, bushes, open bodies of water, beaches, other open spaces, or with solid waste. Specifically, the indicator aligns with JMP's unimproved and open defecation categories— the lowest tier of sanitation services. Higher values indicate areas where people have less access to improved sanitation services.	The rural and urban unimproved/no access rate is multiplied by the rural and urban populations, respectively, to find the number of people with unimproved/ no access to sanitation in each Aqueduct geometry. The rural and urban totals are then summed and aggregated to the HydroBASINS 6 scale, along with total population.	Data for this indicator come from the 2015 sanitation access rates published by JMP. Statistics from JMP's "at least basic" and "limited" fields are summed to represent the percentage of the population with access to improved sanitation. The improved rate is then inverted into the unimproved/no access rate by subtracting improved from 100 percent. This is done for the national, rural, and urban averages in each country. The national average is used to fill in any missing rural or urban averages. The unimproved/no access rate is matched to each Aqueduct geometry (intersect of states, HydroBASINS 6, and aquifers) using the International Organization for Standardization (ISO) codes provided by GADM ("GADM Metadata" n.d.). Rural and urban populations are calculated for each Aqueduct geometry. Rural and urban populations come from a gridded 2010 population data set produced by PBL. The gridded population data set is parsed into rural and urban populations using a 2010 urban extent data layer, and then summed by Aqueduct geometry.

Water risk classification	Water Risk Indicator	Description Indicator	Raw measurement	Calculation
Regulatory and Reputational Risk	Peak RepRisk country ESG risk index	The Peak RepRisk country ESG risk index quantifies business conduct risk exposure related to environmental, social, and governance (ESG) issues in the corresponding country. The index provides insights into potential financial, reputational, and compliance risks, such as human rights violations and environmental destruction. RepRisk is a leading business intelligence provider that specializes in ESG and business conduct risk research for companies, projects, sectors, countries, ESG issues, NGOs, and more, by leveraging artificial intelligence and human analysis in 20 languages. WRI has elected to include the Peak RepRisk country ESG risk index in Aqueduct to reflect the broader regulatory and reputational risks that may threaten water quantity, quality, and access. While the underlying algorithm is proprietary, WRI believes that the inclusion of the Peak RepRisk country ESG risk index, normally unavailable to the public, is a value-add to the Aqueduct community. The peak value equals the highest level of the index in a given country over the last two years. The higher the value, the higher the risk exposure.		RepRisk screens over 80,000 media, stakeholder, and third-party sources daily to identify and analyze ESG-related risk incidents and quantify them into the Peak RepRisk country ESG risk index (RepRisk n.d.). The results of the screening process are delivered to the RepRisk team of analysts, who are responsible for curating and analysing the information. They hand select the items, give each risk incident a score (based on severity, source, and novelty), and write a risk summary. Before the risk incident is published, a senior analyst runs a quality check to ensure that the process has been completed in line with RepRisk's strict, rules-based methodology. After the senior analyst has given her or his approval, the final step in the process, the quantification of the risk, is performed through data science. The Peak RepRisk country ESG risk index takes into consideration the impact of a country's risk incidents within the last two years and the average of a country's Worldwide Governance Indicators. The data used in Aqueduct 3.0 cover October 2016 through October 2018.

APPENDIX F WET PROCESSING IS CONCENTRATED IN EMERGING MARKETS

The Open Apparel Registry (OAR), an open source database of textiles facilities, contains over 42,000 'facilities' across the world and provides a reasonable indication of where textiles production activity is concentrated in relation to fashion brands' supply chains – see Figure 17.[lxix]

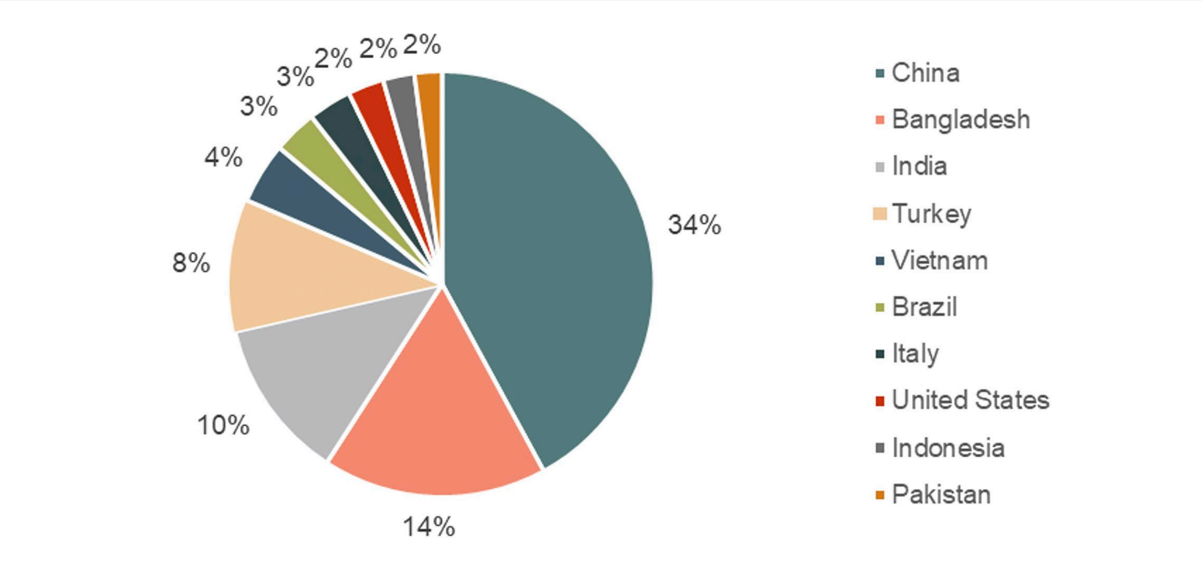

Figure 17: Top 10 Countries by Number of Textiles Facilities. [lxx]

The OAR database does not show what activities take place at a particular facility, but by assigning a unique identification number to each facility it demonstrates the potential for greater supply chain transparency in the future.

The coverage of factories in our analysis differs somewhat from the geographical distribution of facilities listed in the OAR database.[lxxi] Our sample of c. 1600 factories is much smaller than OAR's, but the companies we have identified are all involved in wet processing which is only one part of the supply chain, whereas the OAR database does not identify the activity undertaken at the facility and therefore covers all parts of the supply chain (except retailers). Furthermore, Planet Tracker's sample only includes factories belonging to publicly listed textile companies involved in wet processing.

In the OAR database, China was the most frequently mentioned country (34% of facilities), with Bangladesh second (14%) and India third (10%). In the Planet Tracker sample, India was first with 25% of the wet processing factories we identified. Pakistan came second with only 7% - see Table 15.

At this stage it is not possible to tell if these differences are due to the fact that wet processing is more concentrated in India, or if this is simply a consequence of basing our sample on disclosures by listed companies.

Table 15: Geographic Distribution of Wet Processing Facilities Owned by Listed Companies (Planet Tracker Universe) - Top 20 Countries by Number of Factories.[lxxii]			
Rank	**Country**	**Number of factories involved in wet processing**	**% of total**
1	India	407	25%
2	Pakistan	118	7%
3	China	100	6%
4	Vietnam	68	4%
5	Bangladesh	64	4%
6	Taiwan	44	3%
7	Indonesia	37	2%
8	Japan	34	2%
9	US	31	2%
10	Thailand	26	2%
11	Republic of Korea	25	2%
12	Turkey	22	1%
13	Italy	18	1%
14	Egypt	14	1%
15	Mexico	13	1%
16	Cambodia	13	1%
17	Peru	12	1%
18	Brazil	11	1%
19	Sri Lanka	9	1%
20	Greece	9	1%
		1075	**67%**

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x Source: Planet Tracker research 2020

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xv Source: WRI Aqueduct 3.0, Planet Tracker computations (2020), based on FactSet data

xvi Source: WRI Aqueduct 3.0, Planet Tracker computations (2020), based on FactSet data

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lx WRI produces its own country-level water risk scores but we calculated our own based on the average textile water risk score for the wet processing factories in that country (on the assumption that they tend to cluster in particular areas where the scores may differ from the country-level score).

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lxiv Gross (consumptive plus non-consumptive) and net (only consumptive) withdrawal for four sectors: domestic, industrial, irrigation, and livestock. The (2 x 4=) 8 gridded data sets are available for each month between January 1960 and December 2014.

lxv Accumulated available water monthly at each grid cell between January 1960 and December 2014.

lxvi Groundwater heads for each month and each grid cell between January 1990 and December 2014.

lxvii Spatial aggregation means that water withdrawal and available water are aggregated to hydrological sub-basins. Groundwater heads are aggregated to aquifers

lxviii Temporal aggregation involves applyingstatistical methods to the output time series to get a representative value for the recent situation, while reducing annual anomalies.

lxix Source: Open Apparel Registry website (2020)

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lxxi Refer to Appendix D for a discussion of our methodology

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