

Environmental scoping study

Decent work in the garment sector supply chains in Asia

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This report is part of a regional scoping analysis of decent work in the garment sector supply chains in Asia, conducted by the ILO in partnership with The Swedish International Development Cooperation Agency (Sida). The report has been prepared under the direction of Cristina Martinez, Senior Environment and Decent Work Specialist of the International Labour Organization (ILO).

Executive summary

This report contributes analysis of environmental issues to a scoping project into decent work and the garment industry in Asia. For the purpose of this paper, focus and analysis is restricted to the environmental impacts in the textile manufacturing and garment assembly links of the supply chain.

MAIN FINDINGS

Environmental impacts in the textile and garment supply chain

Environmental impacts are concentrated at certain points in the supply chain, and this report highlights four areas:

- i. the weaving, dyeing and finishing processes in textile manufacturing;
- ii. energy use;
- iii. textile waste associated with garment assembly; and
- iv. the transport emissions throughout the supply chain as materials and then final products are shipped globally.

The most significant impacts however are within the first area, with the main impacts being on use intensity of water resources, chemical use including toxic chemicals, waste water discharges and lack of treatment processes, and energy use and carbon intensity of electricity.

The environmental impacts of textile and garment manufacturing process are highly localised to where production is. The communities surrounding these facilities are significantly impacted in terms of health, quality of life, and in many cases, impacts on livelihoods from farming and fishing. The location of production facilities in major urban areas (in order to access large pools of labour) also means that these facilities are adjacent to houses, schools, other businesses and community facilities.

There is a great deal of difference between best and worst practice in terms of resource efficiency in the sector. This means there are significant opportunities to optimize the environmental and social footprint, but they require a focus on process design up front. The industry provides a context where relatively modern and existing technology can be deployed and be used to address environmental impacts, whilst also achieving productivity and development gains.

Barriers to adopting cleaner production practices in textile manufacturing include; awareness and knowledge deficiencies of inefficient practices and the availability of cleaner production techniques, lack of skilled personnel, lack of trusted information sources, lack of context specific market offerings, difficulty in accessing finance and lack of robust environmental regulation to drive compliance and best practice.

Environmental regulation systems and institutions are still emerging in many study countries. Whilst there are deficits in these regulatory frameworks, this is exacerbated by significant deficits in monitoring, testing and compliance activities. Deficits include lack of institutional capacity in environmental agencies, lack of skilled personnel within agencies, lack of adequate testing and laboratory facilities, and also minimal deterrence for non-compliance.

Intersection between decent work and environment

There are a number of intersection points between environmental impacts and decent work in the textile and garment supply chain. First, the wet processing of textiles not only has

environmental impacts with water use intensity and waste water discharges into the watershed, these processes can also put workers in hazardous positions, especially if adequate safety training, equipment and provisions are not made. Also, workers are further impacted if they live nearby to textile factories and are exposed to contaminated water supplies, and/ or their family livelihoods are negatively impacted by water scarcity or waste water discharges affecting agricultural and fishing industries.

Second, climate change impacts means that heatwave conditions will produce intolerable and dangerous working conditions if adequate ventilation, cooling and drinking water are not provided.

Third, the increasing frequency of extreme weather events such as floods, cyclones and heatwaves, which cause business disruption, can leave workers financially vulnerable if factories are not able to operate and workers lose income.

Fourth, addressing environmental impacts, through the introduction of cleaner production techniques, and the implementation of environmental regulation and strong monitoring and compliance activities, provides the opportunity to not only reduce environmental impacts but develop high level enterprise and employment opportunities in the textile and garment sector. Cleaner production requires higher levels of skill in plant and operations management. Increased monitoring and enforcement of environmental regulations increases demand for cleaner technology and production, this provides demand-pull for new enterprises to provide services to meet this need. If attention is also paid to market and non-market barriers to the adoption of cleaner production, such as access to finance, trusted information sources and knowledge sharing, as well as the participation and access of women to skills development, entrepreneurship and financial support, addressing environmental impacts can create sustainable development.

[Role of multi-stakeholder initiatives and corporate social responsibility programs](#)

The report also examined a number of illustrative examples of corporate social responsibility (CSR) and multi-stakeholder initiatives, to understand the range of activities covered, and how well they matched up to identified deficits. There is a great variety of existing initiatives in these two categories, and other development projects and funding, targeted at the sector.

The examination of CSR initiatives showed the *lack of established shared or common values across the supply chain for environmental and social goals is a key barrier to wider improvements in environmental performance*. CSR provides an important framework for developing business responses to social and environmental issues, but there are significant knowledge gaps in understanding CSR activities in Asian firms, specifically the effects of CSR interventions on firm profitability, workers and environmental conditions.

Multi-stakeholder initiatives can address environmental impacts by providing an opportunity for consensus building around the next steps for action. It also provides good opportunities for cross-organisational learning, and can fill gaps in regulatory or governance arrangements where they are still emerging in developing countries.

However, there exists a multitude of initiatives by governments, the private sector, civil society, and international organisations designed to improve social and environmental standards in the garment value chain. The challenge, being to manage multiple initiatives in a way that avoids duplication and/ or contradictory measures, and that understands that all

these initiatives are competing for the limited bandwidth for change available to each business.

POSSIBLE WAYS FORWARD

The key recommendation is the utilization of the ILO Just Transition Guidelines as a framework to guide the transformative actions proposed. The guidelines offer a policy framework and practical tool to promote a just transition to low-carbon, climate-resilient and inclusive economies. The guidelines cover nine policy areas of critical importance to a just transition (ILO 2015). The Guidelines indicate that International Labour Standards (ILS) are not a separate policy area. Rather, ILS provide the normative framework for all actions and measures.

The Just Transition Guidelines (JTG) provide a higher level umbrella to work regionally instead of nationally or locally by focusing on crossborder impacts and cross-country peer learning and sharing of experiences. *As the textile and garment industry undertakes a series of important reforms at the country level, the application of the ILO Guidelines for a Just Transition to this industry and its consideration at the regional level to address cross-border environmental and labour implications can incentivize the industry to undertake actions that are transformative at the local level at the same time that it addresses regional impacts of the industry ecosystem.*

Specifically, the application of the JTG on regional program development for waste water treatment, water efficiency, and diffusion of best practice cleaner production techniques in the textile manufacturing sector would provide the best cost-effective opportunity to address environmental impacts of the textile and garment industry. Based on the results of this scoping paper, the following recommendations for transformative actions on the ground are proposed:

- In partnership with existing local and international actors and initiatives, undertake close examination of how innovations around best practice cleaner production techniques are introduced and diffused in textile clusters, with a focus on understanding the enabling environment and what factors are context specific and what can be replicated and/ or scaled up regionally. This will require mapping of local and national level initiatives in each of the study countries, as well as country-level analysis of barriers and enabling environment for implementation.
- In doing so, pay special attention to improving adoption of cleaner production techniques lower down the supply chain, and in smaller facilities that have not been engaged with current initiatives. This can address environmental, but also gender implications of impacts, as these lower supply chain links and smaller facilities are more than likely to employ mostly women.
- Focus on developing context specific strategies for skills development, entrepreneurship, enterprise and innovation support, including finance to develop product and service offerings; this should include specific investigations and strategies for female skills and entrepreneurship activities. A regional level program can provide the overall architecture for program activities; a platform for knowledge sharing; cross-country dialogue on specific issues; and common evaluation and performance

metrics. Materials and training resources can also be developed at the regional level, and then customised by local actors for their context. The International Training Center of the ILO has a dedicated program for training constituents in Just Transition and could be engaged to design and deliver a training and skills development programme.

- These strategies should be developed using multi-stakeholder processes, with the participation of local and international actors in a regional process. The interaction with regional and international actors provides encouragement to local actors to force acknowledgement and action to address environmental impacts. Structured dialogue processes, such as tripartite social dialogue offer the best opportunities for initiatives to be fit for purpose as they provide means for workers, employers and government to participate in the process of developing strategies. Local actors not experienced in multi-stakeholder regional dialogue processes may require additional capacity and resources to adequately participate.
- CSR has an important role to play in helping businesses activate their role in social and environmental activities in addition to economic activities. There are significant knowledge gaps of local and national CSR interventions in the study countries and their effects on profitability of local enterprises, workers and environmental conditions.

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1. Introduction

This report provides an overview of the environmental impacts of textile and garment production within Asia. This includes the following countries: Bangladesh, Cambodia, China, India, Indonesia, Myanmar, Pakistan, Sri Lanka, Thailand and Vietnam.

This report contributes a preliminary analysis of environmental issues to a broader scoping project into the garment industry in Asia, undertaken by the International Labour Organisation (ILO) in partnership with the Swedish International Development Agency (SIDA).

A renewed global commitment to sustainable development

With the adoption of the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs), as well as the Paris Agreement on Climate Change in 2015, the international community has at its disposal a global framework to combat climate change, pave the way to a low-carbon and climate-resilient future and set the course for human well-being to 2030 and beyond.

A number of shared principles underpin this global framework, including the need of decoupling economic growth from energy and resource consumption and environmental degradation, the promotion of decent jobs as a means to achieve sustainable development and a just transition for all, meaning that no one is left behind. These principles essentially embody the notion that economies and societies can develop whilst reducing their adverse impact on the living environment and on the long term availability of natural resources.

Many countries have begun to integrate commitments and goals into their national development plans and strategies, by adopting approaches like green growth, greening of economies, low-carbon development and decarbonizing development. If well managed, these transitions to environmentally and socially sustainable economies can become a driver of job creation, job upgrading, social justice and poverty eradication.

The ILO engagement in support of a just transition in the Asian region

The importance of decent work in achieving sustainable development is clearly highlighted by SDG 8, which aims to “promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”. In addition, the recognition in the Paris Agreement of “the imperative of a just transition of the workforce and the creation of decent work and quality jobs in accordance with nationally defined development priorities”, places another important call on countries to undertake climate change actions that equally advance job creation and social justice.

The ILO has been increasingly active in promoting environmental sustainability through the lens of the world of work. The concept of “green and decent jobs” summarizes the particular angle the ILO takes to preserve and restore a sustainable environment through transformative growth both in traditional economic sectors (e.g. textile, manufacturing and construction), or in new, emerging green sectors (e.g. renewable energy and energy efficiency). The term also carries the qualitative notion that green jobs require to be fairly remunerated and productive, need to provide sufficient levels of social protection, ensure

social dialogue, and guarantee rights at work, while contributing to reduce inequalities between women and men.

The 102nd International Labour Conference (ILC) of June 2013 adopted Conclusions concerning sustainable development, decent work and green jobs providing a framework and guidance in a wide range of policy areas where ILO constituents – governments, workers and employers’ organizations – could take action to protect jobs and promote decent work creation in low-carbon and climate-resilient sectors.

Following the ILC 2013 Conclusions, the ILO adopted in November 2015 a set of **Guidelines for a just transition to environmentally sustainable economies and societies for all**. These Guidelines offer the ILO and its constituents a framework and a practical tool to ensure that national and global efforts to tackle climate change and other environmental challenges, advance employment creation goals, social justice and fair transitions for workers, enterprises and communities on an equal footing.

The Guidelines are both a policy framework and a practical tool to help countries at all levels of development manage the transition to low-carbon economies and can also help them achieve their Nationally Determined Contributions (NDCs) and the SDGs. The Guidelines are designed to create decent work on a large scale and ensure that social protection exists where needed. They also include mechanisms for social dialogue among governments, workers and employers’ organizations throughout policymaking processes at all levels (see Figure 1).

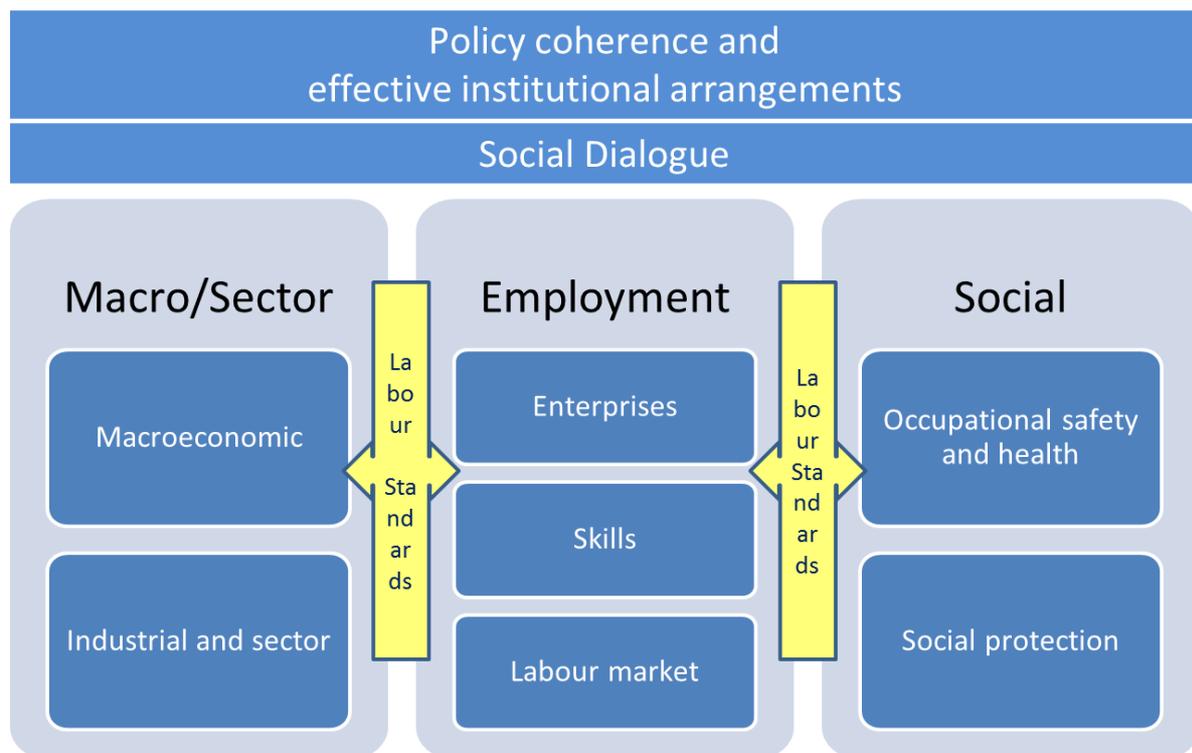


Figure 1: ILO Framework for Just Transition (Source: ILO 2015)

The Green Jobs Programme is the main support vehicle for the ILO’s work to address the implication on employment and social inclusion of the transition towards low-carbon, climate resilient and resource-efficient economies. It promotes the development of sustainable

enterprises and economies that are efficient, socially just and environmentally sound and sustain a fair globalization.

As the textile and garment industry undertakes a series of important reforms at the country level, there has been no application of the ILO Guidelines for a Just Transition to this industry and none or little consideration has been given at the regional level to address cross-border environmental and labour implications.

Methods and structure

The research method used in this scoping project has been literature and document review, with both academic and grey literature consulted. These reviews are complemented by a small number of stakeholder interviews (5). The aim of the review is to highlight areas of environmental impact and where this occurs along the textile and garment supply chain, and to provide some illustrative (rather than comprehensive) examples of the various pathways to improving environmental performance. This includes in the regulative context, brand-led corporate social responsibility programs (CSR), and multi-stakeholder initiatives involving a range of actors such as brands, suppliers and factories, unions, civil society groups and non-government organisations (NGOs).

This review, conducted between August and September 2017, focuses mostly on international level examples, so initiatives involving multiple countries, in line with the expectation that the regional program will also be multi-country. In doing so national, provincial and local initiatives that exist in various forms in the individual countries and regions where textile and garment manufacturing exists are not covered. Analysis and integration of these initiatives (where relevant, and the organisations running them, will be a necessary further step in identifying and designing future program objectives.

For the purpose of this paper, focus and analysis is restricted to the environmental impacts in the textile manufacturing and garment assembly links in the supply chain. This is not to underestimate the environmental impacts in the production of fibres and yarns (e.g. water and pesticides use in cotton farming), the extensive transport and logistics in the globalized supply chain (most by commercial shipping and road transport), and the impacts of rapidly increasing amounts of textile waste going to landfill post-consumption. The focus on textile and garment manufacturing is to match with the potential future regional project.

The review is structured into six sections:

The first section introduces the report, methods, scope and highlights key definitions.

The second section provides an overview of the textile and garment supply chain, identifying the environmental impacts of the textile production and garment assembly links of the supply chain. This section also provides a brief overview of some of the drivers and dynamics of the supply chain, and shows how these exacerbate environmental impacts and/ or provide challenges and opportunities to address them effectively in production processes.

The third section provides a high-level view of the performance of environmental regulation in the study countries, as well as details of relevant international legislation and agreements that also impact environmental performance.

Section four provides an overview and analysis of a number of illustrative examples of brand-led CSR programs that cover the textile and garment industry. These programs represent 'best

practice' CSR activities in terms of level of investment and integration into corporate strategy. Each example shows how multi-national firms approach CSR programs, and the different types of activities that make up these programs. This includes detail on the actors involved, characteristics of the programs and highlighting relevant impacts and practice changes where they exist.

The fifth section provides an overview of a variety of multi-stakeholder initiatives that are also operating in the textile and garment manufacturing sectors. These initiatives are created and implemented through multi-stakeholder dialogue processes including governments (in many cases multiple government participants), civil society groups, NGOs, brands, factories and suppliers, and unions (domestic and international).

The focus in selecting initiatives to review was primarily international, multi-country initiatives to provide reference points for similar activities at a regional scale. The review includes detail on the actors involved, characteristics of the programs including geographical/sub-sector focus, and how they address environmental impacts and/ or support cleaner production. Again, as with the CSR sections, the aim is to be illustrative rather than comprehensive.

The sixth section report summarizes the report findings, conclusions and provides recommendations based on these research findings for further research and actions on the ground to improve environmental performance in the textile and garment industry.

2. Environmental impacts of the textile and garment industry

The textile and garment industry supply chain is one of the most complex and globalised supply chains of any merchandise or commodity. Globally, the market for textiles and apparel is US\$2,000bn annually (WTO2016). According to the World Trade Organisation in 2016 the value of world textile and apparel exports totalled US\$291bn and US\$445bn respectively (WTO 2016). China, the EU and India are the top three exporters of textiles in 2015, accounting for two thirds of global production. The top three exporters of apparel include China, the EU and Bangladesh, accounting for 70% of global production (WTO 2016). From these statistics, it is clear that Asia plays a critical role in the textile and garment supply chain.

The sector also plays a critical role employing people; it is estimated to employ more than 60million people globally (OECD 2015). The sector has also seen substantial growth in employment in the last two decades, in 2000 the sector was estimated to employ 20million people globally (CCC 2015). The vast majority of this employment growth has been in Asian countries, for example in Bangladesh the ready-made garment sector currently employs almost 4 million people up from 300,000 in 2000 (ADB 2014).

The sector is an important source of employment for women. The Clean Clothes Initiative estimates that three quarters of garment workers worldwide are female (CCC 2015). The textile and garment supply chains are highly gendered; the majority of workers are women, and the further down the supply chain the more female the workforce becomes (Hale and Turner 2005).

The sector was one of the earliest to globalise. Textile and garment production has played a unique and defining role in the economic development of many nations. It was the critical

industry that led to the first industrial revolution, and ever since development of a garment industry has signalled more sophisticated industrialisation within national economies, most recently in Asia (Anguelov 2016).

The presence of textile and apparel manufacturing in a country is seen as a trigger for industrial development in related manufacturing activities such as chemicals. It provides large amounts of low skilled employment that provide opportunities for workers to move from informal to formal work. The industry also often brings significant foreign direct investment, and offers emerging economies opportunity to participant in global trade; textiles and apparel making up between 60-90% of total merchandise exports in these economies (WTO 2015).

All of this highlights the importance of the textile and garment industry for many countries, and individual businesses and workers within these countries. For these reasons considering the environmental impacts of these industries and how they might be changed and minimised into the future can seem like a dampener on the development potential of the industry, especially in countries that are relying on this development to address poverty within their populations.

However, the opposite is true, there are significant opportunities available in addressing environmental impacts. This includes introducing cleaner production activities and sustainable development practices that contribute to increased productivity, competitiveness, and develop decent work by increasing labour force skills and knowledge, as well as contribute to achievement of sustainable development goals. Implementing these opportunities requires a comprehensive perspective of the supply chain, including design processes and 'front-of-pipe' technologies and production processes (Martin 2013). As well as strategies to actively upgrade the skills and range of occupations involved in textile and garment production.

2.1 The Textile and Garment Industry Supply Chain

The textile and garment industry has three main areas of production:

- Input production, which includes the production of the basic inputs into textiles; cotton growing, and the production of synthetic materials such as polyester, rayon and nylon.
- Textile manufacturing, which includes spinning, weaving and finishing fabrics.
- Garment assembly and finishing, where garments are assembled from textiles. This can involve multiple enterprises, and include activities from garment sewing, to the addition of zips and buttons, and final finishing and labelling.

Figure 1 provides an overview of the main components of the supply chain, and highlights where the environmental impacts are concentrated. Aspects of textile and garment production and assembly are labour intensive, therefore production has largely shifted to developing countries, to take advantage of lower per unit labour costs. The globalized nature of production means that often these areas of production happen in multiple countries, so transport and logistics are also a major component of the effective operation of the supply chain. Most of the transportation is through commercial shipping and road transport.

The following sections, however focus on the textile production and garment assembly aspects of the supply chain. This is not to minimize the environmental impacts earlier in the supply chain. For example, cotton growing has significant environmental impacts because of its high reliance on water and chemical inputs. Cotton production represents approximately

one third of global pesticide use, and this in turn can have other damaging effects on the environment when pesticides are badly managed (Pan et al 2008).

2.1.1 Textile manufacturing

There are four stages of textile production: yarn formation, fabric formation; wet processing and textile fabrication (Textile world, 2008). Yarn and textile formation includes spinning, weaving and knitting, and is mostly a dry process where bales of fibre are spun into thread. The process uses a lot of machinery and generates noise and dust pollution. Whilst, these processes have minimal environmental impacts, it is still can present harm to workers. Textile mills often use shuttle looms that can cause noise levels up to 100 decibels, above the recommended safety limit of 85db (Pan et al 2008).

Turning a bale of cotton into fabric is a resource intensive process in terms of energy, it is also the strongest value-added link in the production chain (Birnbaum 2008). The below table (Figure 2) illustrates the percentage of the final retail price of a garment that is attributed to different components in the supply chain. Before the cotton can be woven it needs to be bleached and then mercerized (process involving dipping bleached fibres into a bath of sodium hydroxide, then neutralizing them in an acid bath). Mercerizing fibres makes them respond better to dyeing processes, so although not all cotton needs to be mercerized, most is (Angeulov 2016).

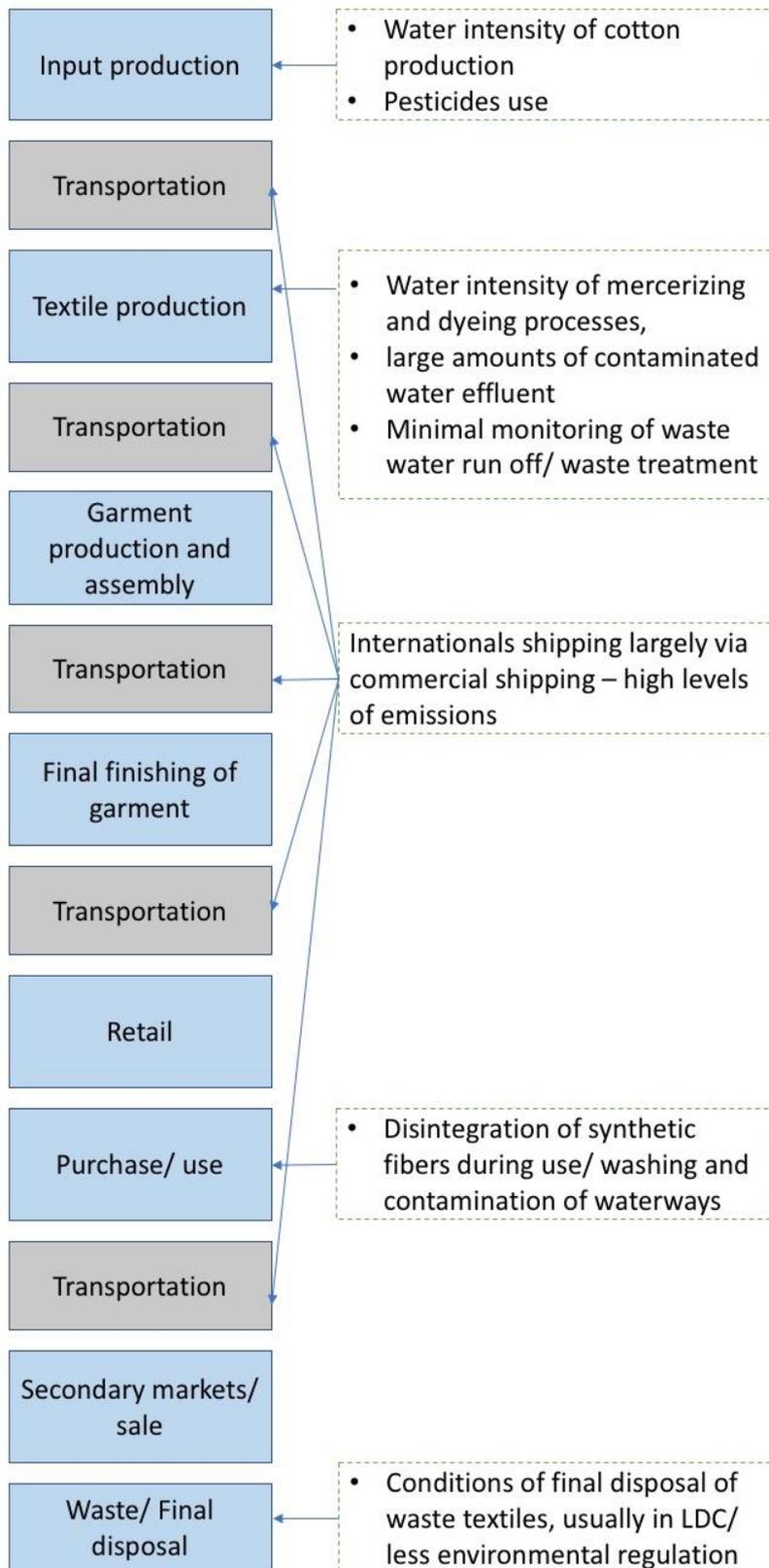


Figure 2: Overview of the Textile and Garment industry supply chain and location of main environmental impacts

PRODUCTION LINK	% OF RETAIL PRICE
Fabric	13
Cut and make (including labour, overhead and profit)	6
Trim	2
Freight on board	21
Duty	4
Clearance and inland freight	1.4
Import office costs	6
Total production and transport costs	53
Retail mark-up	47
Net retail profit	18

Figure 3: Breakdown of final retail price by components of supply chain

Source: Anguelov 2016, based on Birnbaum, 2008

Once mercerized the cotton is spun into yarn and then woven into fabric, which is then dyed. During the spinning process, yarns are treated for fineness and texture, usually through a wet-heating process. The weaving process also includes the application of starch to the fabric to provide strength and stiffness. If synthetic fibres are being blended with the cotton, this results in a further heat intensive process. After weaving, fabrics are dyed based on pattern specifications; starch, sodium hydroxide and chemical dyes and wetting agents are used in these processes. The amount and variety of wetting agents, acids, alkalis and dyes depends on the quality and desired refinement of the textile product, generally the higher the quality, and subsequently the price of the fabric, the more chemically intensive the manufacturing process (Anguelov 2016). An estimated 2-4 kg of chemicals is required per kilogram of finished garment throughout manufacturing; this means that the weight of the chemicals used in garment manufacturing is more than the weight of the finished garments (Swedish EPA 2011). Two thirds of this chemical use occur in the textile manufacturing phase.

These processes can also have significant health impacts on workers, particularly if adequate protective equipment is not available. Respiratory and skin diseases, and damage to the eyes and nervous system are common (BMZ 2014).

Textile manufacturing is amongst the largest industrial users of water; water consumption per kilogram of manufactured textile varies between 5- 500 litres, depending on fibre type; and applied techniques and technologies (Ozturk et al 2016; SIWI & Sustainability Outlook 2015). This results in significant quantities of waste water (including heated water) that contains liquid effluent from the chemical processes in the textile manufacturing processes, which is discharged into local water shed. The process is also energy intensive with significant amounts of electricity required to heat water used in these processes (Murtha 2014).

There are significant inefficiencies with these processes in terms of water use, chemical use and waste water treatment. Water usage varies widely across the industry ranging on average from between 50 and 200 tonnes per tonne of fabric, also an estimated 15% of production dyes are lost during the manufacturing process (Ibrahim 2008).

The most serious environmental impacts come from these wet processes, including bleaching, dyeing, printing and finishing the textile, when waste waters are not treated or treated adequately before being discharged. Wet processes emit volatile organic compounds (VOCs), these compounds vary in concentration from 10 milligrams of carbon per cubic metre (mg/m³) to 350mg/m³ (Textile Today 2008). The waste water from wet processes is a major contributor to water pollution, as it is contaminated with bacteria, chemical dyes and bleaches. The waste water is typically alkaline (high pH), contains solids, oil, and potentially toxic organics such as phenols from dyeing, halogenated organics from bleaching, and heavy metals such as copper and chromium. If pesticides are used in natural fibre production these are also transferred to the waste waters (Haque 2017).

When these waste waters are discharged into water ways the rapid change in pH can create synergistic effects that can increase the toxicity of the chemicals in the water, and pose threats to marine life and people using the water (Textile Today 2008).

The environmental impacts of the textile manufacturing process not only affect workers employed within factories and facilities but because of the impact on water use and contamination of water ways with effluent, these impacts also affect communities living and working in the area of these factories.

For example, in Bangladesh, most of the textile factories are clustered in a small number of geographic locations, usually adjacent to riverbanks, that allows for the transport of materials in and out of the facilities. The livelihoods of fishermen and farmers, and the health of communities in the areas surrounding the riverbanks are significantly affected by the wastes and effluents in the waterways and near crop lands (Textile world, 2008). A similar situation affects communities in the lower Citrium Valley, where textile facilities are clustered in Indonesia (Greenpeace 2015).

2.1.2 Garment production, assembly and final finishing

The environmental impacts are minimal in the garment assembly sectors, in comparison with textile manufacturing. Garment sectors are labour intensive, and working conditions have been the primary focus. This link in the supply chain includes seven different types of activities: design preparation, pattern making, cutting, tailoring, ironing, packaging and storage.

In terms of environmental impacts, these arise in four areas, (Murtha 2014):

- Emissions associated with transportation of textiles to garment factory;
- Energy use in garment assembly;
- Dealing with wastes, primarily textile waste (scraps of fabric from cutting etc.); and
- Production of steam from boiler and associated impacts.

As noted in section 1, the globalized nature of the textile and garment supply chain makes it highly likely that finished clothing products have travelled significant distances during their production. The majority of this transport is via commercial shipping and road transport, both are relatively emissions intensive. However, analysis of transport emissions from global trade

is beyond the scope, and the regional project. Re-localizing production close to final customers has been examined as one pathway for reducing carbon emissions from garment supply chains (see Allwood et al 2006).

Life-cycle assessments of textile products also highlight the relatively low impact of garment assembly to other aspects of the supply chain. In terms of energy consumption, 50% is used in sewing activities, 30% in cutting activities, 20% in packaging (Murtha 2014). Energy is used by machinery, space cooling, lighting and running compressors. Fuel source for energy therefore is important in assessing the environmental impacts in the form of carbon emissions (Munasinghe et al 2016). Energy sources for industrial production are largely from burning fossil fuels, including low efficiency brown coal, which has a higher emissions intensity.

Energy efficiency activities and fuel source switching to renewables, and or lower carbon intensity fossil fuels, are the primary activities that will reduce environmental impacts from energy use in the garment production sectors.

Textile waste, and how this is managed to final disposal is also another environmental impact. Through conventional fashion design processes, pattern making and cutting, up to 15-20% of fabric can be lost (Abernathy, Dunlop et al 1999), this can increase to 50% in small scale production (Niinimäki 2013).

Textile waste quantities can be affected by machine inefficiencies (eg blunt cutting blades) but also by the experience and well-being of the workers. Life cycle assessments of textile processes have shown inexperienced and/ or fatigued workers, or employees working quickly will have higher levels of textile waste (Kasemset 2016).

There are a number of design processes that attempt to minimize textile waste in the cutting and sewing process called zero-waste designs, including the jigsaw puzzle method, and minimal cut (McQuillan 2011) but these processes are not widely adopted as yet.

2.2 Trends and drivers of garment industry and impacts of supply chain

This section discusses the influences of industrial structure, geographical location and industry trends on the environmental impacts of the textile and garment industry.

The textile and apparel sector is described as a 'buyer-driven chain' (CCC 2015), where the driving force of the supply chain is the major brands and retailers. They determine what is produced, where and at what price. To a large extent this is true, but there are also a number of legacy issues from preferential trade agreements, and more recently issues of environmental sourcing that influence the location of supply chain components and their environmental impacts.

Few global industries have been affected and continued to be affected by trade agreements and rules like the textile and garment sectors (Martin 2015). The location of much of the sector up until the early 2000s was driven as a result of the Multi Fibre Agreement (MFA), and a corresponding range of preferential trade agreements that placed various quotas on production of different inputs and outputs of textiles and garments, and mandated rules of origin import codes.

In some countries, such as China, India and Pakistan, the sourcing of the entire textile and garment manufacturing process can be internal, as these countries have large, vertically integrated garment industries, but incentives existed, and to some extent still exist to source fabric in India and then ship it for assembly in another nation (Angeulov, 2016).

The legacy of these arrangements¹ are that certain activities in the supply chain (for example textile manufacturing) clustered in specific geographies, which also had the impact to concentrate the environmental impacts in certain locations. Specialisation and production hubs developed; the leading fabric exporters were India, Nepal, Macao and Turkey (Miroux and Sauvart 2005). Bangladesh, Sri Lanka and Vietnam became specialised in garment assembly (Audet 2004).

The latest WTO trade statistics (2016) comparing textile and garment exports and imports continue to show some areas of specialisation in either textile or garment manufacturing, but the distinctions are less pronounced (see Figure 3 for detail). This means there are more countries and jurisdictions participating in the manufacture of textiles, and hence also the spread of the environmental impacts in terms of water use and waste water effluent into watershed.

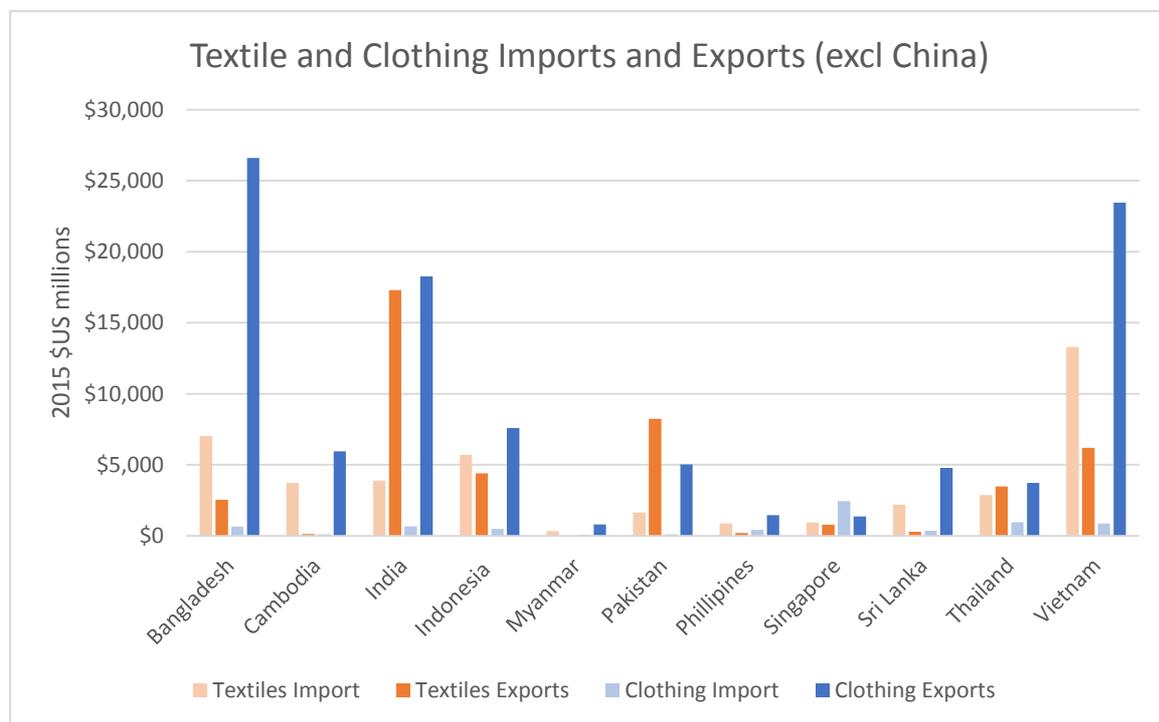


Figure 4: Value of textile and clothing imports and exports in Asia, Excluding China², WTO Trade Statistics 2015

A number of authors have claimed that environmental sourcing is now the major driver in the location of aspects of the supply chain that have high levels of environmental impacts (Greer et al 2009, Khan et al 2009, Angeulov 2016). Environmental sourcing refers to Multi-National Corporations (MNC) strategically locating in countries that are still developing their environmental regulatory systems, such as Indonesia, China, India, Bangladesh and Vietnam in order to exploit regulatory uncertainty. Also, many developing countries seeking to attract foreign direct investment reduce their environmental conditions and / or set up special

¹ The Multi-Fibre Agreement was phased out between 1995 and 2005

² China is excluded because its importing and exporting activity are of a magnitude larger that it would make the chart unintelligible for the other countries. For example, China's clothing exports are \$174bn, dwarfing nearest competitors Bangladesh with \$26bn and Vietnam with \$23bn.

economic zones where environmental regulations are less stringent in order to attract MNC and their investment (Angeulov 2016).

As shown in Figure 2, textile manufacturing represents one of the largest stages of value creation/ cost in the garment supply chain. The pressure on supply chains to minimise costs is driven by both the advent of 'fast fashion' but also 'quick response'. Fast fashion refers to the fashion products that move quickly from the catwalk to high street stores. Examples of fast fashion retailers include Zara, H&M and Uniqlo.

Quick response is related to just in time production, so retailers can demand quick replenishment of basic products. Fast fashion is enabled by quick response, but is different. Fast fashion is quick response of small amounts of a great variety of styles of new merchandise with little or no replenishment, and at a higher frequency (Martin 2013). Both concepts place enormous pressure on suppliers because of the variable volumes and required delivery times, typically orders are outsourced, including to the informal sector, where the fulfilment of the orders becomes relatively invisible to the buyer.

2.3 Opportunities for best practice

There is a great deal of difference between best and worst practice in terms of resource intensity. This means there are significant opportunities to optimize the environmental and social footprint of these links in the supply chain. Best practice requires a focus on processes of garment design and production process design, so that chemical use overall is minimised, and the use of specific chemicals that are toxic and dangerous are eliminated (Martin 2013), investments are made in zero discharge technology and efficient effluent treatment plants, as well as regulatory policies and resources for enforcement.

The textile and apparel industry provides a context where relatively modern and existing technology can be deployed and be used to drive development dividends through backward and forward linkages within the economy (Martin 2013). Below are some measures that could be taken based on existing, available technologies to reduce the environmental impacts of wet processes in the textile industries (Martin 2013, Greer 2010, Textile Today 2008):

- Matching process dyes to the type and weight of the fabric, this can reduce needed chemicals by 10-20%;
- Managing batches to minimize waste at the end of cycles;
- Not using non-degradable or less degradable washing and scouring chemicals;
- Use patch dyeing techniques – this process dyes the fabric at full width, the fabric is passed through a trough containing the dye and then between two heavy rollers which force the dye into the cloth and squeeze out excess dye. This saves up to 80% of the energy requirements and 90% of the water consumption. Dye solution from the dye baths can be reused;
- Reusing dyes from dye baths, and recovering and reusing process chemicals;
- Controlling optimal conditions – quantity, pH, temperature of the water;
- Using fewer toxic dye carriers and finishing agents particularly avoiding carriers containing chlorine, and chlorinated aromatics;

- Establishing and maintaining the appropriate proportions of dye from lab to bulk recipes on the factory floor to reduce redyeing, re-shading and wasting dyes;
- The use of new, less polluting technologies, effective treatment of effluent till it conforms to specified discharge requirements by conventional and novel techniques such as electro-oxidation, coagulation-flocculation, biological treatment, photochemical processing, ion-exchange, and a variety of membrane techniques;
- Recycling waste several times over before discharge.

2.4 Barriers to adopting best practice

Barriers to adopting cleaner production practices in textile manufacturing conform to behaviour change barriers that exist in the adoption of other environmentally efficient practices such as energy efficiency. They include:

- Lack of awareness of inefficiencies in current practices and availabilities of cleaner production techniques;
- Lack of skilled personnel within factories to identify and change practices. This includes awareness of impacts of production, the inefficiencies involved, and therefore the business case for investing in new technologies and production techniques;
- Lack of trusted information sources to provide context specific information and advice on solutions;
- Lack of market offerings of context specific solutions, this includes product and service markets;
- Difficulty in accessing finance to make investments;
- Lack of prior knowledge and due diligence assessment in local financial industry to assess cleaner production investment proposals;
- Lack of environmental regulation and monitoring of compliance, or penalties for non-compliance being too low so it is less costly to pay penalties that make investments. This means demand for cleaner production techniques is reduced.

Related barriers for change that exist at the more macro/ industrial development scale, are the system of planning controls and consents that allow factories to develop in ecological sensitive areas e.g. riverbanks. This makes the environmental impacts more difficult to manage. Also, often within existing industrial clusters the physical space for effluent treatment plants, and plants of sufficient capacity to manage the volume of water required to be treated, has not been planned for, and is therefore not available.

Financial, information and knowledge barriers have already been mentioned, but these barriers are especially compounded for small and medium sized enterprises (SMEs). SMEs make up the majority of enterprises, especially in the lower links of the supply chain (Haque 2017). If access to central effluent systems are not available it is difficult to see how smaller enterprises could invest in and run water treatment.

A further barrier is the organisational capacity of existing organisations that could provide context specific knowledge, advice and networking. Leading actors working on health and safety and environmental regulation already have insufficient capacity to address these

issues, and therefore could not be expected to grow and address further needs without any structured effort to make them larger and more effective (Martin 2013).

2.5 Compounding impacts of climate change

The impacts of climate change are making managing the environmental issues of the textile and garment industry more challenging, and more pressing to be addressed. The IPCC 5th Assessment report (Pachauri et al 2014) notes the following climate change impacts for Asia; temperature increases and precipitation variability (including heavy rain events), more extreme and frequent heatwaves and tropical cyclone events and sea level rises.

Climate change will adversely affect the sustainable development capabilities of most Asian developing countries, with communities living in low lying coastal zones and flood plains most at risk (Pachauri et al 2014). Half of Asia's population lives in these areas. More frequent and intense heatwaves will increase mortality and morbidity in vulnerable groups. Warmer temperatures will also increase the transmission of infectious diseases.

Heatwave conditions will impact workers in factories, leading to heat stress and other associated health impacts. There have been many recent media reports citing hospitalization of workers taken ill (from heat stress) during heatwaves (Star-online news 2017, Guardian 2016). Typically, factories lack proper ventilation and cooling systems, and when heatwave impact normal working conditions are impossible. If temperatures increase beyond the 37 degrees of normal human body's temperature, the body uses sweat evaporation to manage temperature, if workers are in humid and/ or unventilated work areas evaporation is not possible, therefore resting, drinking more water and ultimately ceasing work and leaving the factory are the only options to manage heatwave conditions.

A recent UN reports notes that the worst affected countries for heatwaves and related impacts will be Bangladesh, Cambodia and Burkina Faso. It is estimated that Bangladesh has already lost 3% of daylight working hours due to heat extremes (UNDP 2016), with future climate change increasing these losses. Low cost measures are available now to alleviate heatwave impacts on workers including providing access to drinking water in workplaces, frequent rest breaks, managing output targets to take into consideration heat conditions, but without negatively impacting worker incomes (UNDP 2016).

Increased heavy rain events and associated flooding have massive impacts on social, environmental and economic functions. For example, in Bangladesh floods and associated drainage congestion have a dramatic effect on industrial operations in the textiles and garment sectors. Many factories are located near waterways so very susceptible to floods (and sea level rises). Impacts include business interruption due to flooding in premises, knock on effects in trade and commerce including missing deadlines and orders, impacts and disruptions to water supply and water treatment, damage to utilities cause power outages, damage to transportation and economic exchange networks (in 2004 flood the Dhaka stock exchange was shut down) (Alam and Rabbani 2007). Obviously, these impacts are not just restricted to the textile and garment industries but all industries and communities located in affected areas, but does highlight the vulnerability of the industry to climate change impacts.

Water scarcity is likely to be a major challenge for most of the region due to increased water demand and lack of good water management. Better water management from industrial

processes including textiles and garment production will be a critical adaptation response for the study countries.

2.6 Gender and environmental impacts

Environmental depletion and impacts from a changing climate add increased pressure on women's time, income, health, nutrition and social support systems (UN 2017). Women garment workers tend to be in a vulnerable position especially if they are young, migrant, or poorly educated. As women are most likely to be working in this industry, they are mostly likely to be affected by unsafe work practices (lack of safety equipment), exposure to chemicals and the resultant health impacts. They also most likely live nearby to the facilities in which they work, therefore they, and their families are exposed to untreated waste water effluent in nearby waterways and air pollution from chemicals discharged into waterways.

Impacts on water availability are particularly critical. Women are typically expected to manage household water supply, sanitation and health issues, therefore any hindrance in access to safe drinking water and adequate sanitation affects women at the household level (UN 2017).

If water becomes scarcer as a result of climate change and/or environmental impacts of the textile and garment industry, women will also be disproportionately affected because of their role in water provision within the household, but also because they have less decision-making power over water resources (UN 2017).

2.7 Impacts of vulnerable populations

The environmental impacts of textile and garment manufacturing process are highly localised to where production is located. The communities surrounding these facilities are significantly impacted in terms of health, quality of life, and in many cases, impacts on livelihoods from farming and fishing. The location of production facilities in major urban areas (in order to access large pools of labour) also means that these facilities are adjacent to houses, schools, other businesses and community facilities. The lack of water and sanitation infrastructure further increases the impact of water and air pollution. It is likely that vulnerable populations, such as children, sick and elderly people will also be more vulnerable to the negative health and quality of life impacts that come from the environmental degradation associated with the industry.

2.8 Summary: Environmental impacts of the textile and garment industry

In summary, the environmental impacts of the textile and garment industry are concentrated in three main areas:

- the weaving, dyeing and wet finishing processes in textile manufacturing;
- energy use and textile waste associated with garment assembly; and
- the transport emissions throughout the supply chain as materials and then final products are shipping literally around the world.

The most significant of these however is the first area, with the main impacts being on use intensity of water resources, chemical use including toxic chemicals, waste water discharges and lack of treatment processes, and energy use and carbon intensity of electricity.

There are also significant environmental impacts from production of fibres, including cotton and synthetics that are used to make textiles. Water consumption, use of arable land and chemical and pesticides use and management can all lead to environmental resource depletion and degradation. Post-consumption garment product treatment and disposal is also another aspect of environmental impacts of the textile and garment supply chain. Due to the scope of this report, these issues were not investigated in this paper.

3. Characteristics of environmental regulation in study countries

The previous section highlighted the environmental impacts of the textile and garment supply chain as concentrated in three areas:

- the weaving, dyeing and wet finishing processes in textile manufacturing;
- energy use and textile waste associated with garment assembly; and
- the transport emissions throughout the supply chain as materials and then final products are shipped literally around the world.

Carbon emissions associated with transport and logistics are also common to all globalised supply chains, and whilst also important, actions to address these are better positioned at the global level (e.g. Paris Agreement) with individual nations selecting activities that will best meet their commitments.

The remaining two areas of environmental issues are impacts from textile production; particularly the wet processing which includes intensity of water and energy use, waste water discharges and solid/sludge waste management. Also, there is the energy use in garment assembly and waste management practices of textile waste associated with garment assembly. This second area of emerging emphasis; whilst having less overall impact, the growing levels of textile waste from post-consumption disposal (in developed countries that is then shifted to developing countries for final disposal) this will become more of an issue into the future.

Therefore, the discussion in this section will focus on regulatory frameworks across the region for waste water management, water metering and usage, and solid waste management. In many countries that are part of this scoping study environmental regulations and the associated institutions are emerging (Angeulov 2016).

Figure 4 shows the country rankings in the global Environmental Performance Index (EPI) for each of the study countries in 2016. The EPI ranks how well countries perform on high priority environmental issues in two areas; protection of human health from environmental harm and protection of ecosystems. The 2016 EPI was led by the Yale Centre for Environmental Law and Policy.

The index is constructed from the calculation and aggregation of more than 20 indicators of national-level environmental data. These indicators are combined into nine issue categories, which fit under the two overarching priority areas. Water resources and waste water treatment are indicators of ecosystem protection. EPI indicators and national scores are developed using a proximity to target methodology, which assesses how close a country is to

an identified policy target³. Scores are then converted to a scale of 0 to 100, with 0 being farthest from the target and 100 being closest (Hsu 2016).

All the study countries are in the bottom half of the index, but there is great variation in ranking. Thailand is the highest on the index (91st), with Bangladesh the lowest (173rd). There is also great variety in the improvement over the previous 10-year period. All countries have improved, some only slightly, for example Myanmar, Bangladesh and Sri Lanka, others by more than 20%, such as India and Vietnam.

Figure 4 also reports the EPI scores for Waste water treatment. The indicator measures the proportion of wastewater from households, municipalities and industry that is treated, weighted by the population covered by the sewage network. The target used to calculate the score is 100% wastewater treatment. This means the score is not just related to industrial waste water, but also domestic. Waste water treatment is a deficit for many countries; it is estimated that 80% of the world's discharged wastewater is untreated when released into the environment (UN 2015). However, four of the study countries scored 0 for waste water treatment, Bangladesh, Cambodia, Myanmar and Sri Lanka. This suggests significant investment will be required to improve performance in this area.

Country	EPI ranking (out of 180)	10-year % change	Score for waste water treatment
Bangladesh	173	3.21	0
Cambodia	146	17.52	0
China	109	12.73	78.08
India	141	20.87	48.41
Indonesia	107	10.45	12.69
Myanmar	153	1.3	0
Pakistan	144	16.07	16.58
Sri Lanka	108	3.51	0
Thailand	91	17.68	71.28
Vietnam	131	20.67	19.8

Figure 5: EPI scores for study countries

Source: Hsu et al (2016) 2016 Environmental Performance Index

This discussion highlights that there are varying levels of environmental regulatory performance across the countries participating in the supply chain. Some of this performance is related to the development of regulatory systems in emerging economies. In other cases,

³ Targets are developed from international and national policy goals or established scientific thresholds.

it highlights the tensions between increasing wealth and the pressures of rapid industrialisation. As countries become wealthier they increase investment in systems and infrastructure to improve environmental performance (such as in waste water treatment) but in order to get there, there is often a period of environmental degradation associated with industrialisation. Breaking this paradox and ensuring sustainable development is an essential but ‘wicked’ problem facing many emerging economies.

3.1 National regulations for waste water treatment

All of the countries in the study area have regulations relating to the discharge and treatment of waste water from industrial activities. In some instances, this is a permit system. For example, in Bangladesh, industrial units are classified into four categories. The textile sector and fabric washing sector are under Orange category B, whereas the fabric dyeing and chemical processing units are in the Red category. Industries then require an environmental clearance certificate when they are initially registered by the Department of Environment.

Industries in the Orange B and Red categories need to provide a process flow diagram, and potentially undergo some site inspection/ impact assessment before they are granted clearance. Clearance requires factories to keep records of tests on discharged wastewaters and sludge management. Inspection of factories can be made without notice, and there are penalties for non-compliant firms (Textile World 2008).

A similar permit system exists in Vietnam, Cambodia, Indonesia. Other countries have discharge standards, and or a combination of both.

In most countries, it is not the lack of regulation that is the issue, rather the enforcement of regulations with appropriate inspections, monitoring and options for corrective action (including fines and penalties). With Government agency inspection teams often lacking expertise and resources to adequately assess compliance to standards, provide advice of effluent treatment plans, and/ or assess the adequacy of existing treatment plans. Inappropriate influence and interference in the conduct of assessment and enforcement activities of regulatory agencies is also an issue.

In other cases, there are loopholes and inconsistencies in the application of regulations. For example, when new discharge standards only apply to new facilities, or there is inconsistency between multiple regulations. Recently strengthened regulations in Vietnam, required centralized effluent treatment plants to be built at the start of operation when developing new hi-tech parks, industrial parks and industrial complexes (Circular No. 08/2009/TT-BTNMT), but the broader associated regulation doesn’t provide the same stipulation (Decree 29/2008) (LBCD Consultants 2010).

The existence and application of penalties for non-compliance is also a barrier to improved practice. In Bangladesh, a review of the National Water Act 2013 conducted by the global apparel brand H&M identified a number of issues and made recommendations to improve water sector integrity. The report claims that that it is less expensive to pay penalties, than to invest in ETPs (WIN 2017).

Public disclosure of standards and facilities that are failing to meet these standards is critical to ensure accountability, and avenues of recourse, for communities who suffer the consequences of non-compliance (Hook and Greer 2014). This can include community level participation in establishing and monitoring standards, and determining anti-pollution measures, operating permits and penalties for offending facilities.

3.2 International initiatives

There are increasing international regulations impacting on the textile and garment sectors. Legislation in the EU and some member countries has banned the importation of textiles and footwear that has been processed using certain chemicals (mainly fluorocarbons). The US Environmental Protection Agency initiated a voluntary phase out of the fluorocarbon PFOA, and eight global fluoro-chemical companies agreed to eliminate PFOAs by 2015.

To further address issues of supply chain transparency, the EU in 2014 introduced a 'non-financial reporting' directive that requires companies with more than 500 employees to report on non-financial aspects of their operations including the due-diligence activities they have undertaken to assess supply chains. Member states are required to have implemented the directive by 2017.

The OECD has issued a guidance document for responsible supply chains in the garment and footwear sectors as part of its Guidelines for Multi-National Corporations. The guidance document provides both a framework for assessing due diligence activities, describing how companies can identify and prevent harms relating to human rights, labour, environmental and integrity risks in their own operations and in their supply chains. The document also provides recommendations for specific risks within the sector.

Other countries (Australia, UK) and sub-national jurisdictions (California in the USA) are exploring or adopting supply chain transparency measures in an effort to address labour conditions and modern slavery. These could provide options for extension to environmental conditions.

The WTO has guidelines for industrial discharge levels but leaves it to individual countries to test and monitor compliance with these levels. Compliance with WTO standards is a condition for membership, but non-compliance does not lead to expulsion. In fact, in order for a country to be registered, another country needs to complain, offering evidence that the non-compliance has resulted in significant trade distortions, for any action to be taken (Angeulov 2016).

Trade Agreements also continue to impact on the textile and garment industry. Within the recently negotiated Trans-Pacific Partnership (TPP) tariffs on textiles were to be reduced or eliminated for agreement countries, but the 'yarn forward condition' requires all stages of garment production (weaving, dyeing, finishing, sewing) to be in the country of origin in order to qualify for tariff relief. This would have the impact of agreement countries moving into all aspects of textile and garment production, and therefore potentially spreading environmental impacts of these processes wider⁴. Leading textile producers including China, the EU, India, Korea and Pakistan were not part of the TPP. With the USA withdrawal from the agreement, it is now a moot point, but does show how trade agreements still have the ability to impact the location of production.

3.3 Summary: Characteristics of Environmental Regulation

Environmental regulation systems and institutions are still emerging in the study countries. Regulations exist in all countries regarding the discharge of untreated waste waters into watersheds and the disposal of other wastes. There are deficits in these regulatory frameworks, including around definitions of allowable discharges and contamination

⁴ Although, new facilities would offer the opportunity to apply best practice.

concentrations. However, it is the monitoring, testing and compliance activities where significant deficits exist. This includes lack of institutional capacity in environmental agencies, such as lack of skilled personnel, lack of adequate testing and laboratory facilities, and also deterrence for non-compliance, provided by fines and penalties.

The legitimacy of environmental regulations is essential to not only provide recourse and corrective action to communities affected by environmental impacts but also because regulations provides demand stimulus for cleaner production activities.

4. Corporate Social Responsibility initiatives

The following two sections examine a range of brand-led corporate programs (this section) and multi-stakeholder initiatives (next section) that are operating with the objective to reduce the environmental impacts of the textile and garment industry. In many cases these initiatives also include labour and social improvement objectives as well. In many cases labour improvements were the initial driving reason for the programs and initiatives, and objectives have been expanded to also include environmental conditions.

The aim of these next two sections is to highlight an illustrative range (rather than comprehensive) of activities; identifying component activities, actors and highlighting evaluations and results where available. The focus is also at the international level; initiatives involving multiple countries, to examine the most relevant examples for a prospective regional program. In this section, the highlighted CSR initiatives represent 'best practice' in terms of level of investment and integration into corporate strategy. All of the businesses featured in this section sourced textiles and garments from Asia.

Corporate social responsibility (CSR) refers to the ethical responsibilities that corporations undertake in their business activities that are beyond legal requirements (Nasrullah et al 2014). CSR is usually understood through a stakeholder perspective; stakeholders are all the individuals and groups, who are influenced by or can influence a company's decision or actions. Stakeholders can include investors, employees, customers, suppliers, government and wider society. There are three main categories of responsibilities; social, environmental and economic. Each company's response to these categories will be different.

The concluding section provides discussion of the commonalities and differences among CSR approaches, and also highlights the limitations of CSR activities in achieving wide spread improvements in either social or environmental impacts.

4.1.1 Nike

Nike's corporate social responsibility programs within their supply chain initially focused on labour practices as a result of a number of scandals involving child labour in the late 1990s and early 2000s. Sustainability shifted from being seen as about reputation management to be understood through an innovation lens, specifically how sustainability (broadly defined to include social and environmental outcomes) could be used as a trigger for innovation, particularly in design processes (Adamsons et al 2013). An example of this is Nike's decision to phase out using FS6 gas (a greenhouse gas) with nitrogen from the Nike Air shoe, the R&D activity associated with this commitment was US\$50m and took nearly ten years, but resulted in achieving the objective of phasing out the FS6 gas, and provided enhanced performance in

the new shoe. The company used this as an example of how environmental and businesses goals could be aligned through pursuit of their sustainability strategy.

Nike's sustainability strategy is described as broad and includes board level commitments, sourcing and production teams and third part suppliers. Nike has created a number of internal tools to help identify weaknesses in terms of social and environmental performance in their supply chain, and collect data to provide metrics for measuring improvement and impact (Nike 2016).

They developed the Sustainable Manufacturing and Sourcing Index (SMSI) and the Materials Sustainability Index (SMI). The latter of these internal tools was shared with the Sustainable Apparel Coalition, which assisted in the development of the Higg Index. Nike developed and shared a mobile app, called MAKING, which allows industry to consistently measure sustainability performance of materials in a consistent way, and enable designers to understand the sustainability implications of materials they choose to design with (Nike 2016).

Other knowledge sharing activities include sharing Nike's list of restricted substances, which helped create an industry wide standard manufacturing restricted substances list (MRSL), and they shared water-based solvent formula to enable industry to eliminate some toxic chemicals in a key footwear process. They also made available 400 utility patents under creative commons licence to enable others to use them (Nike 2016).

Nike has listed performance targets including reducing water use in the textile dyeing and finishing processes by 20% and enabling zero discharge of hazardous chemicals by 2020.

Despite all these activities, Nike's latest Sustainability report (Nike 2016) still lists high impacts from their activities the materials input and manufacturing processes, most of which happen in supplier facilities in Asia (see Figure 4). This highlights the limitation of individual CSR programs in creating systemic change and improvements across the textile and garment supply chain.

ENVIRONMENTAL AND SOCIOECONOMIC RESPONSIBILITY ASSESSMENT

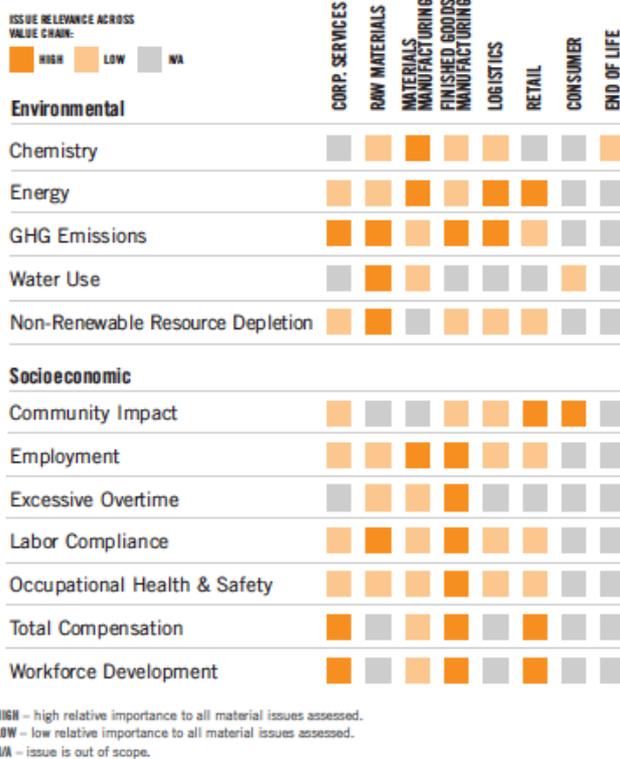


Figure 6: Summary graphic of Nike’s social and environmental impacts

Source: Nike Sustainability Report 2016

4.1.2 Patagonia

Patagonia is a producer and retailer of high performance outdoor clothing and equipment. The company has had a strong reputation for environmental components of CSR. In 1985 it began donating 1% of organisational sales to environmental organisations through its NGO *1% for the planet*. In the 1990s as part of an overall company strategy realignment, they commissioned a study into the environmental impact of its products. This study showed that large amounts of water, energy and chemicals used to make the materials for Patagonia products constituted the largest environmental impact for the company.

Patagonia experienced tension between two core company philosophies; one to build the best product available in terms of durability and multi-functionality and therefore minimising the environmental impacts of shorter product lifetimes. The other to minimise environmental impact, especially from chemicals and processes used to manufacture those products (O’Rourke and Strand 2016). This is best illustrated by the use, and then phasing out of Durable Water Repellents on their clothing. The repellents were made from long chain fluorocarbons that produced toxic and persistent by products that could be absorbed by humans and the environment.

The company’s sustainability strategy includes (Patagonia 2016):

- Sourcing strategies that emphasis long term partnerships, suppliers with operations in multiple countries, and being a bigger presence in these facilities (although capped at 25%).
- Sustainability goals decentralised and integrated within the business, so unit directors, designers often champion new technologies or materials.
- Focused on minimising water use in production, through water-free dyeing and bio-based technologies that give PFC-free finishes.

Patagonia displayed a different strategy for innovation and knowledge sourcing, in that much is externalised, in comparison with Nike, where most was in-house. Patagonia set up a \$20million investment fund called *\$20m and change*, to invest in responsible and disruptive start-ups in the food, water, energy and waste sectors. They invested in *Beyond Surface Technology*, a Swiss based chemical company exploring use of chemicals and finishes based on renewable raw materials that are also cost competitive. Investment in this company could potentially solve the issue of fluorocarbons as water repellents, by replacing them with substitutes that are more ecological sound and have equivalent or better performance.

Patagonia also sees part of their role to share knowledge so it can be scaled up across the industry. The board is empowered through their B-Corporation status to share proprietary information and best practices with other businesses, including direct competitors when there is a material, positive environmental impact.

4.1.3 H&M group

H&M is one of the leading global businesses in fast fashion; where new fashion trends are rapidly translated from catwalks into retail stores. H&M receives daily shipments of new styles of clothing into its stores. The group includes the brands H&M, COS, & other stories, Monki, Cheap Mondays and Weekday.

H&M has been acknowledged for its ambitions for enhanced worker conditions within supplier factories, but this has only had limited translation into improvements (McGregor 2016). For many suppliers, H&M only makes up 10% of suppliers' workload, therefore, as H&M states in their own sustainability strategy it is difficult to insist that suppliers implement better standards (H&M 2016). H&M's strategy to deal with this has been to become involved in a number of industry initiatives in an attempt to scale up transformation of standards across the industry.

The latest iteration of Sustainability Strategy has three goals (H&M 2016):

- 100% leading the change – by promoting and scaling innovation, driving transparency and rewarding sustainable practice;
- 100% Circular and renewable – by developing a circular approach to how products are made and used, using only recycled or sustainably sourced-materials, and only using renewable energy in value chain;
- 100% fair and equal – by having fair jobs for all, and being stewards for diversity and inclusiveness.

Although the goal is 100%, this is acknowledged as an aspiration rather than a target, and something H&M says will take decades to achieve (H&M 2016). Underlying these three goals is a 'change making program' which includes:

- Specific unit level goals;

- Roadmaps that provide strategic and implementation plans for meeting these goals;
- Standards and policies such as Code of Ethics, sustainability commitment, and Higg Index implementation;
- Methods and follow-up, processes that track and report on implementation

Goal setting is done with a science-based process. H&M has research projects with Stockholm Resilience Centre and Ellen Macarthur Foundation to establish parameters of circular textile fibre, and these in turn are used to set goals about materiality for within the business.

The company launched its Sustainability Commitment (SC) in 2016, with the aim to move beyond compliance to promote sustainability performance at suppliers and further down the supply chain. H&M insist the sustainability commitment is shared by all companies that have a business relationship with them. The sustainability commitment has two components; basic compliance with minimum standards, and rewards for suppliers that went beyond compliance.

The SIPP, Supplier Impact Partnership Program, is one of the programs the company has developed to support suppliers in improving their sustainability performance. It also provides a framework for H&M to monitor supplier compliance. The SIPP is closely linked with the SAC's Higg Index and facility modules (see section on Sustainable Apparel Coalition in the next section).

SIPP is used to ensure compliance with minimum standards and is completed before a business can become a supplier to H&M, and repeated each time the facility is visited. For new businesses or high-risk businesses, facilities are checked once a year. For low-risk businesses desktop validation is used. Outputs of the SIPP process is a sustainability Index score, which is a combination of Higg facility module and H&M KPIs. The SIPP process for suppliers also includes access to training, workshops and management systems to enhance the skills of personnel within suppliers.

As at 2016, SIPP had evaluated 80% of supplier factories at least once, some 3550 audits; active first tier suppliers were assessed on average 1.4 times in 2015 (McGregor 2016). It is not possible to assess the compliance levels of suppliers from these assessments or the levels of improvements that suppliers have made by participating in SIPP, from publicly available information.

To address the materials intensity of their production, H&M has increasingly adopted a circular economy perspective. This has included partnering with the Ellen Macarthur Foundation, and becoming one their Top 100 Circular Economy businesses. This has led to some focus on material efficiency within the supply chain, but mostly on recycling and garment collecting. Between 2013-2015, 22,000 tonnes of garments have been collected through the H&M's in-store recycling system – this is equivalent to 100 million t-shirts (McGregor 2016).

4.1.4 Retailer level programs - Walmart

Walmart is US based multi-national low-cost retailer. It is interesting to compare the sustainability issues of a retailers against brands to show how different defining and implementing a sustainability strategy is for retailers.

The main difference is that retailers are dealing with many more products, and a large range of suppliers. However, increasingly retailers are also developing their own clothing brands, so relationships with suppliers and supply chains are becoming more complex for these retailers.

Since 2005 Walmart's sustainability strategy has moved away from customer facing initiatives, like labelling, and sustainability claims on individual products towards more supplier facing initiatives aimed at improving social and environmental standards of practice (Spicer and Hyatt 2017).

In 2005 Walmart set out three goals

- Zero waste;
- 100% renewable energy;
- Sell products that sustained people and environment.

The movement from product specific sustainability claims to more general sustainability claims required different and more sophisticated tools that could guide and evaluate performance of multiple products. Initially progress was made on creating an index by aggregating individual product strategies such as reduced packaging and using organic materials. This led to thinking more holistically about how double dividend could be achieved; reduced costs from energy and resource savings and increased environmental performance.

The company faced a key definitional issue – what is a sustainable product, and from whose perspective? Is it sustainable by product category, or by some higher measure? Walmart identified that they needed a science based approach, and a comprehensive tool that would allow them to compare the attributes of multiple products and product categories. However, they realised they lacked the in-house expertise to make this happen. After considering a number of market offerings, they realised that none would offer the comprehensiveness as well as the transparency that they, and their stakeholders desired (Spicer and Hyatt 2017).

Walmart provide start-up funding for the Sustainability Consortium as a way to address this. The Consortium is a collective action organisation designed to develop holistic and public standards to define and measure product sustainability attributes. Members and partners include manufacturers, retailers, suppliers, service providers, NGOs, civil society organizations, governmental agencies and academics.

The Consortium offered a 'pre-competitive' space for cooperation for businesses and organisations on production processes and data sources (Spicer and Hyatt 2017). In developing a sustainability index for Walmart, the Consortium initially trialled a full Life-Cycle Assessment process on seven products, but later concluded this was uneconomical. They then trialled a review model, where reviews of available literature and studies were examined to see what conclusions could be drawn. The review model identified 'hot spots' and allowed a selection of KPIs and improvement opportunities to be developed (Spicer and Hyatt 2017). Scientific analysis to evidence KPIs was still required to be completed by companies, and this created transaction costs in auditing, aggregating and communicating sustainability attributes of products.

In 2012 Walmart started piloting the KPIs and training its buyers in sustainability. It incentivised adoption by making 5% of performance evaluations driven by sustainability objectives. This drove buyers to look for no and low-cost innovations for sustainability to implement with suppliers.

In addition to the work with the Consortium, in 2009 Walmart also surveyed over 100,000 of its suppliers in four areas; energy and climate, material efficiency, natural resources and people and community. The purpose of this survey was to uncover, low cost innovations that could improve sustainability performance, and that these learnings could be transferred across the supplier cohort.

4.2 Environmental components of CSR activities

Voluntary initiatives led by brands and retailers over the last 20 years, such as codes of conduct, labels, self-assessments and social audits, have provided relevant frameworks for cooperation on issues such as health and safety at work, harmonised standards, and design processes that consider sustainability. The four examples examined in this section show that sustainability strategies need to be endorsed and driven from senior management levels to be fully integrated into the activities of company. The examples have also highlighted the difficulties that these firms have faced in attaining and analysing the social and environmental impacts of their business activities. These are well –resourced multinational firms, so these difficulties would be magnified for smaller businesses.

The desire to know and measure environmental impacts has led to the creation of standards and other resources to assess the sustainability of materials, as well as financing and developing new technologies and production processes that reduce these impacts. These activities are conducted within the firm, or within spin-out organisations. Preferences for science-based measures, while preferred, are not always available or economical. This has spurred further investments in research and development activities to create these measures, but also the development of pragmatic measures that can fill the gaps in the interim. The examples discussed here have also highlighted the importance of collaboration down the supply chain, but also across it, with competitors, in order to achieve widespread impact.

There are limitations to the extent of change that can be attributed to CSR activities. The examples in this section show the challenges and issues that brands face when trying to implement social and environmental standards throughout the supply chains, including the fact that they manufacture in multiple jurisdictions, and work with suppliers where they are just one of the suppliers' numerous customers. Managing the relationships between brand and supplier is done through contracts, controls and codes of conduct, where the brand or retailer is trying to set the parameters under which the rest of the chain operates. However, the value of this supply chain management is largely captured by the brand (through enhanced environmental reputation) with minimal understanding of the costs of achieving this compliance, in a highly competitive environment where competitive advantage is achieved through cost and speed.

The proliferation of tools, indexes and assessment mechanisms is clearly illustrated, with all examples developing these. Although some of these tools and indexes share common elements, they are never applied in replicable ways. Each brand customises the make-up of applications of their tools and mechanisms, which means universal standards are never really agreed or upheld. Brands can always reserve the right to apply their CSR activities how they see fit.

4.3 Summary

There is little indication that demand from consumers for sustainable garments alone will affect the production processes upstream (Martin 2013). Also to date, CSR activities have not

proven to be effective enough in bringing about real improvement in worker's rights or environmental standards and safety and sustainability in the garment supply chain (EU Parliament, 2016).

CSR, when it is unilaterally designed and implemented by companies, tends to be weak and often associated with reputational benefits rather than improved social and environmental performance (Soundararjan and Brown 2016). The lack of established shared/ common value across the supply chain for environmental and social goals is evident, and why most CSR programs fail to improve conditions beyond tier 1 suppliers (Soundararjan and Brown 2016). Governing global supply chains required the development of overlapping interests in generating value, and an equal opportunity to satisfy self-interest (Sachs and Ruhli 2011). The examples presented in this section also show the different strategies that organisations develop to address similar issues.

This study was small, and field investigations of CSR activities in local firms not possible. We need to get a better understanding of the practices and attitudes of local firms for CSR. Generally, there is a lack of understanding of CSR interventions and their effects on profitability of local enterprises, workers and environmental conditions in emerging economies.

5. Multi-stakeholder initiatives

Multi-stakeholder initiatives are increasingly seen as an avenue to achieve transformational change towards sustainability along complex global supply chains. Multi-stakeholder initiatives involve cooperation in varying degrees between many social partners, including companies, worker and employer organisations, NGOs, governments. The initiatives can focus on a specific issue (i.e. labour, environment) or encompass the whole range of issues (OECD 2016). Multi-stakeholder initiatives can be geographically focused or sector focused. As with CSR initiatives, individual programs can have specific objectives such as awareness building; development of code of conducts to which their members must comply; and, monitoring and certification carried out by either an auditing firm or a NGO.

Multi-stakeholder initiatives can overcome some of the limitations of other initiative types, such as CSR, through greater coverage across the entire supply chain and the ability to provide independent monitoring. They can also provide an avenue to provide harmonization and standardization in the increasingly complex system of codes of conducts, labelling and auditing regimes that now characterize the textile and garment supply chain.

The section examines a sample of multi-stakeholder initiatives that are operating with the objective to reduce the environmental impacts of the textile and garment industry. In selecting initiatives to profile the focus was to be illustrative rather than comprehensive, and also to focus on international (multi-country) initiatives in order to examine the most relevant examples for a prospective regional program.

The initiatives are organised into four categories: industry led initiatives, civil society led initiatives, social dialogue initiatives, and country-level initiatives.

5.1 Industry led initiatives

This group of initiatives take their led and central governing aspects from industry, including brands, retailers and suppliers. They often also include other stakeholders such as social and

environmental organisations. The structure of these initiatives is usually the establishment of not for profit separate organisations, that can offer industry some kind of non-competitive space to address sustainability issues in a collaborative manner.

5.1.1 Sustainable Apparel Coalition (Global)

The Sustainable Apparel Coalition (SAC) is an industry wide group of over 100 leading apparel and footwear brands, retailers, suppliers, non-profits and NGOs working to reduce the environmental and social impacts of apparel and footwear products globally. The coalition has created a number of tools for its members to create transparency around product design and production decisions, including the Higg index, which is rapidly emerging as the industry standard. Ironically the inspiration for the Higg Index came out of a meeting between Walmart and Patagonia CEOs as they struggled to assess the sustainability of their supply chains (Gunther 2017).

The Higg Index is a suite of self-assessment tools that allows brands, retailers and production facilities to measure environmental, social and labour impacts from their supply chain activities, and identifies areas of improvement. The Index includes three online 'modules' that are designed for every stage of the garment industry and measure social and environmental impacts of brands, manufacturing facilities and products. SAC members enter data about their business into the modules, and receive a standardised performance score. This score enables bench-marking of individual business results against the industry, highlights areas for improvement, and provides metrics to capture this improvement. The data also populates a database that coalition members can use to evaluate suppliers.

The Index includes questions from basic-level measures (compliance) to more advanced (aspirational) levels. Aspirational levels are based on best practice as currently implemented by SAC members.

SAC members have to adopt the HIGG index, and currently those members who have applied the index are asked not to publish or comment on their scores. The Index is a complicated process and as it is a self-assessment process scores need to be validated for legitimacy. Public availability of scores is expected to be at least three or more years away (Gunther 2017).

The Index is not without criticism, some industry actors argue that as the Index is so complex it is extremely resource intensive and slow to assess. The resource intensity also means that it is difficult for small and medium sized enterprises (SMEs) to participate. Also using the index does not by itself imply that businesses are acting to reduce their impacts.

5.2.1 Bluesign (Global)

Bluesign is a Swiss based organisation founded in 2000 by a group of textile and chemical experts and controlled by SGS, a global certification provider. As a firm, Bluesign operates a label that provides information on the environmental pollution and worker health and safety associated with various chemicals. They utilise a comprehensive process, in partnership with the chemical industry, brands, textile and garment suppliers that works to create transparency about the environmental impact of chemical inputs, helps define appropriate processes and provides a 'screened shelf of chemical inputs' that can be used in textile manufacturing, and that have reduced (relatively) environmental impacts.

Assessing the chemical use and composition in textile manufacturing can be catalytic to increase total resource productivity and lead to cost reductions, because cleaner production

and more environmentally sustainable processes are in place for facilities and factories before garment orders come in (Martin 2013).

5.1.3 Fair Wear Foundation (Dutch based)

Strategic partnership, focused on labour conditions. The Fair Wear Foundation (FWF) works with brands, factories, trade unions, NGOs and governments to verify and improve workplace conditions in textile and garment producing nations. The Foundation also uses knowledge sharing, social dialogue and focus on industrial relations to increase the effectiveness of actions taken by individual companies.

The FWF does not have a single approach, but rather provides a forum for multi-faceted cooperation with stakeholders. It has specialist staff and invests significant time and resources in developing long term relationships with stakeholders both at local and international levels, so they can easily identify relevant partners that need to come together and develop context specific solutions.

In terms of verifying and improving work conditions, FWF 'meets companies wear they are', and then works with the company to identify changes of the greatest impacts. FWF's verification system exists at three levels: verifies at the factory level; implements a complaints procedure in all countries where it is active to serve as a safety net; and verifies at the company level to check whether companies implement the FWF Code of Labour Practices in their management systems effectively (FWF 2017).

FWF concentrates its work in the most labour-intensive components of the textile and garment supply chain – so where the sewing is done. This does not coincide with where the main environmental impacts are, like textile manufacturing. However, it provides an organisational model for local and international social dialogue for implementing practice changes to address environmental issues.

5.1.4 Fair trade Cotton (Global)

In March 2005, the fair-trade association Max Havelaar was the first to launch a fair-trade label for a non-food commodity, cotton. Max Havelaar has worked with about 20,000 small producers from Cameroon, Mali and Senegal, organized as a cooperative association. Cotton farmers from these countries continue to account for the greatest share of the global fair trade cotton production at present (Fair Trade International 2014).

Max Havelaar entered into a partnership with the French company DAGRIS and benefited from the financial support of several bodies (e.g. French Ministry of Foreign Affairs and the Centre for the Development of Enterprise). Fair trade cotton products are sold under different brand names (e.g. Armor Lux, Célio, Cora/influx, Eider, Hacot, Colombier, Hydra, Kindy, La redoute et TDV industries). In order to benefit from a better price (including fair trade premium) for cottonseeds (estimated to equal 20-40% increase from traditional cotton seed), producers must be certified. They also have to meet particular specifications (e.g. use cotton-made bags rather than polypropylene ones, ensure a better sorting of the cotton seeds).

5.2 Civil society/ NGO initiatives

The rise of civil regulation has emerged in response to the perceived weaknesses of CSR to provide comprehensive and lasting change, but also due to the growth of NGO and consumer pressures (Utting 2001). The three initiatives discussed below demonstrate these trends.

5.2.1 Swedish Textile Water Initiative (Sweden and textile/ garment producing countries)

The Swedish Textile Water Initiative started as a collaborative project between 34 Swedish Textile and Leather brands, and the Stockholm International Water Institute. The Initiative is distinct from other cleaner production activities in that water is the primary focus of analysis and improvement (Maxwell et al 2015). The objectives of the initiative are:

- To build knowledge on sustainable water use in the textile and leather sectors;
- Apply and continuously update the STWI guidelines to improve water efficiency;
- Prevent water pollution and improve wastewater treatment, and increase international recognition of the importance of these activities;
- Financial support for retailers and their suppliers in common projects for the development and implementation of the guidelines;
- Build institutional capacities for improved decision making in industrial water governance at the national and provincial levels through governance and water risk assessments;
- Offer a platform for exchange and communication on methods and case study results; and
- Raise the profile of water in global processes that address the environmental impacts of the textile and leather industries (STWI 2017).

STWI, as an initiative has developed in stages. In 2010, Swedish textile brands were looking for solutions to reduce environmental impacts, particularly in water and chemical management. A two-year collaborative research project led to the development of guidelines for water and wastewater within the textile supply chain.

The guidelines were one step in addressing water issues in the textile sector, next was how to implement the guidelines, and ensure that they provided for improvements in water management. From 2012-2014 a pilot project, *Sustainable Water Resources Management for Textile Industries* was run in Delhi and Jaipur with three Swedish brands, Indiska, Lindex and KappAhl. Financing was provided by the Swedish International Development Cooperation Agency (SIDA) and program implementation by the Stockholm International Water Institute. Program funding is used to develop platform investment cases and identify sustainable investments and the return for these investments. Operating cost savings from sustainability investments have reduced average payback times to between 11 months and 3 years (Maxwell et al 2015).

The pilot project evaluations showed the project was successful in improving water and chemical management and leading to a reduction in energy use for the suppliers. This provided business cases for implementation of the guidelines. Evaluation also shows that more than half of the participating factories continued with the implement the guidelines and report on progress after the pilot project had finished (OECD 2016).

The project was then scaled up supplier factories of over 20 Swedish brands, and extended to locations in Bangladesh, China, Ethiopia and Turkey. From 2014 to 2017 the initiative worked with 277 suppliers in Bangladesh, China, Ethiopia, India and Turkey (STWI 2017). STWI operates at the international level by setting norms and standards, but also at local level by providing technical guidance and finance to specific projects (OECD 2016). Although, STWI currently only works with Swedish brands, it provides a model of how to engage with multiple links in the textile supply chain, using water as the common theme. This model is effective when end chain brands and retailers are active participants. IT also provides a model for program delivery and implementation in multiple countries/ local contexts.

5.2.2 Clean Clothes Campaign (Global)

The Clean Clothes Campaign is a grassroots initiative of hundreds of organisations including Trade Unions and NGOs with a broad spectrum of interests including women's rights, consumer advocacy and poverty reduction. The campaign was formed in 1989, to specifically address the rights of workers in the garment and footwear industries globally. The campaign works through (Hale and Wills 2007):

- Raising awareness and pressuring companies and governments to improve rights of workers;
- Work in solidarity with workers fighting for their rights, and take action where these rights are violated;
- Explore judicial mechanisms and lobby for legislation to protect rights and hold companies accountable;
- Promote responsible public and private procurement policies.

The Campaign has a head office in the Netherlands, but offices also exist in many countries around the world. Each country develops and organises its own programme of activity on specific issues that the country has identified as important (Hall and Wills 2007).

Again, the focus of the CCC is not on environmental aspects of the textile and garment sector, but their practices of solidarity of experience between developed and developing country workers, and grassroots organisation provides examples of avenues of knowledge and practice transfer that would be relevant in organisations focused on environmental issues.

5.2.3 Greenpeace's detox (Global)

In 2011 Greenpeace launched a campaign called Detox targeting a group of major garment and footwear brands over their use of toxic chemicals in the production of their products. The campaign included a series of reports released over several years examining water pollutions and hazardous chemical use in the textile and garment sectors. Each report focused on either a specific jurisdiction e.g. China and Indonesia (Greenpeace 2012, 2013) or use and levels of hazardous chemicals (Greenpeace 2012b, 2013b, 2016).

The industry response was ZDHC (Zero Discharge or Hazardous Chemicals), an organisation focused on leading industry to the phasing out of an identified and agreed list of hazardous chemicals by 2020. Members include Nike, Adidas, H&M, Gap, Puma and others. Earlier in 2017 ZDHC released certification standards for chemical formulations conforming to their approved list of non-hazardous chemicals (ZDHC 2017).

5.3 Social dialogue initiatives

For the purposes of this paper, social dialogue refers to a specific type of multi-stakeholder negotiation, consultation or exchange of information between representatives of governments, employers and workers, on issues of common interest relating to economic and social policy. The social dialogue method specifically includes workers in the negotiation through their organisations and unions, and as such provides multi-stakeholder initiatives with the ability to include local partners (local unions, employers and local and provincial governments) in a structured way that is not always accessible in other multi-stakeholder initiatives. In this section, two levels SD initiatives are discussed, ones with international focus and drawing in multi-national partners; and country based initiatives that are focused on SD activities within a particular national context.

International level initiatives

5.3.1 Social and Labour convergence project (Bangladesh)

The Social and Labour convergence project includes global brands, retailers, industry groups, workers' unions, government representatives, non-profit supply chain and auditing experts. Its aim is to improve working conditions in the global apparel and footwear manufacturing sectors through the development of an industry wide, standardized methodology for social and labour performance assessment.

The project is facilitated by the Sustainable Apparel Coalition (SAC) and follows the framework developed by SAC and its members, and is an example of SD initiatives working towards harmonisation and standardisation. The project is developing a common tool, through a multi-stakeholder engagement approach, to enhance transparency whilst reducing the amount of activity directed at auditing, allowing audit resources to instead be directed at performance improvement. Convergence is seen as the criteria to successfully increase transparency and improve working conditions in global supply chains (SLC 2017).

5.3.2 Ethical Trading Initiative (Bangladesh)

Funded by the Governments of the UK, Norway and Denmark, 3F, and Confederation of Danish Enterprises, and supported by Danida. The purpose of the initiative is to strengthen worker's rights and improve industrial relations between factory workers and factory management in the RMG industry in Bangladesh, by developing a scalable model for workplace social dialogue. This includes capacity building and rights-based training of factory workers and factory management across ten pilot factories. Motivated from Rama Plaza factory collapse and Tazreen factory fire. Developing environmental sustainability production is included as an area of efforts, but reported results concentrate on IR impacts (Dieh 2017).

5.3.3 German partnership for Sustainable Textiles (Global)

The partnership was launched in October 2014 by the Federal Ministry of Economic Cooperation and Development (BMZ). The partnership fosters continuous improvement of social, environmental and economic sustainability, by focusing on establishing and applying minimum standards across the textile and garment chain. Standards are seen as a mechanism to provide a common point of knowledge, practice and connection in a global industry with many different actors, driven by different agendas and focus areas. Standards also allow for common definitions, and building metrics that demonstrate progress and change. The partnership was a response to the Rana Plaza disaster in Bangladesh in 2013.

Multi stakeholder processes were used in devising standards. The Partnership worked to harmonise and extend existing standards including those from the ILO (core labour standards), OECD (Guidelines for Multinational Enterprises) and UN (Guiding Principles on Business and Human Rights), sub-sector standards, (such as those for organic cotton and fair-trade products), and certified 'safe use' chemicals list (BMZ 2016). The Partnership has approx. 190 members including Adidas, H&M, Gerry Weber, and German retailers, as well as organisations representing the German textile industry. The partnership process is seen as complementary to regulatory top-down approach by relying on the voluntary adherence of the industry and relevant stakeholders to the minimum standards to be established by the Partnership (HKTDC, 2016).

The Partnership has six working groups to organise its activities, these include:

- Social standards
- Chemical
- Natural fibres
- Review
- Implementation and Internationalisation
- Communication

Members are required to complete a roadmap for their activities on the basis of the partnership's requirements, and then report progress against this roadmap. The Partnership has also launched four planned broad-based initiatives to target specific areas. These initiatives work with suppliers, local stakeholders, trade unions and NGOs. The initiatives are:

- Substitution of toxic chemicals in textile production
- Sustainable water management in cotton cultivation
- Living wages
- Social and labour standards deeper in the supply chain

These initiatives receive funding from German government to support implementation activities, including advising governments on drafting labour and environmental legislation, enabling dialogue between employers and employees, training for union specialists, and support for waste water treatment, testing and monitoring.

Implementation of the agreed standards and then monitoring for compliance has proved difficult, and highlights that SD mechanisms cannot oblige firms to uphold standards (BMZ 2014). A number of companies have recently left the alliance due to the fact they felt they could not comply with the targets set by the alliance. Other companies have not provided roadmaps of how they will meet their self-declared obligations (DW 2017).

[5.3.4 Dutch Covenant on Sustainable Garment and Textile \(Dutch and textile/ garment producing countries\)](#)

The Dutch Government, with trade union organisations and NGOs announced a textile covenant aimed at improving working conditions, low wages and preventing child labour in textile producing countries such as Bangladesh, India, Pakistan and Turkey. The covenant, launched in March 2016 was also a response to the Rana Plaza Disaster of 2013. The agreement will stay in place for five years from the signature date (i.e. 2021).

The covenant has nine themes:

- Protection from discrimination

- Protection from child labour
- Protection from forced labour
- Meaningful dialogue with independent employee representatives
- Achieving a living wage
- Safe conditions and a healthier environment for employees
- Reducing adverse environmental impact by saving on raw materials and creating circular economy
- Reducing amount of water, energy, chemicals used; reducing chemical waste and waste water
- Prevention of animal suffering

Signatories to the covenant agree to inform consumers about the source and production processes of their products. Participating businesses identify the issues that apply to their activities and draw up annual improvement plans, and report progress against these. These reports will be publicly available after the third year. Participating trade unions and civil society members will support implementation plans with their expertise and knowledge, and involve local partners.

75 organisations were signatories to the covenant at launch (representing 35% of the Dutch textile and garment sector), and it is hoped that the agreement will cover 80% of the textile and garment sector in the Netherlands by 2020. The Agreement is still in start-up phase, with businesses still working on drafting their implementation plans.

5.3.5 Sweden's New Global Deal (Sweden and textile/ garment producing countries)

A broad Swedish initiative promoting social dialogue internationally, launched in September 2016 at the United Nations. One of the projects that is part of the initiative is a pilot project 'Promoting Social Dialogue and Harmonious Industrial Relations in the Bangladesh Ready-Made Garment Industry'. This project uses SD to create structures for improving workforce conditions in the Ready-Made Garment sector in Bangladesh. The project develops skills and expertise of managers and union representatives in 150 unionised work sites, and aims to boost workplace cooperation mechanisms and capacity of unions in a further 350, non-unionised workplace. Practical procedures for resolving grievances will be developed in all 500 workplaces. The project is also supported by the government of Denmark, implemented by the ILO in collaboration with the Government of Bangladesh, employers and trade unions.

This model does not address environmental issues, in the RMG sector, labour issues predominate, but the intention is to scale-up the pilot up and down the supply chain. In this instance it could provide a model for cooperation and social dialogue in workplaces where environmental issues are more pressing (dyeing and wet processing sectors).

5.4 Country-level initiatives

5.4.1 Advisory services for Environmental Compliance in Vietnam, ILO Better Work programme (Vietnam)

The ILO BetterWork programme is a collaboration between the United Nation's International Labour Organisation (ILO) and the International Finance Corporation (IFC), a member of the World Bank group, to provide a comprehensive programme bringing together all levels of the

garment industry to improve working conditions and respect labour rights for workers, and boost the competitiveness of apparel businesses.

A pilot project within BetterWork Vietnam is a training program that provides training to factories to understand their applicable environmental obligations, self-assess their facilities, and ensure they comply with environmental regulations. The project provides eight to ten months of training for appropriate officers or managers, individual factory consultancy to assist in self-assessment, improvement and implementation planning, a country guide and self-assessment tool.

Project designed in consultation with stakeholders, including SAC to ensure alignment and avoid duplication among existing initiatives. Focuses on factories' compliance with relevant environmental regulations, which is a pre-requisite to proceed with the Higg Facility Environmental Model.

5.4.2 Bangladesh Water Pact: Partnership for Cleaner Textile (Bangladesh)

Water PACT aims to reduce environmental and associated social impacts that result from prevailing practices in textile wet processing, particularly excessive groundwater extraction and surface water pollution as well as energy and chemical use, through a partnership with stakeholders at all levels of influence. PACT works at multiple levels; with buyers to help them incorporate Cleaner Production into their sourcing guidelines; with textile factories to help them adopt cleaner production; with national government and other stakeholders to create more favourable enabling environment, and with business, government and communities in selected textile manufacturing clusters to foster cleaner clusters.

The Washing-Dyeing node of the textile value chain has 1700 businesses and employees 200,000 workers, net value addition of 20% and growing at 10% per annum. The WDF factories are the second biggest polluter in the country, consuming 1,500b litres of groundwater annually and contaminating surface waters through inadequate effluent treatment, negatively affecting the lives of nearly 12 million people. Ground water levels in the city are falling by about 2 meters per year and the productivity of new boreholes has already declined by almost a third between 1970-2000. Many mills use 250-300 litres of water per kg of fabric, whereas global best practice is around 50//kg (PACT 2016).

The South-East Enterprise Development Facility (SEDF) managed by IFC, in partnership with the UK Government and NORAD, has implemented, with the NGO Solidaridad a resource efficiency programs that has led to significant levels of factory savings by adopting cleaner production, 18 pilot factories collectively save up to US\$2m and 1.3m cubic meters of water (PACT 2016).

PACT helps introduce cleaner production concepts to 500 factories, help 200 factories implement low or no-cost cleaner production, and work with 100 factories to create bankable Cleaner production technology investment plans and facilitate access to finance in this investment.

Also through participating in PACT global apparel buyers develop and apply harmonised decision support guidance to integrate environmental sustainability into design and sourcing decisions. Participating wet processing mills in the buyers supply chain receive assistance in implementing and financing cleaner production measures aligned with this guidance. CP assessments are conducted in three phases: awareness building (500 mills), first assessment

focusing on low or no cost measures (200 mills) and subsequent deeper assessment for 100 mills and prepare technology investment plan to reach higher levels of savings (PACT 2016).

IFC is in discussions with local financial institutions about the development of lending products to support factories to invest in CP. Leading industry associations involved and have partnered to establish a Textile Technology Business Centre to support the adoption of CP through sharing of technical and financial information. Working with textile clusters (first in Konabari, North of Dhaka) to put into practice vision for Cleaner Clusters.

5.5 Additional projects, grants and funding

The Asian Development Bank (ADB) is also making significant investments in projects and access to finance, including providing a US\$20m loan to the Eastern Bank of Bangladesh, to finance construction or expansions of factories to improve safety standards and energy performance (ADB 2016). Another loan of US\$30m to the BRAC Bank to finance social and environmental sustainability projects including construction and expansion of facilities to improve safety standards, as well as the construction of wastewater effluent treatment plants (ADB 2015).

5.6 Summary: Environmental components of SD initiatives

Multi-stakeholder initiatives involving brands, factories, worker and employee associations, NGOs and governments at all levels of jurisdiction, have proliferated in recent decades in the textile and garment supply chain. The majority of these initiatives focus exclusively or primarily in addressing labour conditions. An emerging number of initiatives are now focusing on environmental impacts and the implementation of cleaner production techniques to reduce negative environmental impacts.

Multi-stakeholder initiatives are integral in creating and achieving wide-spread adoption of transformational change across the textile and garment supply chain. In section 2.4 the barriers to adopting cleaner production techniques were highlighted. In summary, these are:

- Lack of awareness of inefficiencies in current practices and availabilities of cleaner production techniques;
- Lack of skilled personnel within factories to identify and change practices. This includes awareness of impacts of production, the inefficiencies involved, and therefore the business case for investing in new technologies and production techniques;
- Lack of trusted information sources to provide context specific information and advice on solutions;
- Lack of market offerings of context specific solutions, this includes product and service markets;
- Difficulty in accessing finance to make investments;
- Lack of prior knowledge and due diligence assessment in local financial industry to assess cleaner production investment proposals;

- Lack of environmental regulation and monitoring of compliance, or penalties for non-compliance being too low so it is less costly to pay penalties than make investments. This means demand for cleaner production techniques is reduced.

The following table (Figure 5) compares how each of these discussed initiatives addressed some of these barriers (according to the author's assessment based on desktop research). From this comparative analysis, multi-stakeholder initiatives provide activities addressing areas including awareness raising, providing trusted sources of information, access to tools and standards, knowledge sharing and networks, applied learning and institutional capacity building and compliance support.

Access to finance and skills development for workers in factories to adopt cleaner production activities are only addressed by a few initiatives. So too, support for the development and implementation of environmental regulations. Specific focus on research and development is not a wide-spread focus across the supply chain either.

Multi-stakeholder initiatives focusing on environmental impacts of the textile and garment industry are still emerging; so, evaluations of their effectiveness are not available to the same level that exists for labour conditions.

Multi-stakeholder initiatives provide an opportunity for consensus building around the next steps for action in addressing 'wicked problems'. These initiatives can be constructive in filling the gaps in regulatory or governance arrangements that state and international organisations have been unable or unwilling to fill, or can bolster and complement state regulation, by adding a new set of carrots and sticks to encourage compliance (Newell 2001) and play a role in process of organisational learning (Zadek 2001).

The challenge is, in an area that is in urgent need of action to address environmental impacts, to manage multiple initiatives in a way that avoids duplication and/ or contradictory measures, and that understands that all these initiatives are competing for the limited bandwidth for change available to each business. Multi-stakeholder initiatives also have limitations, in that there is no guarantee that participating in any initiative will improve firms' social or environmental performance.

Comparative table of multi-stakeholder initiatives

Barriers for implementing cleaner production	Awareness raising with consumers	Skills development for workers	Providing trusted source of info	Developing market offerings	Access to finance	Tools and standards	Knowledge sharing/networks	Support for developing environmental regulations	Institutional capacity building/ Compliance support	R&D	Applied learning
Industry led											
SAC	■		■	■		■	■		■		■
Bluesign			■			■				■	
Fairwear	■	■					■		■		
Fair trade cotton				■		■					
Civil society/ NGO led											
STWI		■	■		■	■	■	■	■	■	■
Detox campaign	■					■	■				
Social dialogue											
Social labour convergence						■	■				■
Ethical trading	■								■		
German Partnership		■	■			■	■	■	■	■	■
Dutch Covenant			■			■	■		■		■
Sweden New Global Deal		■							■		■
BW Vietnam		■				■			■		■
Water PACT		■			■		■		■		■

6. Conclusions and recommendations

This report contributes analysis of environmental issues to a scoping project into decent work and the garment industry in Asia. This scoping project is being carried out by the ILO and in partnership with the Swedish International Development Agency (SIDA).

The aim of the review is to highlight areas of environmental impact and where this occurs along the textile and garment supply chain, and provide some illustrative (rather than comprehensive) examples of the various pathways to improving environmental performance. This includes in the regulative context, brand-led CSR programs, and multi-stakeholder initiatives involving a range of actors such as brands, suppliers and factories, unions, civil society groups and non-government organisations.

The review focused mostly on international level examples, so initiatives involving multiple countries, in line with the expectation that the regional program will also be multi-country. In doing so national, provincial and local initiatives that exist in various forms in the individual countries and regions where textile and garment manufacturing exists are not covered. Analysis and integration with these initiatives (where relevant) and the organisations running them, will be a necessary further step in identifying and designing future program objectives.

6.1 Environmental impacts

For the purpose of this paper, focus and analysis was restricted to the environmental impacts in the textile manufacturing and garment assembly links in the supply chain. Environmental impacts within the textile and garment assembly sectors are concentrated at certain points in the supply chain, in three main areas:

- the weaving, dyeing and finishing processes in textile manufacturing,
- energy use and textile waste associated with garment assembly, and
- the transport emissions throughout the supply chain as materials and then final products are shipping literally around the world.

The most significant impacts are the first area, with the main impacts being on use intensity of water resources, chemical use including toxic chemicals, waste water discharges and lack of treatment processes, and energy use and carbon intensity of electricity.

Climate change will make managing these environmental issues more challenging and more pressing to be addressed. Water scarcity and security are critical issues, and will become more so within the region due to increased water demand and lack of widespread good water management. Better water management from industrial processes including textiles and garment production will be a critical adaptation response. Heatwaves and their related impacts have already affected garment production, and these impacts will only increase. Increased precipitation variability, including increased number of heavy rain events, increased incidents of tropical cyclones and sea level rises will test the resilience of the textile and garment industry in many study countries, and more broadly adversely affect these countries ability for sustainable development.

6.2 Local environmental impacts and effects on vulnerable populations

The environmental impacts of textile and garment manufacturing process are highly localised to where production is. The communities surrounding these facilities are significantly impacted in terms of health, quality of life, and in many cases, impacts on livelihoods from farming and fishing. The location of production facilities in major urban areas (in order to access large pools of labour) also means that these facilities are adjacent to houses, schools, other businesses and community facilities. It is likely that vulnerable populations, such as children, sick and elderly people will also be more vulnerable to the negative health and quality of life impacts that come from the environmental degradation associated with the industry.

6.3 Gender and environmental impacts

The textile and garment supply chains are highly gendered; the majority of workers are women. International and domestic initiatives to date aimed at improving labour and environmental conditions have demonstrated limited success. Future initiatives will need to consider what impacts do codes of conduct have on women, including those employed on casual basis and in small and unregulated workplaces. If codes are difficult to implement in first tier suppliers then they will not reach and benefits the majority of workers (who are women). In fact, they could lead to a two-tiered system where standards are met in some workplaces, but in others the reality is far from the minimum standard (Hale and Turner 2005). Women need to be closely involved in how these codes of conduct and initiatives are created so they can ensure that they adequately address gender issues.

Environmental issues exacerbated by the textile and garment sectors such as water scarcity, will also disproportionately affect women, because of their roles in managing household water supplies and sanitation. Women are further disadvantaged by having less decision-making power and influence over how water resources are managed.

6.4 Best practice cleaner production

There is a great deal of difference between best and worst practice in terms of resource efficiency. This means there are significant opportunities to optimize the environmental and social footprint, but they require a focus on process design across the whole supply chain. The industry provides a context where relatively modern and existing technology can be deployed and be used to improve environmental performance, as well as achieve productivity gains.

Barriers to adopting cleaner production practices in textile manufacturing include; awareness and knowledge deficiencies of inefficient practices and the availability of cleaner production techniques, lack of skilled personnel, lack of trusted information sources, lack of context specific market offerings, difficulty in accessing finance and lack of robust environmental regulation to drive compliance and best practice.

Environmental regulation systems and institutions are still emerging in many study countries. Whilst there are deficits in these regulatory frameworks, this is exacerbated by significant deficits in monitoring, testing and compliance activities. Deficits include lack of institutional capacity in environmental agencies, lack of skilled personnel with agencies, lack of adequate testing and laboratory facilities, and also the minimal deterrence for non-compliance.

6.5 Intersection of decent work and environmental impacts

There are a number of intersections points between environmental impacts and decent work in the textile and garment supply chain. The wet processing of textiles not only has environmental impacts with water use intensity and waste water discharges into the watershed, these processes can also put workers in hazardous positions, especially if adequate safety training, equipment and provisions are not made. Also, workers are further impacted if they live nearby to textile factories and are exposed to contaminated water supplies, and/ or their family livelihoods are negatively impacted by water scarcity or waste water discharges affecting agricultural and fishing industries.

This report has also highlighted the impact of climate change on the supply chain. Heatwave conditions will produce intolerable and dangerous working conditions if adequate ventilation, cooling and drinking water are not provided. The increasing frequency of extreme weather events such as floods, cyclones and heatwaves, that cause business disruption can leave workers financially vulnerable if factories are not able to operate and workers lose income.

The high levels of female employment in these sectors mean that workers, because they are predominantly female will be disproportionately affected by water scarcity and water management issues, because they are responsible for these resources within their households.

Addressing environmental impacts, through the introduction of cleaner production techniques, and the implementation of environmental regulation and strong monitoring and compliance activities, provides the opportunity to not only reduce environmental impacts but develop high level enterprise and employment opportunities in the textile and garment sector. Cleaner production requires higher levels of skill in plant and operations management. Increased monitoring and enforcement of environmental regulations increases demand for cleaner technology and production, this provides demand-pull for new enterprises to provide services to meet this need. If attention is also paid to market and non-market barriers to the adoption of cleaner production, such as access to finance, trusted information sources and knowledge sharing, as well as the participation and access of women to skills development, entrepreneurship and financial support, addressing environmental impacts can create sustainable development.

6.6 Role of CSR programs and multi-stakeholder initiatives

The report examined a number of illustrative examples of corporate social responsibility and multi-stakeholder initiatives, with the purpose to understand the range of activities covered, and how well they matched up to earlier identified barriers to cleaner production activities.

The examination of CSR initiatives showed the lack of established shared or common values across the supply chain for environmental and social goals as a key barrier to wider improvements in environmental performance. CSR provides an important framework for developing business responses to social and environmental issues, but there are significant knowledge gaps in our understanding of CSR activities in Asian firms, specifically the effects of CSR interventions on firm profitability, workers and environmental conditions.

Multi-stakeholder initiatives focusing on environmental impacts of the textile and garment industry are still emerging; and we don't yet have comprehensive evaluations of existing initiatives. These initiatives do provide a method for addressing environmental impacts in a cohesive way across the supply chain, and bringing multiple actors together to build

consensus around the next steps for action. They also provide good opportunities for cross-organisational learning, and can fill gaps in regulatory or governance arrangements, if they are still emerging in countries. Although some organisational learning is limited by the lack of sharing of evaluation results and experiences of businesses as they try to change practices.

Overall, there exists a multitude of initiatives by governments, the private sector, civil society, and international organisations designed to improve social and environmental standards in the garment value chain. The challenge is to manage multiple initiatives in a way that avoids duplication and/ or contradictory measures, provides the 'safe' space for organisational learning and that understands that all these initiatives are competing for the limited bandwidth for change available to each business.

6.6 Recommendations for future research and collaborative action

As the textile and garment industry undertakes a series of important reforms at the country level, there has been no application of the ILO Guidelines for a Just Transition to this industry and none or little consideration has been given at the regional level to address cross-border environmental and labour implications. A key recommendation is to use the JTG as the framework to design a regional programme that addresses the environmental and decent work elements in a holistic way. This programme can include a regional wide training and skills development component with the involvement of the International Training Centre (ITC) of the ILO.

A focus on program development for waste water treatment, water efficiency, and diffusion of best practice cleaner production techniques in the textile manufacturing sector would provide the best opportunity to address environmental impacts of the textile and garment industry. Based on the results of this scoping paper, the following recommendations for further activities are made:

- In partnership with existing local and international actors and initiatives, undertake close examination of how innovations around best practice cleaner production techniques are introduced and diffused in textile clusters, with a focus on understanding the enabling environment and what factors are context specific and what can be replicated and/ or scaled. This will require mapping of local and national level initiatives in each of the study countries, as well as country-level analysis of barriers and enabling environment for implementation.
- In doing so, pay special attention to improving adoption of cleaner production techniques lower down the supply chain, and in smaller facilities that have not been engaged with current initiatives. This can address environmental, but also gender implications of impacts, as these lower supply chain links and smaller facilities are more than likely to employ mostly women.
- Focus on developing context specific strategies for skills development, entrepreneurship, enterprise and innovation support, including finance to develop product and service offerings; this should include specific investigations and strategies for female skills and entrepreneurship activities. A regional level program can provide the overall architecture for program activities, a platform for knowledge sharing, cross-country dialogue on specific issues and common evaluation and

performance metrics. Materials and training resources can also be developed at the regional level, and then customised by local actors for their context.

- These strategies should be developed using multi-stakeholder processes, with the participation of local and international actors. The interaction of local and international actors provides encouragement to local actors to force acknowledgement and action to address environmental impacts. Structured dialogue processes, such as tripartite social dialogue offer the best opportunities for initiatives to be fit for purpose as they provide means for workers, employers and local government to participate in the process of developing strategies. Local actors not used to these processes may require additional capacity and resources to adequately participate.
- CSR has an important role to play in helping businesses activate their role in social and environmental activities in addition to economic activities. There are significant knowledge gaps of local and national CSR interventions in the study countries and their effects on profitability of local enterprises, workers and environmental conditions.

References

Abernathy, F.H., Dunlop, J.T., Hammond, J.H. and Weil, D., 1999. *A stitch in time: Lean retailing and the transformation of manufacturing--lessons from the apparel and textile industries*. Oxford University Press.

Abnett, K <https://www.businessoffashion.com/articles/people/just-fix-it-hannah-jones-nike>

Adamsons, L., Hsieh, N. H., & Paine, L. S. (2013). Governance and Sustainability at Nike, HBR Case Studies Series, 9-313-146, September 2013.

ADB (2016) *Proposed Loan Eastern Bank: Sustainable projects in the textile and garment sector, Bangladesh*, Asian Development Bank

ADB (2015) *Proposed Loan BRAC Bank: Sustainable projects, Bangladesh*, Asian Development Bank

ADB and ILO (2016) *Bangladesh: Looking beyond garments, employment diagnostic study*, Asian development Bank and International Labour Organisation

Alam, Mozaharul, and MD Golam Rabbani. "Vulnerabilities and responses to climate change for Dhaka." *Environment and urbanization* 19.1 (2007): 81-97.

Allwood, J.M., Laursen, S.E., Malvido de Rodriguez, C. & Bocken, N.M.P. 2006, *Well Dressed?* Institute for Manufacturing, University of Cambridge, Cambridge.

Anguelov, N (2016) *The Dirty side of the garment industry: fast fashion and its negative impacts on environment and society*, CRC Press: FL, USA

Audet, D. (2004) Structural adjustments in textile and clothing in the post-ATC trading environment, *OECD Trade Policy Papers 4*, OECD: Paris.

Bass, S., Font, X. and Danielson, L. 2001. "Standards and Certification: A Leap Forward or a Step Back for Sustainable Development," in *The Future is Now: Equity for a Small Planet*, Vol. 2. IIED: London.

Birnbaum, D. (2008) *Crisis in the 21st Century garment industry and breakthrough unified strategy*. New York: The Fashion Index Inc.

BMZ (2014) *Joint achievements in the textile sector*, Partnership for Sustainable Textiles, German Federal Ministry for Economic Cooperation and Development.

CCC (2015) *General Factsheet Garment Industry*, Clean Clothes Campaign, February 2015, available at <https://cleanclothes.org/resources/publications/factsheets/general-factsheet-garment-industry-february-2015.pdf/view>, accessed 15th August 2017.

CottonAustralia (2013) World Cotton report, available at <http://cottonaustralia.com.au/cotton-library/factsheets/cotton-fact-file-the-world-cotton-market>, accessed 15th August 2017.

DIEH (2017) *Spotlight on responsible garment and textile production in Bangladesh*, available at <https://www.dieh.dk/publikationer/cases/case-spotlight-on-responsible-garment-and-textile-production-in-bangladesh/>, accessed 15th August 2017.

Fair Trade International (2014) *Monitoring the scope and benefits of fair trade*, Fairtrade International
FAO (2004) *Review of Global Agricultural Water Use Per Country, Crop Water Requirements*, Food and Agriculture Organization, Rome, Italy (2005)

Greenpeace (2012) Toxic Threads: Putting pollution on Parade, Greenpeace International: Netherlands.

Greenpeace (2012b) Toxic Threads: The big fashion stitch-up, Greenpeace International: Netherlands.

Greenpeace (2013) Dirty Laundry: Reloaded, Greenpeace International: Netherlands.

Greenpeace (2013b) Toxic Threads: Polluting Paradise, Greenpeace International: Netherlands.

Greenpeace (2016) Hidden in Plain Sight, Greenpeace International: Netherlands.

Greer, L., Egan Keane, S., Lin, Z. (2010) *NRDC's Ten Best Practices for textile mills to save money and reduce pollution*, Clean by Design, Natural Resources Defense Council (NRDC)

Greer, L and Hook, L (2014) *Made (Green) in Vietnam*, available at <http://www.dw.com/en/partnership-for-sustainable-textiles-unraveling/a-39957445>, accessed 15th August 2017.

Guardian (2016) Workers face epidemic of heat-related injuries due to climate change, April 26th, 2016, <https://www.theguardian.com/environment/2016/apr/28/workers-epidemic-heat-related-injuries-climate-change-un-report> accessed September 15 2017

Gunther, M (2017) *Behind the Scenes at the Sustainable Apparel Coalition*, Non Profit Chronicles, available here <http://apparelcoalition.org/behind-the-scenes-at-the-sustainable-apparel-coalition/>, accessed 15th August 2017.

H&M (2016) Sustainability Strategy and Commitment

Hale, Angela, and Jane Wills. "Women Working Worldwide: transnational networks, corporate social responsibility and action research." *Global Networks* 7.4 (2007): 453-476.

Haque, R. (2017) *Use and Effectiveness of Effluent Treatment Plants (ETPs) in the Garments Industry of Bangladesh: A Water Sector Integrity Perspective*, WIN and Transparency International Bangladesh.

Hsu, A. et al. (2016). 2016 Environmental Performance Index. New Haven, CT: Yale University. Available: www.epi.yale.edu.

Ibrahim, N. A., et al. "Pollution prevention of cotton-cone reactive dyeing." *Journal of Cleaner Production* 16.12 (2008): 1321-1326.

ILO (2015) Guidelines for a just transition towards environmentally sustainable economies and societies for all, International Labour Organisation (ILO): Switzerland.

Kasemset, C., Boonmee, C. and Khuntaporn, P., 2016. Application of MFCA and ECRS in Waste Reduction: A Case Study of Electronic Parts Factory. In *Proceedings of the 2016 International Conference on Industrial Engineering and Operations Management, Kuala Lumpur, Malaysia*.

Khan, H.S., Ahmed, S., Evans, A.V., and Chadwick, M. (2009) Methodology for performance analysis of textile effluent treatment plants in Bangladesh, *Chemical Engineering Research Bulletin*, 13:61-66.

LBCD Consultants (2010) *Industrial waste water management in river basins Nhue-Day and DongNai project*, Final report prepared for The World Bank and The Ministry of Planning and Investment of Vietnam, available here <http://documents.worldbank.org/curated/en/387681468173043709/pdf/578630v1010SR01al0report01810312010.pdf>, accessed 15th August 2017.

Martin, Maximilian, and Impact Economy. "Creating sustainable apparel value chains." *Impact Economy* (2013): 1-41.

Maxwell, D. McAndrew, L. Ryan, J. (2015), State of the Apparel Sector Report – Water a report for the global leadership award in sustainable apparel, aug 2015, available here http://glasaaward.org/wp-content/uploads/2015/05/GLASA_2015_StateofApparelSector_SpecialReport_Water_150624.pdf, accessed 17th September 2017.

McGregor, L. (2016) H&M Sustainability report stresses need for industry-wide collaboration, Sourcing Journal, April 14th, 2016, available here <https://sourcingjournalonline.com/hm-sustainability-report-stresses-need-for-industry-wide-collaboration/>, accessed 15th September 2017

McQuillan, H. 2011, 'Zero-waste design practice: Strategies and Risk Taking for Garment Design', In: A. Gwilt & T. Rissanen, eds. Shaping Sustainable Fashion, Earthscan, London, pp. 83–97.

Miroux, A. and Sauvart, K.P. (Eds.) (2005) TNCs and the removal of textile and clothing quotas. Geneva/ New York: UNCTAD Current Studies on FDI and Development Series, United Nations Publication.

Munasinghe, M., Jayasinghe, P., Ralapanawe, V. and Gajanayake, A., 2016. Supply/value chain analysis of carbon and energy footprint of garment manufacturing in Sri Lanka. *Sustainable Production and Consumption*, 5, pp.51-64.

Newell, P. 2001. "Managing Multinationals: The Governance of Investment for the Environment," in Journal of International Development, Vol.13, pp. 907-919.

Niinimäki, K., 2013. A renaissance in material appreciation: case study in zero waste fashion. *Journal of Textile Design Research and Practice*, 1(1), pp.77-92.

Nike (2016) Nike Sustainability Strategy – Annual Report 2015

OECD (2016) Swedish Textile Water Initiative, Private sector peer learning: mechanisms profile, OECD: Paris

O'Rourke, D. and Strand, R (2016) *Patagonia: Driving sustainable innovation by embracing tensions*, Berkeley-Hass Case Series, B5853, February 2016.

Ozturk, E., Koseoglu, H., Karaboyaci, M., Yigit, N.O., Yetis, U. and Kitis, M., 2016. Minimization of water and chemical use in a cotton/polyester fabric dyeing textile mill. *Journal of Cleaner Production*, 130, pp.92-102.

Pachauri, R.K., Allen, M.R., Barros, V.R., Broome, J., Cramer, W., Christ, R., Church, J.A., Clarke, L., Dahe, Q., Dasgupta, P. and Dubash, N.K., 2014. *Climate change 2014: synthesis report. Contribution of Working Groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change* (p. 151). IPCC.

Pan, J., Chu, C., Zhao, X., Cui, Y and Voituriez, T. (2008) *Global Cotton and Textile Product Chains: Identifying Challenges and Opportunities for China through Global Commodity Chain Sustainability Analysis*, Winnipeg, Canada: International Institute for Sustainable Development.

Patagonia (2016) Sustainability Strategy

Sachs, Sybille, and Edwin Rühli. (2011) *Stakeholders matter: A new paradigm for strategy in society*. Cambridge University Press, Cambridge

SIWI and Sustainability Outlook (2015) Modelling Sustainability: First Global Report from Sweden Textile Water Initiative. SIWI

SLC (2017) Social Labour Convergence project: About Us, available here <http://slconvergence.org/progress/>, accessed 28th September 2017.

Soundararajan, Vivek, and Jill A. Brown. "Voluntary governance mechanisms in global supply chains: Beyond CSR to a stakeholder utility perspective." *Journal of Business Ethics* 134.1 (2016): 83-102.

Spicer, Andrew, and David Hyatt. "Walmart's Emergent Low-Cost Sustainable Product Strategy." *California Management Review* 59.2 (2017): 116-141.

StarOnline (2017) Panic in Bangladesh factories as workers collapse in heatwave, May 26th, 2017 <http://www.thestar.com.my/news/regional/2017/05/26/panic-in-bangladesh-factories-as-workers-collapse-in-heatwave/> accessed September 15 2017

STWI (2017) Swedish Textile Water initiative, About the Initiative, available here, <http://stwi.se/about/> accessed 30th August 2017.

Swedish EPA (Environmental Protection Agency) (2011) Swedish Consumption and the Global Environment, English Translation, available here <https://www.naturvardsverket.se/Documents/publikationer/978-91-620-1285-4.pdf>, accessed 18th September 2017.

Textile Today (2008) Textile Industries in Bangladesh: A Rising Environmental Degradation Down The Drains, available at <http://www.textiletoday.com.bd/textile-industries-in-bangladesh-a-rising-environmental-degradation/>, accessed 15th August 2017.

UNDP (2016) Climate change and labour: Impacts of heat in the workplace UN, Issues Paper, UNDP, available here <http://www.undp.org/content/undp/en/home/librarypage/climate-and-disaster-resilience-/tackling-challenges-of-climate-change-and-workplace-heat-for-dev.html>, accessed 18th September 2017.

United Nations, Economic and Social Commission for Asia and the Pacific (2017). Gender, the Environment and Sustainable Development in Asia and the Pacific. Sales No. E.17.II.F.18.

United Nations Water. (2015). Water and Sanitation: The Pathway to a Sustainable Future. World Water Day 2015: Water and Sustainable Development. Available: http://www.unwater.org/fileadmin/user_upload/unwater_new/docs/SDG6-Interlinkages%20and2.pdf.

WIN (2017) *Waste water management in the garment industry*, Water Integrity Network, available here <http://www.waterintegritynetwork.net/2017/07/27/wastewater-management-garment-industry/>, accessed 15th August 2017.

WTO (2015) Trade Statistics

Zadek, S. 2001. *The Civil Corporation: The New Economy of Corporate Citizenship*. Earthscan: London.

ZDHC (2017) ZDHC Announces the First ZDHC Accepted Certification Standards for ZDHC MRSL Conformance, available here <http://www.roadmaptozero.com/news/post/zdhc-announces-the-first-zdhc-accepted-certification-standards-for-zdhc-mrsl-conformance/>, accessed 18th September 2017.