

Review

Overview of Environmental, Social, and Energy Transitions in the Textile and Garment Industry in Cambodia and Neighboring Countries

By Dr. Yen Yat, Dr. Sam Chanthy, Mr. Kem Sarom, and Mr. Rin Poleu



July 2024

Acronyms

3R	Reduce, Reuse, Recycle
ABC	Association of Banks in Cambodia
ADB	Asian Development Bank
APTMA	All Pakistan Textile Mills Association
BCCSAC	Bangladesh Climate Change Strategy and Action Plan
BCCTF	Bangladesh Climate Change Trust Fund
BFC	Better Factories Cambodia
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BHRRC	Business & Human Rights Resource Centre
BISP	Benazir Income Support Program
CCCA	Cambodia Climate Change Alliance
CCCSP	Cambodia Climate Change Strategic Plan
CMT	Cut-Make-Trim
COVID-19	Corona Virus Disease 2019
CP	Cleaner production
CSFP	Cambodian Sustainable Finance Principles
CSR	Corporate Social Responsibility
DESIA	Department of Environment and Social Impact Assessment
DoE	Department of Environment
E&S	Environmental and Social
EBA	Everything But Arms
ECC	Environmental Compliance Certificate
EE	Energy efficiency
EE&C	Energy efficiency and conservation
EECP	Energy Efficiency and Conservation Program
EESDP	Energy Efficiency Sector Development Program
EHS	Environmental Health and Safety
EIAs	Environmental Impact Assessments
EMS	Environmental Management System
EPL	Environmental Protection Law
ERIA	Economic Research Institute of Asia
ESG	Environment, Social and Governance
ETI	energy transition index
ETPs	Effluent Treatment Plants
EU	European
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GEP	Gender Equity Program
GFA	Global Fashion Agenda
GGG	global greenhouse gas
GHG	Greenhouse Gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GSP	Generalized System of Preferences
GTF	Garment, Textile, Footwear

IDRC	International Development Research Centre
IFC	International Finance Corporation
ILO	International Labor Organization
IPCC	Intergovernmental Panel on Climate Change
JETP	Just Energy Transition Partnership
KPIs	Key performance indicators
LNG	Liquefied Natural Gas
MCCP	Myanmar Climate Change Policy
MCCS	Myanmar Climate Change Strategy
MEF	Ministry of Economy and Finance
MEPS	Minimum Energy Performance Standards
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MME	Ministry of Mine and Energy
MoE	Ministry of Environment
MoE	Ministry of Environment
MOLISA	Ministry of Labor, Invalids, and Social Affairs
MONREC	Ministry of Natural Resources and Environmental Conservation
MOU	Memorandum of Understanding
MRC	Most Representative Status
MSDP	Myanmar Sustainable Development Plan
MSMEs	Micro, Small, and Medium Scale Enterprises
MW	Megawatts
NCSD	National Council for Sustainable Development
NCSD	National Council for Sustainable Development
NDC	Nationally Determined Contribution
NEECA	National Energy Efficiency and Conservation Authority
NEECP	National Energy Efficiency and Conservation Policy
NES	National Environmental Strategy
NGGS	National Green Growth Strategy
NGO	Non-Governmental Organization
NSSF	National Social Security Fund
OSH	Occupational Safety and Health
PaCT	Partnership for Cleaner Textile
PoNRE	Provincial Department of Natural Resources and Environment
PROPER	Public Disclosure of Industrial Pollution
R&D	Research and Development
RMG	Ready-Made-Garment
S&L	Standards and Labelling
SCP	Sustainable Consumption Production
SEA	Southeast Asia
SREDA	Sustainable and Renewable Energy Development Authority
SSO	Social security coverages
TES	Total energy supply
TWh	Terawatt-hours
UN	United Nations
UNDP	United Nations Development Programme

UNFCCC	United Nations Framework Convention on Climate Change
USD	United State Dollar
VEEIE	Vietnam Energy Efficiency for Industrial Enterprises
VINATEX	Vietnam Textile Industry
VITAS	Vietnam Textile and Apparel Association
VND	Vietnamese Dong
VSD	Variable Speed Drives
WHO	World Health Organization
WPV	Workplace Violence
WWF	World Wildlife Fund

Table of Contents

1. OVERVIEW OF THE GARMENT AND TEXTILE INDUSTRY IN ASIA	4
2. COMPARATIVE ANALYSIS OF ENVIRONMENTAL, SOCIAL, AND ENERGY TRANSITIONS	6
2.1 BANGLADESH	6
2.1.1. Overview	6
2.1.1 Environmental Concerns	7
2.1.2 Social Concerns	9
2.1.3 Energy Efficiency (EE)	11
2.2 CAMBODIA	13
2.2.1 Overview	13
2.2.2 Environmental Concerns	13
2.2.3 Social Concerns	16
2.2.4 Energy Efficiency	19
2.3 INDONESIA	22
2.3.1 Overview	22
2.3.2 Environmental Concerns	23
2.3.3 Social Concerns	25
2.3.4 Energy Efficiency	26
2.4 LAO PDR	27
2.4.1 Overview	27
2.4.2 Environmental Concerns	28
2.4.3 Social Concerns	31
2.4.4 Energy Efficiency	33
2.5 MYANMAR	34
2.5.1 Overview	34
2.5.2 Environmental Concerns	34
2.5.3 Social Concerns	36
2.5.4 Energy Efficiency	38
2.6 PAKISTAN	40
2.6.1 Overview	40
2.6.2 Environmental Concerns	40
2.6.3 Social Concerns	42
2.6.4 Energy Efficiency	44
2.7 VIETNAM	45
2.7.1 Overview	45
2.7.2 Environmental Concerns	46
2.7.3 Social Concerns	50
2.7.4 Energy Efficiency	52
3. CROSS-COUNTRY ANALYSIS	53
3.1 Environmental Concerns	54
3.2 Social Concerns	56
3.3 Energy Efficiency	57
3.4 Environmental Management in the Textile and Garment Industry	58
9. REFERENCE	68

1. Overview of the Garment and Textile Industry in Asia

The textile industry is a **rapidly growing market**. Asia is strongly positioned as the world's number-one garment-exporting region. In 2018 alone, the region exported garment, textiles, and footwear (GTF) goods to a value of \$668 billion, accounting for approximately 63.7 % of global exports. Asia hosts five of the world's top five garment exporters: China, Bangladesh, Vietnam, India, and Cambodia (ILO, 2019). In Bangladesh and Cambodia, it accounts for around 80% of total export earnings; in Pakistan, it makes up over 50% of export revenues. The textile and garment industry has recently experienced annual growth exceeding 10% in Vietnam (GIZ, 2021).

In 2019, the GTF sector provided both **formal and informal employment** to 65 million garment sector workers in Asia, accounting for 75 % of GTF workers worldwide. Globally, it is estimated that about 80 % of GTF workers are women, and in total, 35 million women work in Asia and the Pacific's GTF sector (ILO, 2021a).

Many manufacturing jobs in Asia are concentrated in low- and medium-technology sectors, which tend to be associated with higher carbon dioxide emissions compared to more advanced, higher-technology industries (ADB, 2023). This challenges the regional efforts to transition towards a more sustainable industrial landscape. The highest share of manufacturing jobs is actually in consumer-oriented sectors such as electrical and optical equipment, leather and footwear, and textiles and garments. These sectors are often subject to greater scrutiny from consumers regarding the sustainability features of their products. As a result, the lead firms operating in these consumer-focused manufacturing industries are facing increasing pressure to ensure that the carbon footprints across their entire value chains are minimized (ADB, 2023; Haseeb, Haouas, Nasih, Mihardjo, & Jermisittiparsert, 2020). The carbon footprint from the textile and garment sector is significant, accounting for 6-8% of total global emissions, with 1.7 billion tons of carbon dioxide emissions in 2015, more than all international flights and maritime shipping combined (Sharpe, Retamal, & Fernandez, 2022). Switching to renewable energy, such as solar, hydro, or wind power, can significantly reduce emissions and improve sustainability linked to textile production.

The textile and garment sector has significant environmental impacts. These impacts are concentrated at specific points in the supply chain, including weaving, dyeing, finishing processes, energy use, textile waste, and transport emissions. The most significant impacts are within the first two areas, with the main ones stemming from the use intensity of water resources, chemical use, wastewater discharges, lack of treatment processes, energy use, and high carbon intensity of electricity. The textile industry is highly water- and chemical-intensive, with an enormous water footprint ranging from agricultural water consumption for cotton farming to water consumption in textile printing, dyeing, and finishing.

The sector is one of the largest users of fresh water in the world, across the entire value chain consuming around 93 billion cubic meters (21 trillion gallons) of water annually, enough to fill 37 million Olympic swimming pools (Sharpe, Retamal, & Fernandez, 2022). As textile production is located in countries with insecure water supplies, water crises are forecast in textile-producing countries, including Bangladesh, Cambodia, India, Indonesia, and Vietnam. This expected growth will exacerbate the current water supply and demand gap and contribute to declining water quality. Moreover, the sector is also responsible for **severe water pollution** by discharging large volumes of wastewater containing hazardous substances into rivers and water courses without appropriate treatment. In a recent report, ILO estimated that 20% of industrial water pollution globally was attributable to the dyeing and treatment of textiles (ILO, 2021b). The ADB recommends stronger regulation, including provisions for detailed and timely monitoring of current pollution and projections of future pollution, as well as intervening with mitigating technologies and processes to prevent industrial pollution.

The textile industry is a critical component of the economies of many Asian countries, and the conditions vary across these countries. Still, challenges are largely similar, especially in ensuring decent working conditions for laborers. The textile sector's outsized role in these Asian economies underscores its importance and the urgency in addressing the persistent issues of worker welfare and environmental sustainability. As major drivers of economic growth, these textile-producing nations must balance the industry's commercial success with the need to protect workers' rights and safeguard the natural environment.

The primary customers of garment producers are often global brands prioritizing low prices and tight production timeframes. These brands frequently make changes to product design, volume, and production schedules and place last-minute orders without accepting increased costs or adjustments to delivery dates. The pressures created by such policies and practices typically fall on the factory workers. The harsh working conditions endured by many Asian garment workers have even been characterized as akin to "slave labor"(D'Ambrogio, 2014). Despite repeated warnings and reports from watchdog NGOs, this issue only tends to gain widespread media attention when major, deadly accidents occur in the industry. These dynamics highlight the power imbalance between global brands and the workers who produce their garments. The relentless pursuit of low costs and rapid turnaround times by brands often comes at the expense of the well-being and rights of the workers in their supply chains.

The raw materials that underpin the fashion industry are integral to improving its environmental footprint and meeting the growing sustainability expectations of customers and regulators. In the coming year, fashion industry leaders should view this as an opportunity to tap into the expanding ecosystem of innovative,

sustainability-focused materials. However, a key challenge will be how to help this emerging ecosystem scale effectively. By embracing newer, more sustainable material alternatives, the fashion industry can make tangible progress in reducing its environmental impact. As consumer and regulatory demands for sustainability continue to rise, fashion brands that can successfully navigate and scale the ecosystem of green materials will be well-positioned to meet these evolving expectations (Sugeng, Romasindah, & Saiful, 2022). Addressing the scalability of sustainable materials represents a critical next step for the fashion industry as it works to transform its resource-intensive practices (Hultberg & Pal, 2021). Leveraging the expanding options in this space presents an opportunity for fashion leaders to drive meaningful change in the year ahead.

Environmental Impact Assessment systems in Cambodia, Vietnam, Indonesia, and Bangladesh need to improve monitoring, collection, analysis of data, and enforcement of mitigating measures. The textile and garment sectors are located near major river systems, which are vital to the environmental, economic, and social health of the nearby communities. Working with local stakeholders to build their awareness and capacity is essential to increase the effectiveness of EIA and the overall environmental sustainability of industrial activities associated with the garment sector. On the one hand, it is vital to address high emissions through targeted interventions to adopt energy efficiency and cleaner production methods (Owais Ur Rehman Khan, Clancy, & Neinders, 2016). On the other hand, the growing consumer demand for sustainable products in key manufacturing sectors like textiles and garments could incentivize local factories to proactively enhance their environmental and social practices. This, in turn, could help the manufacturing industry align with global sustainability trends and maintain its competitiveness in international markets.

2. Overview of Environmental, Social, and Energy Transitions

The overview aims to comprehensively understand environmental and social (E&S) and energy transitions in the textile and garment industry implemented in Cambodia, Bangladesh, Indonesia, Laos PDR, Myanmar, Pakistan, and Vietnam. Countries were selected based on CARE and Geres intervention areas and prospects. It aims to gain insights into key trends, challenges, and opportunities of past initiatives, legal frameworks, programs, and approaches that can inform and guide future initiatives and strategies that are more effective and impactful in addressing E&S challenges in Cambodia's textile industry as a priority.

1.1 Bangladesh

o 2.1.1. Overview

The Garment and Textile Industry is a key driver of Bangladesh's socio-economic development. By 2017, Bangladesh had a 162.7 million population, and the industry employed 4.5 million people—mostly women- and generated about 20% of its GDP and about 84% of its total export earnings (World Bank, 2017a). Bangladesh ranks second, only after China, to be the world's biggest exporter of ready-made garments (RMG¹). The destination countries for RMG exports were the European Union, the United States, and Canada, amounting to \$42.6 billion in 2022. The rapid development of Bangladesh's RMG sector is attributed to factors such as the introduction of the Multi-Fibre Arrangement quota system², low-cost labor availability, and a small domestic garment sector. Besides, these industries are expected to expand considerably in the coming years, with the RMG export target set at USD 100 billion as Bangladesh aims to become the world's 24th largest economy by 2030. This rapid expansion in the textile industry is expected to consume a significant portion of the country's energy, leading to substantial annual GHG emissions (Biswas et al., 2024).

Despite these remarkable successes, the issues associated with working conditions, labor rights, and environmental impacts remain a great concern in this sector. For example, more than 1,100 people – mostly garment workers – died when the Rana Plaza factory collapsed in Dhaka city on 24 April 2013, highlighting severe safety problems requiring global scrutiny. However, after the tragic collapse, the Bangladeshi government has improved factory conditions. The sector is considerably safer today, and the capacity of the Government of Bangladesh to monitor compliance is much stronger (ILO, 2023).

1.1.1 Environmental Concerns

The rapid growth of the sector has resulted in harm to the surrounding environment and nature. In Bangladesh, it is estimated that the **water consumption** required by the textile sector was over 4 million litres per day in 2014, which, in business-as-usual scenario cases, the industry would require an additional 6 million litres a day by 2030 to meet the targeted export. Annually, the textile wet processing industry consumes around 1500 billion litres of water to process 5 million tons of fabric (300 L/Kg) (Uddin et al., 2023). In 2016, textile industries produced about 1.80 million metric tons of fabric, which generated around 217 million m³ of **wastewater** containing a

¹ The Ready-made-garment (RMG) sector focuses on producing garments that are already sewn and assembled into finished products, ready for consumers. It involves mass production and activities, such as cutting fabric, sewing, and assembling garments. The Garment, Textile, and Footwear (GTF) sector is broader and covers the entire supply chain of garment production--the creation of textiles (fabric), garment manufacturing, and footwear production.

² The Multi-Fibre Arrangement quota system: is an international trade agreement involving clothing and textiles. The MFA was established in 1974 and imposed quotas on the amount of clothing and textiles that developing countries could export to developed nations (Adam Hayes, 2023).

wide range of pollutants (Hossain, Sarker, & Khan, 2018). According to 'the 1995 Bangladesh Environment Conservation Act and 'the 1997 Environmental Conservation Rules, textile dyeing industries are categorized as "Red industries" that must treat and monitor the wastewater quality conforming to national discharge quality standards (Hossain et al., 2018; Sharna, 2022). However, the report by the World Bank explained that the Bangladesh government has failed to enforce these laws (World Bank, 2022a). As such, water pollution is a severe issue in the delta-based country for which the government has declared three rivers biologically "dead" due to untreated effluent entering them, and industrial pollution is responsible for 60% of pollution in the Dhaka watershed, with garment factories being the second-largest contributor.

Furthermore, the garment and textile industry in Bangladesh has become a contributor to global **greenhouse gas** (GHG) emissions, accounting for an estimated 0.4% of global emissions in 2018. Rapid economic growth has resulted in higher GHG emissions, from 115 million metric tons of carbon dioxide equivalent (MtCO₂e) in 1990 to 221 MtCO₂e in 2018. By 2030, these industries are expected to contribute over 25 million tonnes of CO₂ eq. of GHG emissions. According to a recent study, Bangladesh's RMG produced ~6044 Gg CO₂eq, or the RMG and textile sectors contributed 32.2% and 67.8% of emissions in 2022 (Biswas et al., 2024). Additionally, 70% of primary energy consumption in this sector is derived from natural gas. At the same time, Bangladesh also suffers from severe air pollution, which costs about 9% of GDP annually.

In addition to these challenges, **climate change** is also threatening the well-being of the country's socio-economic growth. A report by the World Bank claimed that climate change would hit poor and vulnerable people the hardest. The sixth assessment report of The UN's Intergovernmental Panel on Climate Change (IPCC) also indicated that the adverse impacts of climate change disproportionately affect marginalized groups, amplifying inequalities and undermining sustainable development across all the regions. Due to their socioeconomic conditions and the broader development context, poor communities, especially in regions with high levels of vulnerability and inequality, are less resilient to diverse climate impacts. The average cost of tropical cyclones in Bangladesh is about \$1 billion annually. By 2050, a third of agricultural GDP could be lost, and 13 million people could become domestic climate migrants. Moreover, in case of severe flooding, GDP could fall by as much as 9 % (World Bank, 2022b).

The Bangladeshi government has taken some measures to address the multifaceted impacts, including

- For industrial control, the Environmental Protection Act (1995) requires all types of industries and projects to be forced to take **environmental clearances**, which is a process of obtaining a permit from the Department of Environment (DoE)

before establishing or operating an industry that might impact the environment. In the last 14 years, from 2009 to 2023, about 74,000 environmental clearances have been given for establishing an industry or implementing projects.

- Moreover, the government has mandated the establishment of **Effluent Treatment Plants (ETPs)** in factories, significantly reducing water pollution from dyeing processes. The data showed that Bangladesh had over 10,000 factories that must have installed ETPs; however, ETPs are a costly method to treat the water used in textile factories, from which about 80% of industrial factories run without waste treatment facilities as of 2022 (Abu Azad, 2023).
- To use and manage water resources effectively and in line with **National Environmental Policy (1992)**, the **Water Act 2013** was enacted for wastewater treatment and pollution control in the textile industry.
- As a **signatory state** of the United Nations Framework Convention on Climate Change (UNFCCC) Fashion Industry Charter for Climate Action, Bangladesh commits to **30 % of GHG** emission reductions by 2030 and net-zero emissions by 2050³ (Biswas et al., 2024). However, the RMG industry still produces 15.4% of the nation's GHG emissions, while the textile industry emits 12.4%. This makes it difficult to meet the Paris Agreement's GHG reduction targets⁴.
- The **government** has also been trying to enforce waste management using the **National 3R (Reduce, Reuse, Recycle) Strategy for Waste Management (2010)** to encourage the RMG industry to adopt 3R models by reducing, recycling, and reusing industrial waste so as to minimize environmental impact.
- To address the impact of climate change, the Bangladesh **Climate Change Strategy and Action Plan (BCCSAP 2009)** was developed. This plan identified 44 key programs and classified them into six themes: disaster management, infrastructure development, mitigation, and low-carbon development. BCCSAP 2009 does not directly target the garment industry; however, many of its key programs and overarching goals have direct and indirect implications for this sector because the BCCSAP 2009 emphasizes disaster management, building resilient infrastructure, and low-carbon development. Further, BCCSAP 2009 also addresses energy efficiency and transitioning to renewable energy, which aims to mitigate the impacts of climate change and reduce the environmental footprint. Additionally, the Bangladesh Climate Change Trust Fund (BCCTF) was established in 2010 with funds from government revenue sources to mitigate the effects of climate change. Meanwhile, Bangladesh plans to raise \$12.5 billion in additional financing for climate action in the medium term.

³ file:///C:/Users/Yat%20Janin%20Da/Downloads/wcms_893846-1.pdf , accessed on July 4, 2024

⁴ <https://www.thedailystar.net/opinion/views/news/bangladeshs-struggle-ghg-emissions-textile-and-rmg-3580256>, accessed on July 4, 2024

1.1.2 Social Concerns

Over the last ten years, Bangladesh has lifted half of its people out of poverty, increased employment for millions of people, and boosted its economy to become the 35th largest in the world. Before COVID-19, the economy grew 7% annually, with GDP per capita reaching roughly US\$2,500. Bangladesh's GDP grew from \$18 billion in 1980 to \$460 billion in 2022, and it is among the world's most important textile and apparel exporters (World Economic Forum, 2024). In 2018, Bangladesh graduated from a least-developed country to a lower-middle-income country, showcasing the country's commitment to economic development and employment.

The garment and textile industry has experienced rapid growth, with the number of garment businesses in Bangladesh increasing from 12 in the early 1980s to 4,482 in 2015. Bangladesh is renowned for its sophisticated garment sector, which employs four million people in over 3,500 factories and exports goods worth \$43 billion to 167 countries. The industry relies on international investment, but most are domestically owned (World Bank, 2022a). Foreign direct investment (FDI) is only encouraged in areas where domestic production is not competitive. The ready-made garment sector has been a significant source of formal employment and poverty alleviation. Labor mobility in Bangladesh's garment clusters has significantly contributed to the development of the industry. The government has actively supported the sector through international investment licenses, duty-free concessions, and the creation of Export Processing Zones in Chittagong and Dhaka. These zones offer businesses tax holidays, expedited customs processing, and finance access.

Despite the remarkable growth in the garment and textile industry, many challenges and issues are associated with working conditions, labor rights, gender equality, and gender-based violence (Gibbs et al., 2019; Uzzaman, Xulu-Kasaba & Haque, 2021). The WBL 2.0 indicator⁵ shows a correlation between the legal framework score and the perception of rights for women in the workplace: Bangladesh is in the lower median for the legal framework score (around 50), indicating that its egalitarian laws are moderately developed. However, the perception of rights in practice appears to be below 50, showing a mismatch between laws and their practical application. A cross-sectional study of eight garment factories with 800 female workers and 395 managers revealed that in the past four weeks, 73.5% of workers reported experiencing or witnessing physical or emotional workplace violence (WPV), while 63.5% of managers reported perpetrating emotional WPV (Gibbs et al., 2019).

⁵ Women, Business and the Law 2024 is the 10th in a series of annual studies of the World Bank measuring the laws that affect women's economic opportunity in 190 economies. This year, it presents two sets of data: Women, Business and the Law 1.0 and an expanded version, Women, Business and the Law 2.0. Women, Business and the Law 2.0 presents a new approach to measure the implementation gap between laws—de jure—and how they function in practice—de facto. It analyzes legal frameworks, supportive frameworks, and expert opinions on the status of women's rights. In doing so, Women, Business and the Law 2.0 introduces two new indicators—Safety and Childcare—and revises the ongoing indicators.

Another study indicated that working women are always in fear of losing their sexual safety and security; for example, the safety indicator highlights that around 55% of economies have comprehensive laws on domestic violence, and 27% have adequate legislation on child marriage, but only 43% have developed comprehensive mechanisms to combat the multiple forms of violence against women. The management generally does not safeguard female workers in Bangladesh (Haque, Sarker, & Rahman, 2019). Deep-rooted cultural norms, traditions, and religious customs have shaped Bangladesh's working environment and women's empowerment (Al Mamun & Hoque, 2022). Critical obstacles include discrimination against women in hiring and promotions based on their gender, where women are frequently employed in lower-paying, less skilled positions while men predominate in managerial and supervisory roles (Basharat & Alam, 2024). Also, female workers often suffer gender-based violence (GBV) and sexual harassment, creating an unsafe and oppressive work environment (Akter, Teicher, & Alam, 2024). A recent study indicates that the Working conditions of RMG workers in Bangladesh are typically characterized by long working hours, poor salaries, unfavorable working postures, noise exposure, emotional and sexual abuse, and workplace violence. The study added that over 40% of the workers reported indebted (Dreher et al., 2023). Equal pay for work of equal value is mandatory, but only 18% of economies have pay transparency measures or enforcement mechanisms in place to combat the gender pay gap.

Many efforts have been made to address these issues. The significant policies, regulations, and laws are as follows:

- **Bangladesh Labour Act (2006) and Minimum Wage Regulation (2011):** The Act and Regulation require industries to set fair wages, safe working conditions, the right to unions/associations, provisions for maternity leave, workplace safety, and compensation for workplace injuries. As the Labor Act of Bangladesh does not offer specific guidelines on the gender mainstreaming approach, GIZ funded a project to empower women in the garment industry by using business-driven approaches to gender mainstreaming. The project has improved the situation of about 82,000 workers, particularly women (GIZ, 2022a). In addition, ILO (2020) also recommended some approaches, including fair share of women's representation, promotion of workplace culture free from violence and harassment, access to healthcare, pension, and social protection (some figures: in 33% of economies, the age at which men and women can retire is not the same, and in 43% of economies, periods of absence due to child-rearing are not taken into account in pension benefits; only 15% of economies offer some form of incentive that affects women's pension benefits), workers' participation in unions and associations, and compliance with non-discrimination, to support decent work and gender equality in the ready-made garment sector, all with a

view to realizing inclusive, sustainable development in Bangladesh (ILO, 2020). After a week of protests calling for higher salaries, Bangladesh agreed to raise the minimum wage for garment workers by 56.25%, from 8,000 takas to 12,500 takas (\$114) per month, plus a 5% annual increment from December 2019⁶.

- The government also adopted the **National Occupational Safety and Health Policy (2013) and the National Plan of Action for Fire Safety and Electrical Safety (2017)**. These mandate factories to ensure health and safety measures, including regular safety inspections and establishing safety committees. ILO supports these policies by assisting factories in improving working conditions in readymade garments (RMG) factories. For example, in the first phase of its Ready Made Garment Program, they inspected 1,549 garment factories for structural, fire, and electrical safety and trained over 800,000 garment workers on occupational safety and health. Building on the achievements of the first phase, the second phase covered strategic areas, such as ensuring factory safety through remediation, governance building to regulate industrial safety, and supporting labor inspection reform effectively (ILO, 2017).
- To create **safer working environments**, particularly against gender-based violence and sexual harassment, and achieve gender equality in the workplace, the government has enacted laws, policies, and regulations. This includes the Bangladesh Labour Act (2006), the Women and Children Repression Prevention Act (2000), the National Action Plan on Violence against Women (2013-2025), and the Bangladesh Garment Manufacturers and Exporters Association (BGMEA) Gender Policy (2019). These legal frameworks indicate Bangladesh's commitment to battle against gender-based violence and sexual harassment and promote gender equality.

1.1.3 Energy Efficiency (EE)

According to the 2021-22 National Energy Balance report of the Sustainable and Renewable Energy Development Authority (SREDA), Bangladesh's total energy supply (TES) stands at 55,020 KTOE, predominantly consisting of 25,687 KTOE from natural gas and 14,300 KTOE from biofuels. Of the total, 34,660 come from domestic production, largely from natural gas and biofuel. Energy imports contribute 20,757 KTOE, almost 40% of the total. Much of this imported fuel is used to generate electricity from Liquefied Natural Gas (LNG) and HFO-based power plants⁷. The garment and textile industry in Bangladesh accounts for 26% of the total energy supply, making it the second-largest consumer of energy in the country. The primary sources of energy consumption for the industry are natural gas (45%) and coal (42%),

⁶

<https://www.reuters.com/world/asia-pacific/bangladesh-hikes-minimum-wage-garment-workers-after-protests-minister-2023-11-07/>, accessed July 4, 2024

⁷ <https://www.lightcastlebd.com/insights/2024/02/renewable-energy-in-apparel-industry/>, accessed on July 5, 2024.

with electricity usage (12%) (World Bank, 2017b). The sector heavily relies on an uninterrupted electricity supply. Historically, many factories used captive power plants run on gas to meet their energy needs. The country has had gaps in gas supply in recent years, and natural gas reserves are dwindling. The government has been importing LNG to meet the increasing energy demand and bridge the gap between supply and demand. When the energy crisis struck, the cost of doing business has surged. As experienced in 2022, many RMG industries depended on generators for at least three hours a day to power up their dyeing and washing units when energy was cut off in the manufacturing hub of Gazipur on the outskirts of Dhaka. The cost of electricity from generators was three times higher than what it should be from the national grid because diesel was costly. During that challenging time, Bangladesh's garment industry faced a double whammy from slowing global demand of 20% and an energy crisis partly caused by the war in Ukraine.

In the context of global changes, two factors increasingly motivated RMG industries to adopt green energy options. Firstly, new regulations, particularly from buyers in Europe and the US, and secondly, they raised the customer consciousness of climate impact, leading to a change in brand vision. For instance, H&M has envisioned becoming a climate-positive changer across its value chain by 2040. Also, Levi's has set a target of becoming net zero by 2050. Other brands like Primark and Zara are also setting similar targets. As manufacturers, this inevitably means lowering the carbon footprint in Bangladesh's Apparel industry. However, there are challenges in energy-saving adoption due to a lack of awareness regarding energy efficiency (EE) technologies, high initial investment costs, unfavorable taxes and duties on EE technologies, and high maintenance costs.

The Bangladesh government is strategizing to make efficiency energy a long-term priority. The key interventions include:

- Under the supervision of SREDA and empowered through the SREDA Act of December 2012, the garment and textile industry is adopting **EE technologies** in its production chain. World Bank has projected that by the end of 2030, 5,332 out of 6,698 RMG industries in Bangladesh will adopt EE technologies (World Bank, 2017b). By adopting the EE technologies, the RMG industry will save about 35% of energy consumption or reduce energy consumption from 0.47 kWh/kg fabric to 0.26 kWh/kg fabric by adopting cleaner production (CP) models.
- The Energy Efficiency and Conservation Rules (2012), Renewable Energy Policy (2008), Energy Efficiency and Conservation Master Plan 2030, and Industry Policy (2016) were developed to promote sustainable industrial practices, including incentives for adopting **EE technologies**, cleaner production methods and transition to more sustainable production processes. The RMG industries are trying to embrace **green energy** with solar panels, using efficient lighting and manufacturing units. One example is AR Jeans Producers, which installs a 45 K.W.

solar power plant with extremely effective monocrystalline panels. It saves 43% more energy than a traditional building using energy-efficient light, window planning that allows more natural light, and advanced sewing machines. Bangladesh has recently become the country that accommodates half of the world's top 100 LEED-certified green industrial units as local entrepreneurs have been investing in environment-friendly manufacturing facilities. Recently, the country has 187 LEED-certified green factories, all but four of which are in the garment sector. Among these LEED-certified garment factories, 63 are platinum-rated, 110 are gold-rated, and 10 are silver-rated ⁸.

1.2 Cambodia

1.2.1 Overview

Cambodia's Garment, Footwear, and Travel Goods (GFT) sector in Cambodia plays a vital role in socio-economic development, generating nearly 70% of the country's total export earnings (GIZ, 2022b); however, exports declined by 13.31 % in 2023 amidst global challenges, from \$12.80 billion earned in 2022 to \$11.09 billion. As of early August 2023, the sector comprised 1,077 factories, 90% of which have foreign ownership, and employed approximately 760,000 Cambodians, predominantly women (80%) ⁹. This sector has significantly reduced poverty and boosted economic growth by creating employment and enhancing living standards. Despite the industry's economic significance, the production technologies employed in many Cambodian textile factories remain relatively basic. Challenges like poor working conditions, low wages, environmental effects, and international market dependency still exist. To address the issues, the Cambodian government and development partners have developed policies that improve labor standards and support sustainable practices, ensuring equitable and environmentally responsible growth.

1.2.2 Environmental Concerns

In Cambodia, the GTF sector has a significant environmental impact. These industries contribute around 85% of the country's **industrial waste**, 70% of industrial toxic water pollution, and 27% of industrial air pollution. According to the Global Fashion Agenda (GFA), the GTF industry generates approximately 140,000 tons of textile waste annually (Khmer Times, 2023). According to the report, the GTF industry generates substantial textile waste, including scraps, defective garments, and packaging materials, and approximately 60% of the fabric used in production becomes waste. Most of the waste undergoes unregulated downcycling and incineration or ends up in landfills, which harms the environment and population. A report by EuroCham indicates that up to 95% of textiles and garments waste can be

⁸

<https://www.tbsnews.net/economy/rmg/bangladesh-hosts-half-top-100-leed-certified-green-factories-across-globe-581062>, accessed on July 5, 2024.

⁹ <https://www.phnompenhpost.com/business/apparel-exports-down-recovery-in-sight>, accessed on July 5, 2024.

recycled, but many factories fail to recycle the waste (Eurocham-Cambodia, 2021). The recycling practices should also be properly monitored as it is reported that Brick factories and garment brands, like Adidas, Gap, and Lululemon, often burn garment waste as cheap fuel. LICADHO¹⁰ urged that systematic action by garment brands and Cambodia's Ministry of Environment is urgently needed to immediately investigate the improper disposal of their waste and take action to remedy the harm caused. The practice appears to have increased in recent years despite causing health and environmental impacts (LICADHO, 2023).

Furthermore, the garment industry alone **consumes resources**, for instance, 300,000 tons of wood each year, for heating purposes (Kunmakara, 2023). In 2023, the Ministry of Environment and Stockholm Environment Institute (SEI) conducted an **air pollution study in the garment factories**.¹¹ The study surveyed 16 garment factories in four provinces of Cambodia: Phnom Penh, Kandal, Kampong Speu, and Sihanouk. At each location, two sampling sites were selected to assess the air quality of each factory: inside the factory to represent indoor air quality and outside the factory to represent outdoor air quality. Four categories of toxic compounds were measured for the air quality sampling: particulate matter at 2.5 microns and 10 microns (PM2.5 and PM10, respectively), nitrogen oxides (NOx), and non-methane volatile organic compounds (NMVOCs) (Chandath, Por, Raksmeay, & Archer, 2023). The study also noted that most of the PM2.5 emissions detected were from the five factories that burned wood as a fuel source. Wood-burning factories were the most polluting in terms of emissions of other pollutants like NOx and NMVOCs.

Indoor PM2.5 and PM10 concentrations were generally similar or lower than outdoor and reference concentrations. However, five factories had significantly elevated indoor PM2.5 concentrations, indicating that outdoor air infiltrated indoors, bringing particles. Other types of fuels, such as diesel, gasoline, and LPG, also had substantial emissions. Direct fuel consumption at factories contributed the majority of emissions compared to indirect emissions. Indirect emissions at power stations were the largest source of CO2 emissions from garment factory operations, while direct consumption of LPG, diesel, and gasoline in the factories also contributed significantly. This high level of resource consumption and waste generation underscores the need for the textile and garment sector to adopt more sustainable practices to mitigate its environmental footprint. Therefore, monitoring particulate matter concentrations in 16 factories that comply with WHO guidelines for human health protection is necessary. WHO guidelines set the threshold values that aim to lessen the adverse effects of exposure to air pollutants—the four toxin compounds— that have been

¹⁰ Cambodian League for the Promotion and Defense of Human Rights (LICADHO) works closely with grassroots communities, human rights defenders and activists to monitor, document and investigate human rights abuses in Cambodia. A Cambodian non-governmental organization, LICADHO has been at the forefront of efforts to protect civil, political, economic and social rights in Cambodia, and to promote respect for these rights by the Cambodian government and institutions. <https://www.licadho-cambodia.org/aboutus.php>

¹¹ <https://epa.moe.gov.kh/pdf/post/f7e6c85504ce6e82442c770f7c8606f0.pdf>

linked to cardiovascular illnesses, cancer, respiratory disorders, and other serious health conditions. Flexible, the guidelines offer interim targets for countries with high pollution levels, intending to reduce gradually (WHO, 2021).

The GTF sector also emits **pollutants into the air** from intensive energy use, solid and hazardous waste emissions, noise pollution, and wastewater pollution discharge (Chandath, Chhay Por, Raksmei, & Archer, 2023). The workers and people living in surrounding areas exposed to these pollutants may encounter various problems that irritate the respiratory system, cause bronchitis, cause lung and eye irritation, and deprive body cells of oxygen, which can cause unconsciousness.

Addressing these issues through concerted efforts by manufacturers, policymakers, labor unions, and other stakeholders will be critical to ensuring that Cambodia's textile industry can continue to serve as a reliable source of employment and economic growth while upholding essential environmental and social safeguards. Moreover, the potential areas for improvement may include upgrading production technologies, strengthening occupational health and safety measures, improving wage structures and collective bargaining mechanisms, and fostering more collaborative and transparent industrial relations. By taking a comprehensive approach to enhancing the sustainability and resilience of the textile sector, Cambodia can position itself as a more attractive and responsible partner in the global supply chain.

Some key policies, regulations, and approaches that have been implemented by the government and development partners in Cambodia to reduce the environmental effects of the GTF industry:

- The **Law on Environmental Protection and Natural Resource Management** (1996) was enacted as a fundamental framework for **environmental protection, pollution control, and natural resource management**. The law requires both public and private projects, including those in the textile and garment sector, to conduct EIA. A guidebook was published in 2012 to clarify EIA aspects such as public participation, cumulative assessment, transboundary impacts, and developing mitigation measures (Sharpe, Retamal, & Martinez-Fernandez, 2022).
- The **Sub-Decree on Water Pollution Control (1999)** and **Sub-Decree on Solid Waste Management (1999)** were developed as a critical regulatory framework to control solid waste disposal and reduce water pollution to protect public health and the environment. The sub-decree sets out requirements for **effluent discharge** and installation of wastewater treatment facilities. Chapter 3 of the sub-decree details the procedures for getting permission before discharging effluents. The factories are obligated to install Effluent Treatment Plants (ETPs) and have them inspected by the Ministry of Environment (MoE) inspectors

(Sharpe, Retamal, & Martinez-Fernandez, 2022). Manhattan Special Economic Zone, located in Svay Rieng province, has installed ETPs to treat wastewater, which has improved water quality in the surrounding areas (GGGI, 2021)

- Sub-Decree on **Air Pollution and Noise Disturbance** (2000) prescribes air quality standards and noise level limits for industrial activities, including textile production. These regulations are combined into an Environmental and Natural Resource Code recently approved in 2023.
- Protecting the environment and addressing **climate change** are key areas for sustainable development. MoE developed **Cambodia Climate Change Strategic Plan (CCCSP) 2014–2023** to strengthen sustainable practices and climate resilience in industrial sectors by adopting green technologies that can decarbonize and promote energy efficiency. To fully implement the CCCSP 2014-2023, MoE has conducted various projects and programs to improve public awareness, including four subsequent studies of knowledge, attitudes, and practices—so-called KAP studies. A result from KAP3 showed that 67% of garment workers were aware of climate change, while more than 80% of respondents in the KAP4 were well aware of climate change (NCSD, 2024).
- **National Sustainable Consumption and Production Roadmap¹²** – The National Sustainable Consumption and Production (SCP) Roadmap under the NCSD and MoE is an implementation guide for promoting resource efficiency and reducing environmental impact, energy, and waste.

1.2.3 Social Concerns

Despite the GFT sector's large contribution to socio-economic development, it faces persistent challenges related to occupational safety, low wages, and fragmented industrial relations. These have resulted in working conditions that often lack adequate standards and protections for the workforce (ILO, 2022a).

Although women occupy 85% of the total workforce, **women are over-represented in lower-status and lower-skill roles**¹³. The **wages** do not reflect genuine skills shortages, and workers are not incentivized to acquire appropriate skills to perform their jobs properly. The factories face hard-to-fill vacancies, but their wages seem unlikely to create a stimulating environment. Notably, most workers are young (15-19 years old) from rural areas with **low skills** or **skills mismatch**, which impacts productivity and, more importantly, personal employment security and income. However, the study found that 49.6 % of garment workers, especially females, had

¹² https://www.switch-asia.eu/site/assets/files/3446/cambodia_roadmap_-_july_2022-1.pdf

¹³

https://www.care.org.au/wp-content/uploads/2017/04/SHCS_Brief-Women-Cambodia-Garment-Industry-March-2017_CA.pdf, accessed on July 5, 2024

never received any training, and 67 % of workers did not show any interest in receiving any skills training in relation to their current job (CDRI, 2021).

Furthermore, 28.6 %, or nearly one in three female garment factory workers, report experiencing **sexual harassment** over the last 12 months in their workplace. Women and men in the garment industry also perceive a regular and daily risk of sexual harassment outside the workplace. 16.5% of women and 7.6% of men have experienced sexual harassment outside the factory during the past year (Care, 2017).

A study by the National Confederation of Christian Trade Unions in The Netherlands (CNV International) and Profundo in 2023 found that almost 80% of the 1197 workers who were interviewed have had to **borrow money to be able to pay for basic daily needs**, like food and medicine. 4 out of 5 garment workers have loans to pay for day-to-day expenses (CNV International, 2023).

Another issue that needs to be addressed is **road safety** for garment and textile workers. AIP Foundation indicated that in 2022, more than 3,900 factory workers were injured, and more than 60 workers died commuting to and from work in the garment and footwear factory sector. Often, many factory workers are crammed into the trucks, causing danger to their safety and well-being. The high risks encountered on their way to work impact the lives of workers and the lives of the family members they support (AIP, 2024).

Labor disputes often exist. Whether it is an individual or collective dispute, the factory staff lacks skills and training in dispute resolution, and assembly line leaders and supervisors lack the training to effectively handle **workers' grievances**. Only a few factories attended training on effective labor dispute resolution from outside organizations like Better Factories Cambodia (BFC), and it was not possible to assess how these skills were applied in the factories. Moreover, dispute resolution at the factory level is prone to conflicts of interest, as factory management may be unwilling to handle complaints to avoid setting precedents for future complaints or demands. Many workers prefer to voice their grievances to external stakeholders, such as brands, as they consider them more reliable and trustworthy than their employers. However, brands rarely step in to address grievances, as they do not consider it their responsibility and do not take sides in the conflict. Lastly, poorly organized unions in the Cambodian garment and textile industry diminish their ability to support workers in voicing their grievances at the factory level, leaving the employer with almost exclusive authority to resolve disputes.

Grievance mechanisms are crucial in improving working conditions in the garment and textile industry. They provide a channel for workers to voice their concerns and complaints related to workplace issues such as health and safety, discrimination, harassment, or wages. Effective grievance mechanisms allow workers to express their

grievances without fear of retaliation, advocate for their rights, and initiate changes to improve their working conditions. This can lead to better labor standards, increased transparency, and improved worker-management relations in the industry. Usually, there are two main categories of grievances: one is workplace-related grievances of an individual nature, such as disputes between workers or between workers and supervisors, or complaints to factory management about production targets, facilities, leaves, etc. Another one is that workplace-related grievances of a collective nature arise between one or more employers and a group of their staff. These may include complaints about employment contract duration, benefits, severance or seniority pay, freedom of association, attendance, etc. The key stakeholders in dispute resolution in this industry include the Ministry of Labor and Vocational Training, the Arbitration Council, the Textile Apparel Footwear and Travel Goods Association in Cambodia, union federations, textile brands, and non-governmental organizations (GIZ, 2023). Factory-level grievance mechanisms in the Cambodian garment and footwear industry are relatively effective for resolving minor individual grievances, with about 90% of cases resolved at this level. However, challenges include informal and improperly organized mechanisms, which are insufficient for resolving complex, serious, or sensitive grievances like discrimination and sexual harassment.

Factory union leadership is often predominantly male, perpetuating a gender imbalance in industrial settings. This is due to historical norms and societal structures that favor men in authority positions, leading to women being underrepresented in decision-making roles within unions. Factory leaders often emerge based on experience, networking, and assertiveness, traits traditionally associated with male workers. Analyses of potential mechanisms show that women in male-majority teams are less confident in their relative performance, less influential, and more swayed by others in team discussions. They also (accurately) believe they will receive less support from team members in a leadership election.¹⁴ This male dominance can lead to a cycle where only a selected group of individuals, often men, are seen as qualified or capable of leading, discouraging women from pursuing leadership roles. A male-dominated leadership structure can reinforce traditional gender stereotypes, discourage women from aspiring to leadership positions, and reduce union effectiveness. This can lead to decreased morale among workers, particularly women, who feel their voices are not heard. The gender dynamics within union leadership can also influence workplace culture, making it difficult for women to voice their concerns or seek support.

The underrepresentation of women in union leadership results in the overlooked representation of their unique challenges and concerns, such as maternity leave, workplace harassment, and equal pay. This lack of advocacy can result in policies that

¹⁴ <https://www.aeaweb.org/conference/2019/preliminary/paper/yRDYfEbZ>

do not address or prioritize the needs of female workers. Diverse leadership can foster innovative solutions and collaborative strategies, benefiting all members and enhancing solidarity among workers. When an issue has different implications for men and women, having multiple women on the committee makes it more likely that the women's views will be heard and not dismissed.¹⁵

Despite Cambodia's progress in establishing a regulatory framework, implementation and enforcement still need to be improved. Strengthening institutional capacity, transparency, and stakeholder collaboration is crucial for effectively applying these regulations and sustainable practices in the garment and textile sector. These shortcomings in the textile industry's operational and labor practices pose risks not only to the well-being of workers but also to the long-term sustainability and competitiveness of the sector.

Social issues associated with the garment and textile industry must be addressed by all relevant stakeholders strategically. In this light, the government, development partners, NGOs, and other stakeholders have jointly worked to address these issues as follows:

- For **working conditions and labor rights**, the government has adopted several laws, regulations, and policies, including Labor Law (1997) Sub-Decree on Occupational Health and Safety (2017), which establishes minimum wage requirements, working hours, and occupational safety and health standards for workers, prohibits child labor and forced labor, mandates employer contributions to social security programs, and outlines specific workplace safety, health, and welfare requirements. The minimum wage for the textile and garment industry is reviewed and adjusted regularly, currently set at \$204 per month (2024). Cambodia's textile and garment industry is regulated by national labor laws and international standards. Key regulations cover employment, wages, working hours, and overtime, with the minimum wage set annually by the National Minimum Wage Council. The law also mandates working conditions, with a maximum of eight hours a day and 48 hours a week, mandatory overtime compensation, paid annual leave, public holidays, and sick leave. Employers must comply with occupational safety and health standards, including providing safe working conditions, necessary safety equipment, and health and safety practices training. Cambodia has a similar score to Bangladesh for the WBL 2.0 indicator on legal frameworks (around 50-60), indicating that its egalitarian laws are moderately developed. The perception of women's rights in practice also remains below 50, indicating that legislative progress is not yet being effectively translated into everyday life.

¹⁵ <https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1743-4580.2008.00219.x>

- The 2016 Trade Union Law and the National **Social Protection Policy** Framework (2016-2025) protect the right to unionize. Still, the unionization process can be cumbersome due to strict requirements for union registration and Most Representative Status (MRS). Social protection measures include maternity leave, child labor restrictions, and protections against workplace discrimination and harassment. Workers are entitled to social protection and healthcare services. According to a report by MLVT, as of August 2024, NSSF [National Social Security Fund] has expanded the scope of healthcare to partner with more than 1573 healthcare facilities across 25 capitals and provinces to serve more than 2.2 million members, including more than 1.56 million workers and more than 430,000 civil servants, former civil servants and veterans, as well as more than 170,000 self-employed individuals (Sen David, 2024).

Despite Cambodia's comprehensive legal framework for labor rights in the garment sector, enforcement remains challenging. Significant gaps exist in compliance and protection for workers, particularly regarding union activities and living wages. Although Cambodia has a comprehensive legal framework for labor rights in the garment sector, enforcement remains difficult. There are major shortcomings in terms of compliance and worker protection, particularly with regard to trade union activities and living wages.

1.2.4 Energy Efficiency

More than 50% of electricity in Cambodia comes from coal and oil as of 2020 (GGGI, 2021). The dependency on fossil fuels will increase to a minimum of 70% by 2030; given the current planning scenario, the government has declared that it would stop further approval of coal plants, instead planning to increase the usage of hydro and renewable energy. **Specifically**, garment factories in Cambodia are mainly using electricity and wood, with wood being the highest, accounting for about 70%. The garment sector in Cambodia consumes an estimated 700,000 m³ of wood annually, with forest wood accounting for 400,000 m³/year. 76% of garment factories continue to rely heavily on forest wood, while only 24% exclusively use plantation wood (Switch Garment project, 2022). The sector's expansion is reflected in its growing energy demand. The Power Development Plan 2022-2040 forecasts that the average growth rate of industrial electricity consumption will increase annually by 14.01% of the total electricity consumption. The growth has led to the doubling of Greenhouse Gas (GHG) emissions from energy consumption in the sector between 2002 and 2012. Global Green Growth Institute's economic modelling projects that a 20% increase in energy efficiency in the garment sector would lead to an increase of 31% in energy productivity by 2030 and US\$ 2 billion of avoided energy costs. The log frame target specific to this Switch Garment project is to decrease GHG emissions by 175,000 tCO₂e by 2025 against the baseline.

Cambodia is committed to increasing its renewable energy capacity by promoting renewable energy sources and developing a National Policy, Strategy, and Action Plan on Energy Efficiency.

- Regarding **energy efficiency (EE)**, the regulatory environment is an important enabling factor for investment. In Cambodia, where sustainable energy practices are still at an early stage, a supportive regulatory environment can accelerate adoption. The National Energy Efficiency Policy (2021-2030)¹⁶ defines policy targets. The National Energy Efficiency Strategy outlines how to achieve the policy targets, and the National Energy Efficiency Action Plan outlines how to implement the proposed strategies. Sustainable finance is an increasingly discussed topic in both the public and private sectors. On the public sector side, the Ministry of Economy and Finance (MEF) and the Ministry of Environment (MoE) are actively involved in the Climate Change Financing Framework and MoE, as well as in the Cambodia Climate Change Alliance, where funding is available to support expenditure and projects aligned with the Climate Change Action Plan. On the private sector side, the Association of Banks in Cambodia (ABC) led the development of the Cambodian Sustainable Finance Principles (CSFP) and Implementation Guidelines for financial institutions. Regarding EE, Cambodia plans to reduce GHG emissions and improve EE by setting a target of a 16% reduction in emissions from the energy sector by 2030. Cambodia also aims to reduce national energy consumption by 20% and national carbon dioxide emissions to 3 million tons annually by 2035 (ADB, 2018; Mika et al., 2021).
- Besides the policies described above, the development sector has also been actively involved in the energy space. ADB and UNDP are working on financing EE projects, and UNIDO is co-implementing an ongoing project that targets resource efficiency and cleaner production. The three ongoing projects are **(1) Energy Efficiency Sector Development Program (EESDP), 2021; (2) Green Industry Awards, 2021; and (3) Energy Efficiency Revolving Fund, 2022**. More laws, regulations, and policies on environmental and resource efficiency, energy and equipment, investments, and green buildings are under development in Cambodia (GGGI, 2021):
- **National Energy Efficiency Policy (NEEP) 2021-2030** - The NEEP 2021 by MME, with assistance from ADB, sets a national target for the reduction of total energy consumption (thermal and electrical) of at least 19% by 2030 vis-a-vis the “Business-as-Usual” (BAU) scenario, from 89,837 GWh to 72,470 GWh. Below are the targets listed by sector:
 - 20% in the industrial sector, from 38,600 GWh to 30,800 GWh
 - 34% in the residential sector, from 17,981 GWh to 11,826 GWh
 - 25% in commercial and public buildings, from 8,552 GWh to 6,431 GWh

¹⁶ <https://ncsd.moe.gov.kh/resources/document/national/energy/efficiency/policy#nogo>

- 29% in public services, from 42 GWh to 30 GWh
- 5% in the transport sector, from 24,662 GWh to 23,383 GWh
- **Cambodia's Power Sector Development Masterplan (2022-2040)**¹⁷—Cambodia's Power Sector Development Masterplan is MME's long-term vision for the power sector through to 2040. Under a medium-growth scenario, power demand is estimated to reach 24,184 GWh in 2025.
- **Sub-decree on Energy Efficiency Standards and Labelling (S&L)**¹⁸ - This MME sub-decree on EE, with the assistance from ADB, UNDP, and CCCA, is based on workshops conducted by the Economic Research Institute of Asia (ERIA) to inform MME on a comprehensive policy and regulatory framework to achieve EE in all sectors for target appliances (lighting, refrigerator, air conditioning, fan, television, water heater, washing machines). Target appliances shall be reviewed in terms of market availability, distribution, power consumption, and market share. Stage 1 of implementation applies to residential appliances, and stage 2 to commercial/ industrial appliances. Priority is given to residential appliances for a broader target.
- The **draft sub-decree energy labeling** for refrigerators and air conditioning is in the final stage of issuance.
- **Prakas for Energy Efficiency** - The Prakas on EE is led by MME with assistance from ADB, UNDP, and CCCA. It lays out Minimum Energy Performance Standards (MEPS)/Energy Efficiency Standards and penalties for noncompliance. The prioritized equipment will be air conditioners and refrigerators, with a target year of 2025.
- The **draft sub-decree for MEPS** for refrigerators and air conditioning is in the final stage of issuance. This sub-decree would empower MME to issue prakas on MEPS.
- **Eco-Labelling Policy**¹⁹—The Eco-Labelling Policy is a joint effort between MISTI and NCSD/MoE. It is still at an early stage, but the policy analysis is completed. The policy promotes awareness and understanding in the marketplace and applies to SMEs and the industrial sector. It starts with Standards and Labelling (S&L), then MEPS, and eco-labeling within a 10-year time span. The timeline of each step will depend on the equipment identified by MISTI.

¹⁷ <https://media.vdb-loi.com/wp-content/uploads/2023/06/Final-PDP-Cambodia-English-version.pdf>

¹⁸

https://data.opendevdevelopmentcambodia.net/en/dataset/0e8252a6-b1d7-492c-83b9-2b9bfe1420e1/resource/618e5300-406c-4567-b6d9-b60b9c2c6d77/download/sub_decree_no_254_11.08.2023.pdf

¹⁹ <https://repository.unescap.org/rest/bitstreams/dccbda1-20b3-46fd-b84c-c8d30fecdd47/retrieve>

- **Solar PV Guidelines**²⁰ - The solar PV guideline is being developed by MME and UNDP and aims to provide technical guidelines for rooftop solar installation.²¹
- **National Energy Efficiency Green Building Concept Development**²² - The Green Building Concept Development is under NCSD/MoE and the Department of Green Economy. The aim is to develop guidelines and certification standards for constructing green buildings, such as minimum green space in residential and commercial sectors, which is not yet for the industrial sector.²³
- **Guidelines and Certification for Green Building**²⁴ - The guidelines and certification are implemented by the Department of Green Economy of the NCSD/MoE and funded by the Mekong-ROK Cooperation with fund management by the Mekong Institute (MI). Both residential and commercial buildings are in focus. Three building components are included in the guideline and certification: energy, water, and material. Target beneficiaries would be SMEs working on improving the design of their building and residential buildings.
- **Construction Law**²⁵—The Construction Law is under development by the Ministry of Land Management, Urban Planning and Construction (MLMUPC) and UNDP. There is discussion around integrating energy regulations into construction. One option is to require minimum efficiency for new and renovated buildings to reduce energy use and emissions, slow down energy demand, and reduce power cuts.

1.3 Indonesia

1.3.1 Overview

Garment-making factories in Indonesia were established in the mid-1970s and have since grown into an important export industry. The garment industry, now the dominant sector within the textile supply chain, is a significant driver of economic growth in Indonesia. Textiles are one of two priority industries in the Indonesian National Industrial Development Plan 2015-2035. **Indonesia achieves a moderate**

²⁰ <https://asiagarmenthub.net/resources/2022/on-site-solar-regulation-and-policy-framework-cambodia-factsheet> , accessed on July 5, 2024

²¹ <https://www.dfdl.com/insights/legal-and-tax-updates/cambodia-launches-principles-for-permitting-the-use-of-rooftop-solar-power/> , accessed on July 5, 2024

²² https://ncsd.moe.gov.kh/sites/default/files/2022-01/Stocktaking_and_Analytical_Options_for_Green_Building_in_Cambodia_2021_En.pdf , accessed on July 5, 2024

²³ <https://www.unescap.org/sites/default/d8files/event-documents/Energy%20Efficiency%20in%20Cambodia%E2%80%99s%20Building%20Sector%20by%20H.E.%20Pak%20Sokharavuth%2C%20Undersecretary%20of%20State%2C%20Ministry%20of%20Environment%2C%20Cambodia.pdf> , accessed on July 5, 2024

²⁴ https://ncsd.moe.gov.kh/sites/default/files/2022-01/Stocktaking_and_Analytical_Options_for_Green_Building_in_Cambodia_2021_En.pdf , accessed on July 5, 2024

²⁵ <https://urbandatabase.khmerstudies.org/get-datas/588> , accessed on July 5, 2024

WBL 2.0 score for legal frameworks (around 60). Therefore, the perception of women's rights in practice is slightly higher, suggesting that legal frameworks are better translated into reality than in Cambodia or Bangladesh.

In 2023, nearly 5,000 large and medium enterprises were involved in textile and garment production, along with more than 500,000 small and micro enterprises. In 2023, the industry employed 3.7 million workers, with 58.7% being women, accounting for 27% of employment in the manufacturing sector (Sharpe, Retamal, & Fernandez, 2022). The sector export earnings reached US\$13.02 billion or 5.62% of the country's total export earnings. The main export destinations are the US, Japan, China, South Korea, and Germany²⁶.

The textile and garment industry in Indonesia includes all aspects of production, including natural and synthetic fiber making, textile spinning, weaving, knitting, dyeing/printing, and production of garments, carpets, and other textile products. Traditional textile production is still in operation, but the modern garment industry is dominated by synthetic yarns and has been described as "low-end, large scale."

The industry, however, faces substantial challenges, including environmental impacts, inefficient energy consumption, GHG emission, wastewater, and other social issues related to working conditions, low wages, unsafe workplaces, and gender-based violence (Hoffner et al., I, 2021; Bhattacharjee, 2019). Efforts to address these issues include initiatives for sustainable textile production, eco-friendly textile and recycling, and workers' rights.

1.3.2 Environmental Concerns

The most significant environmental impacts are derived from the intensity of water resources use, chemical use (including toxic chemicals), wastewater discharges, and lack of treatment processes, as well as energy use and the carbon intensity of electricity²⁷.

Among the G20 countries, Indonesia is ranked **the second highest in water pollution** caused by the textile industry, with 29.25%, slightly below Turkey (32.21%) (Sarasi, Primiana, Harsanto, & Satyakti, 2023). Indonesia's Citarum River basin houses 60% of the country's textile factories, and the river is one of the most polluted in the world. The river covers an area of approximately 13,000 square kilometers, providing as much as 80% of surface water to Jakarta's water supply, 5% of the water needed for irrigation of rice farms, and over **2000 industrial factories** in the area. It supports over 30 million residents for agricultural, domestic, and personal use. However, the emergence of over 200 textile factories on the river banks has caused serious effects

²⁶ <https://asiagarmenthub.net/agh-countries/indonesia>, accessed on July 5, 2024

²⁷ file:///C:/Users/Yat%20Janin%20Da/Downloads/wcms_893849.pdf, accessed on July 5, 2024

on the river's health. Industrial waste in the river has affected 2300 acres of rice fields with heavy metal contamination, costing economic losses of over USD\$866 million and over two decades of pollution²⁸. Industrial wastewater treatment plants were constructed along the Citarum in the late 1980s but failed to improve water quality. Furthermore, the Public Disclosure of Industrial Pollution (PROPER) approach is currently used to reduce industrial pollution by providing the public with information. However, the program is extremely limited due to its lack of transparency and the scope of regulation, which only covers a minimal number of substances and practices²⁹.

Indonesia, the world's **ninth-largest GHG emitter**³⁰, is also extremely vulnerable to the impacts of climate change. From heavy industries like steel and cement production to "light" industries like food and textile manufacturing, the sector makes up nearly 75% of the country's total greenhouse gas (GHG) emissions.

Recently, textiles have produced 92 million tons of waste each year, and the textile industry is expected to produce 134 million tons of textile waste in 2030³¹. The textile waste ends up being burned because it is considered the cheapest solution and does not require much knowledge.

Indonesia is ***ranked in the top third of countries in terms of climate risk***, with high exposure to extreme events such as floods and droughts and long-term changes from sea level rise, shifts in rainfall patterns, and increasing temperature (World Bank, 2021a).

The government has made great efforts to resolve the environmental impact. The following are some of the key efforts:

- In 2020, the government released its first sustainable development plan covering 2020-2024, aiming to **lower GHG emissions**. Indonesia is committed to reducing carbon and water consumption in the textile and garment industry in the production process to reach its goals. At the Business 20 (B20) summit in Bali in 2022, the Indonesian Chamber of Commerce (KADIN) launched its Net Zero Hub in partnership with World Resource Institute Indonesia, WWF Indonesia, CDP, and the Indonesian Business Council for Sustainable Development to offer business leaders the tools and training to calculate their greenhouse gas emissions, set

²⁸ <https://www.ucanews.com/news/waste-destroys-indonesian-river-that-feeds-farms-report/75661>, accessed on July 5, 2024.

²⁹ <https://blogs.ntu.edu.sg/hp3203-2017-10/indonesian-textiles/pollution-in-the-citarum-river/>, accessed on July 5, 2024

³⁰ https://www.climatewatchdata.org/ghg-emissions?end_year=2021&source=GCP&start_year=1960, accessed on July 5, 2024

³¹ <https://www.thejakartapost.com/business/2023/05/10/roadmap-to-2050-exploring-circular-textiles-in-indonesia-and-beyond.html>, accessed on July 5, 2024

emissions-reduction targets and develop tailored strategies to reach their goals. By November 2022, 80 companies in Indonesia will have joined the Net Zero Hub. Forty have completed GHG accounting boot camps to learn to calculate their emissions, while 30 have worked toward setting net-zero emissions targets. PT Pan Brothers Tbk., a leading garment manufacturer in Indonesia, installed solar panels at its operational and production facilities. The panels are expected to reduce up to 2.1 million tons of carbon emissions annually — equivalent to taking more than 450,000 petrol-powered cars off the roads each year. Apparel One Indonesia, a supplier for Adidas, Puma, and other major clothing brands, is also leaning into solar power and reduced its energy-based carbon emissions by 43% in 2023³².

- The government has worked with local and international partners to develop regulatory frameworks to address environmental issues. Regarding **waste management**, the government enacted the Solid Waste Management Act (2008), focusing on municipal solid waste management using 3R principles, Guidelines for implementing Reduce, Reuse, and Recycle through establishing a Waste Bank program to recycle waste, and other decrees. The government is also implementing circular economy principles, such as promoting recycling, reuse, and reduction of single-use plastics, which can help manage waste effectively and reduce the carbon emissions associated with waste incineration and landfilling. By adopting circular economy practices, Indonesia can work toward decarbonization by mitigating the environmental impact of waste and reducing greenhouse gas emissions (Arisman & Fatimah, 2023).

1.3.3 Social Concerns

Indonesia's garment and textile industry occupies 2.4 % of the global market share, ranking it sixth among its suppliers. The International Labor Organization (ILO) indicates that the industry relies heavily on female workers, contributing significantly to the country's economic achievement. Employing 5.2 million workers, women dominate the workforce of all garment and textile factories in the country. The Fair Wear Indonesia indicates that garment factory work conditions vary widely across Indonesia. They are generally much worse in medium- and small-sized factories, which do not attract the same kind of scrutiny as large factories that produce garments for international brands. Women face worse working conditions, greater risks of mental and physical safety, and wage gap and career inequality (ILO, 2022b). Workers in garment factories across the country report experiences of **workplace violence and sexual harassment**³³. A 2017 survey by the Indonesian women's rights organization Perempuan Mahardika revealed that 56.5% of the 773 women garment

³² <https://www.wri.org/outcomes/indonesian-companies-accelerate-industrial-decarbonization>, accessed on July 4, 2024

³³ <https://www.fairwear.org/programmes/countries/indonesia/>, accessed on July 5, 2024

workers interviewed in a Jakarta industrial complex had been sexually harassed³⁴. The same source pointed out in their interview with all women union leaders that the pervasive sexual harassment and abuse in their factories from supervisors, managers, and male machine technicians had negative consequences for their health, wellbeing, and career progression.

Regarding **gender equality** in the sector, the ILO noticed that of the about 4.2 million workers in Indonesia's textile, clothing, and footwear industry, 58% — 2.4 million — were women. Of all the jobs in the industry, 92.5% are operational, such as production operators, production workers, and transportation operators. In contrast, men occupy senior management positions. Further, only 69% of female textile, clothing, and footwear workers have permanent employee status compared to 75.5% of the total male workers.

The Indonesian government has committed to addressing these social issues by adopting various laws, policies, and programs. **When it comes to compensation, around 52% of the world's economies have legal provisions.** For instance, the **Minimum Wage Law** (2003) ensures regular wage adjustments to improve the living conditions of workers. **Moreover, to address gender-based violence in the workplace, empower women, and promote gender equality, under the 2020-2024 administration, the Ministry of Women's Empowerment and Child Protection of Indonesia has identified five priority areas, including reducing violence against women, increasing women's entrepreneurship, supporting mothers and families, decreasing child labor, and preventing child marriage (Care Indonesia, 2024).** Cooperating with Better Work Indonesia (BWI), a partnership of the ILO and the International Finance Corporation (IFC), the garment industries are combating gender inequality and empowering women workers by providing a series of training programs to offer a greater opportunity for women workers to grow and develop (ILO, 2022b). Meanwhile, Garteks, a CNV International's partner trade union in the garment sector and supported by the STITCH program, has been actively engaged in conducting training on gender-based violence and harassment in the workplace, educating both management and members on advocating for labor rights when they have been violated. Another remarkable contribution by the NGO is the role of the Better Work organization. Its five-year strategy aims to **empower women, reduce sexual harassment, and close the gender pay gap** in the global garment industry. Concerning the occupational safety and health standards (OSH), Indonesian garment factories step up to meet OSH; for example, PT Sumber Bintang Rejeki and PT Kanindo Makmur Jaya are modeled factories that have successfully implemented OSH programs.

³⁴ https://media.business-humanrights.org/media/documents/gbvh_textile.pdf, accessed on July 5, 2024

1.3.4 Energy Efficiency

Indonesia is the largest energy consumer in South-East Asia. Total final energy consumption (TFEC) increased by an average of 4.9% per year from 1990 to 2019, from 36.43 million tonnes of oil equivalent (Mtoe) to 144.78 Mtoe. However, Indonesia championed a new target for a modern energy minimum to capture the link between energy consumption and economic growth. The new threshold raises the bar for minimal energy to 1,000 kilowatt/hour (kWh) per person per year, with at least 300 kWh at home and 700 kWh consumed in the wider economy, ensuring that international efforts to end energy poverty ultimately result in meaningful development outcomes. Still, electricity and gas prices are high compared to other textile-producing countries, which has reduced Indonesia's competitiveness in the international market. The energy cost in Indonesian textile industries accounted for 15-25% of the total production cost. In contrast, 30% of energy saving potential would be achievable in Indonesia by 2025 if Indonesia adopted EE technologies (Dewi, Parinderati, Hendrawan, Dewantoro, & Bayuwega, 2019).

The Indonesian government has made remarkable improvements in the transition to energy efficiency. Indonesia's energy intensity in 2021 is considered better than most G20 member countries. The increase in energy intensity in 2011-2020 is 3%. The government holds the key to effective energy transition in the region and ranks 55 out of 120 countries on the energy transition index (ETI) 2023. The ETI score increased by almost 14% since 2014, with the biggest improvement in transition readiness (55%), supported by infrastructure, regulation, and political commitment, which remain critical enablers of the energy transition. Within system performance, Indonesia's scores on the equitable dimension have shown the most improvement, with the biggest push coming from access to electricity. In addition, the Just Energy Transition Partnership (JETP) for Indonesia was launched to mobilize \$20 billion in public- and private-sector financing over a three- to five-year period to facilitate the country's transition from coal to renewable energy, reduce power-sector emissions and achieve net zero by 2050. It lays out a strategy for the country based on expanding renewables in the energy mix (34% by 2030), reducing on- and off-grid coal-fired electricity generation, and additional commitments to regulatory reforms and energy efficiency. Some leading factories have adopted renewable energy models in their production chain; for instance, MAS Holdings, South Asia's largest apparel and textile manufacturer, has announced that two of its factories in Central Java, Indonesia, have switched entirely to renewable electricity. The two factories are the first MAS manufacturing facilities powered by 100 % green energy. It is part of the company's commitment to reduce greenhouse gas (GHG) emissions by 25.2 % by 2025 from 2019 levels³⁵. Three other factories of Pan Brothers in Boyolali regency, Central Java, began operating rooftop solar panels that can generate a 1,800-kilowatt

35

<https://www.ecotextile.com/2022053029414/materials-production-news/mas-factories-switch-to-renewable-energy.html>, accessed on July 5, 2024.

peak (kwp). All the solar panels will generate 2,554kwp in total and should reduce the equivalent of 2.1 million kg of carbon dioxide each year³⁶.

1.4 Lao PDR

1.4.1 Overview

The garment and textile industry plays a key role in socio-economic development, with exports valued at around \$280 million annually, accounting for 6.2% of its GDP, and employing 30,000 workers, mostly women, in 60 exporting factories and 45 subcontracting firms (UNDP, 2020)³⁷. Most garment factories use a cut-make-trim (CMT) model, where most raw materials and inputs are imported from abroad. Despite this reliance on imported materials, the final garment products are primarily exported to the original companies that place the orders (Oraboune, 2011). The garment industry is highly integrated into the global supply chain, with 67 % of Lao PDR's textile exports destined for the European Union (UNDP, 2020). Yet, because it relies on imports for production, the sector's revenue is reduced. Additionally, the capacity of the industries to process locally is still limited, resulting in fewer opportunities for local factories to prosper, which benefits the country's economy.

Laos has a legal score of around 60-70 on the WBL 2.0 indicator, higher than Bangladesh, Cambodia, and Indonesia. However, the perception of rights remains moderate (50-60), which shows that although the legislative framework is fairly advanced, there is still work to be done to ensure this is reflected in practice. The sector also faces remarkable environmental, social, and energy shortcomings. The wastewater and waste from dyeing and finishing processes affect communities and ecosystems. Additionally, this sector also suffers other social issues, such as gender inequality, lower wages, workplace harassment, skills mismatch, lack of proper vocational training, and poor working conditions. Likely, high energy consumption due to many industries' reliance on fuel and coal results in GHG emissions. In order to address these issues, the government and stakeholders need to collaborate and take concrete actions that promote a sustainable and equitable industry.

1.4.2 Environmental Concerns

50% of garment industries and enterprises are in Borikhamxay, Savannakhet, and Vientiane Capital. Vientiane Capital accounts for 32.8% of all enterprises but employs more than half (52.84%) of all industrial employment. Notably, 49% of all industrial enterprises in Vientiane Capital belong to the “wearing apparel,” while “Grain mill products” represent the largest number of enterprises in Savannakhet. In Borikhamxay, “sawmills, planing, and other wood mills” are the largest industrial

³⁶ <https://east.vc/news/from-portfolios/more-indonesian-companies-installing-rooftop-solar-panels/>, accessed on July 5, 2024

³⁷

<https://www.ilo.org/projects-and-partnerships/projects/improving-garment-sector-lao-pdr-compliance-through-inspection-and-dialogue>, accessed on July 5, 2024

sector. In Khammuane, 33.1% of all enterprises belong to the “wood and cork products” sector. In Xayabury, 50% of all enterprises belong to “sawmills, planing, and other wood mills.” Finally, approximately 30% of all enterprises in Vientiane Capital are in the “furniture and fixtures” industrial sector. Across all **air pollutant emissions**, the “cement, lime, and plaster” sector is the largest emitter, producing 80.87% of its SO₂, NO₂, PM10, and total suspended particulates (TSP) emissions.

Waste management is another important issue in Lao PDR. Waste generation rates in cities vary between 0.7 and 1.4 kilograms per person per day. The current amount of generated waste is estimated at around 910,000 tons annually and is projected to increase to around 1.4 million tons in 2035. About 60 % of the urban waste consists of organics, while 30 % of others are recyclables, with the majority (15-25 %) being plastic content (World Bank, 2021b). However, GGGI claimed that there were no policies or regulations, either at the national or city level, in support of waste-to-resource approaches or the principles of Reduce, Reuse, Recycle (3R). The main policy barrier that could hinder the deployment of waste-to-resource approaches is the restriction of using compost produced from municipal solid waste in crops (GGGI, 2018).

Climate change is another critical issue for the country, as it harms public health and decreases productivity. The temperatures will continue rising, and the dry seasons will last longer. Rainfall, storms, droughts, and floods will become more severe and frequent. Rainfall will become more erratic, and weather events such as droughts or floods will become more extreme³⁸. World Bank explains that shortages of food and water and the dangers of heat for vulnerable groups will likely be the top climate change health challenges for Lao PDR. As a result, agriculture and food systems are under threat as more than 70% of the population live dependently on subsistence agriculture, vulnerable to extreme weather events and disasters—and food insecurity, all of which could lead children to be forced to skip or limit meals, with a rise in malnutrition and the many health problems that bring³⁹.

The strong presence of garment products made in Laos's international markets highlights the industry's critical role in the country's economic development and trade relationships. However, it also indicates the need for the industry to remain agile and responsive to evolving global market demands and sustainability requirements in order to maintain its competitiveness and ensure long-term viability.

Lao PDR has established a comprehensive legal framework to govern the management and utilization of its natural resources, including land, forests, water,

³⁸ <https://www.giz.de/en/downloads/giz2014-en-10-facts-climate-change-laos.pdf>, accessed on July 5, 2024

³⁹ <https://www.who.int/laos/news/detail/08-08-2023-lao-pdr-officials-tackle-the-effects-of-climate-change-on-health>, accessed on July 5, 2024

aquatic resources, and wildlife. Many of these laws and regulations were implemented in the late 1990s and have since been updated and revised.

- The **Environmental Protection Law (EPL)** was enacted in 1999 and revised in 2012 to keep pace with Lao PDR's socio-economic development needs. This law is the key legislation governing environmental protection and management, outlining the principles, regulations, and measures for managing, monitoring, restoring, and safeguarding the environment, particularly on clean technology, addressing water usage limitation, hazardous chemicals restrictions, and waste management. The EPL specifically addresses protecting human health, natural resources, and the richness of nature and measures to reduce global warming. In line with the EPL, the **National Environmental Strategy (NES) 2020-2030** was also established to outline sustainable development focusing on reducing pollution and waste, especially for textile and garment industries. Likely, the **National Pollution Control Strategy and Action Plan 2018-2025** has three approaches to prevent pollution—one is to strengthen environmental laws and institutional capacity; the second is to control all types of pollution control, including monitoring pollution levels and implementing pollution control measures, and the third is to raise public awareness pollution⁴⁰. These regulatory frameworks demonstrate the Lao government's commitment to balancing economic progress with environmental sustainability.
- The **Law on Water and Water Resources (No.23/NA)** was enacted on May 11, 2017, to protect, manage, exploit, and develop water and water resources. It outlines principles, regulations, and measures for ensuring quality, quantity, and sustainable water resources. The law also promotes agriculture and industry, protects the natural and social environment, and aims for sustainable development and socio-economic growth. It aims to meet people's living needs and promote sustainable development.
- The Amended **Forestry Law, No. 06/NA (Dec. 2007)**, aims to ensure sustainable forest conservation, management, and use, making forests a stable source of livelihood for the people. It categorizes forests into three categories: Protection Forest, Conservation Forest (or National Biodiversity Conservation Areas), and Production Forest. Each category is designated a different zone and area, with rich or dense forest, degraded forest, bare forestland, and village-use forest. Moreover, conversion of public forestland to another land use type is only allowed in designated areas if it brings maximum benefits to the nation and the wellbeing of people and is included in the national socio-economic development

⁴⁰ <http://www.gms-eoc.org/uploads/resources/922/attachment/Laos-Pollution-Strategy-Plan-2018-2025-draft.pdf>, accessed on July 5, 2024

plan. Entities approved for forestland conversion are responsible for paying fees for technical services, royalties, and conversion fees. For temporary conversions, land must be restored and trees replanted. If the State converts forestland for agreed purposes, compensation will be provided according to laws and regulations. For permanent forestland conversion for long-term purposes, such as roads or hydropower construction, the State owns the timber and forest resources cut or harvested in those forests or forestlands.

- The **Wildlife and Aquatic Law** (2008) regulates managing, monitoring, conserving, and protecting wildlife and aquatic species in their natural habitats. It aims to promote sustainable regeneration and utilization without harming natural resources or habitats and to prevent species extinction. Wildlife and aquatic species are considered property of the national community, with the State representing the national community in managing them. Wildlife includes terrestrial and aquatic life and is classified into three categories: prohibition, management, and common or general. The Ministry of Agriculture and Forestry recommends that the government consider and approve the species list under these categories. It has the authority to include or remove species from the list of animals in the common or general category.
- The **National Strategy on Climate Change** outlines six principles for its response to climate change. These principles include (a) mainstreaming climate change as a core element in the next social-economic development plan, (b) collaborating with international partners for capacity building and technology transfer, (c) prioritizing capacity building in government agencies, technical institutions, private sector, and local communities, (d) developing integrated solutions and co-benefits, (e) implementing innovative financial instruments for optimal implementation, and (f) leading the way in raising public awareness and understanding of climate change impacts (UNDP, 2020). These principles aim to promote sustainable development, poverty eradication, and low carbon growth. The strategy also emphasizes the importance of capacity building in government agencies, technical institutions, the private sector, and local communities in developing and implementing climate change adaptation and mitigation policies. The strategy also emphasizes the need for mindset transformation towards adaptation and mitigation to mobilize communities to implement these actions.
- The **Regulations on ESIA and IEE** (2013) aim to ensure uniformity in conducting Initial Environmental Examinations for investment projects and activities in Lao PDR that cause environmental and social impacts. The Department of Environment and Social Impact Assessment (DESIA) is responsible for reviewing the ESIA regulation, recommending the issuance of the Environmental

Compliance Certificate (ECC), and conducting compliance monitoring. The Provincial Department of Natural Resources and Environment (PoNRE) reviews and issues the ECC and monitors projects requiring an IEE. The aim is to contribute to sustainable socio-economic development and mitigate global warming adaptation.

1.4.3 Social Concerns

Despite significant contribution to socio-economic development, textile and garment industries in Lao PDR face a considerable **constraint in the labor market**, with large and medium industries losing around 3.5% of their workforce monthly. In comparison, small industries lose just over 6% (World Bank, 2012). Many employees have been with the factory for three years or more, indicating high drop-out rates and churning primarily among new labor market entrants. Low wages and poor working conditions are the main reasons workers leave the factory for another opportunity. The main factors affecting labor productivity are the shortage of skilled labor, low education level of workers, high labor turnover rate, and low capital productivity. The competitiveness of the Lao garment industry is impeded by several factors, such as inefficiency in ports and transportation; weak physical infrastructure, lack of backward linkage or supporting industries; lack of access to market information and finance, low labor productivity, and the like (Vixatsep, 2011). Industries are hesitant to invest in improving labor productivity due to high staff turnover, where attrition rates are high by regional industry standards. It is suggested that strategies to enhance worker wellbeing, reduce turnover, and boost productivity in the garment sector must be practical. These include implementing transition support programs, improved labour market information systems, better worker representation, dispute resolution mechanisms, and a factory improvement program with monitoring/certification systems to encourage firms to improve conditions and attract premium buyers.

Additionally, a prolonged period of **high inflation** has changed the job market in the Lao PDR, affected household living standards, and undermined human development. **School dropout** rates remain high at 5%, with boys from low-income households having the highest rate of leaving school. The primary cause of dropouts was the inability to pay schooling costs or the need for children to work and support the family. For instance, young women from rural and peri-urban areas work to earn income and secure a better life for themselves and their families. Many want to continue their education but cannot afford it. Many send remittances home to help siblings gain better education and avoid factory work, which is considered less arduous and offers better income opportunities than household farming (World Bank, 2012). Due to low wages and poor working conditions, large numbers of Laotian workers are seeking work in Thailand, South Korea, and Japan, exposing the workers to debt traps and human trafficking.

The government of Lao PDR has cooperated with development partners and NGOs to resolve these issues by enforcing existing laws, improving workplace conditions, and ensuring fair wages in the garment and textile industry. The commitment is shown through the development of regulatory frameworks as follows:

- The **Labour Law (2013)** aims to enhance the quality and productivity of work by defining principles, regulations, and measures on administration, monitoring, labor skills development, recruitment, and labor protection against workplace discrimination. It aims to ensure modernization and industrialization, safeguarding employees and employers' rights, legitimate interests, and livelihood improvement. The law also clarifies the hours of work and rest for employees based on the location of labor units and employment conditions. Work hours should not exceed six days per week, and rest time for noon should be no less than one hour per day.
- Aligning with labor law, the **National Plan of Action on Gender Equality (2021-2025)** is a provincial and ministerial framework that aims to promote gender equality and eliminate violence against women and children. In the fourth year of this five-year national plan, more than 780 government officials were trained to carry out the policy at sub-national levels. Over the years, remarkable progress has been made in raising awareness and integrating gender equality measures in various sectors.
- The government has also implemented **the Occupational Safety and Health (OSH) Program, which** provides guidelines and training to factory managers and workers on building safer workplaces in the garment industry. Although many factories still lack adequate safety measures, significant progress has been made. For instance, some garment factories provided additional benefits for their workers, such as social security coverages (SSO), some factories offered dormitories and free meals, and some had shuttle bus services, bonuses, and sick leave benefits or other allowances. One of the factories even offered scholarships for the children of some employees.⁴¹

1.4.4 Energy Efficiency

The total final energy consumption increased at an average annual growth rate of 5% from 1,509 KTOE in 2000 to 3,122 KTOE in 2015. By type of fuel, coal grew the fastest at 28.4% per year, followed by electricity at 13.4% per year⁴². In contrast, the total

⁴¹ <https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/Garment-Study-LaoPDR.pdf>, accessed on July 5, 2024

⁴² https://www.eria.org/uploads/media/0_Lao_PDR_Energy_Statistics_2018_complete_book.pdf, accessed on July 5, 2024

primary energy supply increased from 1,618,000-ton oil equivalent (KTOE) in 2000 to 4,765 KTOE in 2015, at an average annual growth rate of 7.5%. Coal was the highest increase over 2000–2015, at an average rate of 42.2% annually. The electricity supply increased by 15.1% per year from 826 GWh in 2000 to 6,803 GWh in 2015.

- The Lao government has taken some important steps to address these challenges. In 2016, it published the **National Policy on Energy Efficiency and Conservation**, which sets a target of a 10% reduction in energy consumption by 2030 compared to a business-as-usual scenario. This target will be included in the country's first revision of its Nationally Determined Contribution (NDC) to the UNFCCC in 2020. Additionally, the government approved the National Green Growth Strategy (NGGS) in 2019, which identifies the industrial sector as a priority area due to its significance for economic, social, and environmental sustainability. A key focus of the NGGS is "the design and implementation of financial mechanisms that provide industrial entrepreneurs access to efficient, environmentally friendly, energy and raw material-saving modern technologies." These policy initiatives demonstrate Lao PDR's recognition of the need to address the environmental impacts of its industrial sectors, including the textile and garment industry.
- In 2011, the **Renewable Energy Development Strategy** was issued to develop new renewable energy resources that are not yet widely explored and used in the country to replace resources that will be exhausted. This strategy outlines a reduction of dependence on fossil fuels to use biofuel production and solar energy use, which will target 30% of energy consumption from renewable sources by 2025⁴³. In addition, the Lao government also built the Policy on Sustainable Hydropower Development which aims to manage hydropower projects exceeding 15 MW to ensure environmental and social sustainability in the country.

However, successful implementation will require concerted efforts to build capacity, strengthen regulations, and mobilize finance to support adopting more sustainable, energy-efficient technologies and practices across the industry.

1.5 Myanmar

1.5.1 Overview

Myanmar is a SEA country that relies on the garment and textile industry as a main source of socio-economic development. The reinstatement of EU trade preferences, or the Everything But Arms (EBA) initiative, incentivized European investors to develop the industry. Between 2012 and 2022, the value of garment exports from Myanmar rose by over 900%, from around US\$0.9 billion to US\$9.2 billion by 2022.

⁴³ <https://policy.asiapacificenergy.org/node/500>, accessed on July 5, 2024

In 2022, the Myanmar apparel industry exported approx. US\$7.6 billion worth of garments, a further approx. US\$1 billion in footwear and US\$650 million in handbags and luggage (Eurocham Myanmar, 2021)⁴⁴. The industry employs about 738,000 workers, predominantly women ⁴⁵. This sector supported thousands of jobs in industries like logistics, transportation, daycare, and food services, and through revenue redistribution, helping families across the country. Globally, while 77% of economies establish center-based childcare provision, only 47% have set up a centralized, publicly accessible register or database of registered childcare providers.

Although this sector is a very important driver of socio-economic prosperity, substantial social environmental issues and high energy consumption are identified. Some identified topics include poor working conditions, many workers earning less than the minimum wage of 4,800 MMK (approx. \$2.55) per day, unsafe workplaces, long working hours, and violations of workers' rights. Waste and pollution are critical environmental concerns, especially untreated wastewater containing dyes and chemicals. Furthermore, heavy reliance on coal and wood for energy consumption leads to severe air pollution.

Due to its substantial impacts, the government and development partners have committed to improving working conditions, managing environmental impacts, and reducing inefficient energy consumption in the garment and textile industry. Myanmar has a low WBL 2.0 score for legal frameworks (around 40), placing the country among the least advanced in terms of legislation. The perception of women's rights is also low, below 40, reflecting a general lack of gender equality in laws and everyday practices.

1.5.2 Environmental Concerns

The garment factories in Myanmar have significant environmental impacts, including air pollution, water over-extraction, water pollution, solid and hazardous waste disposal issues, and deforestation due to wood fuel use in boilers (Switch Asia, 2019). According to the World Bank's (2012) estimation, the solid waste generation in Myanmar was 5,616 tons/day, with the per capita waste generation of 0.44kg/capita/day. This figure was expected to reach about 21,012 tons/day with 0.85 kg/capita/day by 2025⁴⁶. Moreover, Myanmar has suffered severe climate change, ranking as the world's second most affected country between 2000–2019, as cited in the Climate Change Risk Index 2021. For example, Cyclone Nargis in May

⁴⁴

https://eurocham-myanmar.org/wp-content/uploads/2023/11/Myanmar-Garment-Sector-Factsheet_November-2023.pdf, accessed on July 5, 2024

⁴⁵ file:///C:/Users/Yat%20Janin%20Da/Downloads/wcms_535188.pdf, accessed on July 5, 2024

⁴⁶

https://www.iges.or.jp/en/publication_documents/pub/conferencepaper/en/5775/Myanmar_Baseline+Report+1st+Draft.pdf, accessed on July 5, 2024

2008 killed nearly 140,000 people, while Cyclone Mocha in May 2023, though less deadly, exposed the fragility of local communities due to declining state assistance⁴⁷.

Both government and factory owners have taken action to address the issues mentioned above through the following mechanisms:

- The Ministry of Natural Resources and Environmental Conservation (MONREC) established **National Environmental Quality (Emissions) Guidelines**, which were adopted from International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines to provide technical guidance on good international industry pollution prevention practice that can regulate emissions from industry activities, particularly from garment and textile sector so as to control air and water pollutants⁴⁸.
- Myanmar factory owners are implementing a series of measures to improve their environmental practices. The first step is to measure and monitor the impacts of their operations, hire a dedicated environmental management officer, and empower this officer to guide the company towards improvements. Typical garment factories in Myanmar waste millions of kyats each month due to various wasteful practices, such as compressed air leaks, steam leaks, boiler fuel mismanagement, inadequate machine maintenance, inefficient cooling systems, and water leakages. To save money, energy, water, and waste, factories should focus on consumption key performance indicators (KPIs) and train knowledgeable staff to save resources. Over 200 apparel and footwear factories in Myanmar already supply brands and retailers using the Higg Index or BEPI standards, often rewarding suppliers who demonstrate good environmental performance with larger product orders and longer-term sourcing contracts (Switch Asia, 2019).
- The government partners with relevant stakeholders, including the International Finance Corporation (IFC), to work under the **Partnership for Cleaner Textile (PaCT)** program, which aims to promote sustainable water use and energy efficiency in the textile industry by providing technical assistance and capacity building to factories to implement best practices for environmental sustainability. The government also works with international organizations on the Sustainable Textile Initiative: Together for Change (STITCH) program, which aims to improve environmental standards in the garment industry by focusing on reducing water and energy consumption, minimizing waste, and promoting the use of sustainable resources. These efforts align with the Myanmar Sustainable

⁴⁷

⁴⁸

https://www.myanmar-responsiblebusiness.org/pdf/2015-12-29-National-Environmental-Quality_Emission_Guidelines_en.pdf, accessed on July 5, 2024

Development Plan (MSDP) 2018-2030, which aims to promote sustainable industrial practices, using cleaner production techniques and adopting energy efficiency measures⁴⁹.

- The effects of climate change have become a key topic that the government has put much effort into addressing. Myanmar Climate Change Strategy (MCCS 2018-2030) aims to materialize the **Myanmar Climate Change Policy** (MCCP) Vision for the country to be a climate-resilient, low-carbon society that is sustainable, prosperous, and inclusive for the well-being of present and future generations. The objectives of the strategy are to enhance the resilience of socio-economic development to climate change and to control GHG emissions that contribute to global climate change.

1.5.3 Social Concerns

The garment industry in Myanmar is a significant employment source, particularly for young migrant women from rural areas. As of January 2022, it employed 500,000 workers, accounting for 2.3% of total employment and 23% of manufacturing sector jobs (MGMA, 2022). Women play a significant role in garment firms, with 85% of garment workers and 56% of garment firm managers being women, according to a World Bank survey of 100 garment firms. The Myanmar garment industry relies heavily on the Cut-Make-Pack (CMP) system and imports raw materials. Large factories operate through joint-venture agreements or are entirely owned by foreign companies. In 2019, 74% of registered garment factories were small or medium-sized enterprises, with 42% being small or less than 500 workers and 32% being medium-sized. Locally-owned factories had 70% small-sized and 20% medium-sized operations (MGMA, 2022). During the COVID-19, garment workers in Myanmar suffered an 8 % net income loss within six months of the COVID-19 pandemic due to supply chain disruptions and lockdown measures.

Some critical issues associated with the garment and textile industry have recently become a great concern to the growth of this sector.

- The military coup in Myanmar on 1 February 2021 has led to a significant deterioration of human and labor rights in the country, with over **150 factories closing and job losses for over 200,000 workers**.⁵⁰ The situation has been further exacerbated by the lack of a rule of law and mechanisms for workers to access remedies. Freedom of association is not respected, and labor rights activists are arrested, making it nearly impossible to address labor rights violations. The dollar's exchange rate has skyrocketed since the coup, and goods prices have

⁴⁹

[https://themimu.info/sites/themimu.info/files/documents/Core_Doc_Myanmar_Sustainable_Development_Plan_2018 - 2030_Aug2018.pdf](https://themimu.info/sites/themimu.info/files/documents/Core_Doc_Myanmar_Sustainable_Development_Plan_2018_-_2030_Aug2018.pdf), accessed on July 5, 2024

⁵⁰ <https://www.fairwear.org/programmes/countries/myanmar/>

increased more than 2.5 times. However, the minimum wage remains at 4,800 kyats or 1.5 US dollars a day, the lowest of all ASEAN countries. Starting from October 2023, workers received 1,000 kyats in addition to the minimum wage, so they have received 5,800 kyats per day.

- The **risks of labor rights violations** in garment factories have increased drastically since the coup. Over 100,000 garment workers from 212 cases face systemic abuses on a daily basis, including forced and mandatory overtime without leave, gender-based violence and harassment, unsafe working conditions, extremely low pay, arbitrary arrests and detention, child labor, and incidents of business-military collusion. The number of complaints about labor rights violations in 124 factories has also increased, with most cases involving wage theft, denial of rights, discrimination, slanderers, and overtime without pay. Moreover, ILO (2015), in its report on 'Myanmar Garment Sub-Sector Value Chain Analysis' mentions that the textile industry in Myanmar is facing many challenges, including high levels of under-aged workers, low productivity, low occupational health and safety standards, and contributions to environment degradation (ILO, 2015). The study by IDRC in 2015 revealed that young workers were participating in the garment sector in Myanmar but usually made up a small percentage of a factory's workforce, and underage workers were rare. However, young workers often worked the same hours as adults, and laws regulating their working hours and conditions were not enforced.⁵¹
- In August 2023, the Business & Human Rights Resource Centre (BHRRC) released a report on the continued abuse of workers' rights under military rule in Myanmar, highlighting the need for urgent action to protect workers in the garment sector.⁵² The report found that **wage reduction and wage theft** continue to be the most reported allegations, and instances of gender-based violence and harassment are widespread. Fair Wear, a garment rights organization, has been active in Myanmar since 2016, recognizing the country with additional risks regarding implementing labor rights. Member brands active in the country have been required to take additional measures according to their Fair Wear Enhanced Monitoring Framework for Myanmar. Since the start of the military coup, Fair Wear has called for an end to the increasingly violent crackdown against leaders of trade unions and labor rights organizations.

In September 2022, Fair Wear's multi-stakeholder Governing Board approved the adapted Fair Wear policy on business in Myanmar, which aligns with calls made

⁵¹ https://www.bsr.org/reports/BSR_Child_Labor_Myanmar_Garment_Sector_2016.pdf

⁵²

<https://www.business-humanrights.org/en/from-us/briefings/falling-out-of-fashion-garment-worker-abuse-under-military-rule-in-myanmar/>

since September 2021 for all Fair Wear member brands to assess their presence in the country as a matter of urgency. Fair Wear's general requirements for brand sourcing in Myanmar have been adapted to include the expectation that member brands start disengaging from Myanmar. In the exceptional case that a member brand chooses to remain engaged in the country, they must provide Fair Wear a rationale and demonstrate how they plan to adequately respect human rights by conducting human rights due diligence. As of 2024, several major brands have exited the country due to difficulties maintaining labor standards and human rights, citing the current political conditions. However, a few brands have chosen to remain, but they face intense scrutiny and must provide detailed plans for managing human rights risks through comprehensive due diligence. Some brands are required to reevaluate their operations to ensure that they can justify robust safeguards and effective grievance mechanisms.

1.5.4 Energy Efficiency

The most common sources of energy generation are electricity, natural gas, coal, gasoline, propane, wood chips, rice husks, sawdust, charcoal, and ammonia. This means that Myanmar's textile and garment industry relies heavily on non-renewable energy, exacerbating environmental issues and contributing to air pollution and GHG emissions. According to the Economic Research Institute for ASEAN and East Asia, the textile and leather industry consumes about 20% of energy (ERIA, 2019). In contrast, a report by the Asian Development Bank (ADB) shows that renewable energy sources share less than 10% of the energy consumed by the garment and textile industry. Given the country's limited energy resources, the high level of energy usage becomes a critical concern, and EE technologies are needed (ADB, 2015).

On the supply side, the total primary energy supply was 20.48 million tons of oil equivalent (Mtoe) in 2019. Natural gas is mainly used for electricity generation and in industry. In 2019, Myanmar had 6034 megawatts (MW) of installed generation capacity and produced almost 23.19 terawatt-hours (TWh) of electricity. During the same year, thermal (coal, natural gas, and oil) and hydro accounted for 57% and 43% of total electricity generation, respectively.

The textile and garment industry in Myanmar faces several challenges in implementing **energy efficiency measures**. These include financial constraints, lack of awareness and knowledge among factory owners and managers, limited technological access, inadequate training and expertise, inconsistent power supply, regulatory and policy gaps, cultural and behavioral barriers, economic pressures, measurement and verification challenges, and environmental and geographical factors. Factories in Myanmar often operate on tight budgets, making investing in energy-efficient technologies and upgrades difficult. The initial cost of energy-efficient machinery, equipment, and infrastructure can be prohibitively high

for smaller businesses. Lack of awareness and knowledge among factory owners and managers about the benefits of energy efficiency and available technologies can lead to resistance to change and a preference for maintaining existing practices.

Limited access to modern, **energy-efficient technology** can be limited due to supply chain issues, import restrictions, or local availability. Inadequate training and expertise are also challenging, as implementing and maintaining energy-efficient practices require specialized knowledge and skills. In addition, regulatory and policy gaps, cultural and behavioral barriers, and environmental and geographical factors also pose challenges. To address these challenges, coordinated efforts from the government, industry stakeholders, and international partners are needed to provide financial support, training, and technical assistance and develop supportive policies and infrastructure improvements.

According to the National Energy Efficiency & Conservation Policy, Strategy and Roadmap of Myanmar by the Asian Development Bank in 2015, Myanmar aims to achieve 20% energy savings in the electricity sector between 2020 and 2030. Specifically, for the industry sector, energy savings is set for 5.34% in 2020, 5.31% in 2025, and 6.63% in 2030.⁵³ If Myanmar adopts energy-efficient manufacturing technologies, the textile industry in Myanmar could reduce its energy consumption by approximately 25 to 29% of energy consumption⁵⁴. To achieve this goal, the government and stakeholders have enacted laws, policies, regulations, and several initiatives, including:

- **National Energy Policy (NEP2014)** aims to provide a framework for energy management, ensure energy security for sustainable economic development, and provide affordable and reliable energy supply to all categories of consumers, especially those living in remote areas. The policy also sets a target for reducing energy consumption and increasing the use of renewable energy sources.
- **National Energy Efficiency and Conservation Policy (NEECP), Strategy and Roadmap for Myanmar (2015):** This policy aims to guide the country toward sustainable energy consumption by promoting energy efficiency and conservation across all sectors. Specifically, it seeks to reduce dependence on imported fuels, improve energy supply reliability, lower energy costs, and minimize environmental impacts.
- **Myanmar Energy Master Plan (2015)** is a comprehensive strategic document that ADB helped develop to guide Myanmar's energy sector development through 2030. The plan targets a share of 15% to 20% of renewable energy in the total installed capacity by 2020. By 2030, the ideal energy scenario generated

⁵³ <https://www.adb.org/sites/default/files/project-documents/46389/46389-001-tacr-en.pdf>, accessed on July 5, 2024.

⁵⁴ <https://www.adb.org/sites/default/files/project-documents/46389/46389-001-tacr-en.pdf>, accessed on July 5, 2024.

from a mix of sources includes 57% hydropower, 30% coal, 8% natural gas, and 5% solar and wind^{55,56}.

1.6 Pakistan

1.6.1 Overview

Pakistan's textile and garment sector significantly contributes to the economy, accounting for 46% of total manufacturing and 67% of exports. It employs 40% of the labor force and contributes 10.20% to the GDP (Safeer, He, Abrar, & Ullah, 2019). Pakistan is the largest manufacturer and exporter of textile goods, with total annual export earnings of \$13.8 billion (Shah, Warraich, & Kazi, 2012). The major markets for Pakistani textile goods are the United States and Europe, accounting for over 63% of the country's total exports and contributing 8.5% to the GDP. Pakistan has one of the lowest WBL 2.0 scores for the legal framework (around 30-40). The perception of rights for women in practice is very low (around 30), showing a significant gap between minimum legislative expectations and women's lived reality.

However, Pakistan's minimal exports are attributed to low-value addition, unskilled labor, quality issues, management vision, and lack of modern machinery. In addition, the textile industry faces significant challenges such as energy crises, fluctuating yarn prices, shortages of gas supply, law and order issues, currency devaluation, lack of research and development institutions, modern equipment, and high production costs. Moreover, the textile value chain sector is growing and has significant potential for exports. To remain competitive, Pakistan needs to develop efficient production systems and reduce production costs to attract long-term customers overseas.

1.6.2 Environmental Concerns

The textile sector in Pakistan faces significant environmental and social issues, including water body pollution and air pollution from spinning and weaving. The textile industry of Pakistan uses a huge amount of solid fuels, causing environmental hazards such as **air pollution**, which affects the nearby community. Moreover, the industry also uses wood as a fuel, which leads to deforestation in neighboring areas and threatens the overall ecosystem. Furthermore, the wastewater released by the sector consists of water pollutants such as Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Total Suspended Solids (TSS), which directly affect human health and cause Hepatitis B and Hepatitis C in the local communities (Hayat, Hussain, & Lohano, 2020). Only 15% of Pakistan's municipal and **industrial wastewater** is treated before being disposed of. Most wet textile manufacturers treat

⁵⁵ https://policy.asiapacificenergy.org/sites/default/files/1_2015-12-Myanmar_Energy_Master_Plan_red-2.pdf, accessed on July 5, 2024.

⁵⁶ https://policy.asiapacificenergy.org/sites/default/files/2_2015-12-Myanmar_Energy_Master_Plan_red-3.pdf, accessed on July 5, 2024.

only a small portion of their effluent before dumping it into the Sea⁵⁷. Furthermore, the industry sector emits **5% of the country's GHG emissions**, while the textile industry contributes around 9.5% to the country-level industrial GHG emissions and 0.095% to the global GHG emissions.

Pakistan is a **top sufferer of climate change**. Every time a climate event hits the country, its development is pushed decades back. Thus, Pakistan needs to enhance its social and environmental compliance to make its economic development sustainable, and the global community needs to support this development, especially in this era of harsh climatic events⁵⁸. In Pakistan, climate change poses a serious challenge to social, environmental, and economic development and leads to migration within and across national borders of Pakistan. The effects of global climate change in Pakistan are already evident in the form of the growing frequency of droughts, flooding, increasingly erratic weather behavior, changes in agricultural patterns, reduction in freshwater supply, and the loss of biodiversity. Mitigating and adapting actions are considered to be the two key ways of combating climate change. The more immediate and pressing task for the country is to prepare itself for adaptation to climate change. These policy measures address issues in various sectors such as water, agriculture, forestry, coastal areas, biodiversity, and other vulnerable ecosystems. Notwithstanding the fact that Pakistan's contribution to global greenhouse gas (GGG) emissions is small, its role as a responsible member of the global community in combating climate change is dedicated by giving due importance to mitigation efforts in sectors such as energy, transport, forestry, and agriculture.

- As people become more aware of the need for a more responsible approach to the environment, Pakistani textile firms are implementing Sustainable Business Practices, such as **Net Zero Pakistan**, a national partnership involving businesses, government organizations, and sectoral specialists to achieve Pakistan's net zero carbon target by 2050 (Sattar & Urooj, 2022). The alliance aims to set net-zero targets, measure and disclose GHG emissions levels and sources, decarbonize value chains, and advocate for climate action. Moreover, the textile sector also participates in international conventions and platforms like the Better Work Programme, Decent Work Country Programme-IV (2023-27), and The Accord on Fire and Building Safety. The All Pakistan Textile Mills Association (APTMA) has signed an MOU with the National Emergency Operations Centre for Polio Eradication Initiative to create an enabling environment for eradicating polio from Pakistan.

⁵⁷

<https://pide.org.pk/research/environmental-impact-assessment-eia-in-the-textile-industry-a-comparative-study-of-pakistan-and-bangladesh/>, accessed on July 5, 2024.

⁵⁸ <https://aptma.org.pk/pakistans-textile-industrys-battle-with-global-environmental-challenges/>, accessed on July 5, 2024.
<https://www.mocc.gov.pk/SiteImage/Policy/NCCP%20Report.pdf>, accessed on October 6, 2024.

- Pakistani textile companies are implementing government environmental rules and regulations to improve their environmental performance. Despite financial constraints, businesses are willing to invest resources to prevent environmental deterioration with government support. They view regulatory pressure as an opportunity to become more environmentally friendly rather than viewing it as a threat (Sattar & Urooj, 2022).
- Textile firms leverage market competition to improve their environmental performance, focusing on green business practices that uphold ecological standards. International brands often demonstrate a willingness to comply with environmental laws and influence consumers to adopt environmentally friendly habits. Pakistani textile firms implement these strategies, such as long-term contractual relationships with suppliers, contractors, and waste recycling agencies. They also sell cotton waste produced during spinning for inferior yarn and home furnishings production. These efforts help expand into new market niches, grow local and international businesses, and maintain competitiveness, leading to increased market share.
- Pakistani textile firms adhere to international standards like GOTS and BCI, ensuring organic textiles with ecological and social norms. These standards enable producers and processors to export organic fabrics with a single certification in all major markets, increasing sales and revenues. However, several factors hinder textile firms from adopting sustainable business practices despite their efforts to achieve these standards.
- Pakistan's textile exports to Europe and the US have increased due to a renewed commitment to ESG practices. These markets prioritize sustainability, and failure to meet their stringent criteria could jeopardize Pakistan's exports. Pakistan has proactively embraced global standards to protect its position, including preserving its Generalized System of Preferences (GSP) Plus status (Akhtar & Urooj, 2024). Europe has led the charge in adopting ESG regulations and mandating compliance, while Pakistan has risen to the challenge. The textile industry is transforming in response to ESG demands, with industry leaders proving that ESG compliance can enhance competitiveness rather than hinder it.
- The industry's commitment to environmental sustainability and women's empowerment is evident in its alignment with Vision 2050. Companies adopt responsible sourcing, renewable energy, water stewardship, energy conservation,

carbon sink enhancement, and employee welfare. They have achieved significant reductions in water consumption, energy savings, and emissions elimination, embracing the green revolution in the supply chain. Additionally, companies' community programs, part of effective CSR policies, provide employment opportunities, education, and healthcare access. This demonstrates the effective adherence to social compliance in the industry.

1.6.3 Social Concerns

The Pakistani textile and fashion industry faces challenges such as poor working conditions, lack of human rights, and environmental standards.⁵⁹ The country is behind in implementing labor standards, including freedom of association and occupational health and safety. Low wages, discrimination against women, and inadequate protection from sexual harassment and violence further exacerbate the situation. A new report revealed details of how factories used by some of the world's biggest fashion brands, like GAP, Adidas, Asda, H&M, M&S, Puma, Levi's, Primark, and Boohoo and Inditex, are violating minimum wage requirements, enforcing excessive hours (when it comes to the workplace, workers in 36% of mondials economies have the option of requesting flexible working arrangements, either through flexitime or teleworking), ignoring health and safety concerns, and avoiding compensation for injured and killed workers. Low wages combined with high inflation have resulted in 70% of surveyed workers finding it difficult to cover household expenses such as electricity bills, and 21% were not sending children to school because they could no longer afford it⁶⁰.

Despite women making up more than half of the workforce in the GFT sector, they are vulnerable to gender-based violence that frequently occurs in the industry because their voices are not well-heard, and they themselves are not confident to report the case (Sophia Kulow, 2021). A report by Global Labor Justice in Asia found that "rape, slapping, bullying and misuse of power to pursue inappropriate and forced relationships were very common amongst female workers (Anyach Oudhary, 2021). A report against an H&M factory in Bangalore alleges that a batch supervisor physically assaulted a female worker for not meeting her quota. The worker, Radhika, filed a complaint, and the supervisor was told to stop harassing her. However, the situation remained unresolved. In another Indian factory, Roja R., a married woman in her 30s, reported her supervisor stalking her and repeatedly calling her after work hours, promising sexual favors and lighter workloads. When she complained to the factory's administration, they dismissed her complaints as normal and advised her to take the harassment seriously.⁶¹

⁵⁹

[https://www.giz.de/en/downloads/giz2024-en-improvement-of-labour-social-and-environmental-standards-in-pakistans-textile-industry-\(textiles-ii\).pdf](https://www.giz.de/en/downloads/giz2024-en-improvement-of-labour-social-and-environmental-standards-in-pakistans-textile-industry-(textiles-ii).pdf), accessed on July 5, 2024

⁶⁰ <https://labourbehindthelabel.org/press-release-new-report-on-labour-rights-in-pakistan/>, accessed on July 5, 2024

⁶¹ [Gender Based Abuse in the Fashion Industry – Let Clothes Live Long](#)

In Pakistan, women are more vulnerable to abuse due to the country's dire economic situation and, thus, are more likely to succumb to such harassment (Sophia Kulow, 2021). This gender inequality is also evident in the pay gap, where the garment sector gender wage inequality is the highest among all sectors (64.5%) in Pakistan⁶². To take a global view, when it comes to compensation, around 52% of the world's economies have legal provisions.

The government and development partners have significantly improved working conditions, wages, safety, and gender empowerment in the textile industry. The efforts are as follows:

- The Pakistani government has a long history of developing regulatory frameworks related to workers' well-being and protection; for example, the Factories Act of (1934) and the Shops and Establishments Ordinance of (1969) aim to oversee working conditions, the Minimum Wages Ordinance (1961) created to address wage issues, Employment of Children Act (1991) was adopted to prevent labor exploitation and violation of children's rights, the Protection Against Harassment of Women at the Workplace Act (2010) aim to combat gender-based violence and promote women's rights. In 2014, the Punjab Fair Representation of Women Act was enacted to promote the representation and roles of women to a minimum of 33% in each body of the public sector. Another important framework is the Benazir Income Support Program (BISP), a federal unconditional cash transfer poverty reduction program launched in July 2008, with nearly Rs. 90 billion distributed to 5.4 million beneficiaries (low-income households) in 2016.
- Ministry of Commerce is leading initiatives to improve sustainability in the textile industry, focusing on labor rights, social standards, and environmental practices. These efforts aim to boost economic resilience and competitiveness while addressing sector challenges. Major textile companies like MG Apparel and Sarena Textiles are leading these efforts. Micro, Small, and Medium Scale Enterprises (MSMEs) also recognize the need to improve working conditions and enhance competitive potential. With increasing demand from international buyers for sustainably produced textiles, Pakistan's textile industry is undergoing significant modernization, with sustainable production being a key success factor. As Pakistan's Textile Value Chain is disaggregated and strict compliance applies, MSMEs adapt their sustainability goals and implement Environmental, Social, and Governance (ESG) practices to remain competitive and align with international standards.

⁶² <https://www.weforum.org/agenda/2024/04/asia-garment-sector-gender-equality/>, accessed on July 5, 2024

- The government, World Bank, ADB, and ILO have developed programs to promote the welfare and skills of garment workers. For example, the International Labour Organization (ILO) and the International Finance Corporation (IFC) jointly implement the Better Work Program to improve labor standards and competitiveness through training and capacity-building for factory management and workers. World Bank funded about US\$ 50 million for the Punjab Skills Development Program to provide skills, employability, and productivity to garment workers in Punjab. Likely, ADB will fund US\$ 20 million for improving workforce readiness in the Punjab Project⁶³. USAID contributes about US\$ 70 million to promoting gender equality in the garment industry through the Gender Equity Program (GEP) project⁶⁴.

1.6.4 Energy Efficiency

Today, Pakistan is facing a serious energy crisis due to the alarming depletion of energy resources and increasing industry demand, which has badly affected the industrial sector (Masood et al., 2015). The industrial sector contains ginning, spinning, weaving, processing, knitting, stitching, and garments, the largest energy consumer, i.e., 37.6% or 60.21 million TOE of the total energy consumption (O. U. R. Khan, 2016). The textile industry is a major consumer of gas and electricity, accounting for a notable 28 % of the overall electricity and 40 % of the natural gas consumption in the country; however, the energy gap seriously constrains growth in Pakistan. Wasted energy imposes unnecessary costs upon businesses and consumers (Zafar, Fiaz, Ikram, Khan, & Qamar, 2021). Thus, investment in energy efficiency measures within this sector becomes imperative to harvest substantial gains⁶⁵

The government has undertaken key measures to address intensive energy consumption by developing regulatory frameworks and adopting new technologies across sectors. The measures include:

- The Pakistani government enacted the **National Energy Efficiency and Conservation Act** in 2016 to promote energy efficiency and conservation measures. Based on this law, the **National Energy Efficiency and Conservation Authority** (NEECA) was established to implement the law and oversee energy consumption practices across sectors, particularly the garment and textile industry. NEECA then created the **Energy Efficiency and Conservation Program (EECP)**, which aims to save energy usage through regular energy audits, energy management systems, and the adoption of energy-efficient technologies in industries. With the adoption of clean and efficient technologies, the nation has

⁶³ <https://www.adb.org/sites/default/files/project-documents/52069/52069-001-pra-en.pdf>, accessed on July 5, 2024.

⁶⁴ <https://www.usaid.gov/sites/default/files/Gender-Equality-Factsheet-June-2016.pdf>, accessed on July 5, 2024.

⁶⁵ <https://www.brecorder.com/news/40303074>, accessed on July 5, 2024

the potential to save a substantial 10-12 million TOE of primary energy supply. NEECA has set some targets to save approximately 3 million TOE of energy through a range of sector-wide interventions by 2025.

- **Textile and Apparel Policy 2020-2025:** is a comprehensive strategy that aims to transform the textile sector by addressing key challenges, providing financial support, and aligning with global market trends. The policy sets the stage for a vibrant, competitive, sustainable textile industry. To achieve this goal, the policy addresses energy efficiency by promoting the adoption of EE technologies and best practices within the textile industry and using renewable energy sources so as to reduce dependency on fossil fuel imports. The Government of Pakistan developed an \$1,180 million **Energy Efficiency Investment Program** for 2009–2018. 2009 ADB approved up to \$780 million in loans under this program. World Bank then supported the country in developing an energy efficiency roadmap for Pakistan, which requires five years for the country to adopt energy efficiency and conservation (EE&C). The government should allocate one billion rupees contribution to NEECA to implement the EE&C⁶⁶.

1.7 Vietnam

1.7.1 Overview

The textile, leather, and garments industry accounts for nearly 50 % of Vietnam's manufacturing employment (ASEAN Secretariat, 2021). The textile and garment sector significantly contributes to the Vietnamese economy, with exports in textile, clothing, and footwear categories almost doubled over the past five years. Vietnam is now the fifth-largest exporter of textiles and clothing in terms of GDP after China, India, Italy, and Germany. Since 2011, garment exports have increased by 32%, the highest of any nation globally, and more than double the increase experienced in China over the same period. In 2018, the total value of exported textile products increased by 16.7%, accounting for approximately US\$30 billion or 12.5% of national export turnover (Sharpe, Retamal, & Fernandez, 2022).

As of 2021, this sector employed more than 3 million workers. A report from the Vietnam Textile and Apparel Association (VITAS) showed that export turnover reached US\$44.4 billion in 2022, a year-on-year increase of nearly 10 %⁶⁷. However, the start of 2023 brought some headwinds. Exports dipped 19.6% in January and February 2024, reaching \$4.548 billion. This decline raised doubts about the industry's ability to sustain growth momentum amid evolving market movements.

⁶⁶ <https://documents1.worldbank.org/curated/pt/280681555926394575/pdf/Energy-Efficiency-Roadmap-for-Pakistan.pdf>, accessed on July 5, 2024

⁶⁷ <https://vietnamnews.vn/economy/1638944/textile-exports-in-2023-face-most-difficult-year-in-three-decades.html>, accessed on July 5, 2024

Three types of textile and garment firms exist in Vietnam: investor-owned companies (or FDI companies), state-owned corporations, and private (non-state-owned) enterprises. Most Tier 1 suppliers are East Asian firms from the Republic of Korea, Taiwan (China), Hong Kong (China), and mainland China. FDI enterprises dominate export activities, accounting for 62% of Viet Nam's textile and garment exports in 2017. The garment and textile industry in Vietnam adopts the Cut-Make-Trim (CMT) model, accounting for about 70% of the production.

Vietnam ranks higher than the average of the other countries mentioned on the WBL 2.0 indicator, with a legal framework score close to 70. The perception of rights in practice is relatively aligned, at around 60-70, suggesting a more consistent link between laws and their application. Amidst the growth, the sector faces substantial challenges, including high energy and water consumption, air pollution from dyeing processes, a weak system of waste management, and other critical issues, such as low wages, unsafe workplaces, and workplace violence. For the outlook, Vietnam's garment and textile sector is undergoing significant transformation due to the global economic downturn and consumer preference for sustainable alternatives. While this may impact short-term financial stability, shifting towards environmentally friendly production will meet export market regulations and enhance Vietnam's climate action capabilities.

1.7.2 Environmental Concerns

The textile industry in Vietnam is rapidly growing, accounting for 14-15% of the country's total industrial production. However, environmental issues such as wastewater discharges, air emissions, noise, and solid waste still need to be addressed.⁶⁸ The textile production processes and waste generated include the desizing process, scouring process, bleaching process, mercerizing process, dyeing process, printing process, finishing process, and dry process. Desizing removes sizing materials from fabric, while scouring removes waxes and destroys vegetable residues in raw materials. Bleaching processes oxidize colored compounds, releasing pollutants like hypochlorite, chlorine, caustic soda, acids, hydrogen peroxide, and sodium silicate. Mercerizing processes involve immersing fabrics in a strong alkali solution for a short period and then washing off excess alkali. Dyeing processes apply color to the fabric at various stages, generating pollutants such as colors, thickeners, and auxiliaries. Finishing processes preserve textile products by preventing ambient conditions, and the dry process separates the product using centrifuge machines or temperature treatment.

The textile industry generates **solid waste**, including coal residues, cotton dust, fabric residues, waste accessories, and packing wood, paper, metal, and plastic. Solid water

⁶⁸ <https://edepot.wur.nl/32781>

is separated for reuse or recovery. Coal residues account for 35%, cotton dust and fabric residues 20%, and packing and oil residues 22%.

Textile factories frequently use **boilers** in production, generating waste containing SO₂, CO, and NO₂ particles. In 2001, 20 textile companies' fuel demand exceeded the Vietnamese standard⁶⁹. Surveys in Hanoi and Ho Chi Minh found that particle concentration exceeded the maximum allowed by 2 to 3 times, while other parameters met the standard. Volatile solvents, such as chlorine vapor, NO₂, formalin, and acid acetate, are generated during temperature treatment and finish processes, causing respiratory irritation and dusting of cotton. These hazardous emissions pose a significant health risk to workers in the textile industry.

Regarding **wastewater**, textile production is a highly polluting industry, consuming a significant volume of water, energy, dyes, textile auxiliary agents, and chemicals. The production process generates numerous pollutants such as wastewater, waste heat, solid waste, exhaust gas from dryers, and gas emissions from boiler plants. The water norm per ton product is 150-400m³, and the textile industry annually discharges 24-30 million m³ of wastewater to the environment. Only 10% of this wastewater is treated, with the remaining 20-30% discharged directly to body water. Wastewater can occur at any stage of textile production, depending on the types of production processing, dyes used, and equipment type. According to VINATEX (Vietnam Textile Industry), the chemical norm and auxiliary per ton product are 200-1,000kg, and the amount of dyestuff per ton product is 20-80 kg. In 2001, the textile industry employed 3,504,890 tons of dyes and 27,483 tons of other chemicals, with an efficiency of 70-80%. The textile industry generates wastewater containing pollutants from dyes and additives due to large volumes of water and chemicals used in production. However, these pollutants can be removed using appropriate technology and techniques. Firms can neutralize hazardous compounds using chemical agents, or microorganisms can break down organic materials in wastewater, a trend increasingly prevalent in Vietnam's garment manufacturing (Tran, 2023).

Water pollution is a significant issue in Vietnam, with only 30% of industrial wastewater treated in the Red River Delta around Hanoi (Sharpe, Retamal, & Fernandez, 2022). The Vietnamese Government has made significant efforts to establish a regime of environmental protection and regulation. Still, this system has not been able to slow or stem the levels and impacts of environmental damage from industrial activities.

The concentration of the Vietnam industry in sew-cut activities means a focus on low-skill employment and low value-added production. Significant investments in upstream (fiber manufacturing) and midstream (fabric production and dyeing) activities have been made in recent years, rapidly increasing the environmental

⁶⁹ <https://edepot.wur.nl/32781>

impacts of the sector in Viet Nam. These production processes require major investments in technology, clean industrial processes, and regulation to manage the environmental impacts and risks, especially to Vietnam's sensitive and over-utilized water resources.

Key efforts and their potential impacts that the government and development partners have made:

- The textile industry is increasingly sourcing green materials for environmental conservation, reducing chemical usage, and resource conservation. This practice aligns with the requirements of the **Law on Environmental Protection (2020)**, which mandates that factories adhere strictly to environmental standards and undergo regular EIA⁷⁰. Many Vietnamese textile firms use green materials in production, with some establishing research and business development centers. Material suppliers like Faslink are investing in R&D and introducing green textiles made from lotus, coffee, mint, and bamboo, which have lower environmental impacts than traditional textiles.
- **Sustainable Textile and Apparel Program:** Established by the Vietnam Textile and Apparel Association (VITAS), it aims to promote sustainable production practices in the industry. Vietnam's textile and garment industry is encouraged to invest in green technologies, adopt sustainable practices, and ensure transparency in its supply chains. By improving resource efficiency and reducing environmental impact, this program pushes a significant shift towards green transformation, with an increasing focus on producing raw materials from recycled or organic sources. Consumers, brands, and regulators increasingly demand that products be produced environmentally friendly.
- **Greening the Textile Sector:** the guidelines developed by The World Wildlife Fund (WWF) aim to provide practical recommendations for improving environmental performance towards its sustainability goals, such as reducing water and energy consumption, minimizing waste, and promoting the use of sustainable materials⁷¹. The existing legislation documents of Vietnam, which directly address the sector or general manufacturing industries, are structured at different levels⁷². **The National Green Growth Strategy (NGGS) 2012-2020** was a national strategy that supports this guideline. Manufacturing companies in the sector must comply with legal requirements on environmental performance, including laws and regulating documents, as well as other legal documents providing instructions, orientations, and incentives for green transformation.

⁷⁰ https://winrock.org/wp-content/uploads/2023/02/LuatBVM-T-Eng_20230203.pdf, accessed on July 5, 2024

⁷¹ https://wwfasia.awsassets.panda.org/downloads/greening_textile_sector_in_vn_eng.pdf, accessed on July 5, 2024

⁷² https://wwfasia.awsassets.panda.org/downloads/greening_textile_sector_in_vn_eng.pdf

- **Development Strategy to 2030, Vision to 2035:** this long-term strategy aims to promote resource efficiency, reduce waste, and enhance the industry's environmental and social performance. The strategy sets out specific targets, such as⁷³:
 - ❖ GHG emissions should be 15% lower by 2030 and 30% lower by 2050 than in 2014.
 - ❖ Between 2021-2050, energy consumption should decrease by 1-1.5% per year
 - ❖ By 2030:
 - Renewable energy should account for 15-20% of Vietnam's energy supply;
 - Forest cover should be stable at 42%, and
 - 30% of irrigated crops should use advanced water-saving techniques.
 - ❖ By 2050
 - Renewable energy should account for 25-30% of Vietnam's energy;
 - 60% of irrigated crops should use advanced water-saving techniques.

The full impact of this strategy provides a roadmap for sustainable development in the industry.

- **Environmental Impact Reduction Targets:** By 2023, the industry plans to reduce energy consumption by 15% and water consumption by 20%. Achieving these targets will contribute to the industry's overall sustainability and help mitigate its environmental footprint.
- Vietnam's textile and garment industry owes much of its success to its relentless pursuit of technological advancements and innovation.
- ❖ **Digital Transformation:** The industry is undergoing a digital transformation that optimizes processes and boosts efficiency using end-to-end integrated solutions. Digital technologies enable real-time monitoring of production lines, facilitating quick adjustments and quality control.
- ❖ **Automation and Robotics:** reduce labor-intensive tasks, enhance precision, reduce production costs, and make Vietnam's textile and garment products more competitive.

⁷³ <https://www.vietnam-briefing.com/news/vietnams-national-green-growth-strategy-unpacked.html/>, accessed on July 5, 2024

- ❖ **Supply Chain Management:** the real-time tracking, inventory management, and demand forecasting ensure smoother operations and minimize disruptions.
- ❖ **E-commerce and Online Platforms:** The emergence of e-commerce and online platforms has provided more opportunities for reaching global customers directly with consumers, reducing dependence on traditional distribution channels.
- ❖ **Sustainability Solutions:** promote sustainable practices using water and energy-saving technologies, waste reduction solutions, and eco-friendly materials, which are part of the industry's sustainability.

1.7.3 Social Concerns

Although remarkable efforts have been made to improve the working conditions in the garment and textile industry, the sector still faces a number of labor challenges, including high employee turnover, gender-based discrimination, excessive overtime, and low wages⁷⁴. A recent study (Oudhary, 2021) indicates that of the 763 women interviewed in factories in three Vietnamese provinces, 43.1% said they had suffered at least one form of violence and/or harassment in the previous year. A large majority of those interviewed said they had experienced unwelcome verbal abuse and harassment in the past year, and a third had experienced physical harassment, such as kissing, touching, hitting, punching, or leaning.

Another study that interviewed **437,740 workers** on forced labor by the Global Fund to End Modern Slavery in 2021 found that 6.11% (308) of surveyed workers reported experiencing forced labor and could be considered victims of forced labor in the apparel industry (Zhang et al., 2021). About 78.08% of respondents worked in government-registered enterprises, and 21.92% worked in informal garment industries. Roughly one-third (34.37%) of workers in this industry across Vietnam work in the informal sector. Working in the informal sector is more common in the South, while close to 40% of the workforce in Ho Chi Minh City is employed in informal enterprises.

The perception that women and girls should be responsible for unpaid care work is deeply embedded in society. In 2016, a study was undertaken for the first time to estimate time spent on unpaid care work by women and men. It found that Vietnamese women spent around 270-300 minutes per day on unpaid care work compared to 140-170 minutes per day for men.

Furthermore, barriers exist to women's efforts to take senior positions. The IFC revealed that 47% of listed companies in Vietnam have no women on their boards. An ILO study further found that of the 70% of enterprises in Vietnam that have a

⁷⁴ <https://www.fairwear.org/programmes/countries/vietnam/>, accessed on July 5, 2024.

board of directors, only 5% have a gender-balanced board, and only 22% of senior management positions are held by women ⁷⁵.

Regarding the debts among workers, approximately 26.69% of the apparel workers went into debt across Vietnam. About 8.4% of workers report working to pay off an advance wage or loan. In Da Nang, 17.08% of respondents reported working to pay off debts, compared to 9.40% in Thai Binh and 4.92% in Ho Chi Minh City. Among workers who took out a loan, the average original debt in Vietnam was 80.85 million VND. This amount was 103.34 million VND in Thai Binh, compared to 87.72 million in Da Nang and 53.94 million in Ho Chi Minh City. The common average length of debt was around two and a half years, with an average interest rate of 0.59%. The most common reason for a loan is home repair (35.61%), equipment (12.26%), food (8.96%), and transportation to work (16.04%) (Sheldon Zhang et al., 2021).

In addition, Vietnam's long history in the sector means it has strong skills and institutions to support much of the supply chain, including clothing design and localized design-make-sell capabilities. However, these capabilities are weakening as the sector in Vietnam focuses predominantly on sew-cut-trim/garment assembly activities. Garment assembly activities are labor-intensive, using mainly low-skilled labor, but have relatively minor environmental impacts compared to other parts of the supply chain.

There have been numerous attempts by the government of Vietnam, the Vietnam General Confederation of Labour, INGOs, and international organizations to address these labor issues.

- The government and development partners developed programs to **raise awareness** among apparel workers about their rights and empower them to report any abuses or violations by their employers, ultimately promoting a safer work environment. The Ministry of Labor, Invalids, and Social Affairs (MOLISA) is a responsible body that provides legal education and training programs for garment workers. World Bank funded “**Skilling up Vietnam: Preparing the Workforce for a Modern Market Economy**” to strengthen garment workers' skills and capacity for high performance and productivity (World Bank, 2014). The **Better Work Vietnam Program**, funded by ILO and IFC, aims to promote workers' rights by training them on labor standards, improving working conditions, building a safe workplace environment, and conducting awareness campaigns.
- Regarding **gender equality and women empowerment**, the government has undertaken significant efforts by adopting regulatory frameworks, such as the

⁷⁵

https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@asia/@ro-bangkok/@ilo-hanoi/documents/publication/wcms_825083.pdf, accessed on July 5, 2024

Gender Equality Law (2006)⁷⁶ and the National Strategy on Gender Equality. The National Strategy on Gender Equality for 2011-2020 has produced positive indications of the government's efforts to empower women. Based on the National Strategy on Gender Equality (2021-2030), Vietnam expects women to hold key leadership positions in 60% of state management agencies and local administrations at all levels by 2025 and 75% by 2030. The strategy also guarantees that by 2025, 80% of women suffering from domestic and gender-based violence will be given access to at least one of the basic support services, and the figure is expected to reach 90% by 2030. To achieve this goal, one of the key actions is to integrate gender and gender equality into the curriculum at schools and pedagogical universities starting in 2025.

1.7.4 Energy Efficiency

The textile and garment industry consumes 30% of the nation's electricity consumption.⁷⁷ Over the last 30 years, the factories have been powered by a coal-dependent energy supply, which has resulted in some of the fastest-growing greenhouse gas emission (GHG) rates in the world. The dyeing and finishing processes in the garment industry are responsible for 3% of CO2 emissions. Factories in Viet Nam are trying to reduce this considerable footprint. By 2015, its per capita emissions were four times what they were in 2000. Following the pledge made at the UN Climate Change Conference (COP26), Vietnam targets a carbon-neutral status by 2050 through an ambitious decarbonization process, targeting big economic contributors. As a first step, the country is now urgently working to cut its GHG emissions by at least 8% by 2030.⁷⁸ The local industry has planned to reduce energy consumption by 15% and water consumption by 20% by the end of the year. That trajectory is well-aligned with the law on economic and efficient energy use (2010), the law on environmental protection (2022), and other national programs, which include strict audits for high-energy consuming factories and with brands' demands to have their producing partners comply with environmental, social, and governance (ESG) standards.

Vietnam Textile and Apparel Association (VITAS) has recently proposed to the government to secure 18.5 million USD in investment for a sustainable development program for its partner factories. Still, incentives and investments are not yet available as local factories desire. For example, Viet Long factories invest in clean energy through rooftop solar panels, often influenced by brand sourcing. However, challenges persist as brands and factories struggle to meet their goals. The resulting electricity only covers 10-20% of their needs, and the remaining electricity must be

⁷⁶ <https://www.rcrc-resilience-southeastasia.org/wp-content/uploads/2018/01/2006-Law-on-Gender-Equality.pdf>, accessed on July 5, 2024.

⁷⁷ <https://vietnamnet.vn/en/vietnam-s-textile-and-garment-industry-fights-to-survive-2133903.html>, accessed on July 5, 2024

⁷⁸ <https://www.betterwork.org/greening-viet-nams-textile-and-garment-sector-a-high-stakes-challenge/>

purchased from the government, making it difficult to demonstrate a clean energy source.

International partners and investors are also keen to support Vietnam with its transition to a lower carbon, less fossil fuel-reliant economy. The Bank offered US\$158 million in loans and technical support for the Vietnam Energy Efficiency for Industrial Enterprises (VEEIE) Project, which aims to improve energy efficiency in Vietnam's industries. The International Finance Corporation (IFC) has provided technical recommendations to 112 facilities since 2019, saving over 830,000MWh of electricity and generating around 27,000MWh solar power annually, reducing greenhouse gas emissions by over 360,000 tons annually. Vietnam is also one of the countries selected to receive climate financial support from the Just Energy Transition Partnership (JETP), a financing cooperation mechanism aiming to help coal-dependent emerging economies make a just energy transition.

Vietnam's abundant sunlight makes it an ideal location for **solar installations**, with Vietnam ranking eighth in installed solar capacity in 2021. The country has 16,504MW of solar capacity, accounting for 2.3% of the world's total (Tran, 2023). A Danish-owned Specter garment factory, completed in An Giang for \$17 million, was awarded the LEED gold certification for design excellence in energy and environmental management. The factory aims to cut emissions by around 1,600 tons of CO₂ annually, partially powered by solar energy.

A sustainability awareness campaign was launched targeting the workforce, focusing on ways to save water. With its 900-strong workforce, the factory produces knitting garments for the international market. For the past two years, it has embarked on a 5 million USD investment to green its production. Its sustainability measures included machine and equipment replacement, a control system upgrade, waste-heat recovery interventions, workforce training and awareness programs, and 6,500 solar panels in the facility. The new solar system helped reduce about 25% of the electricity used by the company from the national grid and is also a solution that could significantly reduce carbon emissions in the textile industry.

2. Cross-Country Analysis

Textile and apparel manufacturing are key economic drivers in South Asia but major contributors to polluting emissions. Prioritizing its efforts to green the textile sector has the potential to significantly reduce environmental impacts, help optimize economic opportunities, and create new jobs in the region. A shift toward sustainability will help local manufacturers reduce the carbon footprint of their industries. Additionally, it will position them as preferred suppliers to international brands and companies amid a global shift toward diversification. Amidst the growth in the sector, it is clear that countries in the region understand the challenges and

impacts of the garment and textile industries on the environment, society, and energy consumption.

In terms of social impact, the garment and textile industries must address working conditions for employers, workers, unions, and their nearby communities in each country's policies and regulations. For instance, the Law on Labor, Occupational Health and Safety, National Security Fund, Worker Union, or regulations on Minimum Wage. Many other regulations in relation to the social well-being of the workers have also been developed and practiced.

On the environmental management side, the textile and garment industry in each country reviewed has demonstrated positive progress and achieved remarkable outputs in pollution control. Water pollution Acts, Wastewater Management Guidelines, Hazardous Waste Management Standards, Air Pollution Control Acts, and Noise and Vibration Standards are all existing regulation tools these countries have implemented. These regulatory frameworks aim to ensure that the textile and garment industry minimizes its negative environmental footprint and maximizes the positive outcomes for workers, the environment, and the surrounding communities. The development and enforcement of these E&S regulations reflect the increasing priority placed on responsible and sustainable manufacturing practices within the textile and garment sectors of each country. In addition, and beyond just policymaking, there is also a growing emphasis on practical implementation and compliance monitoring to translate these regulations into tangible improvements on the ground. This includes investments in industrial wastewater treatment facilities, emission control technologies, energy efficiency upgrades, worker safety programs, and community engagement initiatives. The holistic approach to addressing social and environmental concerns demonstrates a more comprehensive vision for sustainable development in these key manufacturing industries.

2.1 Environmental Concerns

Globally, the fashion industry creates an estimated 92 million tonnes of textile waste each year. To put that into perspective, the equivalent of one truck full of clothes is dumped in a landfill or burnt every second. If the current trend continues by 2030, we are expected to be discarding 134 million tonnes of textiles a year⁷⁹. Moreover, the global garment and textile industry consumes up to 79 billion cu.m of water per year. Around 2,700 liters of water was consumed for the production of a T-shirt, enough for a person to drink for 2.5 years. The recyclable garment market was estimated at \$6.9 billion in 2022 and is expected to reach \$9.4 billion in 2027, with an annual growth rate of 6.4 % in the period. The sustainable development model is

79

<https://newseu.cgtn.com/news/2021-06-26/Indonesia-s-fast-fashion-pollution-problems-fueled-by-consumer-demand-11oHJceggmc/index.html>, accessed on July 5, 2024

increasingly the choice of consumers, and up to 63 % of consumers consider brands' sustainability when making purchasing decisions ⁸⁰.

In fact, the garment sector is one of the world's most polluting and carbon-intensive industries.⁸¹ One major source of carbon emissions in the textile industry is transportation. Transportation is a significant carbon emitter due to the various stages of the production process, such as shearing, scouring, spinning, and assembly. Martin and Herlaar's (2020) study found that supply chain options for a single wool sweater varied from condensed chains in Sweden, Gotland, Lithuania, and Estonia to those farther away in Australia and Uruguay. Condensed supply chains produced about six kilograms of CO₂ per sweater, while spread-out supply chains produced 14 kg.⁸² This highlights the environmental benefits of optimizing and shortening textile supply chains where feasible.

Moreover, emissions are also a major concern during the actual production of textiles. The manufacture of polyester, a widely used synthetic fiber, is particularly emissions-intensive. Producing 1 kilogram of woven polyester fabric results in the release of 27.2 kg of CO₂.⁸³ It is estimated that 35 % of all microplastics in the ocean come from washing synthetic fabrics and are being ingested by a variety of marine wildlife. Washing clothes releases 500,000 tons of microfibers into the ocean each year — the equivalent of 50 billion plastic bottles.

Beyond greenhouse gas emissions, textile production also contaminates water and land. Textile dyeing and finishing processes account for approximately 20% of the world's water pollution.⁸⁴ This is primarily due to the discharge of untreated or inadequately treated effluent (wastewater) from textile factories, which can contain a range of hazardous chemical contaminants. Addressing the environmental impacts of transportation, production processes, and wastewater management will be crucial for the textile industry to reduce its substantial carbon and ecological footprint. Strategies such as supply chain optimization, process improvements, and enhanced wastewater treatment can help mitigate these environmental challenges.

Textile production has been significantly improved to reduce negative environmental impacts. One promising technology for polyester is dope dyeing, which creates

⁸⁰

<https://vietnamnews.vn/economy/1502117/sustainability-requirements-pose-new-challenges-to-garment-textile-industry.html>, accessed on July 5, 2024

⁸¹ Parsons, L.; Lawreniuk, S.; Sok, S.; & Buckley, J. (2022) Hot trends: How the global garment industry shapes climate change vulnerability in Cambodia. Royal Holloway, University of London and University of Nottingham. <https://www.solidaritycenter.org/wp-content/uploads/2022/07/Hot-Trends-Report.pdf>

⁸² Martin, M., & Herlaar, S. (2020). Environmental and social performance of valorizing waste wool for sweater production. *Sustainable Production and Consumption*, 25, 425-438. <https://doi.org/10.1016/j.spc.2020.11.023>

⁸³ Palacios-Mateo, C., van der Meer, Y., & Seide, G. (2021). Analysis of the polyester clothing value chain to identify key intervention points for sustainability. *Environmental Sciences Europe*, 33(2). <https://doi.org/10.1186/s12302-020-00447-x>

⁸⁴ Palacios-Mateo, C., van der Meer, Y., & Seide, G. (2021). Analysis of the polyester clothing value chain to identify key intervention points for sustainability. *Environmental Sciences Europe*, 33(2). <https://doi.org/10.1186/s12302-020-00447-x>

pigments and fibers simultaneously, resulting in a 30-50% lower environmental impact and less overproduction of materials.⁸⁵ Naturally derived dyes biodegrade more easily, quickly expand in color options, and are less harmful if they escape into the environment. By moving towards more efficient dyeing procedures and incorporating naturally derived dyes, the apparel industry can decrease toxic chemicals released in effluent and reduce the amount of materials wasted during the dyeing process.

Government support is critical in encouraging environmental sustainability in SMEs in developed countries. However, the evidence of regulations shaping environmental intentions is less clear in developing countries, possibly due to weaker regulatory institutions (Berry, Sharpe, & Fernandez, 2022). Competitors have been identified as the single stakeholder group influencing the formation of environmentally friendly intentions among owner-managers in developing country contexts. Environmental organizations and associations influence owner-managers to undertake environmental initiatives, suggesting that environmental intentions are not as concerned with managing external stakeholders in emerging markets. This is especially true when regulatory devices are limited in number and not sufficiently known or adopted by businesses, as is the case in Africa and Asia.

To address concerns regarding leather production and contaminated effluent, measures such as reusing processing formulas, replacing salt with boric acid or silica gel for preservation, and using plant-based tanning solutions or chrome exhaustion methods can significantly impact the industry. To decrease emissions during transportation, factories should be chosen geographically closer together, and the type of transport vehicle used can affect the level of carbon emissions released into the environment. Shorter supply chains between industries involved can improve traceability.

Microplastics and microfibers can be controlled during production using lasers instead of scissors and by adjusting the fiber structure during all lifecycle phases. There have been calls for more industry regulations for workers nationally and globally. For example, the organic cotton industry has called for better federal regulation and enforcement regarding chemical drift, while the polyester industry should focus on reducing spills and increasing regulations.

In terms of **environmental management** in the textile and garment industry, The textile and garment industry is not only vulnerable to the effects of climate change but also a significant contributor to the problem. This industry substantially impacts the climate and environment, requiring large amounts of water, energy, and raw materials while generating significant waste and contributing to air and water

⁸⁵ Palacios-Mateo, C., van der Meer, Y., & Seide, G. (2021). Analysis of the polyester clothing value chain to identify key intervention points for sustainability. *Environmental Sciences Europe*, 33(2). <https://doi.org/10.1186/s12302-020-00447-x>

pollution across its value chain. The textile and garment production process consumes substantial volumes of water, and the dyeing and finishing stages produce wastewater that often contains harmful chemicals and heavy metals. The untreated wastewater is frequently discharged directly into water bodies, making the textile industry a major source of water pollution. Additionally, the industry requires significant amounts of energy, primarily from fossil fuel-based sources, which results in the emission of greenhouse gases that exacerbate climate change. A recent synthesis report by the ILO 2022 on Knowledge Intensive Business Services⁸⁶ highlighted the weaknesses in environmental regulatory systems in four focus countries (Bangladesh, Cambodia, Indonesia, and Vietnam). The report identified capacity gaps in specific occupations and business services to support more sophisticated environmental activities. It also underscored the lack of knowledge sharing and learning from previous Environmental Impact Assessments (EIAs) and the absence of a process to compare actual environmental impacts with forecasted impacts and use this knowledge to strengthen future EIA efforts.

Environmental management in the textile and garment sector involves various stakeholders, including government departments responsible for setting up and monitoring laws and regulations; industrial enterprises developing and implementing projects; civil society actors and citizens tracking the effectiveness of regulations; international buyers driving environmental standards; and workers engaged in achieving environmental sustainability goals within their factories. Without the active and dynamic engagement of all these stakeholders, the textile and garment industry will struggle to achieve true environmental sustainability.

To address these environmental and climate challenges, the textile and garment industry is increasingly adopting sustainable practices and technologies, such as the use of organic and recycled raw materials, renewable energy sources, carbon-neutral and zero-discharge production processes, and the implementation of environmental management systems to monitor and reduce the environmental impact of their operations. Some of the specific measures being taken by the Asian textile and garment industry to reduce its environmental footprint include:

- Environmental Management System (EMS)
 - Environmental Policy and Planning: Many textile and garment companies have developed comprehensive environmental policies outlining their commitment to environmental stewardship. These policies set the foundation for planning and implementing environmental objectives and targets across the business. By adopting an Environmental Management System (EMS), companies can closely monitor their resource usage, identify areas for

⁸⁶ <https://www.ilo.org/media/366811/download>

improvement, and implement targeted measures to optimize efficiency and reduce waste.

- Adoption of Sustainable and Resource-Efficient Manufacturing Practices: The textile and garment industry increasingly adopts sustainable and resource-efficient manufacturing practices to minimize water and energy consumption. Strategies such as lean production, eco-design, sustainable management practices, and closed-loop production targets can significantly reduce the environmental impact of textile and garment manufacturing.

Some examples of these sustainable manufacturing practices include:

- Implementing water recycling and wastewater treatment systems to reduce freshwater withdrawal and discharge of polluted effluents.
- Transitioning to renewable energy sources, such as solar or wind power, to reduce reliance on fossil fuel-based energy.
- Optimizing production processes to minimize material waste, energy use, and emissions through techniques like just-in-time manufacturing and process automation.
- Designing products with circularity in mind, using recycled or biodegradable materials, and enabling garment recycling or reuse at the end of their lifecycle.
- Adopting closed-loop production models that reuse and repurpose waste streams as inputs for new manufacturing processes.

▪ Water and Wastewater

- Water-Efficient Technologies: Textile and garment manufacturers are implementing a range of water-saving and water-efficient technologies to reduce their water consumption. Examples include low-water dyeing processes, air dyeing methods, and ozone-washing systems, which can significantly reduce the industry's reliance on freshwater resources.
- Water Pollution Prevention: The industry is implementing various prevention measures to address water pollution. These include reducing toxic chemicals, installing effective wastewater treatment systems, and adopting sustainable water management practices to minimize the discharge of polluted effluents into local water bodies.
- Water Stewardship: Many textile and garment companies embrace water stewardship practices to manage water resources responsibly. This involves reducing overall water usage, implementing water recycling and reuse strategies, and collaborating with local communities to minimize the environmental impact of their water consumption.

- Energy and Greenhouse Gas Emissions

- Renewable Energy: The textile and garment industry increasingly turns to renewable energy sources, such as on-site solar, off-site wind farms, and hydropower, to reduce greenhouse gas emissions and reliance on fossil fuels.
- Energy-Efficient Practices and Technologies: Companies are implementing a range of energy-efficient measures and technologies across their operations. These include upgrading to efficient HVAC systems, implementing good energy management practices, deploying smart building controls, and adopting green building design principles to optimize energy use and minimize carbon emissions.
- Energy Management Systems: The adoption of comprehensive energy management systems enables textile and garment manufacturers to closely monitor their energy consumption, identify areas for improvement, and implement targeted strategies to optimize their energy use and reduce their carbon footprint.
- Carbon Offsetting: As an additional measure, some textile and garment companies are exploring carbon offsetting programs to compensate for their residual emissions by supporting initiatives that reduce or sequester greenhouse gases in other areas.
- Sustainable Sourcing of Raw Materials: Textile and garment brands increasingly source more sustainable and eco-friendly raw materials, such as organic cotton, recycled fibers, and other renewable or recyclable alternatives. This shift aims to reduce the industry's reliance on non-renewable resources and minimize the climate impact of raw material extraction and processing.

- Chemicals

- Chemical Footprint Reduction: Textile and garment manufacturers are exploring various measures to reduce their chemical footprint. This includes reducing chemical usage, implementing closed-loop production systems, and adopting more sustainable production practices to minimize the environmental impact of chemical-intensive textile processes.
- Use of Eco-Friendly Chemicals: The textile and garment industry relies heavily on various chemicals, including dyes, finishes, and coatings. By transitioning to more eco-friendly chemical alternatives, companies can significantly reduce the environmental impact of their textile and garment production.
- Chemical Management: Proper chemical management practices, such as reducing chemical usage, implementing robust safety measures, and adopting sustainable production methods, are crucial for minimizing the environmental impact of the textile and garment industry.

- Chemical Safety and Compliance: Ensuring compliance with relevant safety and environmental regulations is a priority for textile and garment manufacturers. By promoting chemical safety and regulatory compliance, companies can mitigate the potential environmental risks posed by using hazardous chemicals in their operations.
- Waste
- Hazardous Waste Management: The textile and garment industry generates various forms of hazardous waste, including chemical waste, contaminated materials, and wastewater. Implementing effective hazardous waste management practices is essential to minimize the environmental impact of these waste streams.
 - Circular Economy Principles: Embracing the principles of a circular economy, the textile and garment industry focuses on reducing waste generation and promoting recycling and upcycling initiatives. Establishing proper recycling facilities enables the collection and processing of post-industrial and post-consumer waste into new materials and products.
 - Circular Design: Designing textile and garment products for greater durability, repairability, and recyclability is a key strategy for minimizing waste across the industry's value chain.

Lean Manufacturing: Adopting lean production principles and implementing efficient manufacturing techniques can help optimize processes, reduce excess inventory, and minimize waste generation within the textile and garment industry.

2.2 Social Concerns

The apparel industry faces labor issues beyond material sourcing, including health and safety concerns due to exposure to microfibers, dyes, and chemicals. Fire safety is also a concern due to hazardous conditions, machinery, and highly flammable fibers. The lack of understanding of health and safety protocols among workers is blamed, and factory management and regulatory bodies must ensure compliance. This is particularly relevant in developing countries, where labor concerns are consistent across the industry. Therefore, factories must communicate and oversee these protocols effectively. On the other hand, producers could also install better automatic fire alarms, encourage responsible equipment placement, and manage the promotion of "Occupational Health and Safety" in the textile industry. By implementing these necessary regulations, governing and regulatory bodies can force change in an industry that has previously valued profits over impact.

The so-far policy recommendations are 1) to enhance the continuous implementation of social assistance programs for textile and garment workers,

aiming to create an inclusive and resilient system; 2) to continue providing emergency assistance; and 3) to improve identification mechanisms to increase awareness of upskilling and reskilling training. The textile and garment industry should implement social assistance programs to create an inclusive and resilient social safety net. These programs should include income support, unemployment benefits, access to affordable healthcare and social security, skill development and reskilling initiatives, housing and childcare assistance, and targeted support for vulnerable groups like women and migrant workers. By establishing a robust framework, policymakers can create a more resilient workforce that is better equipped to cope with industry-wide challenges. During times of crisis, policymakers should continue providing emergency assistance, such as financial aid, tax relief, and supply chain stabilization measures.

WBL 2.0 also raises the alarm about challenges that remain persistent in childcare and their impact on women's employment: Childcare remains a major challenge for many economies, as evidenced by the results obtained on this new indicator. Women continue to bear a disproportionate burden of unpaid work, devoting on average 2.4 hours more per day than men to these responsibilities, a significant proportion of which is childcare. These disparities limit their participation in the global workforce, which stands at just 50%, compared with almost 75% for men. Limited access to affordable, quality childcare exacerbates the situation. Less than half of economies offer financial assistance or tax breaks to parents of young children, and only 62 economies (less than a third) have established quality standards for these services.

Furthermore, only 47% have a centralized register or publicly accessible database to inform families about registered childcare providers. This lack of infrastructure hinders access to reliable solutions for parents, particularly women seeking to enter or re-enter the job market. This is **a key lever for women's empowerment**. Data shows that widening access to childcare services can significantly increase women's participation in the workforce, with an increase of around one percentage point in the short term and a doubling of this effect within five years. However, despite the importance of this lever, the overall average score for the childcare indicator remains low, at 47.6 out of 100, and 90 of the 190 economies analyzed score 25 or less. **Urgent action is needed.** The backlog in areas such as labor market regulation, accessible and quality childcare, and women's safety underscores the urgent need for improvement. In practice, women's rights in these areas are largely underdeveloped, with only a minority of experts believing that “almost all women” have access to adequate childcare. These shortcomings, although identified, call for concerted action to reduce structural inequalities and enable women to reconcile their family and professional responsibilities.

Additionally, improving identification and awareness mechanisms to increase participation in upskilling and reskilling training programs is crucial. This can involve detailed skills assessments, worker surveys, and collaboration with industry stakeholders. Effective communication and outreach strategies should be employed to ensure workers are aware of available opportunities and encouraged to participate. Implementing these policy recommendations helps build the textile and garment industry into a more resilient, adaptable, and skilled workforce capable of navigating challenges and embracing future opportunities.

3.3. Energy Efficiency

For energy efficiency, the textile and garment industry has, to some extent, adopted diverse energy efficiency technologies for their production processes. These include:

- High-efficiency electric motors (IE1, IE2, IE3, IE3+)
- Variable speed drives (VSDs)
- Power quality solutions like APFC panels and active filters
- Advanced control systems and optimization software (e.g., compact HMI, 800xA, Freelance 800F, open control systems)
- Instrumentation and measurement technologies (e.g., COMMANDER 1900R temperature controllers, 600T pressure transmitters)
- Energy management software like CPM-plus
- Renewable energy applications like solar photovoltaic

The energy source mix also varies across different textile processes - fuel is the dominant energy source in wet processing, while electricity is the major energy input for yarn spinning. Moreover, the rapid growth in energy consumption demands the incorporation of more advanced techniques and technologies that provide energy efficiency improvement opportunities. Saving energy is no longer a luxury but a necessity for the industry to remain competitive.

There are two main approaches to improving energy efficiency in the textile and garment industry – 1) Optimizing existing processes and retrofitting equipment and 2) Replacing old machinery with modern, sophisticated, and efficient technology. While adopting new technology may seem more appealing for quicker energy savings, the upfront capital cost can be challenging. Therefore, it is crucial to thoroughly analyze the benefits of waste, water, material, and other savings to justify the capital investment. It is a wise move if the cost-benefit analysis supports the technological upgrade. Otherwise, focusing on process optimization and retrofitting can be a more prudent approach.

Broader energy management practices are also vital, such as optimizing lighting usage, adopting more energy-efficient electric motors and heating systems, and transitioning to green energy sources like solar, geothermal, wind, and biomass.

Regular energy audits to identify and address inefficiencies are also important. By implementing a comprehensive set of energy efficiency measures, the textile and garment industry can achieve significant cost savings, enhance competitiveness, and reduce its environmental footprint. The industry's shift towards greater energy efficiency is crucial to its long-term sustainability.

Summary of E&S Progress of the Reviewed Countries

Country	Environment	Social	Energy
Cambodia	The textile-linked sectors in Cambodia significantly contribute to environmental issues, generating 85% of industrial waste, 70% of toxic water and air pollution, and consuming 300,000 tons of wood annually for heating.	Cambodia's textile and garment industry is regulated by national labor law and international standards, including minimum wage, working hours, and occupational safety standards. The law also prohibits child and forced labor, mandates employer contributions to social security programs, and outlines workplace safety, health, and welfare requirements. However, enforcement remains a challenge due to strict requirements for union registration and Most Representative Status. Grievance mechanisms are crucial in improving working conditions, but factory-level mechanisms are insufficient for complex, serious, or sensitive grievances. Strengthening institutional capacity, transparency, and stakeholder collaboration is crucial for effectively applying these regulations and sustainable practices in the sector.	The country's energy consumption is primarily coal and oil, with a projected increase of 70% by 2030. The National Energy Efficiency Policy (2021-2030) outlines policy targets and strategies for achieving these targets. The development sector is also actively involved in the energy space, with the ADB and UNDP working on financing EE projects and UNIDO co-implementing an ongoing project targeting resource efficiency and cleaner production. Other laws, regulations, and policies are under development, including the National Sustainable Consumption and Production Roadmap, the National Energy Efficiency Policy 2021-2030, Cambodia's Power Sector Development Masterplan, the Sub-decree on Energy Efficiency Standards and Labelling, the Prakas for Energy Efficiency, Solar PV Guidelines, the National Energy Efficiency Green Building Concept Development, and the Construction Law.
Lao PDR	The country faces challenges from climate change, with rising temperatures, longer dry seasons, and severe weather events. Over 70% of the population relies on subsistence agriculture, putting food security and malnutrition at risk. Laos must adapt to global market demands and	Young women factory workers often send remittances to help siblings gain better education and avoid factory work. High drop-out rates and churning primarily among new labor market entrants result in the sector operating below full capital utilization due to labor shortages. Firms are hesitant to invest in improving labor productivity due to high	The Lao PDR government has set a 10% reduction target in energy consumption by 2030, aiming to improve the country's energy intensity by 3% per year. However, the primary energy intensity level in the country has regressed by 72.3% between 2010 and 2015 due to limited information on energy consumption patterns, a

	sustainability requirements to maintain its competitiveness in its garment and textile sector, complying with Lao PDR's comprehensive legal framework for managing natural resources, including the Environmental Protection Law (EPL) enacted in 1999. The National Environmental Strategy (NES) 2020-2030 focuses on sustainable development, particularly for the textile and garment industries. The National Pollution Control Strategy and Action Plan 2018-2025 aims to strengthen environmental laws, control pollution, and raise public awareness. Policies and regulations are needed to support waste-to-resource approaches and reduce air pollution.	staff turnover, which also leads to insufficient investment in workforce skills upgrading and training. Workers lack voice and representation, leading to a lack of collective bargaining and access to premium buyers, further exacerbating labor supply issues and hindering the industry's ability to attract premium buyers. Law on Labor does not offer much protection for individuals since it offers many loopholes for unscrupulous employers for fact-sheet on Lao's Garment Industry.	lack of capacity for energy efficiency planning and implementation, and a lack of understanding of energy efficiency benefits. The government is also implementing its National Green Growth Strategy, prioritizing the industrial sector for local economic and social development and environmental sustainability.
Vietnam	Vietnam's textile industry faces environmental issues such as wastewater discharges, air emissions, noise, and solid waste. The industry uses boilers, generating waste containing particles, SO₂, CO, and NO₂, which pose a significant health risk to workers. Wastewater production is highly polluting, consuming a substantial volume of water, energy, dyes, textile auxiliary agents, and chemicals. Vietnam's environmental policy is based on regulations and standards, with the Law on Environmental Protection of 1994 being the	Vietnam's garment sector is facing significant risks of forced labor, child labor, and child slavery, according to a 2018 Anti-Slavery International assessment. Workers face excessive working hours, forced overtime, denial of sick leave, and threats of retaliation. The lack of effective institutional protection for workers' rights and a culture of fear and intimidation further exacerbates their precarious circumstances. Trade unions are often seen as extensions of management, and NGOs' role in supporting worker welfare is limited. Addressing these structural vulnerabilities requires a multi-stakeholder approach that strengthens labor	The country ranks eighth in installed solar capacity in 2021, accounting for 2.3% of the world's total. Vietnam's garment factories are facing declining orders and struggling to manage financial strain while prioritizing energy-saving and emission-reducing measures. The textile industry can use steam as a green energy source for various production processes, including yarn production, fabric dyeing, pattern printing, drying, and ironing. The fluidized bed boiler, particularly the "Zero Waste with Biomass" variant, is gaining traction as a clean

	key instrument. The textile industry is increasingly sourcing green materials for environmental conservation and resource conservation.	rights protections, empowers workers, and promotes workplace respect and dignity.	energy solution. Vietnam's textile and garment enterprise successfully integrated saturated steam from a Zero Waste system, demonstrating the potential for integrating environmentally friendly energy solutions into production processes and contributing to the industry's sustainability efforts.
Bangladesh	The rapid growth of Bangladesh's textile and garment industry has led to a concentration of operations in select districts, causing significant harm to human health, ecosystems, and the environment. Despite being profitable, the textile sector has become one of the most polluting. This factory concentration leads to severe air, water, and soil pollution in urban areas, causing negative impacts on the environment. The textile industry in Bangladesh produces 2,000,000 tons of dyes, affecting over 200 rivers. Wastewater from textile and apparel factories is estimated to reach 349 million m³ by 2021. The country has the highest level of antibiotic river pollution, with harmful chemicals found in crops and vegetables. The contaminated water and air also cause gastrointestinal and respiratory diseases. The Bangladesh Environment Conservation	The rapid expansion of the fast fashion industry in Bangladesh has led to significant environmental and social challenges. The textile sector has degraded the living standards of local communities, causing soil erosion and the proliferation of organic and inorganic particulate matter. This has led to public health risks and soil and air quality contamination. The concentration of textile manufacturing hubs in certain districts has also strained local infrastructure, public services, and community cohesion, as the rapid industrialization outpaces the capacity of these areas to adapt and provide for growing populations.	Renewable energy could be a great enabler in the path to decarbonization in Bangladesh. The country's total energy supply is primarily from natural gas and biofuels. However, the industry consumes 26% of the total energy supply, mainly natural gas and coal. The industry has faced disruptions in power supply in the past, and the government is strategizing to make solar energy a long-term priority. Importantly, the Bangladesh government focuses on rooftop solar systems, wind power, net metering, and Decentralized Renewable Energy (DRE) solutions. Floating solar technology is considered a viable option due to the country's abundant water resources, but further research is needed to understand its potential and implementation fully. Off-grid solar solutions are being adopted at a private level, with companies adopting green energy through solar panels, efficient lighting, and manufacturing units.

	Act requires T&A factories to install effluent treatment plants, but few do.		
Pakistan	Pakistan's textile sector faces environmental and social challenges like water and air pollution. To address these issues, Pakistani textile firms are implementing Sustainable Business Practices, such as Net Zero Pakistan, a national partnership to achieve Pakistan's net zero carbon target by 2050. The alliance aims to set net-zero targets, measure and disclose GHG emissions, decarbonize value chains, and advocate for climate action. The sector also participates in international conventions and platforms, such as the Better Work Programme and The Accord on Fire and Building Safety. The All Pakistan Textile Mills Association has signed an MOU with the National Emergency Operations Centre for Polio Eradication Initiative.	The Pakistani textile and fashion industry faces challenges like poor working conditions, human rights issues, and environmental standards. The country is behind in implementing labor standards, leading to low wages, discrimination against women, and inadequate protection from sexual harassment and violence.	Initiatives like smart meters, thermal optimization, and fuel economy standards can help save energy. The National Energy Efficiency and Conservation Authority aims to save 3 million TOE of energy through sector-wide interventions by 2025. Investing in energy efficiency can reduce operational expenses, decrease greenhouse gas emissions, and enhance export competitiveness. In addition, the textile and garment sector faces energy crises due to orthodox processes, conventional infrastructure, inefficient HV, inadequate use of equipment, and non-compliance with standard inspection techniques.
Myanmar	Garment factories in Myanmar face significant environmental challenges, including air pollution, water over-extraction, waste disposal issues, and deforestation due to wood fuel use in boilers. Typical garment factories in Myanmar waste millions of kyats each month due to wasteful practices like compressed air leaks, steam leaks, boiler fuel mismanagement, inadequate machine	Since the coup, labor rights violations in garment factories have significantly increased, with over 100,000 workers facing daily abuses such as forced overtime, gender-based violence, unsafe working conditions, low pay, arbitrary arrests, child labor, and business-military collusion. Complaints about these violations have also increased, with most cases involving wage theft, denial of rights, discrimination, slanderers, and overtime without pay.	The textile and garment industry in Myanmar faces challenges in implementing energy efficiency measures due to financial constraints, lack of awareness, limited access to technology, inadequate training, inconsistent power supply, regulatory gaps, cultural barriers, economic pressures, measurement and verification challenges, and environmental and geographical factors. Coordination between government, industry stakeholders, and international partners

	maintenance, inefficient cooling systems, and water leakages. Over 200 factories in Myanmar supply brands and retailers using the Higg Index or BEPI standards, often rewarding suppliers with larger product orders and longer-term sourcing contracts.		is needed to address these issues and promote sustainable practices.
Indonesia	Indonesia's textile industry is a major environmental concern because of the intensity of water and chemical usage, wastewater discharges with a lack of treatment processes, and carbon-intensive energy use. Indonesia is ranked second highest in water pollution caused by the textile industry, severely impacting local agriculture domestic and personal use. Additionally, the textile industry in Indonesia contributes significantly to Greenhouse Gas emissions and generates 134 million tons of textile waste by 2023. To address this environmental issue, the government has made great efforts to implement its first sustainable development plan (2020-2024) to lower GHG emissions and reduce water and carbon use. The government has also enacted the Solid Waste Management Act (2008) to solve textile waste, focusing on reducing pollution and promoting the circular economy.	Indonesia's garment and textile industry occupies 2.4 % of the global market share and employs 5.2 million workers, most of whom are women. The industry relies heavily on female workers. The women workers face worse working conditions, risks of mental health and physical safety, wage gaps and career inequality, and experiences of workplace violence and sexual harassment. These issues in garment factories vary widely across Indonesia, especially in medium- and small-sized factories. A 2017 survey revealed that 56.5% of female garment workers experienced sexual harassment from their supervisors, managers, and male machine technicians. Regarding gender equality, women occupy lower-level roles, while men dominate senior management positions. To address these social issues, The Indonesian government has shown commitment by adopting a range of laws, policies, and programs like the Minimum Wage Law (2003) and cooperating with Better Work Indonesia (BWI), a partnership of the ILO and the International Finance Corporation (IFC) to combat gender inequality and	Indonesia is the largest energy consumer in South-East Asia. From 1990-2019, Indonesia increased energy consumption by about 4.9% per year, from 36.43 million tonnes of oil equivalent (Mtoe) to 144.78 Mtoe. Even though the Indonesian government championed a new target for a modern energy minimum to capture the link between energy consumption and economic growth, the price of electricity and gas is still high compared to other textile-producing countries, impacting the competitiveness of its textile industry in the international market. The energy cost in Indonesian textile industries accounted for 15-25% of the total production cost compared to similar industries in other countries, which only accounted for 5%. Indonesia ranked 55 out of 120 countries on the Energy Transition Index (ETI) 2023, which increased the score by almost 14% since 2014. The Just Energy Transition Partnership (JETP) for Indonesia was launched to mobilize \$20 billion in public- and private-sector financing over three to five years to support the shift from coal to

	empowering women workers through providing training programs. Concerning the occupational safety and health standards (OSH), Indonesian garment factories step up to meet OSH; for example, PT Sumber Bintang Rejeki and PT Kanindo Makmur Jaya are modeled factories that have successfully implemented OSH programs.	renewables, reduce power-sector emissions, and achieve net zero by 2050. Some leading factories have adopted renewable energy models in their production chain.
--	---	--

9. Reference

- ADB. (2018). *Cambodia: Energy Sector Assessment, Strategy, and Roadmap*. Retrieved from <https://www.adb.org/sites/default/files/institutional-document/479941/cambodia-energy-assessment-road-map.pdf>
- ADB. (2023). *ASEAN and Global Value Chains - Looking into resilience and sustainability*. Retrieved from Manila, Philippines:
- Akhtar, N., & Urooj, A. (Producer). (2024, February 26). Pakistan's textile industry embraces ESG practices: Sustainability that lasts. *Business Recorder*. Retrieved from <https://www.brecorder.com/news/40290663>
- Akter, R., Teicher, J., & Alam, Q. (2024). Gender-Based Violence and Harassment in Bangladesh's Ready-Made Garments (RMG) Industry: Exploring Workplace Well-Being Issues in Policy and Practice. *Sustainability*, 16(5), 2132.
- Al Mamun, M. A., & Hoque, M. M. (2022). The impact of paid employment on women's empowerment: A case study of female garment workers in Bangladesh. *World Development Sustainability*, 1, 100026.
- Anderson Hoffner, L., Simpson, J., Martinez-Fernandez, M. C., & Patumtaewapibal, A. (2021). *Turning up the heat: exploring potential links between climate change and gender-based violence and harassment in the garment sector*: ILO Working Paper.
- Anyach Oudhary. (2021). Gender-Based Abuse in the Fashion Industry. *Let Clothes Live Long*. Retrieved from <https://letclotheslivelong.org/2021/01/17/gender-based-abuse-in-the-fashion-industry/>
- Arisman, & Fatimah, Y. A. (2023). Waste Management in Indonesia: Strategies and Implementation of Sustainable Development Goals (SDGs) and Circular Economy. In S. K. Ghosh & S. K. Ghosh (Eds.), *Circular Economy Adoption: Catalysing Decarbonisation Through Policy Instruments* (pp. 131-157). Singapore: Springer Nature Singapore.
- ASEAN Secretariat. (2021). *ASEAN Investment Report 2020-2021- Investing in Industry 4.0*. Retrieved from Jakarta, Indonesia:
- Basharat, L., & Alam, M. J. (2024). Workplace Environment for Gender Equality and Sustainable Career Planning: The Case of Bangladesh *People, Spaces and Places in Gendered Environments* (Vol. 34, pp. 77-97): Emerald Publishing Limited.
- Berry, F., Sharpe, S., & Fernandez, M. C. M. (2022). *Greening the sector - Environmental initiatives and tools in the Asian garment sector*. Retrieved from ILO Working Paper 52. Geneva:
- Bhattacharjee, S. S. (2019). Fast fashion, production targets, and gender-based violence in Asian garment supply chains *Labor, Global Supply Chains, and the Garment Industry in South Asia* (pp. 207-227): Routledge.
- Biswas, M. K., Azad, A. K., Datta, A., Dutta, S., Roy, S., & Chopra, S. S. (2024). Navigating Sustainability through Greenhouse Gas Emission Inventory: ESG Practices and Energy

- Shift in Bangladesh's Textile and Readymade Garment Industries. *Environmental Pollution*, 345, 123392.
- CDRI. (2021). *What Skills Training Do Cambodian Garment Workers Need?* Retrieved from <https://cdri.org.kh/publication/what-skills-training-do-cambodian-garment-workers-need>
- Chandath, H., Chhay Por, I., Raksmeay, Y., & Archer, D. (2023). Air pollution and workers' health in Cambodia's garment sector.
- Chandath, H., Por, I. C., Raksmeay, Y., & Archer, D. (2023). *Understanding Air Pollution in the Garment Sector and Health Impacts on Workers: A Cambodian Case Study*. Retrieved from Phnom Penh, Cambodia:
- D'Ambrogio, E. (2014). *Workers' conditions in the textile and clothing sector: just an Asian affair? Issues at stake after the Rana Plaza tragedy*. Retrieved from
- Dewi, R. G., Parinderati, R., Hendrawan, I., Dewantoro, M. W. B., & Bayuwega, W. D. (2019). *Energy Efficiency Monitoring in Textile Industries to Achieve GHG Emissions Reduction Target in Indonesia*. Paper presented at the IOP Conference Series: Earth and Environmental Science.
- Dreher, A., Yusuf, R., Ashraf, H., Ahmed, S. A. S., Strümpell, C., & Loerbroks, A. (2023). Work-family conflict, financial issues and their association with self-reported health complaints among ready-made garment workers in Bangladesh: a cross-sectional study. *International Archives of Occupational and Environmental Health*, 96(4), 483-496.
- ERIA. (2019). *Myanmar Energy Statistics 2019*. Retrieved from
- Eurocham Myanmar. (2021). *The Garment Industry in Myanmar: Status Update and Current Dilemmas: Should We Stay or Should We Go?* Retrieved from Yangon, Myanmar:
- GGGI. (2018). *Solid Waste Management in Vientiane, Lao P.D.R: Situation assessment and opportunities for waste-to-resource*. Retrieved from
- GGGI. (2021). *Impact Assessment of Measures to Support Sustainable Energy Investment in the Garment Sector*. Retrieved from Seoul, Republic of Korea:
- Gibbs, A., Jewkes, R., Willan, S., Al Mamun, M., Parvin, K., Yu, M., & Naved, R. (2019). Workplace violence in Bangladesh's garment industry. *Social Science & Medicine*, 235, 112383.
- GIZ. (2021). *Promoting Sustainability in the Textile and Garment Industry in Asia (FABRIC)*. Retrieved from Bonn and Eschborn, Germany:
- GIZ. (2022a). *Bangladesh: Empowering women in the garments industry – Business-driven approaches to gender mainstreaming*. Retrieved from <https://gender-works.giz.de/competitions2020/bangladesh-empowering-women-in-the-garments-industry-business-driven-approaches-to-gender-mainstreaming/>
- GIZ. (2022b). *Fostering a Sustainable Textile Industry in Cambodia - Sustainable Economic Development*. Retrieved from Phnom Penh, Cambodia:
- GIZ. (2023). *Grievance Mechanisms in the Textile and Garment Sector in Cambodia*. Retrieved from Phnom Penh, Cambodia:
- Haque, M. F., Sarker, M. A. R., & Rahman, M. S. (2019). Sexual harassment of female workers in manufacturing sectors in Bangladesh. *Journal of Economics and Business*, 2(3).

- Haseeb, M., Haouas, I., Nasih, M., Mihardjo, L. W., & Jermisittiparsert, K. (2020). Asymmetric impact of textile and clothing manufacturing on carbon-dioxide emissions: Evidence from top Asian economies. *Energy*, 196, 117094.
- Hayat, N., Hussain, A., & Lohano, H. D. (2020). Eco-labeling and sustainability: A case of the textile industry in Pakistan. *Journal of Cleaner Production*, 252, 119807.
doi:<https://doi.org/10.1016/j.jclepro.2019.119807>
- Hossain, L., Sarker, S. K., & Khan, M. S. (2018). Evaluation of present and future wastewater impacts of textile dyeing industries in Bangladesh. *Environmental Development*, 26, 23-33.
- Hultberg, E., & Pal, R. (2021). Lessons on business model scalability for circular economy in the fashion retail value chain: Towards a conceptual model. *Sustainable Production and Consumption*, 28, 686-698.
- ILO. (2015). *Myanmar Garment Sub-Sector Value Chain Analysis*. Retrieved from Yangon, Myanmar:
- ILO. (2017). *Improving Working Conditions in the Ready-Made Garment Sector in Bangladesh (RMG Programme) - Phase I*. Retrieved from
- ILO. (2019). *Securing the competitiveness of Asia's garment sector: A framework for enhancing factory-level productivity*. Retrieved from
https://asiagarmenthub.net/resources/2021/wcms_732907.pdf
- ILO. (2020). *Understanding the Gender Composition and Experience of Ready-Made Garment (RMG) Workers in Bangladesh*. Retrieved from
- ILO. (2021a). *Moving the needle: Gender equality and decent work in Asia's garment sector*. Retrieved from https://asiagarmenthub.net/resources/2021/wcms_807523.pdf
- ILO. (2021b). *Opportunities for a Just Transition to Environmental Sustainability and COVID-19 recovery in the textile and garment sector in Asia*. Retrieved from
<https://webapps.ilo.org/static/english/intserv/working-papers/wp054/index.html#ID0EUC>
- ILO. (2022a). *Cambodia: Garment Industry*. Retrieved from Phnom Penh, Cambodia:
- ILO. (2022b). *Indonesia's garment industry to combat gender inequality and empower women workers*. Retrieved from
<https://www.ilo.org/resource/news/indonesias-garment-industry-combat-gender-inequality-and-empower-women>
- ILO. (2023). *The Rana Plaza disaster ten years on: What has changed?* Retrieved from
<https://webapps.ilo.org/infostories/en-GB/Stories/Country-Focus/rana-plaza#intro>
- Khan, O. U. R. (2016). Promoting Cleaner Production and Energy Efficiency in the Industry of Pakistan: A Case Study of Textile Manufacturing Sector.
- Khan, O. U. R., Clancy, J., & Neinders, J. (2016). Promoting cleaner production and energy efficiency in the industry of Pakistan: A Case Study of the Textile Manufacturing Sector. *University of Twente, Netherlands*, 2015-2016.
- Kunmakara, M. (Producer). (2023, March 13). Textile industry energy audits rising. *The Phnom Penh Post*. Retrieved from
<https://www.phnompenhpost.com/business/textile-industry-energy-audits-rising>

- Masood, A. K., Muhammad, S., Iftikhar, S., Altaf, H., Ullah, W., & Shabbir, F. (2015). Energy efficiency in textile sector of Pakistan: Analysis of energy consumption of air-conditioning unit. *International Journal of Environmental Science and Development*, 6(7), 498.
- MGMA. (2022). *Report of Assessment Survey on Myanmar Garment Industry 2021 - Workers' Perspective*. Retrieved from Yangon, Myanmar:
- Mika, K., Minna, M., Noora, V., Jyrki, L., Jari, K.-o., Anna, A., . . . Nicholas, H. (2021). Situation analysis of energy use and consumption in Cambodia: household access to energy. *Environment, Development and Sustainability*, 23(12), 18631-18655. doi:10.1007/s10668-021-01443-8
- Oraboune, S. (2011). Lao PDR's Industrial Development Policy and Intermediate Goods Trade *Intermediate Goods Trade in East Asia: Economic Deepening Through FTAs/EPAs* (pp. 267-296). Bangkok, Thailand: Bangkok Research Center, IDE-JETRO.
- Safeer, A. A., He, Y., Abrar, M., & Ullah, A. (2019). Diagnostics of the Challenges and Potential Solutions to Improve Export Competitiveness in International Markets: The Case of Pakistani Readymade Garments Industry. *Journal of Competitiveness*, 11(3), 128-143.
- Sarasi, V., Primiana, I., Harsanto, B., & Satyakti, Y. (2023). Sustainable supply chain of Indonesia's textile & apparel industry: opportunities and challenges. *Research Journal of Textile and Apparel, ahead-of-print*(ahead-of-print). doi:10.1108/RJTA-08-2022-0091
- Sattar, S., & Urooj, A. (Producer). (2022, October 28). Sustainable Business Practices in the Textile Sector of Pakistan. *Aptma*. Retrieved from <https://aptma.org.pk/sustainable-business-practices-in-textile-sector-of-pakistan/>
- Shah, W., Warraich, U. A., & Kazi, A. K. (2012). Challenges Faced by Textile Industry of Pakistan: Suggested Solutions. *Kasbit Business Journal*, 5, 33-39.
- Sharna, F. J. (2022). *How Can Bangladesh Strengthen the Law in the Context of Climate Adaptation and Equity for Women? A Study of the Bangladesh Environment Conservation Act, 1995 and Environment Court Act, 2010*. Macquarie University.
- Sharpe, S., Retamal, M., & Fernandez, M. C. M. (2022). *Assessing the impact - Environmental impact assessment in the textile and garment sector in Bangladesh, Cambodia, Indonesia, and Vietnam*. Retrieved from Geneva, ILO:
- Sharpe, S., Retamal, M., & Martinez-Fernandez, M. C. (2022). *Assessing the impact: Environmental impact assessment in the textile and garment sector in Bangladesh, Cambodia, Indonesia and Viet Nam*: ILO Working Paper.
- Sheldon Zhang, Kyle Vincent, Meredith Dank, Katrina Cole, Cameron Burke, Andrea Hughes. (2021). *Prevalence of Forced Labor in Vietnam's Apparel Industry*. Retrieved from https://www.gfems.org/wp-content/uploads/2021/09/VietnamApparelLaborStudy_FinalReport.pdf
- Sophia Kulow. (2021). *Mass Layoffs in Pakistan's Textile Industry Have Led to Increased Gender-Based Violence Among Workers*.
- Sugeng, A. N. R., Romasindah, W., & Saiful, S. (2022). Regulatory and Policy Arrangement of The Textile Industry and National Textile Products for Clothing Resilience.

- Switch Asia. (2019). *Environmental management in Myanmar apparel industry*. Retrieved from Research Note 02/19:
- Tran, M. C. (Producer). (2023, July 12). Green Production in Vietnam's Textile Industry: Progress Report. *Vietnam Briefing*. Retrieved from <https://www.vietnam-briefing.com/news/green-production-in-vietnams-textile-industry-progress-report.html/>
- Uddin, M. A., Begum, M. S., Ashraf, M., Azad, A. K., Adhikary, A. C., & Hossain, M. S. (2023). Water and chemical consumption in the textile processing industry of Bangladesh. *PLOS Sustainability and Transformation*, 2(7), e0000072.
- UNDP. (2020). *Circular economy greenhouse gas mitigation opportunities in Lao PDR - Enhanced nationally determined contribution considering the circular mitigation potential in Lao PDR*. Retrieved from Vientiane:
- Uzzaman, M. A., Xulu-Kasaba, Z. N., & Haque, M. E. (2021). Personal safety and fear of sexual harassment among female garment workers in Bangladesh. *International journal of environmental research and public health*, 18(24), 13406.
- Vixathep, S. (2011). Efficiency and Productivity Change in Lao Garment Industry: A Nonparametric Approach. *Journal of Cooperation Studies*, 19(1), 87-111.
- World Bank. (2012). *Lao PDR - Labour standards and productivity in the garment exports sector - A survey of managers and workers*. Retrieved from Vientiane, Lao PDR:
- World Bank. (2014). *Skilling up Vietnam: Preparing the workforce for a modern market economy*. Retrieved from <https://documents1.worldbank.org/curated/en/729391468126891915/pdf/829400AR0ENGLIOBox0379879B00PUBLIC0.pdf>
- World Bank. (2017a). *Building a Textile and Apparel Market in Bangladesh*. Retrieved from <https://documents1.worldbank.org/curated/en/418051597318106620/pdf/Building-a-Sustainable-Textile-and-Apparel-Market-in-Bangladesh.pdf>
- World Bank. (2017b). *Demand-Side Energy Efficiency Opportunities in Bangladesh*. Retrieved from <https://documents1.worldbank.org/curated/en/845631543398730054/pdf/132544-Bangladesh-Demand-Side-Energy-Efficiency-FINAL.pdf>
- World Bank. (2021a). *Indonesia: Climate Risk Country Profile*. Retrieved from https://climateknowledgeportal.worldbank.org/sites/default/files/2021-05/15504-Indonesia%20Country%20Profile-WEB_0.pdf
- World Bank. (2021b). *World Bank Supporting Lao PDR to Improve Solid and Plastic Waste Management*. Retrieved from <https://documents1.worldbank.org/curated/en/099325012222130931/pdf/P1710110b54c4f02f0971e0bbf37d361e13.pdf>
- World Bank. (2022a). *Bangladesh: Country Climate and Development Report*. Retrieved from <https://openknowledge.worldbank.org/server/api/core/bitstreams/6d66e133-e49d-5ad9-b056-7b1a6c6206ed/content>

- World Bank. (2022b). *Urgent Climate Action Crucial for Bangladesh to Sustain Strong Growth*. Retrieved from <https://www.worldbank.org/en/news/press-release/2022/10/31/urgent-climate-action-crucial-for-bangladesh-to-sustain-strong-growth>
- World Bank. (2024). *Women, Business and the Law 2024: Executive Summary*. International Bank for Reconstruction and Development / The World Bank. <https://openknowledge.worldbank.org/>
- World Economic Forum. (2024). *Bangladesh's leap from poverty to textile powerhouse offers lessons for African countries*. Retrieved from <https://www.weforum.org/agenda/2024/02/how-bangladesh-offers-lessons-for-sustainable-industrialization-in-africa/>
- Zafar, S. S., Fiaz, M., Ikram, A., Khan, K. I., & Qamar, U. M. (2021). Barriers are involved in the energy efficiency in the manufacturing industries of Pakistan. *International Journal of Energy Economics and Policy*, 11(2), 293-299.
- Law on Labor does not offer much protection for individuals since it offers many loopholes for unscrupulous employers.
- <https://cleanclothes.org/resources/publications/factsheets/laos-factsheet-2-2015.pdf>
- ADB. (2015). *Republic of the Union of Myanmar: Institutional Strengthening of National Energy Management Committee in Energy Policy and Planning*. Retrieved from <https://www.adb.org/sites/default/files/project-documents/46389/46389-001-tacr-en.pdf>
- AIP. (2024). *Factory and Garment workers' safety in focus: Cambodia hosts a second national workshop to address and seek solutions for safer commutes to work*. Retrieved from <https://www.aip-foundation.org/factory-and-garment-workers-safety-in-focus-cambodia-hosts-second-national-workshop-to-address-and-seek-solutions-for-safer-commutes-to-work/>
- Care. (2017). *'I know I cannot quit.' The Prevalence and Productivity Cost of Sexual Harassment to the Cambodian Garment Industry*. Retrieved from https://www.care-international.org/files/files/publications/SHCS_Full_Technical_Report_March_2017.pdf
- CNV International. (2023). *Making the case for higher wages in the Cambodian garment sector*. Retrieved from <https://www.cnvinternationaal.nl/Resources/Persistent/6/8/8/4/68845ceff8d7e76c2db893d55067f94a3ff2dd68/CNVI-0394%20Living%20wages%20in%20the%20Cambodian%20textile%20sector%202023%20final.pdf>
- Eurocham-Cambodia. (2021). *Sustainable Textiles*. Retrieved from https://www.eurocham-cambodia.org/uploads/c38ef-sourcing-from-cambodia_sustainable-textile-latest.pdf
- GGGI. (2021). *Sustainable City Strategic Plan 2020-2030 for Seven Secondary Cities*. Retrieved from Khmer Times. (2023, June 2, 2023). Cambodia sets the course for a sustainable, circular textile industry. *Khmer Times*. Retrieved from <https://www.khmertimeskh.com/501300984/cambodia-sets-course-for-sustainable-circular-textile-industry/>
- LICADHO. (2023). *Bound by Bricks: An Opportunity to End Debt Bondage and Child Labour in Cambodia*. Retrieved from <https://www.licadho-cambodia.org/reports.php?perm=243&english>
- NCSD. (2024). *Fourth Study of Understanding Public Perceptions of Climate Change in Cambodia: Knowledge, Attitude, and Practice (KAP4)*. Retrieved from <https://ncsd.moe.gov.kh/dcc/news/consultation/workshop/KAP4>

Sen David. (2024, July 11, 2024). NSSF membership has risen to more than 2 million individuals. *The Khmer Times*. Retrieved from <https://www.khmertimeskh.com/501521102/nssf-membership-rises-to-more-than-2-million-individuals/>