

On the responsiveness of producers towards environmental legislation in the Indian textile industry

A study commissioned by amfori and conducted by AEclipse.

2023

Executive Summary



This report investigates the responsiveness of producers in the Indian textile industry towards existing environmental legislation to identify success factors and barriers in mitigating pollution risks. Evaluating this responsiveness is necessary to understand the potential impact of the proposed EU Corporate Sustainability Due Diligence Directive (CSDDD) and Corporate Sustainability Reporting Directive (CSRD) on the textile supply chain. The study is based on three pillars: compilation of programmes regarding pollution abatement in India, review of existing literature outlining producer behaviour concerning pollution regulations, and case studies investigating the responsiveness towards legislation by small and medium enterprises.

The study focuses on the high-risk textile industry sector in India, one of the most dynamic textile-producing markets in the world. The research question is whether and how companies in the Indian textile industry react to pollution-related regulations and incentives. From this question, the effectiveness of pollution mitigation and reduction strategies can be evaluated.

The report outlines the importance of identifying and mitigating pollution risks in global supply chains, as pollution contributes to 9 million excess deaths annually and causes an estimated USD 4.6 trillion loss to the worldwide economy. The proposed EU CSDDD and CSRD legislation aims to address this issue by proposing due diligence measures and reporting on social and environmental risk factors throughout EU companies' supply chains.

The study offers several key policy recommendations across local, national, and European levels and suggests measures companies sourcing from Indian textiles can take to mitigate risk. The findings identify the most effective strategies to achieve these goals based on the compilation of programmes, literature review, and case studies.

Overall, the report provides valuable insights into the behaviour of producers in the Indian textile industry towards environmental legislation and pollution mitigation strategies. The findings can inform policy development and support companies in improving their sustainability and responsible business practices.

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AEclipse Key Recommendations

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Shift towards an incentive-based approach, effectively changing how the government enforces legislation.

1



2

More centralised oversight to improve the effectiveness of state Pollution Control Boards given the current patchwork of standards, enforcement, and pollution awareness.

Encourage clustering around shared infrastructure by reducing bureaucratic hurdles to Integrated Textile Parks and Special Economic Zone participation and adopting a cluster-based approach to limit the proliferation of small-scale production and the associated sustainability challenges.

3



4

Facilitate reporting and environmental pressure from downstream by installing physical monitoring in India to track and interact with suppliers more directly.

Companies should understand the benefits of due diligence and the need for reporting standards.

5



1. Introduction

In the early 2000s, the European Union (hereafter EU) began introducing a range of policies and directives to promote sustainable and responsible business practices. With the introduction of an EU Corporate Sustainability Due Diligence Directive (hereafter CSDDD) proposal in 2022, the policies are now set to expand in scope to cover responsible supply chain practices beyond the blocks' borders.

The proposed text covers both social and environmental factors of due diligence. Ecological aspects are worth investigating, as the Directive expands many elements not present in previous regulations with similar goals implemented at the national level. These include measures related to both climate change and environmental protection. Under these national legislative frameworks, pollution emerges as a topic of particular importance. A potential motive for this focus is that pollution contributes to 9 million excess deaths annually (16% of total deaths), as well as causing an estimated USD 4.6 trillion loss to the global economy (Landrigan et al., 2018). Therefore, it is paramount that sufficient measures are taken to identify, mitigate and prevent pollution-related risks in global supply chains. This process is one of the primary goals of current EU CSDDD legislation.

“Our study seeks to understand producer responsiveness towards environmental legislations in the Indian textile industry.”

To further define key risks of interest, the proposed Directive identifies high-impact sectors in which pollution risks are the most prominent. This study focuses on one of these high-risk sectors, the textile industry. This study examines the behaviour of producers operating downstream in the global textile supply chain. It will focus on one of the most dynamic textile-producing markets in the world - India. By better understanding whether and how companies in the textile industry react to pollution-related regulations and incentives, it evaluates vital aspects of pollution mitigation and reduction strategies. It also identifies factors contributing to their potential success or failure.

The following analysis is based on three pillars:

- Compilation of programmes regarding pollution abatement in India, focusing on the states of Maharashtra, Gujarat, and Tamil Nadu.
- Review of existing literature outlining producer behaviour concerning pollution regulations.
- Case study of the small-medium enterprise sector to examine factors contributing to producer behaviour in India.

Based on the above, the study then outlines several key policy recommendations. These include informing policy on local, national and European levels and supporting companies in mitigating pollution risk in their supply chains, suggesting the most effective strategies.

2. Background

Environmental, social, and governance (hereafter ESG) legislations are significant and have been developed and expanded in the EU since the 2000s. Before delving into our research question, we aim to highlight some of the critical legislation followed by introducing the proposed CSDDD to provide essential background knowledge of the ESG legislative framework.

2.1. Existing European & National Legislation

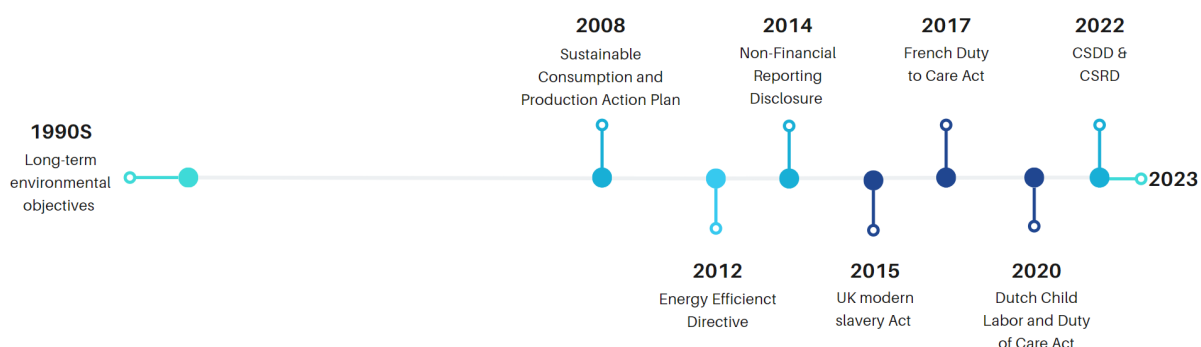


Figure 1: Critical national and European supply chain legislation overview.

Note: Light blue coloured points relate to European legislation, and dark blue points relate to national legislation.

National Laws

UK modern slavery act, 2015: Requires that any firm with a turnover of more than £36 million publicly discloses all aspects relevant to modern slavery in their supply chain. Still, the law does not penalise the non-compliers (Modern Slavery Act, 2015).

French Duty to Care Act, 2017: Requires companies with more than 5000 employees to publicly disclose all abuses of their direct and indirect subsidiaries (European Coalition for Corporate Justice, 2018)

Dutch Child Labour Due Diligence Law, 2020: Requires that all companies publicly disclose all child labour issues in their entire supply chain. It penalises non-compliers up to €8,200 (Littenberg, 2019).

German Supply Chain Due Diligence, 2023: Requires companies with more than 1000 employees in Germany to conduct human rights and environment-related due diligence on their supply chain. It penalises non-compliers with fines of up to €800,000 or 2% of the annual average consolidated turnover (Federal Government of Germany 2021).

European Laws

Sustainable Consumption and Production Action Plan, 2008: Specifies environmental objectives and proposes an action plan to improve the sustainable performance of products throughout their life cycle (European Parliament, 2020).

Energy Efficiency Directive, 2012: (amended in 2018) Determines a set of binding measures to help achieve a 20% energy efficiency improvement by 2020 (European Commission, 2012).

Non-financial Reporting Disclosure, 2014: Requires public-interest corporations with more than 500 employees to disclose information on their ESG issues. SCDD & SCRД are the updated and corrected versions of NFRD.

CSDDD 2022: Requires companies to conduct thorough due diligence on their suppliers and business partners. This involves site visits to assess operations and environmental/social impact, reviewing policies to address risks, ensuring regulatory compliance, and evaluating internal management and processes. These measures aim to identify and mitigate environmental and human rights risks effectively.

CSRD 2022: Broadens the scope of the CSDDD by requiring large companies to report specific risks and opportunities about environmental, social human rights, and governance factors and their effect on people, the planet, and their operations. Supervisory authorities will define penalty charges based on the companies' net global sales.

2.2. Importance of the Textile Industry

The global textile industry is an essential pillar of growth for the worldwide economy. According to a recent report, the global textile industry has an estimated value creation of USD 920 billion and is expected to grow to USD 1,230 billion by 2024 (Mordor Intelligence, 2021). China, the EU, and India (World Trade Organisation, 2022 (WTO)) have significantly contributed to textile industry growth in the past decade. The three accounted for nearly 70% of total exports during 2021.

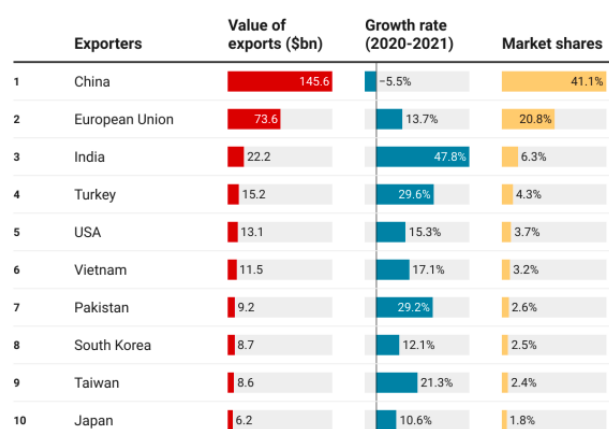


Figure 2: Top Textile Exporters in 2021.

Note: Source: WTO (2022).

While the textile industry is essential to economic growth, it is also a significant source of environmental pollution (Deore & Narula, 2018). Due to its highly polluting nature, the textile industry has been identified as a high-impact sector under the CSDDD proposal published by the EU. The proposed CSDDD highlights the importance of a structured social and human rights due diligence system and the need for businesses to consider their environmental impact in their strategic decision-making and management practices.

The textile industry is responsible for 20% of global clean water pollution, 10% of global greenhouse gas emissions, and other contamination forms (European Parliament, 2020). Textile production imposes various ecological threats throughout the supply chain. Studies have highlighted that the main concerns regarding pollution in textile production are related to the use of water (Chen et al., 2017) and efforts to dispose of toxic waste (Imtiazuddin et al., 2018). The disposal of harmful waste often contaminates nearby soil, air and water sources.

As illustrated in Figure 3, the processes within the textile industry can be categorised into four parts: fibre production, textile production, textile wet processing/fabric finishing and packaging/transportation. The overall process requires various resources, such as raw materials and chemicals. These materials are sometimes inefficiently used and disposed of. Thiry (2011) reported that 35% of all chemical pollutants are related to the textile industry.

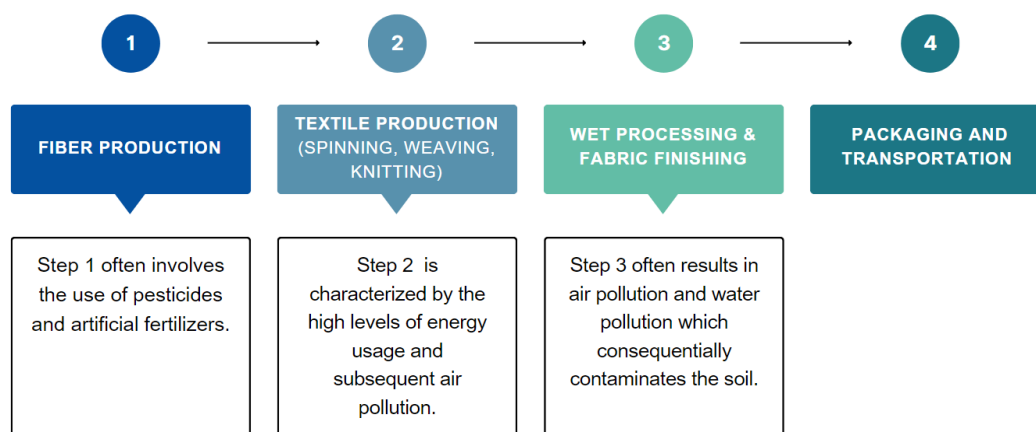


Figure 3: Processes within the textile industry.

Note: Based on Gardetti (2017).

2.3. Indian Textile Industry

2.3.1. Overview

India is one of the most prominent actors in the textile industry, responsible for an estimated 4% of global textile production. The country's main outputs are producing and processing cotton, jute, silk, and wool. The Indian textile industry comprises over 1400 large textile companies but also relies on the production capacity of Micro, Small & Medium Enterprises (hereafter MSMEs). According to the Ministry of MSMEs (2022), nearly 12.2 million MSMEs were active in India (India Brand Equity Foundation, 2022). Market competition has pressured MSMEs to modernise and expand while implementing cost-reduction methods. The MSME Development Act (in 2006) designates enterprises into two groups: manufacturing and service. According to the Ministry of MSMEs, the sector consists of 11.7 million (96.17%) micro-enterprises, 0.43 million (3.49%) small enterprises and 0.04 million (0.32%) medium enterprises (Ministry of MSMEs, 2022).

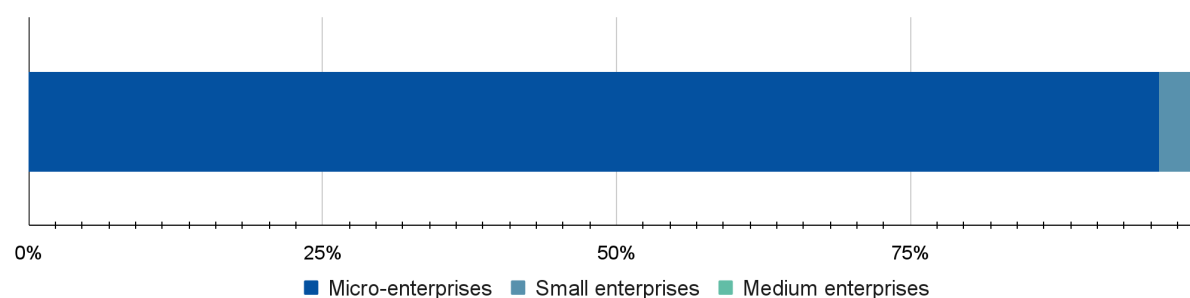


Figure 4: Composition of the Micro, Small and Medium Enterprises sector, 2022.

Note: Source, Ministry of MSMEs (2022).

The textile industry in India is characterised by two main features: sector classification and clusters. First, the production sectors are classified as organised or unorganised. 95% of India's textile industry comprises the unorganised sector¹, while only 5% is associated with the organised sector. The standard practices within the organised sector involve spinning- and composite mills used to mass-produce textile products. Technological innovation and advances in production practices are observed within this sector due to the increasing automation of production processes.

Contrary to this, the unorganised sector is associated with the traditional textile production practices that are otherwise less prevalent outside India. This includes units focused on weaving, knitting and fabric processing. Notably, the sector is the second biggest employer in India. While the organised sector is relatively capital-intensive, the unorganised sector is characterised as labour-intensive. Nevertheless, the complementarity between both sectors is essential to the Indian textile industry (Seshaiah et al., 2006; Sen & Majumdar, 2015).

¹ This unorganised sector often implements modern techniques and machinery.

2.3.2. Supply Network with EU Market

The EU market is highly diversified, with global supply chains interconnecting the world. According to UNComtrade and Eurostat, around 64%-68% of EU apparel and 40%-60% of EU textile trade were imported from non-EU member countries between 2015-2021. This suggests that extra-region trade in the textile market is essential for EU countries. Asian countries are the largest exporter of textile-related goods to EU countries, with exports from India amounting to 8.8% in 2021.

Furthermore, according to the Ministry of Textiles (2022), the total volume of Indian textile exports to EU countries amounts to USD 5,626 million over 2020-2021. As seen in Figure 5, EU textile imports from India vary significantly regarding the destination country. However, the top 5 importing European countries collectively are responsible for 70% of European textile imports from India.

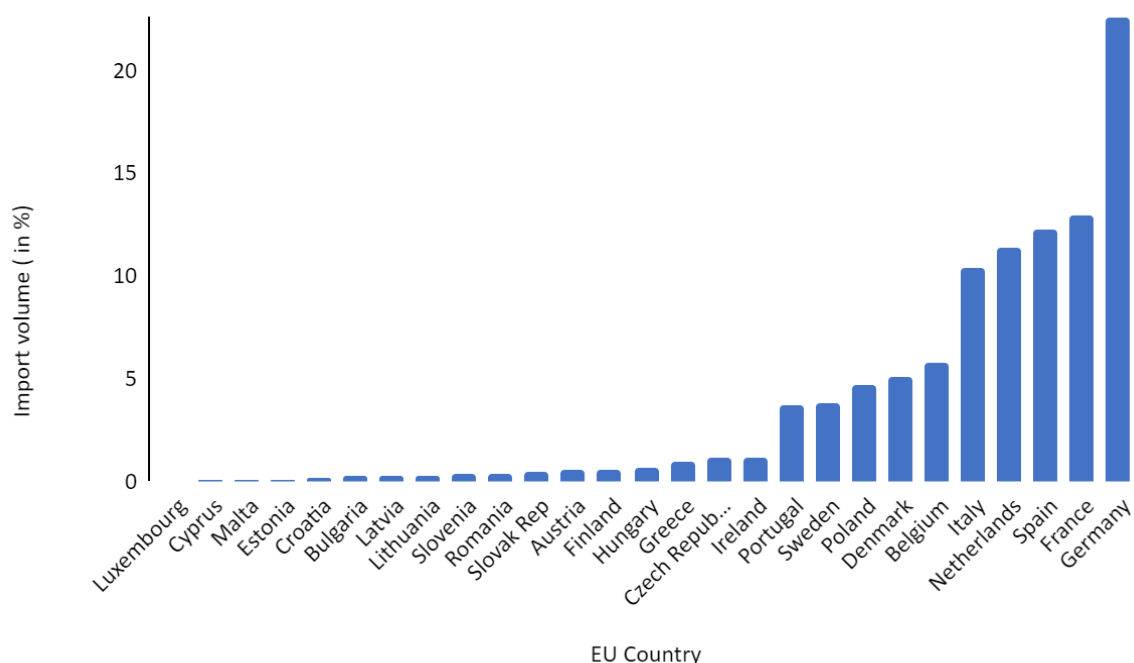


Figure 5: Indian textile imports in EU countries.
Note: Source: Ministry of Textiles India (2022).

2.3.3. The Concentration of Textile Clusters

The textile industry in India is also characterised by clustering. Textile clustering is a geographic concentration of companies, suppliers and related businesses engaging in similar activities. Clustering improves resource access, network growth, infrastructure, and supply chain efficiencies. There are an estimated 6,400 clusters. Of these, the largest 50 clusters account for most of the production in India. There are three types of clusters: industrial, handloom and handicraft. Through the Scheme for Integrated Textile Parks (hereafter SITP) launched in 2005, the Indian government provides clusters with high growth potential with infrastructure support. This included strategic interventions in first aid

centres, road provision, and a power distribution network. These interventions led to the sanction of 59 textile parks by the Ministry of Textiles, of which 22 have been completed. The SITP was most actively applied within four states: Gujarat, Maharashtra, Andhra Pradesh, and Tamil Nadu. Many influential clusters are located within these states, which led them to become essential textile hubs within the country.

Maharashtra currently accounts for 10.4% of India's total textile production and 25% of the country's total cotton production and is the most industrialised state in India. The geographical grouping of clusters within the state is based on the SITP and currently consists of 13 government-owned textile parks in Maharashtra (Ministry of Textiles, 2019).

Another type of congregation occurs under Special Economic Zones (hereafter SEZ), mainly in export-oriented Maharashtra regions. As of now, two different special economic zones in Maharashtra are concentrated on textile production, namely Kesurdi Khandala SEZ in the Kolhapur district and Chincholi SEZ in the Solapur district (Industry Experts, 2023).

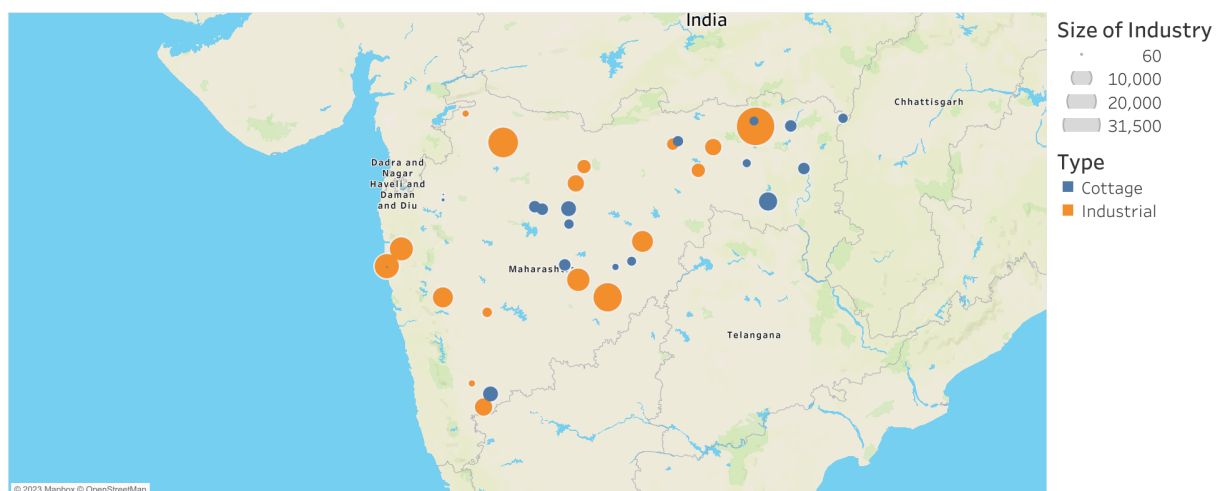


Figure 6.1: Concentration of textile clusters in the state of Maharashtra.

Another state that specialises in textile manufacturing is Tamil Nadu. It accounts for 41% of India's cotton production and 70% of knitwear production capacities. The state comprises nearly half of the large and medium textile mills and 792 out of the 996 small mills in the country. Like Maharashtra, Tamil Nadu is divided into clusters and has experienced government intervention, creating five integrated textile parks (Press Information Bureau, 2019). Tamil Nadu's supply chain is also concentrated geographically within the areas of Tirupur (Cotton and Dyed Fabric), Coimbatore (Cotton and Dyed Fabric), Madurai (Cotton and Silk), Chennai (Silk and Finished Textiles) and Karur (Home textiles). Notably, the different production methods have little to no overlap (Textiles & Apparels India Scenario, 2019), highlighting the need for producer collaboration. The state has 42 SEZ's out of which only 2 are for the textile industry: Uthukuli (Textiles) and Chengleput (Apparel and Fashion) (Ministry of Commerce and Industry, 2022).

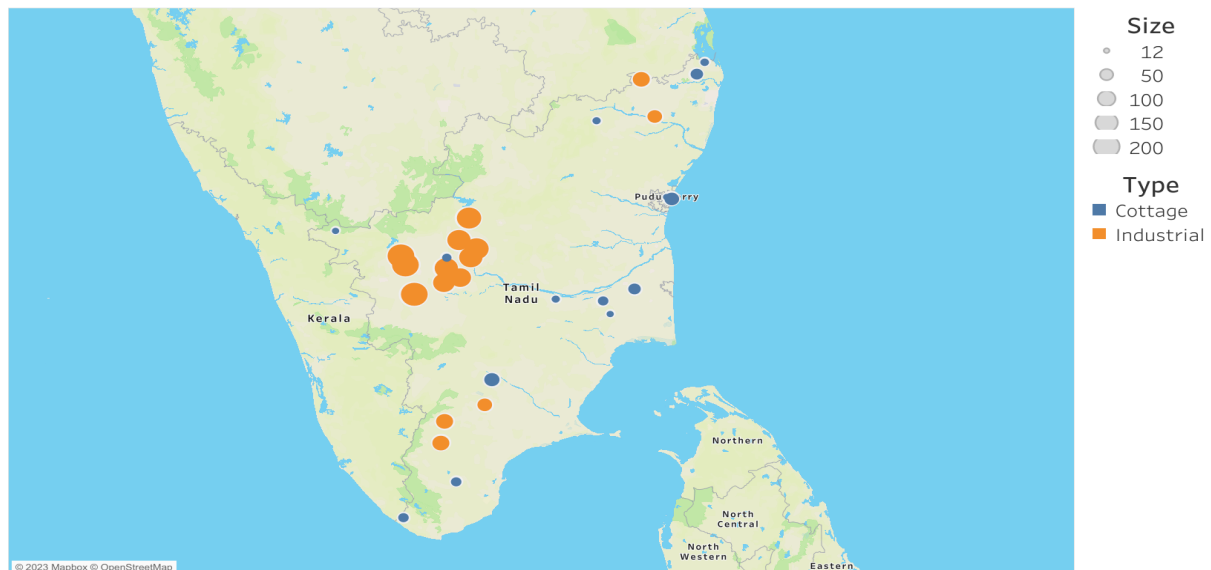


Figure 6.2: Concentration of textile clusters in the state of Tamil Nadu.

2.3.4. Pollution in Major Clusters

According to the Central Pollution Control Board (hereafter CPCB), the Indian textile industry is especially chemical-intensive and often pollutes the environment at various stages of the production processes. The CPBC's 2020 annual report shows that 22% of the 2,740 units within Grossly Polluting Industries (hereafter GPIs) did not comply with the water disposal standards. A GPI is an industry that discharges more than 100 kilolitres of wastewater / toxic chemicals daily (Arif et al., 2021). In 2020, out of the 1,277 GPIs registered near the Yamuna River basin, 454 were producers for the textile industry.

Most water pollution in the textile industry arises during wet processing (Madhav et al., 2018). An estimated 72% of all water used in the textile industry is needed for the wet processing of the material (see Figure 7). This process step includes methods such as bleaching, dyeing, and printing.

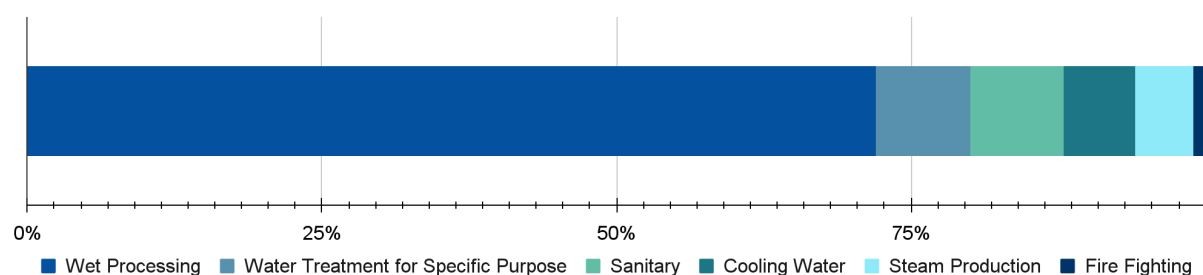


Figure 7: Water consumption pattern in the Textile Industry
Note: Source: Madhav et al., 2018.

An estimated 50 - 100 litres of fresh water are required to produce 1 kg of textile (Uqaili & Harijan, 2011). Other inputs are shown in Figure 8. As previously mentioned, water pollution from textile production has a more significant global impact than other pollution forms. Nevertheless, small production facilities may need more financial resources or knowledge to handle wastewater disposal appropriately. This causes ecological damage (Saxena et al., 2017; Sarayu & Sandhya, 2012) as the toxic chemicals used in the production of textiles are disposed into the environment, as illustrated in Figure 8.

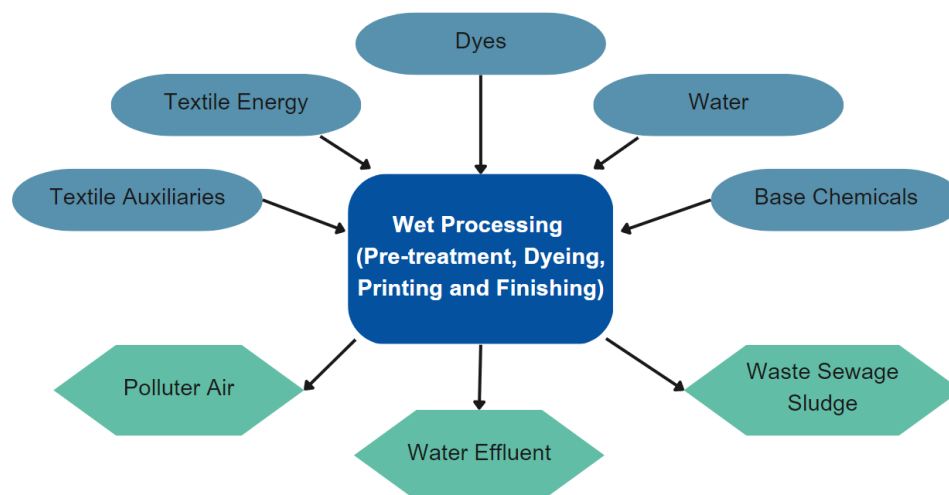


Figure 8: Input/Output of the wet processing in textile production
Note: Replicated from Chavan (2001).

Several studies investigated pollution levels in significant textile production clusters in India. In Maharashtra, a common form of water pollution is the contamination of clean water sources by heavy metals used in textile production (Bhagure & Migraine, 2011). Studies such as Singare et al. (2011) and Singare et al. (2013) have indicated that highly industrial regions play a prominent role in the dispersion of heavy metals through pollution. Furthermore, Amte and Mhaskar (2013) have shown that water pollution violations in less industrial regions in Maharashtra are often related to the dyeing and bleaching processes. The inappropriate disposal of toxic chemicals has a clear negative impact on the health of the citizens and the aquatic environments (Gita et al., 2017).

Various studies examined the textile industry's impact on the local water pollution measured in Tamil Nadu. A notorious case in Tamil Nadu is the water contamination of the Noyyal River in the city of Tiruppur. This contamination was mainly due to the chemicals used in the dyeing process (Sellamuthu et al., 2011; Babu et al., 2017). Moreover, wastewater pollution in the textile industry has been identified in smaller villages such as Karur (Sivakumar et al., 2011) and Mettupalayam (Mukherjee & Nelliya, 2007). This highlights that water contamination may arise in large and small-scale textile production regions.

2.4. Indian Legislative Environment Regarding Pollution

The legal framework for environmental protection in India fundamentally rests on five main pieces of legislation at the national level:

- 1) **The Water Act of 1974** was enacted to provide for the prevention and control of water pollution. A follow-up piece of legislation, the Water Cess Act of 1977, further allowed for imposing levies on water use for certain industrial activities. The Water Act was amended in 1988 and 2003. Besides its stated goal of maintaining and restoring water wholesomeness, another lasting consequence of this act was the precise identification and hierarchisation of the relevant regulatory authorities, which we will discuss further below.
- 2) **The Air Act of 1981** was the first legislation to prevent, control, and abate airborne pollution. To do so, it makes provisions for government authorities to declare pollution control areas, imposes restrictions on specific industrial units and practices, and defines the inspection and measurement processes and possible penalties. The air act was amended in 1987 to include noise as a form of air pollution.
- 3) **The Environment Protection Act of 1986** and amended in 1991. This umbrella law empowers the central government to “take all such measures it deems necessary or expedient for protecting and improving the quality of the environment and preventing, controlling and abating environmental pollution” (The Environment (Protection) Act, 1986). The act has allowed the government to issue decrees and rules regarding industrial waste management, wildlife protection and hazardous chemicals regulation, amongst many other things.
- 4) **The Energy Conservation Act of 2001** was ratified as a step toward revamping energy efficiency and reducing energy waste. It deals with energy consumption standards for equipment and appliances. This legislation imposes energy consumption norms on large consumers, ensuring their compliance with specific energy usage limits. Additionally, it mandates that newly constructed buildings adhere to the Energy Conservation Building Code, which provides guidelines for incorporating energy-efficient design principles. Furthermore, the act requires appliances to meet performance standards and display energy consumption labels.
- 5) **The National Green Tribunal Act of 2010** was established to provide judicial and administrative remedies for pollution and other environmental damage victims. The act established the National Green Tribunal (NGT), a specialised forum for the effective and expeditious resolution of environmental disputes and matters related to enforcing environmental laws.

As mentioned, the Water Act of 1974 was the first legislative framework to define some roles and responsibilities in enforcing environmental protection. The leading regulatory authorities are the Central Pollution Control Board (hereafter CPCB) and the subsidiary State Pollution Control Boards (hereafter SPCBs). They act on instructions of the National Green Tribunal and are based on the Comprehensive Environmental Pollution Index. This index measures and assigns weights to different pollutants, ambient pollution concentration and the number of people affected to categorise industrial clusters as Polluted Industrial Areas. These can be of three sorts: Critically Polluted Areas, Severely Polluted Areas, and Other Polluted Areas. After that, the authorities are entrusted with remediating these areas, seeking damages, and preventing any expansion of polluting activities.

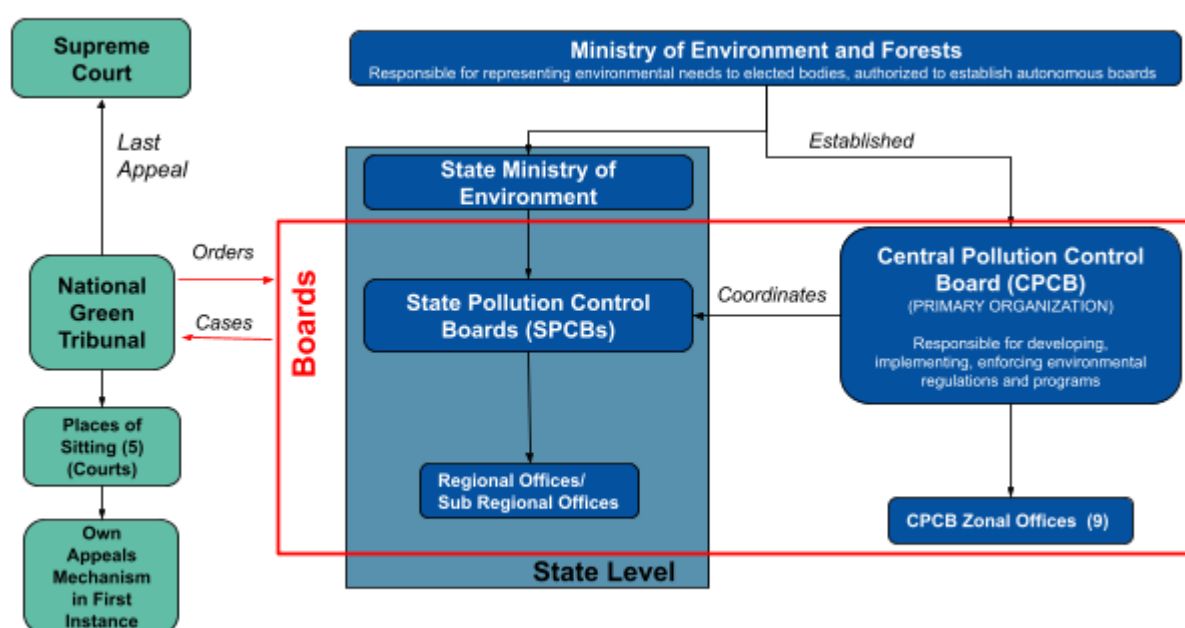


Figure 9: Organisational chart of governmental and legislative bodies acting on the environment and pollution.

Note: Sources: The United States Environmental Protection Agency, National green tribunal.

2.5. Lax Implementation of Pollution Laws

Environmental regulations are critical in ensuring that economic activities do not harm the environment. However, poorly designed laws can lead to unintended consequences, including social costs, ineffective enforcement, and technological inefficiencies. This is particularly true in developing countries, where institutional and infrastructural challenges can make it more difficult to implement and enforce regulations effectively. India is one such country where environmental regulations have often been criticised for their rigid nature and ineffective enforcement (Duflo et al., 2013). In this context, examining the strengths and weaknesses of India's regulatory framework for environmental

governance is essential. This chapter discusses the challenges of environmental regulation in India and examines case studies from Maharashtra, Gujarat, and Tamil Nadu.

2.5.1. Challenges and Limitations of Command-and-Control Regulations

In India, current regulations mainly involve command-and-control (hereafter CAC) laws, such as banning or restricting polluting activities, and mandating specific technologies or direct activity bans, regardless of actual emissions. These regulations can impose net social costs if the positive externality from pollution reduction is lower than the economic value of the restricted activity (Greenstone et al., 2017). Furthermore, rigid CAC regimes also raise the issue of ineffective enforcement for the regulator (Duflo et al., 2013). Lastly, CAC instruments can negatively influence the adoption of technological efficiency among compliant firms, giving a competitive advantage to polluting firms and creating adverse incentives (Dutta & Narayanan, 2011).

Ideally, CAC instruments, such as blanket bans, should only be used in exceptional cases where the potential environmental damages are substantial and enforcement in other ways is difficult. In practice, bans have often been imposed because of ongoing government failure to regulate pollution effectively, such as in cases where they have failed to ensure that manufacturing plants install and use pollution control equipment (Greenstone et al., 2017). Government bodies responsible for managing pollution in the textile industry have failed to regulate it, leading to judicial intervention. According to Manjunath and Tayal (2013), the government must take proactive measures and be accountable for effective environmental management. The judiciary's role in directing policies should be studied contextually, but policymaking should remain the executive's responsibility.

2.5.2. Case Studies about Environmental Regulations in Key Regions of Interest

The Central Pollution Control Board aims to limit industrial emissions. However, implementing these standards is challenging. The lack of data on compliance allows for limited systematic analysis, but recent work shows serious enforcement issues with existing regulations. For example, there are high levels of non-compliance in Gujarat and Maharashtra. Duflo et al. (2013) find that the regulatory emission limit is exceeded in over half of their interviewed companies. A potential reason for this non-compliance is that regulatory inspections are infrequent.

Furthermore, a survey of nearly 1000 industrial plants in Gujarat, Maharashtra, and Tamil Nadu, conducted in 2015 showed that mandating the installation of air pollution control equipment is not enough to ensure compliance with emissions standards (Greenstone et al., 2017). Despite having sophisticated air pollution control devices such as bag filters installed, nearly 60% of the plants in Gujarat still showed high pollution levels, with the mean emissions exceeding the standard by a factor of two or more. Plants are incentivised to fulfil the minimum standard outlined in legislation, such as installing capital equipment. Still, lax government enforcement allows plants to avoid such action and the equipment's related operational and maintenance costs (Greenstone et al., 2017).

Apart from the lack of effective enforcement measures, it is also necessary to focus on the underlying incentives of firms in understanding the high level of non-compliance concerning environmental regulation. A paper by Dutta and Narayana (2011) studies the impact of CAC environmental regulation on the technical efficiency of chemical firms in and around Mumbai, Maharashtra. The study uses a stochastic production function and panel data from 50 water-polluting small- to medium-scale firms over three years (2004-2006). The results show that polluting firms are technically more efficient than those that comply with pollution legislation. The paper concludes that the limited funds available to these small and medium-scale firms, combined with the CAC nature of pollution monitoring and enforcement, may hinder adopting environmentally benign technologies. The authors suggest a market-based incentive scheme may be a better solution (Dutta & Narayana, 2011).

In a study by Venkatachalam (2015), the negative externalities caused by the polluting manufacturing and processing units in the textiles industry in Tirupur, Tamil Nadu, are highlighted. Despite benefitting from increased income and employment, the uncontrolled negative externalities have adversely affected agricultural and allied activities and caused severe constraints on industrial growth. According to the paper, the existing CAC approach is the root cause of the current problem in the region, and a complete revamp of the existing weak institutions is needed to achieve sustainable development at the regional level. Effective government regulation is necessary to introduce these instruments and ensure their success. The author highlights that site-specific institutional and behavioural aspects must also be considered while introducing such tools (Venkatachalam, 2015).

In summary, the lax implementation of pollution laws in India is a significant challenge to environmental governance. Current regulations rely mostly on command-and-control (CAC) instruments, such as banning or restricting polluting activities and mandating specific technologies, regardless of actual emissions. These types of regulations can impose net social costs, raise issues of ineffective enforcement, and negatively influence the technological efficiency of compliant firms. Case studies from Maharashtra, Gujarat, and Tamil Nadu highlight the high levels of non-compliance with existing regulations and the need to address the underlying incentives of firms to adopt environmentally benign technologies.

3. Literature Review

This section compiles several strands of empirical literature relating to legislation compliance, supply chain management and firm responsiveness towards legislation. A funnelling approach is employed whereby a generic overview of the system is outlined and then channelled to our area of interest, sustainable supply chain management in India.

3.1. Firm Compliance with Legislation

Governments worldwide are introducing environmental policies and regulations to incentivise companies to take proactive steps towards sustainability. However, the effectiveness of such policies and regulations is not straightforward, and the response of firms to these measures varies based on several factors. Social nudges are emerging as a new approach to incentivise firms towards sustainable choices. This chapter explores the effectiveness of environmental legislation and social nudges on compliance.

3.1.1. Firm Responsiveness

Given the diverse and complex ways policies affect them, investigating the influence of legislation on firms is crucial. Furthermore, examining which environmental policies significantly impact companies and the heterogeneity of these effects is essential. Mandatory or voluntary regulations and company size are factors that determine the effectiveness of legislation.

One aspect that determines the effectiveness of policies is the size of companies. Multinational companies that spread their operations across countries can quickly improve their social performance and adapt more readily to new regulations (Aguilera-Caracuel & Ortiz-de-Mandojana, 2013). On the other hand, large firms are more likely to resist regulatory pressures, especially when those pressures are weak (Doshi et al., 2013). This finding is confirmed by survey responses from around 1000 managers of manufacturing facilities in developing countries that show that smaller entities tend to be more responsive to stakeholder pressures. In contrast, larger firms may be more resistant (Darnall et al., 2010). However, smaller companies may struggle to meet regulatory pressures. In the Indian context, larger firms were more proactive in environmental management initiatives, as they had more resources to invest in environmental management practices (Singh et al., 2014).

According to the literature, mandatory regulations have been proven to have a powerful impact on environmental performance (Christmann, 2004; Darnall et al., 2010; Henriques & Sadosky, 1999). However, these regulations can also harm a country's competitiveness and the company's profit (Dean & Brown, 1995; Jaffe et al., 1995; Dechezleprêtre & Sato, 2017). Conversely, firms choose to participate in voluntary policies if financial incentives are involved (Leyva-de la Hiz et al., 2018) or for strategic reasons, such as reputation building (King et al., 2005).

Based on this brief literature review on the effectiveness of environmental legislation, internal and external pressures can significantly influence the adoption of proactive environmental management practices in firms. Singh et al. (2014) concluded that the primary factors that drive the adoption of such practices in Indian firms are both internal factors, such as top management support and employee participation, as well as market pressures, including demands from commercial buyers and suppliers of goods and services. Interestingly, external forces from regulatory and societal stakeholders were not crucial in the Indian context.

Murty and Kumar (2003) discovered that Indian firms' productive efficiency rose as they complied more with environmental regulations and water conservation initiatives. This supports the Porter hypothesis, which states that laws can mutually benefit firms and other stakeholders (Porter, 1996). Therefore, careful, well-informed, and characteristic-driven environmental policymaking could maximise the mutual interest of society and the firm.

3.1.2. Social Nudges

In economics, individuals can be nudged towards a choice by changing their decision without limiting their freedom of choice (Thaler & Sunstein, 2008). For example, giving customers a paper bag instead of a plastic bag as a default option is a nudge only if the plastic bag is still available. A “green nudge” incentivises individuals to make more sustainable choices (Camerer et al., 2003). In the case of new environmental legislation, green nudges can stimulate compliance. This section will present empirical evidence of the effects of nudging and its effectiveness for compliance.

The previous empirical literature on nudging has yet to focus on the textile industry. Nevertheless, given the available literature on firms that resemble features of firms operating in the Indian textile industry, we believe that these findings can be applied to our case. In particular, studies on environmental regulation, supply chains and MSME firms outline incentives for legislation compliance.

Lawton (2020) studies the effectiveness of nudging organisations to comply with environmental regulations in the UK². By interviewing managers who focused on environmental matters, the author found that employees were most responsive to social norm nudges where a person's desire to fit in is used as the incentive. The author found that a firm's fear of appearing unethical or as an underperformer in the market was a primary driver of compliance. Furthermore, Gilliland and Manning (2002) strengthen this finding by highlighting that informal regulatory control can be supported via community pressure and market competition.

² The author studies the effectiveness of the Carbon Reduction Commitment.

Studies related to the agricultural sector have shown that green nudges are effective regarding supply-chain compliance³. Ferrari et al. (2019) review 23 empirical studies on nudging-based interventions towards sustainable practices. Most of these studies focused on nudging farmers to greener methods across countries such as the US (Brown, 2018; Wallander et al., 2017) and Germany (Peth et al., 2018). Producers were most responsive to nudges related to the salience of the legislation, social norms and comparisons with other producers. Essentially, producers are nudged to comply with the regulation by the threat of a bad reputation within their community and the market.

Russo and Tencati (2009) show that social nudges are highly influential among MSME firms from various sectors in Italy. They find that smaller firms are more likely to embody Corporate Social Responsibility (hereafter CSR) if there is sufficient community pressure to comply. The authors argue that this is due to the firms' dependence on domestic consumption and local endorsement of their enterprise. The study finds that smaller corporations attempt to comply with regulations through informal measures as their limited size and scarce resources restrict their compliance with formal standards. This raises the concern that even if firms want to comply, various barriers impede them.

Gaarder and van Doorn (2021), in name of the International Labour Organisation (ILO), outline several nudges to address barriers Micro and Small Enterprises face. Most relevantly, they introduce the following recommendations:

1. *Clarify and simplify the law so individuals can better understand how to comply.*

Individuals can be nudged to comply with legislation by presenting compliance as a simple-to-understand alternative.

2. *Improve the ability to comply by providing resources and affordable alternatives.*

As the ILO outlines, individuals can be nudged to comply with new legislation by removing barriers to compliance. A common barrier is financial cost. The provision of resources and affordable alternatives are ways through which policymakers can make compliance easier.

3. *Strengthen the social dialogue nationally and internationally on the issues targeted by the new provisions.*

The ILO highlights how individuals are more likely to comply when the issue that is being targeted is clear and relevant to them. Stimulating a social dialogue increases the salience of the issues being addressed, presenting compliance as a sound decision.

³ To the best of our knowledge, similar studies have not been conducted on the textile industry.

3.2. Responsiveness of Global Value Chains to Developed Countries' Corporate Social Responsibility Legislation

Comprehensive CSR policies are predominantly prevalent within developed countries in the Global North. Furthermore, they may (as is the case with the EU CSDDD) be limited to large multinational companies. Nevertheless, these considerations do not limit the effects of CSR initiatives to the country in which they are legislated or to the companies it explicitly targets. Indeed, 80% of global trade is estimated to be linked to multinational companies' global value chains (Lee, 2016). As such, it is unsurprising that the literature finds significant pass-through of both mandatory and voluntary due diligence initiatives from large multinational firms to their suppliers in developing countries (Komba et al., 2023). These effects are naturally intensely idiosyncratic and context-dependent (Timmis, 2017), but some general insights may be gleaned from the existing literature.

Firstly, adopting standards by a developed economy tends to increase imports from other developed countries whilst reducing those originating in developing countries (Swann, 2010). Furthermore, this effect tends to be more vital in agriculture, as well as in textiles, when compared to other manufacturing sectors. Indeed, Timmis (2017) finds that standards may catalyse developing countries' exports when they reduce information asymmetries between multinationals and their suppliers. This information asymmetry is considered more prominent in the manufacturing industry, so standards are more beneficial. Alternatively, it may be because manufacturers can pass the added costs onto the consumer through a "fair trade" label, whereas producers of more basic goods cannot (Alamgir & Banerjee, 2019).

Secondly, size matters. Komba et al. (2023) state that large and vertically integrated firms are better equipped to deal with the costs and requirements associated with compliance. Within the Indian context, Chakraborty and Chatterjee (2017) similarly find that larger firms increased their innovation spending to comply with new German dye regulations relatively more than small and medium firms. These considerations led Timmis (2017) to conclude that standards, in a vacuum, exclude smaller firms from global value chains.

Since certification processes are expressly noted as costly in terms of resources and time, they are associated with a significant decline in developing country firms' export volumes (UNCTAD, 2013). This is also because the costs associated with process upgrading are ultimately levied on the supplier (Golini et al., 2018), facilitating the process described by Komba et al. (2023). Again, smaller firms are shown to struggle substantially with these costs in the absence of financial and technical assistance (Ahabou et al., 2017).

Hence, the literature highlights the critical role played by so-called lead firms. These firms, which can be local but primarily consist of multinationals, drive a high economic, social, and environmental performance not only through their role as buyers (and thus as enforcers in the absence of local institutional standards) but also by providing knowledge (Khattak & Pinto, 2018).

Returning to the Indian context, Tewari and Pillai (2005) find that compliance with the German dye regulation was widespread even among small companies, as lead firms helped lower the adjustment cost. The increased innovation spending found by Chakraborty and Chatterjee (2017) was mainly focused on technology transfers rather than internal research and development. Furthermore, this adaptation by dye producers led the Indian government to adopt and extend foreign legislation to the domestic market, thus institutionalising enforcement. These considerations made Komba et al. (2023) define knowledge transfer and technical assistance as the “standard remedy” for ensuring that developing country firms may continue to participate in the value chain.

When designed correctly, these interventions change an organisation's decision environment to make compliance more appealing.

3.3. Supply Chain Management

This chapter discusses MSMEs' challenges in developing and implementing sustainable supply chain management practices. It starts from a worldwide case study approach and then focuses on the context of developing economies such as India. The chapter highlights the importance of stakeholder engagement, supplier motivation, and resource constraints as significant factors influencing MSMEs' willingness to adopt green initiatives. The chapter concludes with a discussion of the challenges faced by Indian MSMEs in implementing sustainable practices and the role of government policies and support in promoting sustainable environmental practices in MSMEs.

3.3.1. Green Supply Chain Management

Green supply chain management is a subset of sustainable supply chain management that focuses on reducing the environmental impact of the supply chain (Ahi & Searcy, 2013). This may involve implementing environmentally friendly practices, such as using renewable energy, reducing emissions, and minimising waste. Green supply chain management is essential to achieving overall sustainability in the supply chain.

This report examines the behaviour of micro, small and medium-sized textile producers in India towards environmental legislation. However, it is crucial to understand how MSME producers worldwide have adopted green supply chain initiatives and responded to environmental regulations. This will be discussed in the following subchapter.

Small- and medium-sized suppliers play a significant role in supply chains, and their environmental management capabilities can substantially impact the supply chain's overall environmental performance (Lee & Klassen, 2009). However, due to resource constraints and limited knowledge and expertise, MSMEs need help developing and implementing effective environmental management practices.

Perron (2005) highlights several barriers that MSMEs in Canada face when trying to improve their environmental performance. This study mostly looks at a mental model which comprises motivation and perception that MSMEs have of environmental regulation. The study finds ineffective information dissemination about environmental programs, the need for identifying the right environmental opportunities, funding, workforce, in-house expertise, and negative attitudes towards environmental legislation as essential barriers to adopting and implementing such legislation.

To overcome barriers towards implementation, Lee and Klassen (2009) investigate factors that could foster the environmental management capabilities of MSME suppliers in supply chains. These factors include regulatory pressures, collaboration with customers, supplier development programs, adoption of environmental management systems, performance metrics, and access to financing. Compliance with environmental regulations and meeting customer requirements can increase business opportunities. Lee (2008) does a similar study to test the willingness of MSMEs to comply with environmental legislation among 142 MSMEs in South Korea. The paper finds that buyer environmental requirements effectively push MSMEs to adopt green supply chain initiatives. Moreover, improved organisational capabilities and resources were positively linked to supplier compliance.

In a related study, Arend (2014) explores the social and environmental performance of MSMEs and how it is influenced by their motivations, capabilities, and instrumentalism. The authors argue that MSMEs have unique characteristics that influence their social and environmental performance and that a comprehensive understanding of these factors is necessary to promote sustainability in MSMEs. The study concludes that policymakers and other stakeholders can encourage sustainability in MSMEs by understanding these factors and developing targeted strategies to address them, such as providing financial support, technical assistance, and regulatory incentives and promoting a culture of sustainability and social responsibility among MSMEs and their stakeholders.

The literature highlights the importance of stakeholder engagement, supplier motivation, and resource constraints as significant factors influencing MSMEs' willingness to adopt green initiatives.

3.3.2. Implementation of Sustainable Supply Chain Management Initiatives: Case of Developing Economies

To successfully implement Sustainable Supply Chain Management Initiative (SSCM) practices, it is crucial to identify and eliminate the most dominant barriers (Al Zaabi et al., 2013). Different industries and sectors face other drivers for adopting sustainable practices, with factors such as customer pressure, competitive advantage, and regulatory compliance playing a role (Jia et al., 2018). The most frequently used methodologies for identifying the drivers and barriers of SSCM implementation and

their relative significance are Interpretive Structural Modelling (ISM)⁴ (Diabat et al., 2014; Majumdar & Sinha, 2018; Mangla et al., 2018; Raut et al., 2019; Al Zaabi et al., 2013) and Analytical Hierarchy Processing (AHP)⁵ (Govindan et al., 2014).

Implementing SSCM in traditional supply chain management can be incredibly challenging for MSMEs. Compared to larger enterprises, MSMEs have fewer resources and less environmental expertise, making it difficult for them to adopt green practices (Govindan et al., 2014). With economies of scale, they likely avoid higher costs, coordination effort and complexity, and insufficient or missing communication in the supply chain (Al Zaabi et al., 2013). Regarding the incentives, larger firms with global supply chains and reputational risks are more committed to sustainable practices than smaller firms with local markets (Jia et al., 2018). As a result, MSMEs may be more reluctant towards SSCM implementation, which further contributes to their relatively poor environmental performance (Majumdar & Sinha, 2018).

In the previous decade, the Indian industry has been pressured to adopt SSCM practices due to environmental concerns, multinational customers' requirements, and government regulations (Al Zaabi et al., 2013). However, implementing these practices could have been faster and more efficient. One of the most significant challenges faced by Indian MSMEs in successful SSCM implementation is the non-availability of new technology, materials, and processes (Govindan et al., 2014). IT implementation and facilities for reverse logistics are also typically inadequate in Indian MSMEs (Al Zaabi et al., 2013). Technology barriers directly impact other categories of difficulties. Therefore, tackling these challenges is vital (Govindan et al., 2014).

Further challenges to SSCM implementation are the need for more political support, weak and ambiguous regulation, and enforcement (Al Zaabi et al., 2013). India lacks significant government assistance, proper monitoring and measuring systems for suppliers' environmental practices, efficient taxation norms, and import duty (Govindan et al., 2014). Raut et al. (2019) describe the lack of effective governmental policies as the main underlying barrier to sustainable growth in the Indian textile industry (see Figure 10). Outdated infrastructure and corruption among companies, certification bodies, and governments pose significant challenges (Jia et al., 2018). Addressing these barriers will require a strategic regulatory framework with specific resource consumption targets and other support systems to encourage sustainable supply chain practices (Mangla et al., 2018).

SSCM implementation is costly, especially for MSMEs, and the return on these investments could be more self-evident in the short run (Al Zaabi et al., 2013). In India, bank loans are only sometimes available, which creates further difficulties for companies to finance their investments in sustainable supply chains (Govindan et al., 2014). Lack of know-how and information is also a significant barrier:

⁴ The ISM technique allows for interactive learning and helps understand complex relationships among variables in the. The method can be used individually or in a group and uses graphics and words to frame the structure of complex issues (Al Zaabi et al., 2013).

⁵ The AHP methodology involves three steps: identifying barriers and creating a prioritisation model, collecting data through a questionnaire, and determining weights for each barrier category and specific barrier (Govindan et al., 2014).

personnel of SMEs need to be adequately educated about sustainability or trained in effective pollution abatement. The lack of education in these areas results in unawareness or disbelief in environmental initiatives (Govindan et al., 2014). Lastly, CSR and stakeholders' environmental awareness, which could be key driving factors of SSCM implementation, are also often absent in the case of Indian SMEs (Mangla et al., 2018).

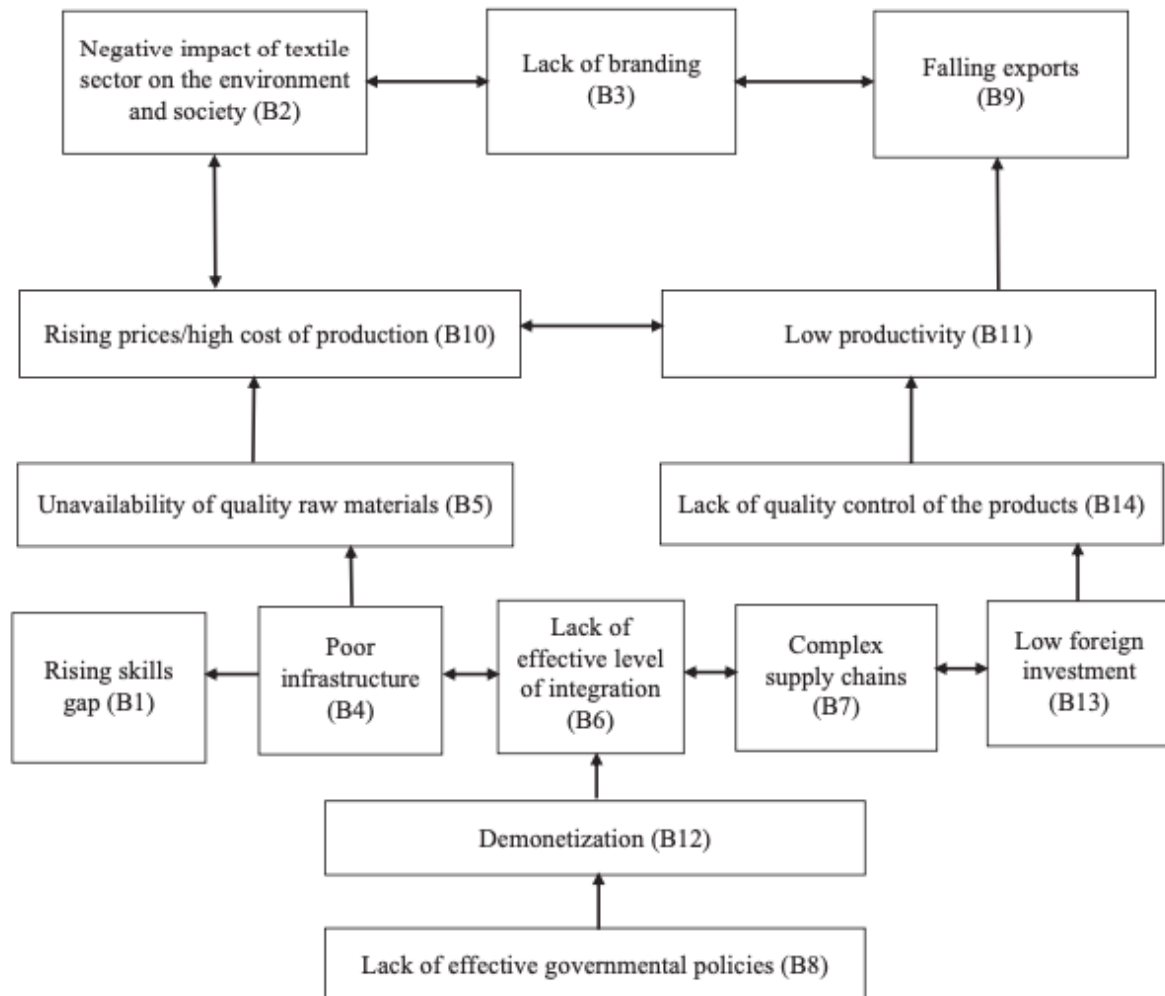


Figure 10: ISM-based model of significant barriers to the sustainable growth of the Indian textile industry.

Note: Source: Raut et al. (2019).

4. Methodology

The degree of responsiveness of Indian textile producers to environmental legislation can be influenced by several factors that play a crucial role in determining how producers understand, view, and act upon environmental legislation. The following are key drivers that influence their responsiveness; regulatory enforcement, economic factors (such as production costs and competitiveness), institutional support, buyer pressure, availability of pollution abatement and sustainable technology, and producer awareness of environmental standards. Producers with more pollution awareness and responsiveness to legislation are more likely to successfully implement and align with proposed CSDD and CSRD practices, contributing to a more sustainable and responsible supply chain. Our research methods were thus tailored to best capture these key drivers and discover other determinants of responsiveness.

Ethical guidelines were followed throughout the research process. Informed consent was obtained from all participants and survey respondents. Individuals were also free to choose whether to participate while ensuring the confidentiality of their responses and identity with anonymous response options. Notably, our research team is entirely composed of master's students in economics, not social auditors, so our findings should be taken from an economic point of view.

4.1. Instruments and Approach

Other qualitative methods were adopted to overcome the limited availability of government data on compliance, along with the absence of registries and the prevalence of informality, which presented significant challenges in accessing reliable information. Survey and interview data were primarily utilised. We obtained micro-level data to gain insights into individual producers' decision-making processes and operational dynamics. Due to the informal structure of the industry and lack of trust, establishing direct, in-person contact with the respondents was essential. This approach enabled us to establish a conducive environment for open and candid discussions and gather accurate information first-hand.

First, online interviews were conducted before the field research. Relevant stakeholders, including business associations and NGOs, were interviewed to gain context on the textile industry and a more comprehensive understanding of the institutional environment. Fairwear, Solidaridad, and The Confederation of Indian Textile Industry are among these stakeholders. These insights on the industry's state and producers' attitudes helped shape the survey's direction and tone.

The survey was designed to collect quantitative and qualitative data related to the research objectives. It included closed- and open-ended questions to capture specific information and participants' perspectives. The reason for this approach was to gather data on the individual producer level to understand their decision-making processes and operations. It was distributed to 11,000 textile producers across Maharashtra, Rajasthan, Tamil Nadu and Gujarat and sent electronically. Questions captured key responsiveness drivers by focusing on the following categories: producers and government, producers and buyers, pollution reduction, exports and exposure. The following are a few examples:

Key Driver	Question	Answer
Producers and Government	How can the government better support cotton companies in reducing pollution?	Open
Producers and Buyers	If a textile buyer requires pollution reduction, would it be easier to:	<ul style="list-style-type: none"> • Invest in pollution reduction • Seek other buyers
Pollution Reduction	What challenges exist in implementing measures to reduce pollution?	<ul style="list-style-type: none"> • High costs • Insufficient government support • Low availability of alternatives
Exports and Exposure	What effect do you believe the CSRD or CSDDD will have on your company?	<ul style="list-style-type: none"> • Positive • Neutral • Negative

Our field approach was to perform 3 case studies. We applied our research instruments across two main textile clusters in Maharashtra: Dharavi and Bhiwandi, and a selection of two sustainable textile companies. Because network links play a significant role in reaching both informal and formal textile producers in India, our initial lack of such led us to rely heavily on NGO partners to conduct these case studies. We connected with the non-profits Labour Education and Research Network (hereafter LEARN) and Association of Community Organizations for Reform Now (hereafter ACORN) International to reach textile clusters, as they both have direct contact and work closely with producers and workers. The Dharavi and Bhiwandi (Naryan compound) textile clusters were selected because they have many small and medium-sized companies, respectively.

Since the research question applies to the entire supply chain, we factored this into our selection of clusters. Dharavi and Bhiwandi also comprise multiple production stages, so this, along with their differences in size and level of informality, contributed to the representativeness of our sample. Additionally, two upcycling textile companies are included to supplement our findings: I was a Sari and ReCharka.

In the field, ethnographic methods were employed, in-person interviews, one-on-one survey distribution, and complemented with observations. Factory owners and workers in Dharavi and

Bhiwandi were administered the survey. After the survey, field interviews were conducted with survey respondents and LEARN and ACORN International members. Field interviews with these same respondents were less structured, allowing for a more conversational approach with open questions and encouraging participants to share their perspectives, experiences, and insights more unrestrictedly. These interviews yielded a deeper understanding of operational barriers and the decision-making process of producers. This approach of on-site visits and interviews was also used in the upcycling case.

On-site visits allowed us direct observations of the conditions, market structure, and production processes. For example, observations on relationships between producers in different clusters' communities revealed details on the market structure. Chemicals, machinery, and waste disposal practices used in the process were also noted.

4.2. Limitations and Challenges

During the research process, we encountered several challenges and limitations that influenced our approach and affected the generalizability of our findings. First, the survey that was distributed online faced a response rate of under 1% despite offering incentives. This was likely due to a need for established trust with respondents and the inevitably sensitive nature of the pollution and government-related questions. Further, in-person surveys had a relatively small sample size of twelve responses, limiting the findings' external validity. Additionally, the sample did encompass multiple production stages but did not represent all sizes. The focus was MSMEs as they constitute most of the industry, so the sample did not include large producers, members of Integrated Textile Parks and Special Economic Zones, and producers from different regions.

Data collection for the in-person survey was time-intensive, requiring visits to individual factories. Due to the sensitive nature of specific questions, we had to gauge the comfort level of each respondent to not deter them from participating. As a result, we had difficulties obtaining complete responses from participants. This non-response bias required us to rely on field observations to identify inconsistencies in survey responses. Additionally, the unstructured style of the in-person interviews potentially introduced response bias.

The evaluation of our results involved a qualitative and in-depth analysis of three case studies: Dharavi, Bhiwandi and upcycling. Instead of conducting a quantitative analysis of survey results, we focused on comparing the responses obtained from different case studies. Survey responses were a crucial source of qualitative data for the three case studies, alongside our field observations and interview responses. The combination of qualitative analysis, field observations, interviews, and survey results provided information on our key drivers, a robust foundation for our research findings, and a more comprehensive understanding of responsiveness.

5. Case Studies

5.1. Dharavi

5.1.1. Introduction

The following case study focuses on two days spent in the Dharavi slum of Mumbai. Dharavi, once a fishing village, today houses many migrant workers who cannot afford to live in the city. It is considered the largest slum in Asia and one of the most densely populated areas in the world. Indeed, between 700 thousand and 1 million people are believed to reside in this area of 2.5 square kilometres. Nevertheless, “Dharavi is not an offshoot of villages nor is it a rejection of the city; it is a society in its own right” (Saglio-Yatzimirsky, 2013, p. 246).

For the small-scale sector, we were granted access to Dharavi’s textile sector thanks to two local NGOs. Association of Community Organizations for Reform Now (hereafter ACORN) International and the Labour Education and Research Network (hereafter LEARN). Both NGOs operate out of small community centres in the slum, with human contact at the core of their activity. LEARN is a non-profit organisation dedicated to mobilising women informal workers throughout the urban slums of Maharashtra. In contrast, ACORN International operates globally to organise low-income workers and improve their living standards.



Figure 11: Workers visited at LEARN



Figure 12: Ambiance of Dharavi.

While visiting LEARN, we met seven women, several of whom had experience in the textile industry. We interviewed them and heard about their experiences working in the textile industry in small enterprises around Dharavi and as home-based workers. On the other hand, ACORN International took us on a tour of Dharavi and allowed us to meet and talk directly with the producers and owners of these small enterprises. We visited six companies encompassing a range of industries within the textile industry, including dyeing, printing, cutting, tannery, sewing and stitching, that were both part of the formal and informal sectors. Most companies sell their products in the (hyper)-local market.

Consequently, these visits and conversations allowed us to study the context within which small-scale textile producers operate, to understand the regulatory environment within which they find themselves, and to identify some obstacles to improving and enforcing these standards. Furthermore, the interview

process allowed us to approach these questions from the standpoint of producers and their workers, thus painting what we believe to be a complete picture.

Even during Labour Day, the atmosphere in Dharavi is energetic. There is no idleness. Everyone is busy. Hawkers sell anything from pencils to suits and sweets. Once you look beyond the façade of street vendors, an incredible variety of shops becomes visible: Maruti Electronics, Ashif Optic, Kareemi Restaurant, and NS Garment – just a snippet of the eclectic assortment on Dharavi Main Road. Dharavi concentrates a mix of various individuals, cultures, religions and businesses on a stretch of land the size of Monaco and embodies the entrepreneurial spirit that such autonomous communities often exhibit (Weinstein, 2014).

As such, many inhabitants of the slum are employed by local, informal, small-scale businesses. This hyper-localised economy is estimated to produce a GDP of approximately USD 600,000,000 (Kaushal & Mahajan, 2021). Most of the activity revolves around four sectors: textile production, leather manufacturing, pottery, and recycling, which mainly depend on small-scale industries (Saglio-Yatzimirsky, 2013). Until recently, most production was focused on the domestic market. In the 1980s, with India opening to the international market, Dharavi's producers increasingly focused on foreign buyers and exports. Even though official numbers are hard to come by,⁶ Kaushal and Mahajan (2021) estimated that around 20,000 factories were operating in Dharavi.

5.1.2. Environmental Awareness and Conditions

Since the size of the Dharavi market is significant, analysing their perception of pollution is interesting. However, environmental awareness is low, with knowledge of climate change and related issues needing to be improved. Additionally, the concept of pollution lacks understanding. Indeed, there is minimal pollution, according to the business owners operating in the cutting, sewing, and stitching branches. The reason for this answer is a focus on waste as the definition of pollution. While it is true that most of the waste from production activities is collected, sold, and reused circularly, this fails to consider other forms of pollution occurring throughout the process. Furthermore, the circularity refers to the fact that many scraps are used as fuel for the pottery kilns, which is harmful to the environment.

In the Tera Compound, the dyeing district of Dharavi, the method employed is “hot hand” dyeing. The dyes are mixed with water and discarded directly into the sewage system. There is no treatment of the wastewater. This ultimately leads to sewage funnelling chemicals directly into the Mithi River. This process is not limited to chemicals; Dharavi's water system is heavily polluted (see Figure 13). Following the Maharashtra Pollution Control Board (2019) analysis of the Mithi River quality over their measurements 2017-2018, the

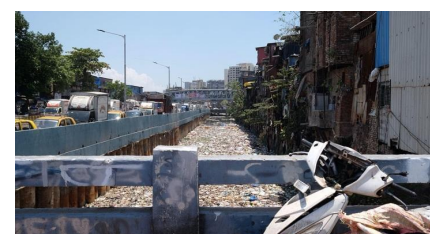


Figure 13: Dharavi sewage flowing into the Mithi River.

⁶ Most of the sector is informal, and companies exit and enter each day.

water quality did not comply with bathing criteria in all dimensions. ACORN International's representatives asserted that while the government occasionally cleans the Mithi River and sewage system of plastic pollution but does not treat the water appropriately.

Similarly, the interviewees at LEARN are generally unaware of the extent of pollution or its proper definition. They mention that the phrase *climate change* has become more prevalent but believe it is limited to air pollution. When asked about water pollution specifically, the community responds that it is aware of it and that they notice it is leading to more diseases, specifically for young children and during the monsoon, when the sewage system may flood. Aside from that, both the workers and producers have minimal knowledge of the existing environmental legislative framework. Some women even mistakenly reported that no environmental legislation exists in India. Additionally, they are unaware of any European or international environmental legislation, including the proposed CSDDD and CSRD.

While a lack of information about pollution exists, even what the local community is aware of understandably appears low on their list of priorities. Producers say that their margins are shallow already, and the pressure from buyers regarding price is too intense for them to be able to implement any mitigation strategies. On the other hand, although exposed to many hazards through pollution, workers see improvements in other areas such as pay, facilities and working hours as far more pressing. Reputational issues and pressure from the local community were not found to be especially prevalent or effective. Nevertheless, workers and producers indicated that they would be fine with complying with higher environmental standards if they were provided with the means to do so without reducing their already meagre earnings.

5.1.3. Working Conditions

Since pollution issues have yet to be subject to much interest in the context of the small-scale textile manufacturers of Dharavi, it is hard to ascertain or describe the regulatory environment within which they may be resolved further down the line. To understand how standards are established, whether they are complied with and how enforcement mechanisms function, one must thus focus on the more relevant issues of the day. Namely, working conditions.



Figure 14: Representative two-story factory.

The main textile production area in Dharavi lies in the Ramavandi area. Inadequate working conditions are the norm here, as we observed. The most apparent risk is fire hazards. Despite minimal ventilation, excessive heat was a fixture of all production units. We observed fire hazard⁷ in almost all factories, and emergency exits were non-existent. This leads to detrimental outcomes in cases of accidents. For example, in February 2023, a fire burned down 100 production units and caused significant losses (Baliga, 2023). The only mitigation measures we recorded are smoking and cooking bans inside the manufacturers.

Aside from these issues, we observed workers in the dyeing factories working without protective equipment. No gloves were worn while handling the hazardous materials. Moreover, individuals worked in sandals while chemicals regularly spilt out of their barrels. Additionally, the chemicals were stored in self-engineered large containers on the factory's second floor. Therefore, if the building had structural issues, large spillage would occur. We could smell the chemical fumes swarming around the factory when going through the factory. In one dyeing plant, the only source of ventilation was the “fresh” air of an open garage door.



Figure 15: Representative dyeing factory.

The garment workers interviewed at LEARN who worked in these factories, both in the formal and informal sectors, confirmed these observations and further recounted exploitative working conditions and instances of sexual harassment and abuse. They were not paid a living wage; some were employed temporarily or without contracts. According to the factory owners, their employees work around ten to twelve hours a day and are mostly paid on a commission basis. These aspects made it difficult for workers to provide for themselves and their families. For instance, a woman reported getting paid 0.5 Rupees per colouring, 0.05 Rupees per wash, equivalent to 10 (1) grams of rice. Those working from home had to buy the necessary tools (e.g., containers for dyeing and washing) themselves. On top of that, they are also pressured into tight deadlines and do not get paid if they cannot meet them.

Furthermore, the women are not provided with holidays; they receive a much lower salary if they take a day off. Many workplaces did not have toilets, and sometimes where they did, employees would be penalised if they took a toilet break. Moreover, gender-based segregation of the restrooms is not a given. This facilitates cases of sexual abuse and harassment, which are extremely common, as the experiences of these women illustrated.

⁷ E.g., loose hanging electricity wires, old machinery.

The workers also spoke about their exposure to harmful and toxic materials. These chemicals include, e.g., an acid that causes skin rashes and even loss of eyesight. They were initially not given gloves; if they were, they were of low quality to provide absolute protection. In addition, the dye used for dyeing clothes coloured their hands, and the emissions of toxins caused breathing problems and other health issues. This problem was exacerbated for home-based workers for whom the harmful substances could also threaten their family members.

5.1.4. Perception of Improvements

Even though the working conditions described above are dire, the factory owners did make some improvements to decrease the violations and improve efficiency. Some factories invested in ventilation to reduce fire hazards. Chairs and tables were installed to allow approximately one sqm of space per tailor, and added air conditioning and bright fluorescent lights. The factory owners stressed that the workers are their primary asset and will do everything possible to improve their working conditions. However, no investments were made to reduce the pollution risks.



Figure 16: Working conditions of a garment cutter in Dharavi.

According to the workers in our meeting with LEARN, the wages have increased over time, but not enough to cover the rising living costs. As is common in the informal sector, some workers said they earn below the minimum wage. Furthermore, despite the introduction of specific protective measures, such as the provision of safety equipment (e.g., boots, safety nets, gloves), the installation of toilets, as well as increased segregation from male colleagues, the women at LEARN still face issues with molestation, harassment, and exposure to toxic materials in their work environment.

5.1.5. Drivers of Improvements

Mohammad, the owner of a sports garment factory in the middle of Dharavi, explained that the buyer-seller relationship primarily induced these working conditions. Indeed, he stated that buyers are only interested in the price-quality ratio of products, thus leading suppliers to disregard other aspects of the production process and minimise costs wherever possible. Additionally, Mohammad mentioned that the production costs of a single pair of training pants are 250 Rupees. In comparison, the sale price only reaches 255 Rupees, thus leaving him a profit margin of 5 Rupees. This small profit margin is also a feature of the extensive competition present in Dharavi. If a producer cannot fulfil an order, their neighbour will. These highly tight margins mean that any investment in improving working conditions or abating pollution is unthinkable for producers and is only considered if it can enhance the firm's efficiency.



Figure 17: Mohammad in his textile factory.

According to the workers present in the LEARN meeting, the slight improvements in working conditions can be attributed to the interplay between government legislation and advocacy from, e.g., labour unions that demand factory owners adhere to regulations. However, according to Sairaj Methari, a representative of ACORN International, participation in labour unions is heavily discouraged by employers and could potentially lead to retaliatory measures. Additionally, the unions themselves are far from perfect, suffer from corruption and do not necessarily have the means to help in many cases. For example, inscription fees have increased, whilst the effectiveness of unions has remained the same. Furthermore, employers and the government often squash protests, leading to inefficient collective bargaining positions of unions.

5.1.6. Enforcement

One thing is clear; domestic buyers do not demand anything apart from low prices and acceptable quality from their suppliers. Whilst both employers and workers pointed to this relationship as that to which producers are most responsive, it is not used to demand regulatory compliance in any way. Therefore, the only entities that enforce regulation in this sector are the government, NGOs, and labour unions. In the garment sector in Dharavi, unannounced government audits do happen. According to a formal bra manufacturer in Kalyan Wadi, Dharavi, the government audited their firm in February 2023. This audit focused on working conditions and non-compliance with environmental legislation. On the other hand, per definition, there are no audits conducted by the government in the informal sector. Moreover, enforcing and monitoring regulations becomes virtually impossible for home-based workers, who account for most of the informal garment sector (Gross & Kharate, 2017).

Despite these challenges, the workers mostly complain to labour unions. The women shared the story of a female worker who complained about her wage being reduced due to taking a holiday every Sunday. The union successfully addressed the issue by conversing with the owner. On the other hand, the women expressed little faith in directly appealing to the government or their employers.

5.1.7. Concluding Remarks

In conclusion, the priority of factory owners and workers is to improve the working conditions in Dharavi. Given this essential concern, both actors do not concentrate on pollution reduction measures. Additionally, environmental awareness needs to be revised. For example, employees have heard about “climate change” but do not know its meaning. On the other hand, factory owners in the cutting and sewing facilities do not believe they pollute since the scraps are “recycled”.

Conversely, domestic buyers only care about the price-quality relationship and disregard all other aspects, misaligning incentives from an optimal pollution standpoint. A last mechanism that is underutilised in Dharavi is the enforcement of legislation. The government performs unannounced audits. However, since the Dharavi economy is mainly informal, no enforcement by the government is performed.

5.2. Bhiwandi

5.2.1. Introduction

Bhiwandi, located in the Thane district of Western Maharashtra, holds a strategic position approximately 30 km from Mumbai (see Figure 18). Situated near the Mumbai-Agra highway, it serves as a significant commercial and trade centre with a population of approximately one million people. Having established itself as an early player in the manufacturing industry, Bhiwandi rapidly emerged as a critical textile hub of India during the 20th century.

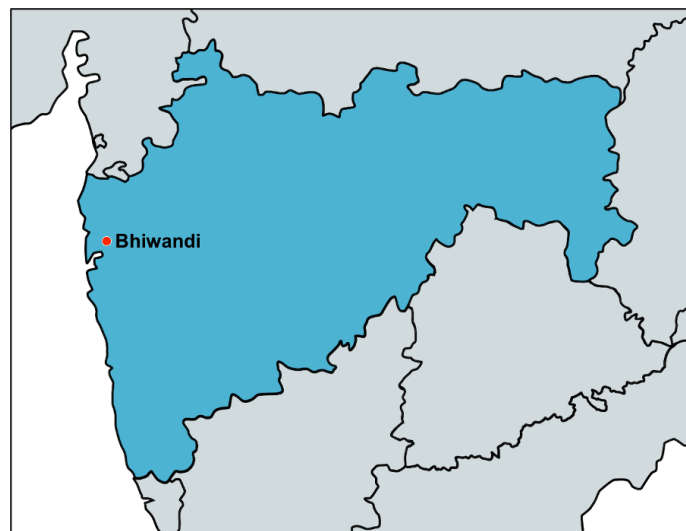


Figure 18: Geographical location of Bhiwandi, Maharashtra.

The majority of production in Bhiwandi (around 80%) is order-based, relying on orders from textile buyers. This dependency on buyers for orders reduces the bargaining power of producers. The industrial units in Bhiwandi are predominantly owned and financed by entrepreneurs, with banks playing a minor role by providing financing for only about 4% of all activities. Consequently, most units need support to expand due to low-profit margins and limited capital availability, resulting in the proliferation of small and medium-sized enterprises. The small scale of these units also hinders their accessibility to government schemes and support (ni-MSME, 2021).

Bhiwandi is home to approximately 1.2 million power looms, accounting for around one-third of the country's total (ni-MSME, 2021). However, the power loom industry in Bhiwandi has faced concerns such as rising competition from China and high electricity prices. Additionally, the recent trends of demonetisation and the implementation of Goods and Services Taxes (GST) have led to a significant decline in its growth over the past few years. According to TheWire, 60% of



Figure 19: Power looms in operation.

power looms have closed since the 2000s (Shantha, 2019).

The textile industry in Bhiwandi heavily relies on migrant workers, with approximately 2 million individuals originating from Uttar Pradesh and Bihar (Wajihuddin, 2020). The Narayan compound, one of the representative compounds in Bhiwandi, showcases the typical workforce composition. The migrant workers are predominantly young men, while older workers tend to have spent a long time in Bhiwandi. The Narayan compound, like other compounds, consists mainly of registered plants. It focuses on four intermediary steps of the textile industry: weaving, sizing, spinning and dyeing. The spinning machines operate 24 hours a day, with workers working around 12 hours daily, irrespective of challenging conditions such as heat, noise, and air pollution. Limited sanitary and protective measures are provided, with gloves available but lacking proper toilet and bathroom facilities.

Our study case on the medium-sized industry focuses on the Narayan compound. We commence by providing an overview of the production process, emphasising the associated risks of pollution. The primary concern lies in the limited awareness and inadequate disposal methods employed. Subsequently, we will delve into the intricate web of stakeholder relationships, mapping the connections from the buyers to the community. Lastly, we will offer concluding remarks to summarise our research's key findings and insights.

5.2.2. Pollution Sources and Regulation Enforcement Problems

Decreasing pollution in textile manufacturing is difficult due to the interconnectivity between production steps. The main stages of the textile manufacturing process are presented in Figure 20. Notably, the research team spoke to producers from each process step and observed each in action, as shown in Figure 21.

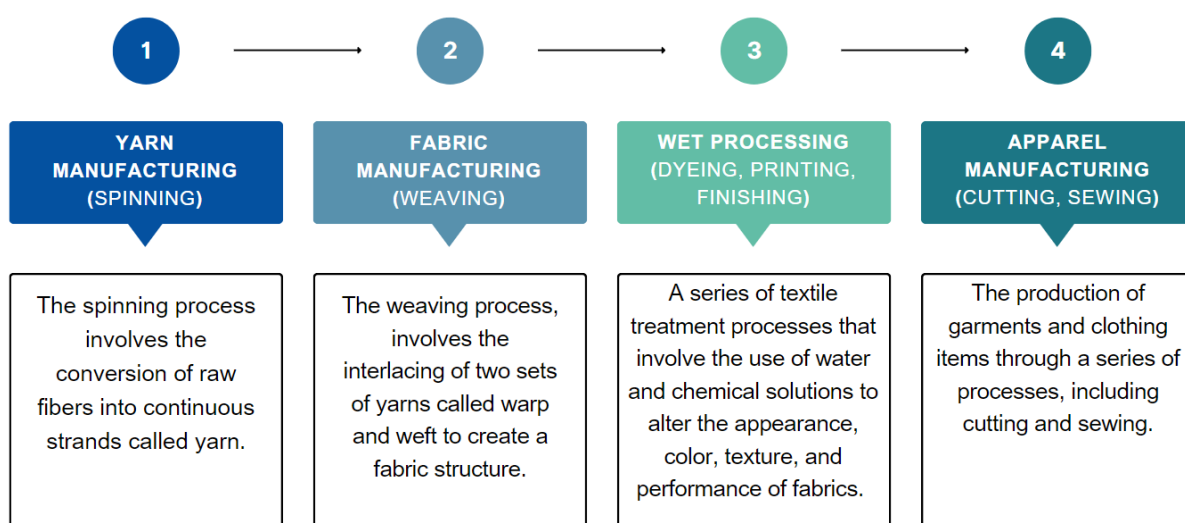


Figure 20: A process flow chart of the textile manufacturing process.

In textile production, chemicals are used in several steps. Buyers are often responsible for selecting the ingredients used in the production process, as producers are typically provided with the materials. In line with the literature review (see 3.3.2), local producers often lack knowledge about the composition of chemicals used in the production process as they follow instructions from buyers.



Figure 21: Yarn manufacturing process.

Chemicals such as hydroxide peroxide, ethyl acetate, microsil, and defoamers are used in the dyeing process, resulting in a strong odour throughout the various production steps. Sellers have limited knowledge of proper disposal methods for the remaining chemicals, leading to their ultimate disposal in nearby water streams and streets.

When asked about their pollution reduction measures, producers in the bundling and pre-treatment dryer sectors responded that they did not consider themselves polluters and therefore did not see the need to address pollution. Nevertheless, in bundling, oils are used in the production process and later rinsed out (see Figure 22). In the pre-treatment dryer stage, sellers acknowledge that a significant portion of the wastewater is either evaporated into the air or improperly disposed of.

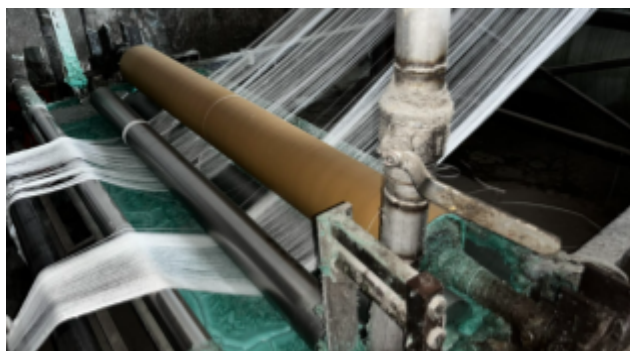


Figure 22: Textile sizing machine with processing chemicals.



Figure 23: Maize starch powder mixed with Bahuchar Chemical in Bhiwandi

Figure 23 depicts the main ingredient in the pre-treatment process. As previous literature has indicated, the limited awareness of polluting practices is a primary concern concerning pollution abatement initiatives.

5.2.3. Stakeholder Relationships

In the case of Bhiwandi, four important stakeholders emerge: domestic textile buyers, sellers, government, and the community. We interviewed relevant stakeholders about their priorities and synergies with other partners. They relayed to us some important information which is outlined below.

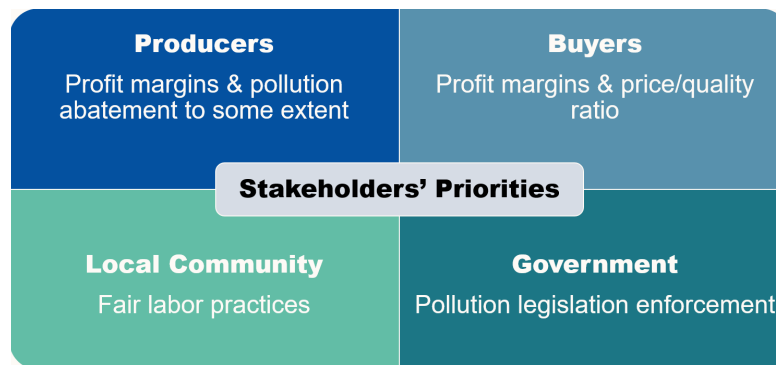


Figure 24: Priorities of the stakeholders in textile production.

Buyers

Large domestic textile buyers supply cotton and thread material to producers who spin, stitch, and return orders to the buyers. These direct buyers are operating in the domestic market. However, it could be that they further sell on the international market. The buyer's main priority is their profit margins and price/quality ratio. Their involvement in the sustainability requirements of the production processes is limited. The supply chain is shaped by outsourcing work rather than selling products from one entity to another at any given stage. Buyers supply raw materials to factories where the factories process the product in pre-specified ways. Most factories cannot make decisions regarding production processes or materials. Moreover, this also creates legal issues as labour outsourcing makes business relationships harder to define and categorise for due diligence. They do not press on pollution abatement standards, nor is there pressure to upgrade technology or processes if there is timely delivery of products.

Producers

Textile buyer firms usually outsource their basic production process to producers. These firms establish long-term stable relationships with a few producers, with the factory we went to being one of the latter. The final product is unknown to the producers, but the general sentiment from the interviews we performed is that the product line could range from suits to saris and other clothing.

Similarly to the buyers, these producers prioritise profit margins and consider pollution abatement regulations only since there is direct pressure from government agencies. We interviewed workers in a dyeing plant about the enforcement measures. They outlined that government officials relay new information on regulation to the producers. For example, local authorities alert the producers if a new filter needs to be installed. However, while essential guidance is provided, funding is not. Loans can be difficult to receive for such technology improvements. There are unannounced visits by government officials, and appropriate steps are taken if regulations must be followed.

Government



Two leading government agencies are monitoring the pollution adherence standards in Bhiwandi: the Maharashtra Pollution Control Board (MPCB) and the local municipality. The government prioritises sustainable practices and adherence to pollution abatement. For producers in Bhiwandi, it offers financial support for sustainable practices in the form of an electricity subsidy for operating machines at various production stages. Interviews with stakeholders revealed that electricity costs have recently increased to INR 40,000 (EUR 451) monthly from INR 24,000 (EUR 270), almost 60%. This subsidy helps reduce cost pressures for the producers.

However, loans are difficult to receive for technology improvement, and the process is lengthy. As outlined previously, there are unexpected factory checks by officials. In case of non-adherence, a one-month notice period is given to remediate non-compliance, after which the factory is closed. A government permission certificate is necessary to re-open the factory, which can take up to a month, given that all rules and regulations are followed diligently.

Local Community

There is no communal pressure for pollution reduction. While the interviewees did not explicitly mention this, it could be that the household pressure effect remains in vain, or people have gotten used to the pollution and do not want to consider it. There is trust in the community; people can freely walk into each other's factories. However, there is pressure from the community regarding worker safety. Workers are given safety gloves since textile factories deal with many chemicals (see 5.2.2). Water is poured on the roofs of factories to reduce heat. However, basic sanitation measures like bathrooms are still missing. Moreover, the safety gloves are insufficient to prevent harm from the chemicals workers are exposed to. We found that safety standards are dealt with in a lax nature, requiring more stringency.

5.2.4. Concluding Remarks

Bhiwandi represents many of the issues plaguing the goal of sustainability in the Indian textile industry. It shows how prominent and well-documented production regions can pose issues for regulatory enforcement for national and international stakeholders. The cause of concern in these regions is the costs and need for more resources and awareness, making it hard for any regulatory body to conduct its work thoroughly. That, coupled with the highly interconnected supply chain, makes cloth hard to track across the process and makes reporting sustainability metrics difficult. Bhiwandi also represents the solution to our problem, using the profit incentive. Supply chains are better managed by those who are actively involved in them. Internally addressing issues related to standard compliance emerges as a favourable alternative to relying on an omniscient government.

5.3. Upcycling

5.3.1. Introduction

Despite the mainstream textile chain in India being largely cost-minimising and unaware of pollution impacts, sustainability and pollution-conscious companies are emerging. These companies focus on positive ESG performance and sell to a narrow consumer base. They are not integrated into global brands' supply chains, and their unique operations and challenges, in contrast to the majority, reveal why this is the case. We met with two small enterprises in this niche market to understand their operations, impact, and the conditions preventing the widespread adoption of sustainable methods. Both enterprises divert waste from landfills and upcycle such into new textile and consumer products. From these interactions, we identify key similarities and differences between mainstream producers and pollution-reducing companies such as these. Our comparisons provide further insight into the textile industry and yield more complete policy recommendations.

5.3.2. I was a Sari

Process and Practices

I Was a Sari (hereafter IWaS) embeds sustainability and artisan empowerment at the core of its process and practices. With a presence in the circular economy since 2013, the Mumbai-based company has received awards such as Eco Age's Green Carpet while forging partnerships with European labels such as Gucci (Iwasasari, 2023).

IWaS transforms discarded saris, traditional Indian garments, into new, distinctive garments. The brand also builds ties with the local community by providing opportunities for women from disadvantaged backgrounds, recognising the importance of fair wages and flexible work arrangements in empowering women workers. The company also upholds fair trade principles, ensuring its workforce receives equitable remuneration and operates in safe and dignified working conditions.

Upskilling and Informal Labour

Many IWaS artisans have migrated from rural areas to urban centres like Mumbai, never previously worked, or discontinued their education at an early age. Upskilling is thus achieved through flexible training programs and working arrangements, the latter being at least five working hours per day and payment options on an hourly or per-piece basis. They informally employ about 80% of their workforce to preserve this flexibility. The monthly wage range for workers at IWaS is 8,000 and 30,000 rupees, while the living wage for the Mumbai area sits around 24,000 rupees. IWaS pays at least the minimum wage of 10,956 for full-time workers but needs support to reach the living wage (Commissioner of Labour, 2023). Regardless, their pay starkly contrasts the low wages prevalent in the informal textile industry, where women often earn around 20 rupees per hour.

Scaling up production

Due to their engagement with informal workers and upcycling methods, the company must overcome several barriers in scaling up its operations. First, the time required for cutting, stitching, and embroidering upcycled fabrics demands more time than conventional manufacturing methods. Figure 26 shows the manual cutting of individual saris, and Figure 27 shows the stitching of these custom-cut pieces into bags.



Figure 26: A tailor cutting individual saris.



Figure 27: Stitching of sari material into a bag

Their emphasis on fair labour practices, such as fair wages, flexible schedules, and home-based working, allows the company to be sustainable, but this impedes scaling. Many home-based workers lack access to large sewing machines, an example of how home-based work is incompatible with highly mechanised tasks. Another obstacle stems from the diverse quality of materials utilised by IWaS. Since upcycling involves repurposing pre-existing fabrics, the textiles' composition, durability, and texture vary significantly. This heterogeneity poses difficulties in ensuring consistent quality and prevents mechanisation since products cannot be standardised and must undergo a rigorous quality control process.

Legislative Environment, Certifications

While the company strives to align with domestic environmental regulations and meet compliance requirements, it must work on balancing perfect compliance and profitability. IWaS falls within the framework of the Indian Companies Act of 2013, which mandates companies to reinvest at least 2% of the company's average net profits towards CSR measures in the next three financial years (Ministry of Company Affairs, 2013). The company's commitment to compliance with legislation, including CSR requirements, subjects it to heightened scrutiny and enforcement attention compared to entities under the radar.

A further barrier to compliance is the company's struggle to adhere to the REACH legislation, an EU law designed to safeguard human health and the environment from chemical risks (European Commission, 2023). Although non-EU companies are not held responsible, if they sell within the EU consumer market (European Chemicals Agency, 2023), EU importers of non-EU goods are, and thus increasingly expect foreign suppliers to comply. However, traceability issues are inherent for vintage materials and dead stock, which usually have a material composition that is impossible to ascertain without costly laboratory tests. This is just one example of legislation with unintended negative consequences for sustainable textile enterprises.



Figure 28: Diverse composition of fabric materials in the workshop.

IWaS also faces the challenge of product certification. Within the emerging ESG-conscious market, the demands of customers and companies downstream in the supply chain prioritise environmental sustainability and ethical production practices. This shift in demand has prompted many small businesses with direct buyer contact to seek certifications to ensure their practices align with the expectations of their Western clients. A typical example is the SA8000 Standard, which is based on internationally recognised work standards (Social Accountability International, 2023). Certification requires adherence to municipal health and safety standards, including building codes (Katz et al., 2016). In Maharashtra, the industrial ceiling height minimum of 3.35 metres applies (Government of Maharashtra Urban Development Department, 2018). Obtaining the certification is a challenge for IWaS and other small companies in Mumbai, as the cost and availability of height-compliant spaces are prohibitive.

5.3.3. ReCharka

Process and Practices

ReCharka is another small upcycling company that faces a unique set of challenges. Their primary goal is to divert plastic waste from landfills and convert it into upcycled products. By diverting and upcycling plastic, they have a significant environmental impact given their small size, converting 1500 kg of plastic waste per month into about 1200-1500 products. Plastic bags are cut into strands, woven onto bobbins, and then intricately woven on handlooms, as shown in Figures 29 and 30. The use of traditional handlooms, a meticulous 4-person process, and plastic inputs require specialised upskilling, and mechanised looms are incompatible with the delicate nature of the raw material. ReCharka's process is manual and time-intensive, like other upcycling methods, making scaling up operations



Figure 29: Plastic cutting and traditional weaving.



Figure 30: Woman working on a traditional handloom



Figure 31: Cofounder Abhishek Paranjpe and the sorted MLP donations.

unfeasible.

The Indian market accounts for 90-95% of the company's sales, showing a growing domestic demand for fair trade within the upper-class demographic. Their margins fluctuate depending on the distribution channel, ranging from 15-20% as a manufacturer selling to other brands and up to 40% when sold directly through their distribution network in India. To maintain a steady supply of plastic waste, the company relies on the local community and the demographic mentioned above for plastic donations. Courier costs to collection centres are covered by donors. ReCharka aims to showcase upcycling as a self-sustaining business model and thus does not seek government subsidies, rendering these local ties for donations essential.

Their process is sustainable from start to finish—first, reCharka sources thread from Polygenta, a company that converts plastic. Bottle plastic is too thick to be woven but can be spun into thread, so Polygenta diverts bottle waste for this production stage. Second, a significant share of the collected waste is multi-layered plastics (MLP), a notorious contributor to litter in India. MLP combines plastic and metal, which many recycling collectors reject. Unlike other recyclers, reCharka accepts and processes MLP sheets, bubble wrap, wrappers, tin wrap, and thick plastic; Figure 31 shows these sorted donations. Only 10-15% of the collected plastic waste is left unusable and then undergoes pyrolysis for conversion into industrial products, ensuring no waste is in landfills.

5.3.4. Comparison

Scalability

The sustainable practices we observed are both intentionally and inherently unscalable. Since only a few hands can add value during upcycling, production occurs under one roof. No individual stage in upcycling has marginal costs reduced by increasing scale, inhibiting bulk orders. Even if mechanisation were possible, these companies would abstain as it defeats their purpose of upskilling local labour and limiting pollution.

As a result, upcycling is not practicable for mainstream textile companies. For most, pollution reduction instead takes the form of dye substitution, effluent treatment, or large batch sizes. Compared to sustainable companies, transitions for most producers (including small firms) require much more significant investment and capacity and, thus, government support.

Different Markets

Since these sustainable methods result in a price premium, the result is a narrow customer base largely restricted to high-income domestic consumers and Western buyers. The idiosyncratic nature of these companies' goods and lack of standard processes means they must vertically integrate and sell as their brand rather than white labelling. EU-based or global brands, even those that value ESG in their supply chains, would thus not source intermediate or finished goods from these enterprises. Conventional production, however, unlike traditional methods using alternative inputs, is intrinsically cost-minimising and integrated with global supply chains. There is minimal visibility as a brand to final consumers and none whatsoever to the ESG-conscious segment, ruling out sustainability premiums. Only with sufficient capacity building and transparency can most producers reach this growing consumer segment and meet increasing due diligence requirements.

Labour Standards

Both companies share two main features and challenges with the broader industry. First, like mainstream MSMEs, IWaS finds that low-profit margins are the central limit to improving conditions and paying higher wages. Both alternative companies pay at least minimum wage but not a living wage because doing so would require efficiency beyond what is possible for slow, manual production. However, many small, informal companies fail to pay even the minimum wage. Further, these sustainable companies also engage heavily with the informal sector. While informal employment frequently enables exploitation, informal workers in the sustainable segment benefit from flexible arrangements, home-based work opportunities, and high safety standards. In other words, informality is salient in the industry and can work harmoniously with sustainable goals if proper safeguards and protections are in place.

Policy and Certifications

The second challenge sustainable and mainstream companies share is the relationship with the public sector. Limited transparency permeates the broader textile market but is an issue even with sustainable practices and most in-house production. The diverse materials, plastic, and cloth composition make this the case. Supplying inputs across dispersed household and industrial sources also inhibits traceability for IWaS and reCharka. For example, 67% of SMEs violate the REACH requirements mentioned above due to difficulties and the costs of tracing composition (European Chemicals Agency, 2023).

Transparency, tracing, and reporting are thus an issue even for the most vertically integrated, intentionally sustainable textile companies. These companies struggle to meet requirements and obtain independent ESG certifications such as the SA8000 Standard for labour. Therefore, suboptimal reporting potentially threatens the proposed CSDDD and CSRD. Since the textile industry is severely fragmented, it could be that an issue identified in a downstream supplier does not get reported to the upstream buyer. Thus, companies need to set up extensive reporting networks throughout their supply chain so that the proposed CSDDD and CSRD have the intended effect.

Proactive commitment to legislative compliance, including CSR requirements and local labour laws, subjects these two alternative companies to heightened scrutiny and enforcement attention compared to companies under the radar. For example, upcycling companies bear the burden of REACH compliance, even though they did not produce the material in violation and are reducing waste. As for IWaS, there needs to be more local government incentives for pollution reduction and improved labour conditions outside of wage support on the individual worker level. The specific needs of sustainable companies are not considered in local regulations, and there are no targeted subsidies and incentives for these pollution reduction methods. In summary, regardless if sustainable or conventional methods and practices are used, small textile enterprises in India lack a voice in influencing policy to better incorporate their differences in capacity and capabilities.

5.3.5. Concluding Remarks

Although they exist outside the scope of the proposed CSDDD and CSRD, IWaS and reCharka are rare examples of firms that align with the EU's SDGs, as reflected in these laws. However, two primary differences from mainstream textile companies prevent alternative methods from being adopted across the industry. First, neither diversion nor upcycling has increasing returns to scale. Second, their textile market segment relies entirely on high-income and Western consumers.

6. Discussion

6.1. Case Study Relevance

The case studies have outlined various issues in the responsiveness towards environmental legislation. These issues are not confined to specific regions studied and are emblematic of the problems across India as a textile production hub.

Implementation of Sustainable Supply Chain Management (SSCM) is greatly hindered in India as the supply chain structure is convoluted geographically and functionally (see 3.3.2). As found, the economy in Dharavi is fragmented, with various small-scale suppliers operating next to each other. Since partial orders are placed with different suppliers, it is challenging for companies to map their supply chains. On the other hand, Bhiwandi is full of supply chains, often within a few 100 metres of where they started. Even functionally, they overlap in activities and buyers, making it incredibly hard to track a single piece of cloth from start to finish. These aspects make it strenuous for governments to hold companies accountable as these companies themselves often do not know their products' buyers and suppliers. Similarly, in the case of upcycling producers, the informal labour force is still deeply involved, and stages of production are contracted to home-based workers. Informality is hence ubiquitous to Indian textile producers of different sizes and types.

Our research aligns with the findings of Kombu et al. (2023), demonstrating that the scale of operations significantly influences the level of responsiveness in India's textile industry. Bhiwandi and Dharavi, the two areas we investigated, highlight this stark contrast. Dharavi is primarily characterised by small-scale operations selling domestically and demonstrating minimal government regulation compliance. Conversely, Bhiwandi, home to medium-sized businesses operating mainly in the domestic market and potentially the export market⁸, display higher compliance levels. The larger scale of operations increases visibility to local government and facilitates investments in pollution reduction and adherence to regulatory audits.

On the other hand, upcycling companies, which are small-scale operations, operate sustainably. However, a few key challenges remain to implement upcycling companies broadly. First, the labour-intensive nature of upcycling makes it difficult to scale these operations. Second, sustainable production processes command a premium price over standard fashion, restricting the customer base to predominantly high-income domestic consumers and Western buyers. These factors may limit the broader implementation of such practices within the textile industry. Despite the dominance of informality and small-scale production, our observations of the upcycling facilities reinforce the potential for such businesses to be both sustainable and profitable. This confirms findings by Perron (2005) on the viability of sustainable practices within small-scale industries, though mainstream companies will require additional resources through government schemes for this to take hold.

⁸ As discussed, the direct buyers in Bhiwandi operate in the domestic market. However, we have no information on whether the products eventually end up on the international market.

Our study supports the findings of King et al. (2005) and Lee (2008) that firms are often environmentally responsive when incentivised with financial rewards or for strategic considerations. A critical disconnect in the buyer-supplier relationship emerged as a contributing factor to environmental concerns. In Dharavi and Bhiwandi, the buyers' primary concern is the balance between price and quality, making pollution reduction a secondary, if not absent, strategic priority. This aligns with Lee's (2008) observations on buyers' behaviour.

A troubling lack of transparency is evident in the relationship between suppliers and global downstream brands, further complicated by extensive fragmentation and multi-levelled outsourcing. This "two-way blindness" constrains the potential for buyers to exert influence over suppliers to lessen pollution.

From our case studies, two significant findings emerge. Firstly, the size of a company serves as a critical determinant in how legislation may encourage behavioural change regarding pollution. Secondly, an obstacle to effective legislative implementation is the buyer-supplier relationship that focuses on the price-quality equilibrium.

Indeed, as observed by the two examples of upcycling companies, some firms exhibit an inherent motivation to improve their environmental footprint. Nevertheless, specific barriers prevent these companies from expanding their operations and influence. These hurdles, ranging from operational scale to strategic focus, warrant further exploration and remediation in the ongoing drive for industry-wide sustainability.

6.2. Enforcement Challenges

India's environmental regulation faces numerous obstacles that impede its efficacy, including inadequate enforcement and institutional and infrastructural deficiencies. The current framework largely relies on command-and-control tools, which Greenstone et al. (2017) critiqued for their overall social costs and adverse effects on technological efficiency.

During our investigation, we noted a disparity in enforcement across the textile industry, with the relationship between the industry and the government fluctuating considerably across different clusters. For instance, many producers evade registration and taxation in Dharavi, thereby skirting labour and environmental obligations. This evasion is particularly prevalent among small-scale units, where informality and a lack of legal awareness conspire to hinder compliance. Given these companies' small scale and margins, we deemed this behaviour to be driven primarily by necessity rather than a malicious attempt to evade laws.

Contrarily, firms in Bhiwandi demonstrate a higher level of compliance, particularly regarding adopting environmentally friendly technologies (as depicted in our Bhiwandi case study). This heightened

compliance stems from increased sector formalisation and local government involvement, leading to greater awareness, as proposed by Govindan et al. (2014).

For the sustainable upcycling enterprises under our scrutiny, their proactive efforts to adhere to regulations and meet global standards have led to more rigorous oversight from local and state government agencies. This scrutiny underscores the complexities of aligning environmental stewardship with regulatory compliance.

In addition to the challenges associated with enforcing environmental regulations, we also gained insights into the impact of incentives through our case studies. Our observations align with Arend's (2014) findings, suggesting that incentives can be effective for small and medium-sized enterprises (SMEs) when combined with other institutional support mechanisms.

However, in the small-scale operations of Dharavi, incentives are conspicuously absent. We saw little to no government support for capacity building or enhancing production processes, corroborating the need for a more integrated approach.

In Bhiwandi, the sole support mechanism available is an electricity subsidy. This subsidy primarily functions as a buffer against rising electricity costs rather than an incentive to transition from coal to gas power. The government has employed drastic measures, such as direct factory closures, to force producers to adopt sustainability standards such as air filter installations and effluent water treatment. However, providing incentives or support for such pollution abatement strategies is necessary for these penalties to be enough to stimulate widespread change. They might even constitute a weak force putting unnecessary burdens on companies or creating incentives for engaging in corruptive behaviour (although no signs of corruption have been noted during our fieldwork).

One significant obstacle to effective legislative implementation is resource limitations, which hinder efforts to minimise environmental impacts. This observation resonates with empirical literature, including studies by Govindan et al. (2014), Lee (2008), and Perron (2005), which identify resource constraints as a barrier to compliance.

With producers in Dharavi and Bhiwandi operating on slim profit margins, they need more capacity to enhance their environmental standards. Therefore, introducing targeted incentives could solve these resource constraints, helping promote more sustainable practices within the industry.

6.3. Recommendations

Shift towards an incentive-based approach, effectively changing how the government enforces legislation.

As discussed, enforcement of environmental legislation is lax. A potential improvement following the literature review is to experiment with innovative regulation. For example, the current CAC systems are suboptimal compared to a proposed market-based scheme (Greenstone et al., 2022).⁹ This underlies the importance of policy experiments to identify pollution abatement schemes that are both effective and efficient.

An example of innovative regulation is green nudges, which have been proven to effectively induce producers towards sustainability (Camerer et al., 2003). The government of India could provide specific schemes that make it attractive for companies to improve their environmental efforts without limiting their choices.

More centralised oversight to improve the effectiveness of state Pollution Control Boards given the current patchwork of standards, enforcement, and pollution awareness.

India faces monitoring challenges due to the PCB's limited workforce and poor data collection and testing quality. Networks of low-cost ambient monitoring instruments and satellite data can be employed to improve data collection and reliability. A precondition to achieving better environmental performance is to experiment with innovative regulation through evaluated pilots at a high level. However, this approach is rare in India, and evidence-based policymaking is still prevalent (Greenstone et al., 2017). Additionally, since many enterprises are not registered, more centralised and robust data collection can enhance the effectiveness of environmental regulations and pilot evaluations in India. More coordination across central and state Pollution Control Boards and municipal government agencies is necessary to streamline standards and allocate resources needed for capacity building.

⁹ It is limited to "focus areas" such as dyeing plants. Secondly, it offers no positive incentives for companies, nor does it offer any financial support for implementing pollution reduction measures required by law. Thirdly, the execution of the laws is decentralised, which creates significant differences in execution when compared state-by-state or even municipality-by-municipality.

Encourage clustering around shared infrastructure by reducing bureaucratic hurdles to Integrated Textile Parks and Special Economic Zone participation and adopting a cluster-based approach to limit the proliferation of small-scale production and the associated sustainability challenges.

Textile companies' involvement in ITPs and SEZs increases their capacity to abate pollution, but many MSMEs resist participating. The Ministry of Textiles prioritises ITP and SEZ growth, and MSMEs who join can benefit significantly from all the associated amenities. These include shared infrastructure, upgradation subsidies, and environmental capacity-building measures. These are currently outweighed by MSMEs' social preferences for the benefits of proprietorship.

As discussed, textile producers are already highly clustered but cannot experience any potential sustainability advantages to clustering due to these proprietorship preferences. As such, barriers to ITP and SEZ participation should be overcome by streamlining the application process and tailoring participation benefits towards the needs of existing clusters. Further, since participating companies are well versed in the new legislation and adhere to some reporting standards, they are likely more primed to implement EU supply chain legislation successfully.

Facilitate reporting and environmental pressure from downstream by installing physical monitoring in India to track and interact with suppliers more directly.

The two-way transparency resulting from fragmentation means brands and EU companies sourcing from Indian textiles can benefit from physical monitoring over other means. Gaining an understanding of the market organisation and contacting outsourcers through physical presence, while costly, is necessary given the high level of informality. Our fieldwork alone allowed us to access subcontractors that are difficult to trace from downstream in the supply chain. At least a few representatives with a physical presence in India may help to ensure that standards, whether from corporate codes of conduct or legislation, are met.

Companies should understand the benefits of due diligence and the need for reporting standards.

The case studies outlined a problem of insufficient environmental awareness with (domestic) suppliers. The effective implementation of the proposed Corporate Sustainability Due Diligence Directive (CSDDD) and Corporate Sustainability Reporting Directive (CSRD) hinges upon a symmetric knowledge and urgency component between all stakeholders. If suppliers do not see the need for due diligence, then they will not perform it coherently in their supply chain, which could harm the efforts made by European buyers.

Therefore, the public and private sectors need to provide an infrastructure that fosters knowledge transfers and informs all stakeholders about the urgency of environmental and human rights standards. A potential implementation of such a policy is that a non-governmental organisation sets up an information campaign that informs companies about the harm of pollution to their employees and the environment.

On the other hand, the public sector in India can implement more legislation to underline the importance of due diligence. It is worth noting that environmental standards demanded by European buyers exceed the legally enforceable standards in India. Implementing these higher standards in India incurs additional costs, placing producers at a competitive disadvantage since buyers prioritise price over environmentally conscious practices. As a result, only large producers are prepared to meet higher standards, and the majority can only do so if faced with substantial pressure and support from buyers.

Furthermore, Indian legislation primarily concentrates on individual manufacturing plants (usually in narrow sectors of interest) rather than an all-encompassing approach to the entire supply chain. This selective focus complicates achieving standardisation, leading to increased monitoring costs. The wide discrepancy in technical capabilities across sellers further exacerbates this challenge, particularly for those needing access to technology that EU buyers might expect.

Thus, an effective sustainability transition in the textile industry requires a holistic approach, encompassing legal and technical harmonisation, market forces, and buyer expectations.

7. Conclusion

European supply chain legislation, such as the proposed CSDDD or CSRD, is correct in its primary goals and assumption. It introduces a push for transparency in global supply chains, a feature which requires significant improvement. It is also reasonable that such legislation is introduced from the importer countries, as it maintains a level playing field for producer countries.

However, primary issues remain in the implementation of these legislations. In our research, we studied India as one of the countries that may be affected by the introduction of CSDDD and CSRD. We find several issues that might contribute towards the limited impact of the legislation, mostly related to the structure of the Indian textile industry. The majority of the companies in India are SMEs. However, the legislation is focused on larger firms.

Based on the two first cases, Dharavi and Bhiwandi, we see that small informal and medium formal companies need to improve their track record regarding pollution. Furthermore, they are not positioned to be impacted by international supply chain legislation. We formulate two hypotheses on why this might be the case:

- They are not exposed to global supply chains and are not pressured by buyers to improve sustainability.
- They need to be larger and less resource-constrained to comprehend and introduce measures for improving sustainability in their production process.

Our study suggests that exposure to Western markets may not significantly affect profit-maximising companies that tap into the robust demand for inexpensive, non-sustainable goods. Likewise, the potential impact of EU legislation on small firms appears minimal due to the challenges of implementing such regulations in small, resource-limited or niche markets. Consequently, the size of a company could be a primary determinant of its responsiveness to the forthcoming Corporate Sustainability Due Diligence Directive (CSDDD) and Corporate Sustainability Reporting Directive (CSRD) in India.

Given the highly fragmented nature of India's domestic textile market, a company's size may limit the impact of these EU directives. As discussed, small-scale companies in India have more difficulties engaging in sustainable practices. However, two exceptions to this trend emerge in our case studies - reCharka and IWaS. These companies have excelled in sustainable business practices, attributable to their direct exposure to Western markets, independence from global supply chains, and an innate drive towards sustainability.

Effective environmental regulation is critical to ensure that economic activities do not harm the environment. India must continue to develop its regulatory framework to address the challenges and limitations of the current system. This requires a multi-stakeholder approach involving the government, industry, civil society, and academic experts to create a comprehensive and innovative regulatory

framework that considers the unique needs of each industry and region. By doing so, India can achieve its sustainable development goals and promote a cleaner, greener, and healthier future for all.

In addition to these findings, our case studies illuminate challenges in enforcing national and international production standards. These issues are not unique to the regions we studied but reflect broader, systemic problems throughout India's textile production industry. The way forward necessitates addressing these obstacles and fostering conditions conducive to sustainable, compliant practices.

8. References

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