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JUST TRANSITION Convention Bangladesh 2025

Uniting for Just and Fair Future

September 2025

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Disclaimer

Acknowledgements

The Organizing Committee of the Just Transition Convention Bangladesh 2025 extends its heartfelt gratitude to everyone who made this convening possible.

We first acknowledge the workers of Bangladesh from all sectors whose resilience, experience, and aspirations are the foundation of a just climate, energy, and technology transition.

We thank our co-hosts and partners including trade union federations, workers' associations, women and youth networks, civil society organizations, employer bodies, brands and buyers, research institutions, and development partners for their collaboration and solidarity. In particular, we appreciate the leadership and stewardship of Bangladesh Labour Foundation (BLF), Bangladesh Institute of Labour Studies (BILS) and the support of Mondiaal FNV for making this multi-stakeholder platform possible.

Our sincere appreciation goes to Government of Bangladesh counterparts, especially representative from MoLE, DoL and DIFE for constructive engagement toward fair, evidence-based policy pathways.

We are indebted to the speakers, panelists, moderators, and presenter who shared insights and practical roadmaps; to the researchers and contributors whose studies anchor our dialogue in facts; and to the youth leaders and women worker representatives who insisted on inclusion, dignity, and future-ready skills.

This publication benefited from the dedication of our Editorial Board and Content Team, Design & Communications Team, and the Event Secretariat & Volunteers who worked tirelessly on coordination, registrations, outreach, interpretation, media, documentation, and hospitality.

We are grateful to the media community for amplifying worker-centered narratives and to all participants for bringing candor, curiosity, and a commitment to shared solutions.

Finally, any shortcomings are our own. This book is a living document; we welcome feedback to improve future editions and to keep the journey toward a Just Transition accountable, inclusive, and evidence-driven.

On behalf of the Organizing Team
Just Transition Convention Bangladesh 2025

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Preface

The Just Transition Convention Bangladesh 2025 marks a defining moment in our collective journey toward a fair and inclusive future of work. It brings together workers, trade unions, government representatives, employers, brands, civil society, development partners, researchers, women and youth leaders, to deliberate on how Bangladesh can navigate climate change, energy transition, and technological transitions without leaving anyone behind.

Bangladesh is simultaneously one of the most climate-vulnerable nations and a cornerstone of global supply chains. Our workers are already experiencing the double pressure of climate change and automation. Rising heat stress, floods, waterlogging, and displacement threaten their livelihoods, while digitization, artificial intelligence, and automation reshape industries at unprecedented speed. The transition is inevitable and the question is whether it will be just.

A Just Transition provides the answer. Anchored in the ILO's Guidelines for a Just Transition, aligned with ITUC's global call for climate justice, and responsive to international frameworks such as the EU Corporate Sustainability Due Diligence Directive (CSDDD), the UN Guiding Principles on Business and Human Rights, and Bangladesh's Nationally Determined Contributions (NDCs), this Convention affirms that justice, equity, and rights must be at the heart of economic transformation.

This publication captures the insights, debates, and strategies shared at the Convention. It documents how global supply chain expectations intersect with national labour reforms and the lived realities of workers. It highlights that protecting livelihoods requires more than technological upgrades. It demands reskilling and upskilling, gender-responsive policies, social protection for the climate-affected, and inclusive dialogue that empowers youth and marginalized groups.

Yet, beyond frameworks and policies, this book also reflects the courage of women workers confronting displacement and digital exclusion, the determination of young people seeking skills for green jobs, and the solidarity of trade unions, civil society, and employers striving to reconcile competitiveness with dignity and fairness.

The Just Transition Convention Bangladesh 2025 is more than an events, it is a platform of hope and action. It underscores that the path to climate resilience, clean energy, and technological innovation must also be a path to shared prosperity and social justice. The voices and visions captured here are not only for today's dialogue but for shaping tomorrow's commitments.

Organizing Team
Just Transition Convention Bangladesh 2025

Message

It is my honor to extend warm greetings to all participants of the Just Transition Convention Bangladesh 2025. This convention represents a historic milestone for the labour movement and for all those who believe in a fairer, more sustainable future for Bangladesh.

For over two decades, the Bangladesh Institute of Labour Studies (BILS) has worked tirelessly to amplify the voices of workers, strengthen trade unions, and advocate for policies that uphold rights and dignity. Today, as Bangladesh stands at the crossroads of climate change, energy transition, and digital disruption, this mission is more critical than ever. This issues is a serious concern now. The choices we make now will determine not only the resilience of our economy but also the equity of our society for generations to come.

The Just Transition is not a technical agenda; it is a moral imperative. It calls on us to confront hard questions: Who bears the costs of climate and technological shifts? Who reaps the benefits? And how do we ensure that the burdens are not disproportionately shouldered by those who already live and work on the margins? For women workers balancing invisible care burdens, for youth navigating an uncertain labour market, and for informal workers who remain excluded from protections, the answers to these questions will shape their futures.

This convention offers a space for courage and imagination. Through research presentations, worker testimonies, and policy dialogues, we aim not only to understand the scope of the challenge but to co-create pathways that are inclusive, gender-just, and anchored in the principles of decent work. The adoption of a National Workers' Call to Action will be a landmark outcome—setting forth clear demands and guiding a collective agenda that places workers at the center of climate, energy, and technological policy frameworks.

I extend heartfelt thanks to the Bangladesh Labour Foundation, Mondiaal FNV, our trade union allies, development partners, academics, and civil society organizations for joining forces in this endeavor. May this convention inspire a renewed commitment to solidarity, shared responsibility, and visionary action. Let us together shape a Bangladesh where the future of work is not just about survival in the face of disruption, but about justice, dignity, and shared prosperity.Thus, this event can push forward the demands to ensure the transition for worker's just & fair.

Syed Sultan Uddin Ahmmed
Executive Director
Bangladesh Institute of Labour Studies (BILS)

Message

It is with immense pride and conviction that I welcome you all to the Just Transition Convention Bangladesh 2025. This gathering is more than a conference; it is a defining moment for Bangladesh, where the voices of workers and communities converge with national and global visions for climate justice, energy transformation, and technological change.

The challenges before us are vast. Climate change is reshaping the very landscapes in which our people live and work. The global shift toward green technologies is redefining industries. Automation and artificial intelligence are disrupting labour markets at unprecedented speed. For a nation like ours deeply integrated into global value chains yet acutely vulnerable to climate impacts these transformations carry both immense risks and unparalleled opportunities.

Workers stand at the heart of this paradox. From the ready-made garment sector to agriculture, fisheries, construction, leather, and transport, millions contribute daily to sustaining our economy. Yet, too often, their voices are absent from policy conversations about the future of work. The reality is clear: without deliberate planning, these transitions could exacerbate inequalities, exclude women and youth, and push informal workers deeper into precarity.

This is why the principle of a Just Transition is so vital. It is a framework rooted in fairness, social justice, and the dignity of work. It insists that progress cannot be measured by GDP growth or technological advancement alone, but by whether workers have decent jobs, access to social protection, and an equal stake in shaping the pathways ahead.

As we convene here, our shared task is to chart a future that is green, digital, and equitable. This convention provides an inclusive platform to reimagine policies, strengthen alliances, and co-create solutions where no one is left behind. I believe the Workers' Call to Action that emerges from this process will not only guide Bangladesh but also inspire regional and global dialogues on inclusive transitions.

I express my deepest appreciation to our partners Bangladesh Institute of Labour Studies, Mondiaal FNV, civil society organizations, policymakers, academics, and above all, the workers whose resilience and determination light the path forward. Together, let us commit to building a Bangladesh where the transition to sustainability is also a transition to justice, dignity, and hope.

A K M Ashraf Uddin
Executive Director
Bangladesh Labour Foundation

Message

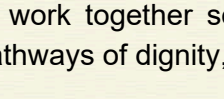
It gives me great honor, on behalf of Mondiaal FNV, to extend my warm greetings to all participants of the Just Transition Convention Bangladesh 2025. This convention represents a crucial step forward in our collective effort to ensure that climate action, energy transformation, and technological change are anchored in justice, fairness, and dignity for all workers.

For decades, Mondiaal FNV has stood in solidarity with workers, trade unions, and civil society in Bangladesh. We believe that the challenges of climate change and rapid technological transformation cannot be addressed without putting workers at the center of the conversation. A Just Transition is not simply about adopting new technologies or reducing emissions it is about ensuring that no worker, no community, and no generation is left behind in the process.

This gathering brings together an inspiring coalition of voices: women workers demanding equality, young people seeking opportunities in green and digital economies, and trade unions safeguarding rights in times of disruption. Their resilience and determination remind us that the path to a fair future must be participatory, inclusive, and rooted in solidarity.

Mondiaal FNV is proud to support this platform, where research, dialogue, and action converge to shape new solutions. I am confident that the outcomes of this convention including the Workers' Call to Action will strengthen national and global efforts toward a future that is not only sustainable, but also just.

I extend my sincere thanks to the Bangladesh Labour Foundation, the Bangladesh Institute of Labour Studies, our partners, and all participants who have joined hands in this historic effort. Let us continue to work together so that the transitions ahead whether climate, energy, or technological become pathways of dignity, equity, and hope for every worker in Bangladesh.



Ruben Korevaar
Policy Advisor
Mondiaal FNV

Message

Bangladesh stands at a crossroads where climate change, energy transition and rapid technological transformation are redefining the world of work. For a country whose economy is deeply embedded in global value chains particularly in sectors like RMG, leather, agriculture, construction, fisheries and transport, the stakes could not be higher. Millions of workers, especially women, youth and those in informal jobs, face growing uncertainty as automation, decarbonization and global supply chain reforms reshape their livelihoods.

This is precisely why the Just Transition framework is so critical. It is not simply about balancing jobs with climate ambition; it is about embedding justice, equity and participation into every step of structural transformation. A Just Transition ensures that workers are not left behind but are equipped with new skills, protected by robust social safety nets and actively engaged in shaping the policies that determine their futures.

For Bangladesh, aligning with EU GSP+ obligations, human rights due diligence (HRDD), and the global decent work agenda is both a necessity and an opportunity. Trade unions, labour organizations and civil society must be integral voices in this dialogue. Without their participation, the risks are stark: exclusion of vulnerable groups, widening inequality and erosion of labour rights. With their participation, however, we can secure a transition that is inclusive, sustainable and rooted in dignity.

This Just Transition Convention Bangladesh 2025 organized by the Bangladesh Labour Foundation (BLF), in partnership with the Bangladesh Institute of Labour Studies (BILS) and with support from Mondiaal FNV, provides us with a timely platform to bridge the gap between policy ambitions and worker realities. It brings together government ministries, senior officials, civil society organizations, trade union leaders, policymakers, academics and above all, workers in a historic gathering. Across multiple sessions of knowledge sharing, dialogue and exchange, we will build pathways that ensure the voices of workers remain central to Bangladesh's green and digital future.

I extend my sincere thanks to all participants for their presence and contributions. Together, let us seize this moment not only to discuss the challenges of transition but to design a roadmap that is fair, future-ready and worker-centred. In doing so, we ensure that the journey toward sustainability is not just ambitious, but truly just.

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National Advisor
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JUST TRANSITION CONVENTION BANGLADESH 2025

"Uniting for Just and Fair Future"

Background and Context

The global economy is undergoing a dual transformation that includes a structural shift toward greener development in response to accelerating climate change and a rapid technological revolution driven by digitization, automation and artificial intelligence[1]. For climate-vulnerable nations like Bangladesh, which are intricately linked to global value chains, these transformations present a paradox of immense opportunities and unprecedented challenges[2].

Key employment sectors in Bangladesh including Ready-Made Garments (RMG), leather and tanning, agriculture, construction, transport, and fisheries employ millions of workers, many in informal and precarious jobs[3]. These sectors now face intensifying pressure due to global decarbonization commitments, the rise of green technologies, and the uptake of automation and AI-driven production systems. While these shifts promise increased productivity and enhanced environmental performance, they also pose risks: mass job displacements, widening digital and green skill gaps, and the marginalization of women, youth, and informal workers from future-ready economies[4], [5].

Rooted in principles of fairness and social justice, a Just Transition ensures that the move to a green and digital economy is inclusive, participatory and anchored in decent work, social protection, gender equity, and workers' rights[6].[7]. It offers a roadmap for harmonizing climate action with livelihoods, so that no one is left behind in the journey toward sustainability. Despite this imperative, the Just Transition narrative remains underdeveloped in Bangladesh. Trade unions, labor organizations, and civil society actors; those most affected by and capable of shaping these transformations are largely missing from national discussions on climate change, energy planning, digital transformation, and employment strategies[8],[9].

To bridge this critical gap, the Bangladesh Labour Foundation (BLF), in partnership with the Bangladesh Institute of Labour Studies (BILS) and with support from Mondiaal FNV, is convening a National Convention on Just Climate, Energy and Technology Transition. This multi-stakeholder dialogue platform will bring together trade union leaders, policymakers, academia, civil society and development partners to collectively shape a worker-centered, inclusive transition framework rooted in rights, equity, and democratic participation. The overarching aim is clear to ensure that the future of work in Bangladesh is not only climate-resilient and digitally empowered, but also socially just, gender-inclusive and anchored in the voices of those who sustain the nation's economy.

1. *International Labour Organization (ILO). (2023). Global employment trends for youth 2023: Investing in transforming futures for young people. Geneva: International Labour Office.*
2. *United Nations Development Programme (UNDP). (2024). Climate adaptation, work and equity: Pathways for just transition in the Global South.*
3. *Bangladesh Bureau of Statistics (BBS). (2023). Labour Force Survey 2022–2023. Ministry of Planning, Government of the People's Republic of Bangladesh.*
4. *World Economic Forum (WEF). (2023). The future of jobs report 2023. Geneva: WEF.*
5. *JustJobs Network. (2022). Reimagining just transitions in Asia: Equity, resilience and participation.*
6. *United Nations Framework Convention on Climate Change (UNFCCC). (2023). Work programme on just transition pathways: Technical report.*
7. *International Trade Union Confederation (ITUC). (2024). Just Transition Centre annual report 2024. Brussels: ITUC.*
8. *Bangladesh Labour Foundation (BLF). (2024). Policy reflections on workers' inclusion in green and digital transitions. Dhaka, Bangladesh: BLF.*
9. *Bangladesh Institute of Labour Studies (BILS). (2025). Strategic priorities on just transition and decent work. Dhaka, Bangladesh: BILS.*

Purpose and Objectives

The primary objective of this national convention is to bring together a broad coalition of stakeholders to initiate a structured, inclusive and evidence-based dialogue on how Bangladesh can achieve a just, equitable and inclusive transition in response to the urgent challenges of climate change, energy transformation and technological disruption with a strong focus on workers' rights and voices.

The convention aims to:

- Raise awareness among the stakeholders on how climate and technological shifts affect the world of work.
- Amplify the voices of workers especially women, youth and informal workers from vulnerable sectors.
- Disseminate research findings on sectoral impacts and share real-life worker testimonies.
- Facilitate dialogue among trade unions, policymakers, civil society, businesses and development partners.
- Identify policy gaps and propose actionable recommendations for a Just Transition.
- Adopt a national-level Workers' Call to Action with clear demands for inclusive transition pathways.

Rationale

Bangladesh is already experiencing the multifaceted impact of climate-induced disasters, energy reforms, automation and shifting global supply chain demands. These changes are rapidly transforming the economy and the world of work. Yet, most workers remain unaware of these transitions and unprepared to adopt. Currently, there are no formal consultation platforms where trade unions can engage with policymakers on climate, energy or technology-related issues.

Outcomes

- Adoption of a National Workers' Call to Action on Just Transition, outlining clear demands and priorities from the labour movement.
- Sector-specific policy and program recommendations, developed through participatory breakout sessions and expert dialogues.
- Increased visibility of trade union perspectives in national-level policy discourses on climate, energy and digital transition.
- Strengthened collaboration and alliances among trade unions, civil society organizations, development partners, employers and policymakers.
- Concrete inputs for future national strategies, legislative reforms and collective bargaining frameworks, ensuring a fair and worker-centered transition agenda.

Conclusion

The National Convention on Just Climate, Energy and Technology Transition offers a unique opportunity to shape a new vision, one where no worker is left behind and where the transition is truly just, inclusive and sustainable. Participants are encouraged to engage meaningfully, contribute ideas and drive collective action that prioritizes people, protects dignity and promotes rights at the center of Bangladesh's transition journey.

JUST TRANSITION
Convention Bangladesh
2025

Uniting for Just and Fair Future

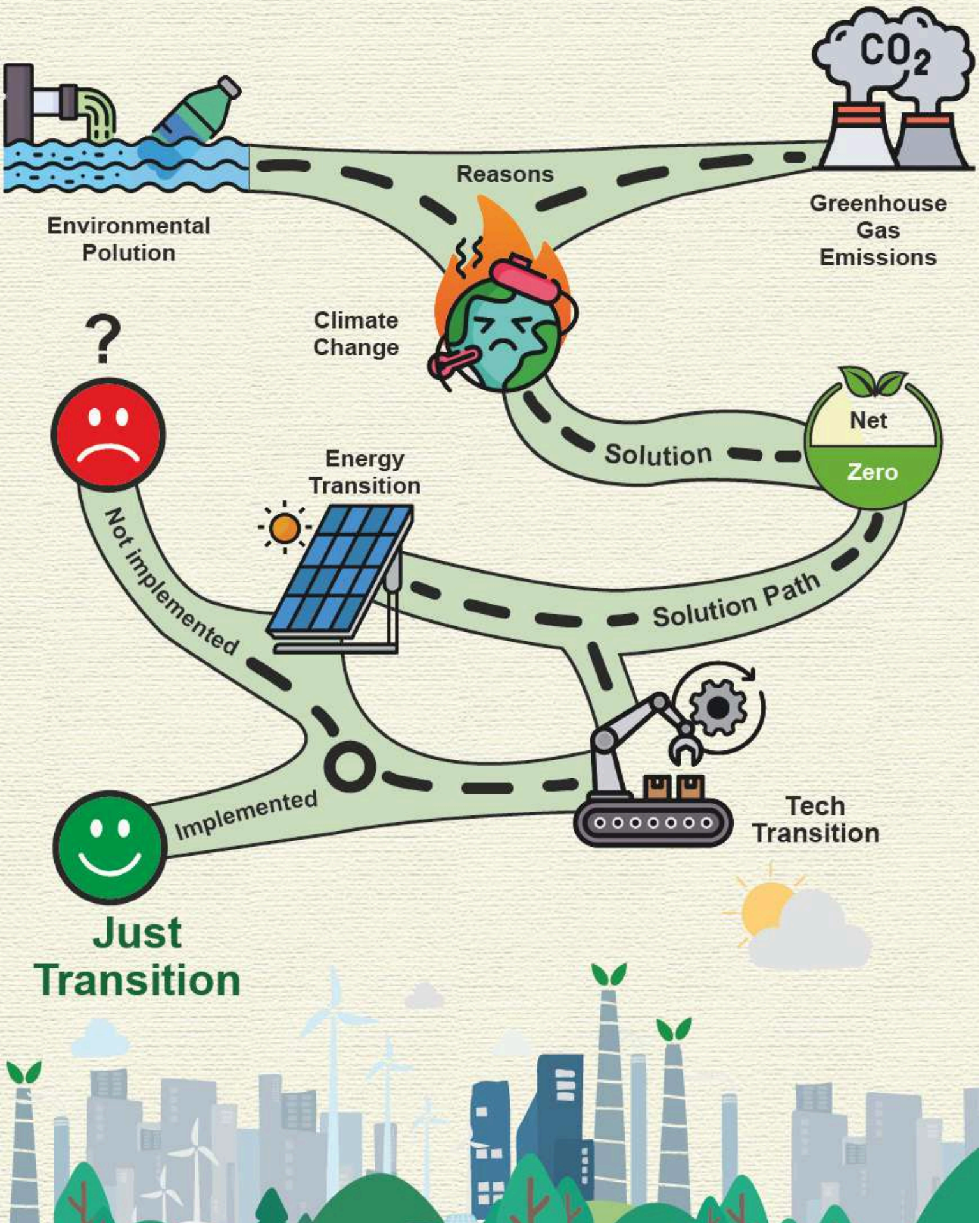
Acronyms

Keywords	Full Form
AI	Artificial Intelligence
BBS	Bangladesh Bureau of Statistics
BILS	Bangladesh Institute of Labour Studies
BLF	Bangladesh Labour Foundation
CAD	Computer-Aided Design
CAM	Computer-Aided Manufacturing
CETP	Central Effluent Treatment Plant
CPD	Centre for Policy Dialogue
CSDDD	Corporate Sustainability Due Diligence Directive (EU)
CREWSnet	Climate Resilience Early Warning System Network
DIFE	Department of Inspection for Factories and Establishments
DoL	Department of Labour
EPB	Export Promotion Bureau
GCF	Green Climate Fund
G-SKOP	Garments Shromik Kormochari Oikya Parishad
HREDD	Human Rights and Environmental Due Diligence
IBC	IndustriALL Bangladesh Council
ILO	International Labour Organization
ITUC	International Trade Union Confederation
JT	Just Transition
KII	Key Informant Interview
RMG	Ready-Made Garments
SDG	Sustainable Development Goal
SKOP	Sramik Karmachari Oikya Parishad

Glossary

Term	Meaning
Adaptation	Adjustments in natural or human systems in response to actual or expected climate impacts, aimed at reducing harm or taking advantage of opportunities.
Alienation Effect (in Political Ecology)	A phenomenon where top-down environmental regulations separate local communities from resources they traditionally manage, leading to distrust and non-compliance.
Climate Justice	An approach to climate action that emphasizes fairness, equity, and the disproportionate burden borne by vulnerable groups.
Co-management	A governance model where responsibility for natural resource management is shared between government institutions and local communities.
Decent Work	Employment that is productive, secure, and provides fair income, social protection, and rights at work, as defined by the International Labour Organization (ILO).
Debt Trap	A cycle where individuals or households are forced to take high-interest loans repeatedly, making it nearly impossible to escape long-term indebtedness.
Energy Transition	The shift from fossil fuels toward renewable and sustainable energy sources.
Environmental Regulation	Rules and restrictions designed to conserve ecosystems, biodiversity, or resources, often through bans, permits, or quotas.
Equity	Fair distribution of resources, responsibilities, and benefits, recognizing the different needs and conditions of vulnerable populations.
Fishing Ban	A seasonal prohibition on fishing, usually implemented to protect breeding species, but often controversial in local contexts due to livelihood impacts.
Governance	The processes, institutions, and systems through which decisions about resource use, rights, and responsibilities are made and enforced.
Green Jobs	Employment that contributes to preserving or restoring the environment, reducing carbon emissions, and supporting sustainable development.
Intergenerational Poverty	The transmission of poverty from one generation to the next, often reinforced by limited access to education, skills, or diverse livelihoods.
Just Transition	A framework for shifting toward a low-carbon economy in a way that is fair, inclusive, and ensures that workers, communities, and vulnerable groups are not left behind.
Livelihood Diversification	The pursuit of multiple income sources to reduce dependence on a single, often fragile, livelihood (such as small-scale fishing).
Participatory Governance	Decision-making processes that actively involve local communities and stakeholders in policy design and implementation.
Patronage Politics	A system in which access to benefits (such as aid, jobs, or permits) is distributed based on loyalty, connections, or political influence rather than eligibility or need.
Political Ecology	An academic field examining how power, politics, and economics shape environmental policies and access to resources.
Resilience	The ability of individuals, households, or ecosystems to anticipate, absorb, adapt to, and recover from shocks and stresses.
Sustainable Livelihoods Framework (SLF)	A development approach emphasizing the strengthening of household assets (human, financial, social, natural, physical) to build resilience and reduce vulnerability.
Vulnerability	The degree to which a community, household, or ecosystem is exposed to and unable to cope with climate, economic, or political shocks.

JUST TRANSITION ROUTE



The Just Transition Framework: A Conceptual Review on Inclusive and Equitable Transformation

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Abstract

Climate change, automation, and digitalization are reshaping global economies, and the just transition framework has emerged as a critical approach to ensure fairness, equity, and resilience amid structural change. Rooted in labor movements and environmental justice, just transition emphasizes that environmental sustainability and technological innovation must advance alongside social protection, decent work, and inclusive growth. This review examines the conceptual foundations, policy instruments and sectoral pathways that define just transition, with particular attention to its application in the Global South where climate vulnerability intersects with informal and precarious labor markets. The study synthesizes diverse literature to highlight the evolution of the concept from its early association with coal sector transitions in industrialized nations to its broader relevance across global value chains, agriculture, fisheries, construction and services. Core dimensions such as procedural, distributive, recognition, and restorative justice are explored as essential pillars for inclusive change. The analysis underscores key challenges, including worker displacement, barriers to reskilling, unequal access to finance, and risks of "just-washing," where superficial interventions replace substantive structural reforms. Policy toolkits like spanning social dialogue, social protection, skills development, industrial upgrading and place-based strategies are identified as vital mechanisms to anticipate disruptions and foster equitable opportunities. Importantly, this review stresses the role of governance and multi-stakeholder collaboration, including trade unions, civil society and financial institutions, in embedding justice principles into transition planning. It also emphasizes measuring outcomes through employment quality, gender equity, community resilience, and spatial distribution of benefits. By consolidating conceptual insights and practical pathways, this paper argues that just transition is not optional but essential for meeting the Paris Agreement and Sustainable Development Goals. Fairness and inclusivity are the social contracts that make ambitious climate and technological transformations durable, ensuring that no worker or community is left behind in the shift to sustainable economies.

Keywords: Just Transition, Climate Justice, Sustainable Development, Labor Rights, Inclusive Growth

Introduction

As we move through the twenty-first century, two major forces are reshaping our economies and job markets: the urgent need to decarbonize due to climate change and the swift spread of digital technologies, automation, and artificial intelligence. These transitions are inevitable; however, achieving justice is not guaranteed. The idea of a just transition represents both a moral commitment and a practical strategy for guiding structural changes, ensuring that our environmental goals and technological advancements go hand in hand with fairness, decent work, and social stability. Instead of viewing job losses, wage pressures, or regional downturns as mere side effects of progress, a just transition seeks to foresee disruptions, mitigate harm, and create opportunities, particularly for workers and communities that might otherwise be overlooked (ILO, 2015). This vision is rooted in labor movements and environmental justice, highlighting that sustainable development cannot thrive without addressing the human costs associated with change.

While initial discussions focused on coal regions in wealthier countries, the conversation has expanded. Nowadays, this perspective is applied to energy systems and heavy industries, manufacturing within global value chains, construction and urban services, as well as agriculture and fisheries already feeling the effects of climate change. It also encompasses service sectors transformed by platforms and data (Lim et al., 2024). In many economies, most workers are outside formal contracts; thus, a credible understanding of justice must go beyond traditional employment boundaries to include informal and gig workers (Chen, 2012). This expansion reflects a global reality: over 60% of the world's workforce is informal, especially in the Global South, where climate vulnerabilities intersect with precarious labor conditions (Dewan et al., 2022). As economies work towards decarbonization, these workers face heightened risks from supply chain disruptions to extreme weather without the safety nets that formal employees enjoy.

Despite the increasing focus on just transitions, there are still significant gaps in our understanding. A lot of the current research is quite compartmentalized: environmental economists tend to zero in on carbon pricing and tech adoption, while labor experts are more concerned with retraining programs. Unfortunately, this often means they overlook important intersections with issues like gender, migration, and informality (Jasanoff, 2018). For example, studies on coal phase-outs in Europe and North America do a great job of highlighting local revitalization efforts, but they rarely consider how digital automation can worsen inequalities in low-skill jobs (Emmons Allison et al., 2019). In developing regions, the situation is even more dire; research on just transitions in agriculture or fisheries often prioritizes ecological restoration at the expense of worker agency, neglecting how colonial histories and trade dependencies contribute to vulnerability (McCauley & Heffron, 2018). Additionally, there’s a lack of empirical evaluations of policy outcomes few studies actually track long-term metrics like wage equity or community resilience after transitions, which leads to an overreliance on anecdotal evidence (Krishnan et al., 2022). This fragmentation makes it tough for policymakers to create integrated strategies that balance speed with fairness, especially as the 2030 Agenda for Sustainable Development and the Paris Agreement call for urgent action that doesn’t leave anyone behind. These gaps highlight the need for a more comprehensive framework that connects different disciplines and scales from local communities to global supply chains. Current discussions also reveal some tensions: how do we balance urgency with participation? Can market-driven innovations achieve justice without government intervention? And in a time of rising

Climate Justice

Climate justice is the principle of placing equity and human rights at the heart of climate change policy. It highlights the unequal historical responsibility for the climate crisis, arguing that wealthy nations and corporations that profited most from high emissions have a duty to help vulnerable countries and communities mitigate climate impacts, as these groups contributed the least to the problem.

protectionism, how can we ensure that transitions don't provoke social backlash? Tackling these questions requires not just descriptive reviews but also forward-thinking analyses that challenge assumptions with real-world evidence(Werksman & Delbeke, 2024).

The goal of this study is to address existing gaps by offering a thorough conceptual review of just transitions, specifically designed for educational and policy purposes. It aims to: (1) clarify key definitions and historical roots, making the term accessible to those who aren't specialists; (2) introduce an analytical framework that connects the drivers of change to policy pathways and measurable outcomes, allowing for systematic diagnosis and evaluation; (3) examine essential tools, governance structures, and sector-specific applications, with a focus on inclusivity for marginalized communities; and (4) outline current debates while suggesting practical steps to turn principles into action. By bringing together insights from various fields such as economics, sociology, environmental science, and labor studies this review not only enhances teaching by providing a structured approach but also emphasizes practical tools for fair decarbonization. Ultimately, it makes the case that just transitions are essential, not optional: they create the social agreement needed to achieve ambitious climate objectives, promoting economies that are both environmentally friendly and beneficial for people.

Conceptual Foundations

At its heart, a just transition is all about bringing together environmental sustainability and technological competitiveness while ensuring that democratic participation and social protection are front and center (ILO, 2015). It emphasizes that the quality of the process is just as important as how quickly we make changes. The concept is built around four interconnected ideas. First up, procedural justice highlights the need for those affected like workers, small suppliers, and communities to have a real say in the decisions that impact their futures. This means providing them with information, opportunities for consultation, collective bargaining, and co-design (Cha, 2020). Next, distributional justice focuses on how the costs and benefits are shared among different social groups, regions, and generations; equity isn't just an afterthought, it's a fundamental part of the design (Roelvink, 2009). Third, recognition justice sheds light on how factors like gender, age, migration status, disability, and informality shape vulnerability and access to opportunities. A transition that overlooks these differences risks repeating past exclusions in new sectors (Bolton & Kacperczyk, 2023). Finally, restorative justice tackles historical harms and damaged environments not just by compensating for losses but by investing in skills, health, and local economic diversification to help communities become more resilient over time (Krishnan et al., 2022). Timing is crucial across these ideas: we need justice before disruption (through anticipation and prevention), during disruption (with bridging support), and after disruption (by creating lasting opportunities) (ILO, 2015).

Historical Evolution

The concept of just transition originated in the 1970s, driven by labor unions in North America. It addresses various aspects of disadvantage, vulnerability, and opportunity. By taking a human rights approach, just transition strives to eliminate current inequalities, promote social engagement, and foster various forms of fairness (ILO, 2015; Wang & Lo, 2021; Werksman & Delbeke, 2024). Moreover, the phrase “just transition” first came about in the late 20th century, rooted in the efforts of labor and environmental justice advocates. Unions were pushing for income support and re-employment options for workers who lost their jobs due to pollution regulations or factory shutdowns (Stevis & Felli, 2015). Fast forward to the last ten years, and this concept has really gained traction in mainstream policy discussions. International labor standards have started to highlight decent work and social dialogue as key drivers of climate action (ILO, 2015). Climate talks began incorporating just transition as part of the commitments countries make United Nations Framework Convention on Climate Change (Hickmann et al., 2021). Additionally, regional development practices have introduced planning that focuses on communities reliant on industries facing risks (Filipović et al., 2022). Sustainable finance, corporate reporting, and supply-chain due diligence have also woven the social aspects of climate action into investment and procurement strategies (Eccles & Krzus, 2019). What we’re seeing isn’t just one program but rather a whole family of policies: a comprehensive approach that combines structural changes with protections and pathways, all tailored to the specific needs of different sectors and regions (Ivanyna et al., 2021).

What Makes a Transition “Just”?

A transition is considered just when it’s fair in both how it’s done and what it achieves. Practically speaking, this means decision-making should be open and inclusive; social protections and active labor-market policies must safeguard people from unnecessary harm; upgrading strategies like adopting new technologies, cleaner materials, and improving efficiency should go hand in hand with targeted investments in skills and support for small businesses. The benefits, such as new job opportunities, cleaner air, and safer workplaces, should be shared widely rather than concentrated in the hands of a few. It’s also crucial to prioritize groups that have historically been marginalized in the job market, including women, youth, migrants, and informal workers, ensuring they are at the forefront rather than an afterthought (Abraham, 2019). Justice doesn’t have to slow things down. In fact, having solid safeguards and pathways to opportunity can help build the social trust needed to make bold moves on emissions, productivity, and resilience.

An Analytical Framework: Drivers, Pathways and Outcomes

The overall just transition framework and process has illustrated in Figure 1 and it is developed according to the concept of the United Nations Climate Change Agreements (Molitor, 2023). It describes the details process of Just Transition framework.

When it comes to teaching and designing policies, it’s really useful to break things down into three layers. First, we have the drivers, which are the forces that push for change. These include decarbonization targets and regulations, shifts in what consumers want, trade rules, technological advancements, the impact of climate change like heatwaves and floods, and the evolving due-diligence requirements in global supply chains (IPCC, 2021).

Next up are the pathways, which are the various combinations of policies and investments that help direct those forces. This can involve regulatory standards, industrial and innovation policies, social protection measures, skills development, public procurement, social dialogue, and place-based development (IPCC, 2021; Ivanyna et al., 2021). Finally, we have the outcomes, which are the results that really matter: the quantity and quality of jobs, wage shares, firm productivity, emissions and local pollution levels, inclusion and gender equity, and overall community well-being (Chen, 2012; Roelvink, 2009). This framework encourages a thorough diagnosis looking at who is affected, how, when, and where and helps to align the right tools with the problems at hand, while also evaluating whether the outcomes are fair and sustainable (Diluiso et al., 2021; Gürtler et al., 2021)

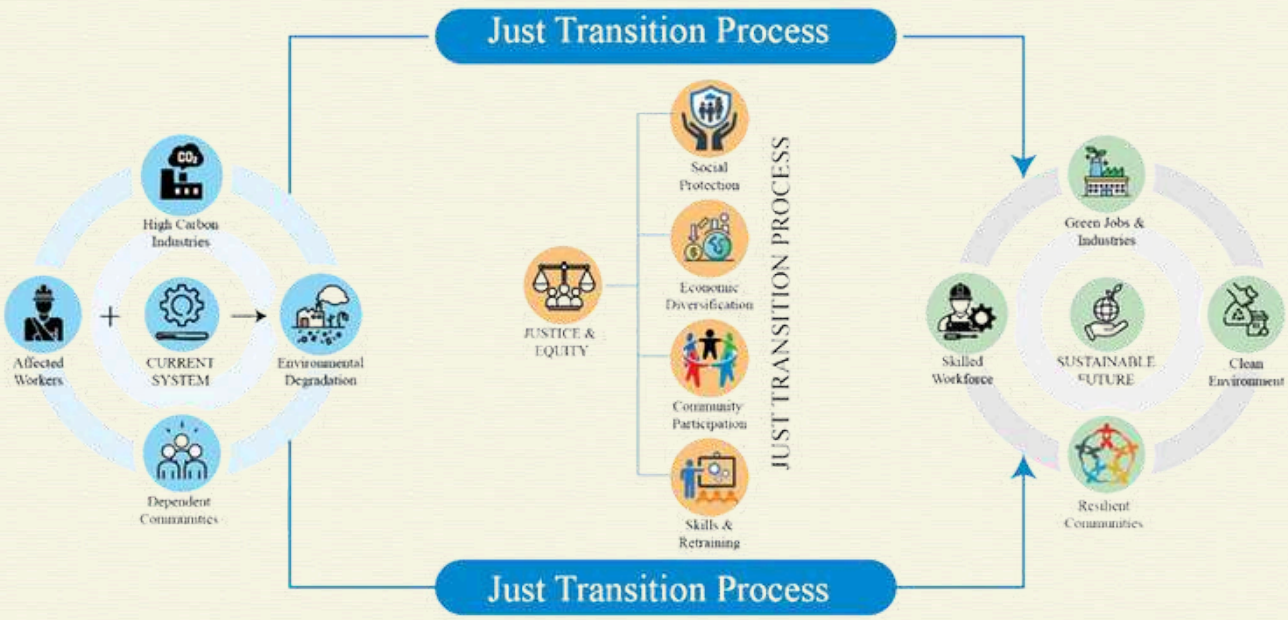

Figure 1: Framework and pathways of Just Transition Process

Priorities of Just Transition

According to the London School of Economics and Political Science, a just transition rests on four core priorities (Figure 2) especially given the predominant focus on workers in industries and regions upended by the move to low-carbon energy, like coal-reliant areas (Hizliok & Scheer, 2024). A just transition is all about having solid social dialogue think negotiation, consultation, or sharing information among workers, businesses, and governments on issues that affect us all. It's crucial to strengthen social protection with policies that deal with the impacts of job losses and provide fair compensation. Additionally, it emphasizes the importance of creating decent jobs and skill-building initiatives to pave the way for new employment opportunities, while also ensuring that gender equality is woven into the fabric of these efforts (Hizliok & Scheer, 2024).

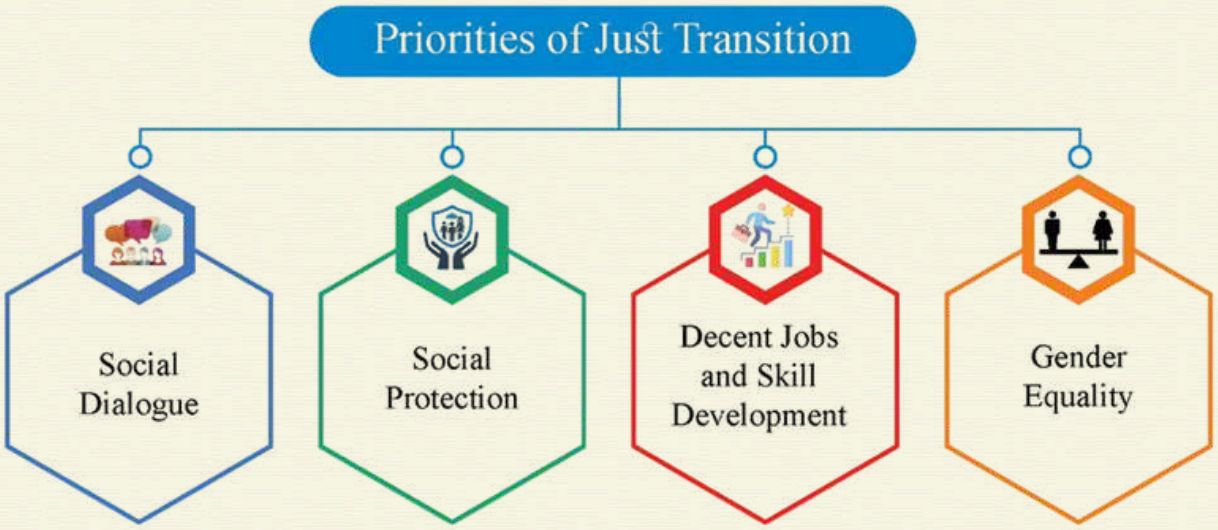

Figure 2: Major priorities of Just Transition

Principles of Just Transition

According to the UNCC, seven principles are predominantly regarded as the principles of Just Transition (Hickmann et al., 2021; ILO, 2015). These are depicted here:

i. Active encouragement of emission reduction – The potential for adverse impacts on fossil fuel-dependent regions should not justify the delay or avoidance of climate initiatives. Putting things off is not fair. A fair transition is in line with meeting internationally agreed-upon climate goals by quickly cutting emissions to near zero.

ii. Participation – Participation is crucial. We need to ensure that key stakeholders, especially those directly affected like employees, women, and marginalized communities are not just included but empowered to shape the strategies for this transition.

iii. Inclusion – Inclusion is essential too. The transition should be designed so that everyone is part of the process, with programs and safety nets in place to share the impacts fairly across society.

iv. Transparency – Transition planning and execution should be conducted openly, with consistent monitoring and assessment of progress.

v. Solidarity – We need to foster cooperative dialogue and partnerships among governments, the private sector, and community organizations as we develop fair transition plans.

vi. Human rights – we must uphold human rights throughout this process. This includes ensuring access to healthcare, quality jobs, and protection against discrimination.

vii. Equity and fairness – Equity and fairness should be our guiding principles, ensuring just outcomes for all generations and balancing local and global contexts.

In addition, According to the Climate Justice Alliance (Climate Justice Alliance, 2016, 2017), there is eight principles of Just Transition, which are illustrated in Figure 3.

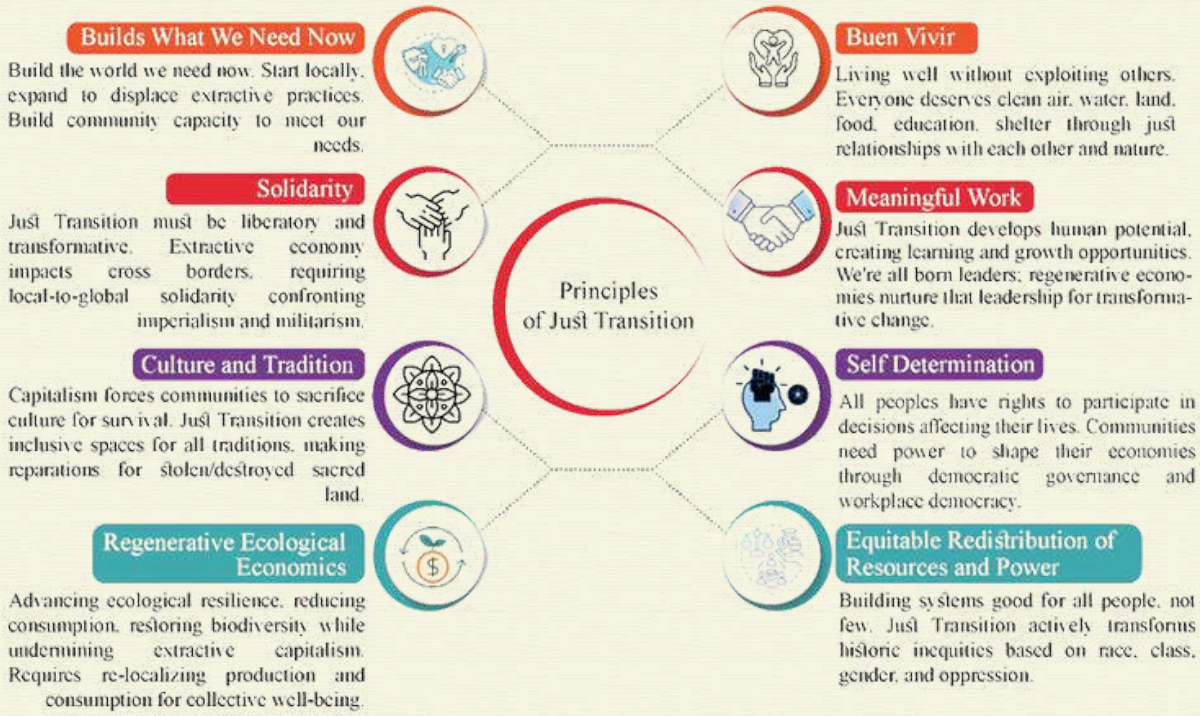

Figure 3: Principles of Just Transition

The Policy Toolkit

A just transition draws on a broad but coherent set of instruments. Social dialogue and collective bargaining institutionalize worker voice in transition planning and in the adoption of new technologies, making it possible to negotiate retraining guarantees, redeployment pathways, and safety standards alongside productivity goals (Krawchenko & Gordon, 2021). Social protection unemployment insurance where it exists, wage subsidies, severance top-ups, portable benefits for workers outside standard employment, and climate-shock safety nets prevents temporary shocks from turning into long-term scarring. Skills policy combines rapid reskilling and upskilling with recognition of prior learning and career services; modular, employer-endorsed credentials make it easier for workers to cross sectoral boundaries, while targeted programs expand access for women and youth (Wang & Lo, 2021).

Industrial and innovation policy directs investment into low-carbon technologies and process upgrades, supports cluster development and supplier upgrading, and conditions public support on fair-work practices. Public investment and procurement create early markets for cleaner materials and services while embedding labor standards into purchasing criteria (Krawchenko & Gordon, 2021; Wang & Lo, 2021). Place-based development strategies help regions dependent on at-risk industries diversify their economic base; successful programs blend small-business finance with infrastructure and amenities that attract and retain people. Occupational safety and health must be refreshed for a warming world: heat-stress protocols, better ventilation and chemical management, flood-safe facilities, and emergency preparedness are now part of competitiveness as well as care. Due diligence and disclosure both in law and through voluntary standards make human-rights and environmental performance in supply chains measurable and comparable, while investors increasingly require that climate strategies demonstrate social outcomes, not only emissions reductions. Finally, the finance architecture matters concessional and blended finance, guarantees, and dedicated just-transition funds can crowd in private capital while lowering the risk to workers and small firms (Krawchenko & Gordon, 2021; Newell & Mulvaney, 2013).

Governance and Institutions

Because transitions cut across ministries and markets, governance is a coordination problem. Governments set direction through targets and timelines, align portfolios across labor, industry, education, energy, and environment, mobilize budgets, and devolve implementation to regions and municipalities that are close to firms and communities. Employers and industry bodies plan technology adoption in a way that maps skill needs, invests in training and safer processes, and cascades expectations through supplier codes and purchasing. Trade unions and worker organizations represent workers in tripartite forums and at the workplace, monitor impacts, and help design safeguards and opportunity pipelines. Civil society and community organizations bring evidence about vulnerable groups, ensure that recognition and access to justice are not rhetorical, and co-create local strategies. The financial sector and development partners connect capital to outcomes, provide technical assistance, and structure risk-sharing so that small and medium-sized enterprises can participate. Universities and training providers scan the frontier, update curricula, and deliver short, stackable programs. Effective governance depends on institutions that make participation routine rather than episodic and on data systems that render choices and results visible (Newell et al., 2023; Newell & Mulvaney, 2013).

Sectoral Pathways and the Informal Economy

Although the concept is economy-wide, entry points are typically sectoral. In energy and heavy industry, justice questions arise around phasing down high-emitting assets, building out renewable capacity and grids, and piloting new vectors such as green hydrogen and circular materials. Manufacturing suppliers embedded in global value chains confront simultaneous demands for cleaner production, better labor outcomes, and digital quality systems; here, supplier upgrading and access to affordable finance and technology are critical. Construction and urban services must adapt to heat and flooding while meeting rising expectations for waste and water management; public procurement is a powerful lever. Transport and logistics involve fleet conversion, charging and fueling infrastructure, public transit expansion, and retraining for drivers and mechanics. Agriculture and fisheries require climate-smart practices, water stewardship, and coastal adaptation, along with off-farm processing and services that diversify livelihoods (Abram et al., 2022; Gather et al., 2025).

A defining test for many countries is whether informal workers are seen and supported. Because a large share of economic life occurs outside standard contracts, programs must extend protections and services beyond formal payrolls, reduce the cost and complexity of formalization, and design municipal and sectoral initiatives with representative organizations of informal workers. Waste pickers, street vendors, and home-based producers are not peripheral; they are central to the social foundations of transition (Abram et al., 2022; Gather et al., 2025; Newell & Mulvaney, 2013).

Measuring Progress and Accountability

The LSE has mentioned four indicators to measure the progress of Just Transition which is depicted in Figure 4 (Hizliok & Scheer, 2024).

Figure 4: Indicators of measuring Just Transition

To move beyond aspirations, monitoring and evaluation should pair program management metrics with distributional and spatial analysis. Inputs such as public spending on reskilling, social protection, and local development indicate effort but not success. Process indicators coverage and quality of social dialogue, participation of women and youth, accessibility of grievance and remedy reflect whether justice is being practiced in decision-making. Outputs numbers of workers trained and certified, firms upgraded, worksites retrofitted, local plans approved show capacity conversion. Outcomes measure what ultimately matters: net employment created or lost, job quality as reflected in contracts, wages, and safety, emissions and pollution intensity per unit of output, firm survival and productivity, and community well-being. Disaggregation by gender, age, location, and employment status reveals whether benefits are shared. Spatial analysis identifies regions at risk of decline or positioned for growth. Life-cycle analysis helps avoid burden shifting along supply chains, where environmental gains in one place can imply social or ecological costs elsewhere. Transparency is essential: publishing indicators, audits, and minutes of social-dialogue forums enables course correction and builds trust (Htitich et al., 2024).

Debates and Live Tensions

The literature and practice are shaped by several unresolved tensions. One pits pace against fairness: decarbonization and technological upgrading must move quickly to meet environmental and competitive realities, yet institutions and budgets have finite capacity to absorb change; neglecting justice erodes social license and can slow progress more than it speeds it. Another concern competing visions of prosperity: some strategies emphasize green growth through innovation and investment, while others argue for sufficiency and demand-side changes; each implies different labor-market trajectories. Scope is also debated: adding every social objective risk diluting focus, yet to narrow a scope misses systemic risks such as informality. Global asymmetries in technology access, trade terms, and climate finance shape who bears the costs and who reaps the benefits across borders. A further risk is “just-washing,” where minimal training or traditional corporate social responsibility is rebranded as just transition without structural change or accountability. Finally, the interface with automation and AI is double-edged: technology choices can complement climate goals and create safer, higher-quality jobs, but they can also intensify displacement and surveillance if adopted without worker voice and data rights (Ciplet & Harrison, 2020; McIlroy et al., 2022).

Global South and Supply-Chain Lens

Where economies are integrated into global value chains, justice is negotiated in triangular relationships among suppliers, brands, and financiers. Suppliers face rising expectations for emissions, chemical management, due diligence, and digital traceability, often with tight delivery schedules and thin margins. A fair approach requires predictable timelines to allow planning and capital budgeting; cost-sharing mechanisms where brands and financiers co-invest in cleaner technology and skill development; access to affordable finance and technical assistance, especially for small firms; and market incentives, such as procurement preferences or price premia, that reward verified improvements. Macroeconomic context public debt, energy price volatility, and limited fiscal space constrains what is feasible domestically; aligning climate and development finance with labor outcomes, rather than only tonnes of carbon reduced, is therefore decisive (de Ruyter & Bentley, 2024; Karaosman et al., 2025).

From Concept to Practice: A Basic Roadmap

Policymakers and social partners can translate principles into programs through a sequence that emphasizes evidence, participation, and iteration. The first step is to establish a baseline and a forward view: map emissions, technologies, employment and skills, informality, gender and youth gaps, and climate risks at sector and regional levels. The second is to organize structured social dialogue and scenario planning that make trade-offs explicit and co-define credible pathways. The third is to pair safeguards with opportunity pipelines, combining income support, safety and grievance mechanisms with skills, small-firm upgrading, and cluster development so that people can move toward emerging roles rather than simply away from declining ones. The fourth is to prepare a finance plan that blends public budgets with concessional and private capital and that attaches clear milestones to disbursements. The fifth is to anchor responsibilities institutionally, designating lead agencies and tripartite bodies and aligning mandates across labor, industry, education, and environment. The sixth is to pilot in priority sectors or regions, learn quickly, and scale what works. The final step is to monitor, disclose, and adapt, using transparent indicators and independent review to keep programs honest and effective as conditions change (Krawchenko & Gordon, 2021; Mertins-Kirkwood & Duncalfe, 2021).

Conclusion

Just Transition reframes structural change from a trade-off between jobs and the planet into a design challenge for fair, inclusive, and competitive economies. It ties justice principles to policy pathways and outcomes, ensuring transitions are done with workers and communities, not to them. Practically, it requires sound diagnosis, active participation, balanced policies, and credible finance. Rather than slowing ambition, Just Transition makes environmental and technological change durable and socially acceptable.

For Bangladesh, the focus must be on reskilling and upskilling programs, especially for women and informal workers, alongside stronger social protection systems to cushion job losses. Strengthening dialogue between government, employers, and trade unions will help workers' voices shape policy. Access to affordable finance for both green technology and human capital development is also critical. Importantly, embedding gender-sensitive approaches into national strategies will ensure women benefit equally from digitalization and green growth. With inclusive governance, worker-centered policies, and targeted investments, Bangladesh can turn the challenges of automation and climate change into opportunities for a fairer, greener, and more resilient future.

Bibliography

- Abraham, J. (2019). Just transitions in a dual labor market: Right wing populism and austerity in the German energiewende. Journal of Labor and Society, 22(3), 679–693. https://doi.org/10.1111/lands.12438
- Abram, S., Atkins, E., Dietzel, A., Jenkins, K., Kiamba, L., Kirshner, J., Kreienkamp, J., Parkhill, K., Pegram, T., & Santos Ayllón, L. M. (2022). Just Transition: A whole-systems approach to decarbonisation. Climate Policy, 22(8), 1033–1049. https://doi.org/10.1080/14693062.2022.2108365
- Bolton, P., & Kacperczyk, M. (2023). Global Pricing of Carbon-Transition Risk. Journal of Finance, 78(6), 3677–3754. https://doi.org/10.1111/jofi.13272
- Cha, J. M. (2020). A just transition for whom? Politics, contestation, and social identity in the disruption of coal in the Powder River Basin. Energy Research and Social Science, 69, 101657. https://doi.org/10.1016/j.erss.2020.101657
- Chen, M. A. (2012). The Informal Economy: Definitions, Theories and Policies WIEGO Working Papers. WIEGO Working Paper, 1(August), 26. www.wiego.org
- Ciplet, D., & Harrison, J. L. (2020). Transition tensions: mapping conflicts in movements for a just and sustainable transition. Environmental Politics, 29(3), 435–456. https://doi.org/10.1080/09644016.2019.1595883
- Climate Justice Alliance. (2016). Just Transition: A Framework for Change. Climate Justice Alliance. https://climatejusticealliance.org/just-transition/
- Climate Justice Alliance. (2017). Just Transition Principles. In Climate Justice Alliance (pp. 1–8). https://climatejusticealliance.org/wp-content/uploads/2019/11/CJA_JustTransition_highres.pdf
- de Ruyter, A., & Bentley, G. (2024). Enabling a just transition. In Contemporary Social Science (Vol. 19, Issues 1–3, pp. 1–20). Taylor & Francis. https://doi.org/10.1080/21582041.2024.2360953
- Dewan, S., Ernst, E., & Achkar Hilal, S. (2022). World employment and social outlook: Trends 2022. In International Labour Office. International Labour Organization.
- Diluiso, F., Walk, P., Manych, N., Cerutti, N., Chipiga, V., Workman, A., Ayas, C., Cui, R. Y., Cui, D., Song, K., Banisch, L. A., Moretti, N., Callaghan, M. W., Clarke, L., Creutzig, F., Hilaire, J., Jotzo, F., Kalkuhl, M., Lamb, W. F., … Minx, J. C. (2021). Coal transitions - Part 1: A systematic map and review of case study learnings from regional, national, and local coal phase-out experiences. Environmental Research Letters, 16(11), 113003. https://doi.org/10.1088/1748-9326/ac1b58
- Eccles, R. G., & Krzus, M. P. (2019). Implementing the Task Force on Climate-related Financial Disclosures Recommendations: An Assessment of Corporate Readiness. Schmalenbach Business Review, 71(2), 287–293. https://doi.org/10.1007/s41464-018-0060-4
- Emmons Allison, J., McCrory, K., & Oxnevad, I. (2019). Closing the renewable energy gender gap in the United States and Canada: The role of women's professional networking. Energy Research and Social Science, 55, 35–45. https://doi.org/10.1016/j.erss.2019.03.011
- Filipović, S., Lior, N., & Radovanović, M. (2022). The green deal – just transition and sustainable development goals Nexus. Renewable and Sustainable Energy Reviews, 168, 112759. https://doi.org/10.1016/j.rser.2022.112759
- Gather, J., Prowse, M., & Seussler, D. (2025). Pathways towards just transitions in the Global South. Energy Research and Social Science, 127, 104293. https://doi.org/10.1016/j.erss.2025.104293
- Gürtler, K., Löw Beer, D., & Herberg, J. (2021). Scaling just transitions: Legitimation strategies in coal phase-out commissions in Canada and Germany. Political Geography, 88, 102406. https://doi.org/10.1016/j.polgeo.2021.102406
- Hickmann, T., Widerberg, O., Lederer, M., & Pattberg, P. (2021). The United Nations Framework Convention on Climate Change Secretariat as an orchestrator in global climate policymaking. International Review of Administrative Sciences, 87(1), 21–38. https://doi.org/10.1177/0020852319840425
- Hizliok, S., & Scheer, A. (2024). What is the just transition and what does it mean for climate action? The London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/explainers/what-is-the-just-transition-and-what-does-it-mean-for-climate-action/
- Htitich, M., Krylová, P., & Harmáček, J. (2024). Just Transition Score: Measuring the relative sustainability of social progress. Environmental and Sustainability Indicators, 23, 100440. https://doi.org/10.1016/j.indic.2024.100440
- ILO. (2015). Guidelines for a just transition towards environmentally sustainable economies and societies for all (Issue October, pp. 5–9). ILO Geneva.

- IPCC. (2021). Climate Change 2021 The Physical Science Basis Summary for Policymakers: Sixth Assessment Report. Climate Change 2021: The Physical Science Basis., 2(1), 3949.
- Ivanyna, M., Stern, N., Oman, W., & Bhattacharya, A. (2021). Climate Action to Unlock the Inclusive Growth Story of the 21st Century. IMF Working Papers, 2021(147), 1. https://doi.org/10.5089/9781513573366.001
- Jasanoff, S. (2018). Just transitions: A humble approach to global energy futures. Energy Research and Social Science, 35, 11–14. https://doi.org/10.1016/j.erss.2017.11.025
- Karaosman, H., Marshall, D., & Ward, I. (2025). For the many not the few: introducing just transition for supply chain management. International Journal of Operations and Production Management, 45(3), 700–732. https://doi.org/10.1108/IJOPM-07-2023-0587
- Krawchenko, T. A., & Gordon, M. (2021). How do we manage a just transition? A comparative review of national and regional just transition initiatives. Sustainability (Switzerland), 13(11), 6070. https://doi.org/10.3390/su13116070
- Krishnan, M., Samandari, H., Woetzel, J., Smit, S., Pacthod, D., Pinner, D., Nauclér, T., Tai, H., Farr, A., Wu, W., & Imperato, D. (2022). The net-zero transition: What it would cost, what it could bring. In McKinsey Global Institute. McKinsey & Company. https://www.mckinsey.com/~/media/mckinsey/business functions/sustainability/our insights/the net zero transition what it would cost what it could bring/the-net-zero-transition-what-it-would-cost-and-what-it-could-bring-final.pdf
- Lim, C. H., Basu, M. R., Carriere-Swallow, M. Y., Kashiwase, K., Kutlukaya, M., Li, M., Refayet, E., Seneviratne, D., Sy, M., & Yang, R. (2024). Unlocking Climate Finance in Asia-Pacific: Transitioning to a Sustainable Future. In The New Climate Economy. The Global Commission on The Economy and Climate. http://www.newclimateeconomy.net/
- McCauley, D., & Heffron, R. (2018). Just transition: Integrating climate, energy and environmental justice. Energy Policy, 119, 1–7. https://doi.org/10.1016/j.enpol.2018.04.014
- McIlroy, D., Brennan, S., & Barry, J. (2022). Just transition: A conflict transformation approach. In Handbook of Critical Environmental Politics (pp. 416–430). Edward Elgar Publishing. https://doi.org/10.4337/9781839100673.00039
- Mertins-Kirkwood, H., & Duncalfe, C. (2021). Roadmap to a Canadian Just Transition Act A path to a clean and inclusive economy. www.policyalternatives.ca
- Molitor, M. R. (2023). The United Nations Climate Change Agreements. In The Global Environment (pp. 210–235). Routledge. https://doi.org/10.4324/9781003421368-13
- Newell, P., Daley, F., Mikheeva, O., & Peša, I. (2023). Mind the gap: The global governance of just transitions. Global Policy, 14(3), 425–437. https://doi.org/10.1111/1758-5899.13236
- Newell, P., & Mulvaney, D. (2013). The political economy of the “just transition.” Geographical Journal, 179(2), 132–140. https://doi.org/10.1111/geoj.12008
- Roelvink, G. (2009). Scales of justice: Re-imagining political space in a globalizing world – By Nancy Fraser. In New Zealand Geographer (Vol. 65, Issue 2, pp. 163–164). JSTOR. https://doi.org/10.1111/j.1745-7939.2009.01158_5.x
- Stevis, D., & Felli, R. (2015). Global labour unions and just transition to a green economy. International Environmental Agreements: Politics, Law and Economics, 15(1), 29–43. https://doi.org/10.1007/s10784-014-9266-1
- Wang, X., & Lo, K. (2021). Just transition: A conceptual review. Energy Research & Social Science, 82, 102291.
- Werksman, J., & Delbeke, J. (2024). The Paris Agreement. In Delivering A Climate Neutral Europe (pp. 35–55). Routledge. https://doi.org/10.4324/9781003493730-3


Over the past two years
Dhaka's temperature
rose by 2.75°C
65% workers suffer from
heat stress
Working hours will be
reduced by 2030 5%

Bangladesh Apparel Sector in the Highway of Technological Transition: Worker Impacts and Pathways to Justice

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Abstract

Bangladesh, the world's second-largest exporter of Ready-Made Garments (RMG), contributes 7.87% of GDP and over 81% of export earnings, employing nearly four million workers, the majority of whom are women. As the industry faces increasing global competition and sustainability pressures, the technological transition toward automation under Industry 4.0 presents both opportunities and challenges. This study, commissioned by the Bangladesh Labour Foundation (BLF) with support from Solidaridad Network Asia and conducted by BRAC University, assesses the status and implications of automation in the apparel sector using mixed methods, including surveys with 429 workers in Dhaka, Gazipur and Narayanganj, 26 KIIs, and 4 FGDs. Findings reveal that automation in Bangladesh's apparel industry remains at a low to medium level (score 2.5–3 out of 5), with full automation limited to spinning, dyeing and fabric finishing. The sewing section, where most workers are employed remains largely semi-automated. Nevertheless, data automation systems, including digital IDs, IoT-based monitoring, and mobile payments, are increasingly adopted. Automation has improved efficiency, productivity, and quality, with automated machines producing up to 200 pieces per hour compared to 50–60 pieces manually. Worker surveys highlight reduced physical strain, fewer errors, and increased family time, while management interviews cite improved competitiveness and profitability. However, challenges include significant worker displacement (30.58%), gendered impacts with women disproportionately affected, wage stagnation despite higher productivity, limited formal training (only 41% received structured training), and heightened job insecurity. The study emphasizes the urgent need for a Just Transition, aligning with SDGs 5 (Gender Equality), 8 (Decent Work), 9 (Industry, Innovation, and Infrastructure), and 10 (Reduced Inequalities). Policy recommendations call for structured reskilling, stronger social protections, gender-responsive training, and integration of Human Rights and Environmental Due Diligence (HREDD) standards. Without inclusive planning, automation risks deepening inequalities; with proper interventions, it offers pathways for sustainable growth and worker empowerment in Bangladesh's RMG sector.

Keywords: Automation, Ready-Made Garments (RMG), Just Transition, Labour Rights, Bangladesh

Introduction

The ready-made garment (RMG) industry is the backbone of Bangladesh's economy, accounting for 81.29% of export earnings and contributing 7.87% to GDP in FY2024, while directly employing nearly four million workers, the majority of whom are women. The industry, which took shape in the 1960s and expanded rapidly during the 1980s, has transformed Bangladesh into the world's second-largest apparel exporter. Its products now reach over 150 countries, with the United States, Germany, the United Kingdom, Italy, and France serving as leading markets. Despite it, apparel exports faced a 5.22% year-on-year decline in FY24, signaling structural challenges amid intensifying global competition. Productivity gaps remain stark, with Bangladesh's labour productivity per hour ($5.9) lagging behind Vietnam ($6.4) and India ($7.2) (Nomura & Kimura, 2022). Furthermore, a 60% skill gap persists in the RMG sector, undermining competitiveness (EPB, 2024).

The sector is now undergoing a profound transformation driven by Industry 4.0 technologies such as automation, robotics, computer-aided design (CAD), computer-aided manufacturing (CAM), radio frequency identification (RFID), the Internet of Things (IoT), and artificial intelligence (AI). These innovations enhance supply chain efficiency, reduce costs, and improve transparency (Kincade & Regan, 1994; Z. H. Khan et al., 2023; Mohamad et al., 2022). Yet, as global competitors such as China and India accelerate adoption of these technologies, Bangladesh risks falling behind due to its reliance on traditional manufacturing systems and inadequate investment in upskilling (Khan, 2008; RMG Bangladesh, 2024).

Automation presents a double-edged sword. While it offers opportunities for efficiency and competitiveness, it also raises concerns of large-scale job displacement. Projections suggest that by 2041, 5.38 million jobs across multiple sectors in Bangladesh may be at risk, with the RMG industry alone facing potential losses of 2.7 million jobs, or 60% of its workforce (a2i, 2019). Evidence indicates that unskilled workers are particularly vulnerable, as automation replaces manual processes with machine-based operations (Salman et al., 2023).

In this context, a Just Transition seeks to ensure that industrial modernization occurs in a fair, inclusive, and sustainable manner by integrating upskilling and reskilling initiatives, social protection policies, and participatory governance. Beyond productivity and competitiveness, global buyers are increasingly demanding compliance with human rights and environmental due diligence (HREDD) standards to maintain preferential trade benefits such as GSP+. For Bangladesh, aligning with these requirements is essential not only to sustain export competitiveness but also to safeguard workers' rights in the era of technological transition.

This study therefore investigates the status, readiness and challenges of technological transition in Bangladesh's apparel sector, with a focus on its implications for workers. By examining how automation reshapes production processes, employment patterns, and labour rights, the study highlights pathways to achieve a fair and inclusive Just Transition that secures both industry growth and social justice.

On the other hand, another study titled ‘Automation in RMG sector: Impact on Employment through a Gender Lens’ showed the comparison between Human Labour vs. Automation in the Apparel sector that is illustrated in the following table (Sarwar & Raihan, 2024).

Table 1: Comparison between Human Labour and Automation

Human Labour	Automation
Manual Manufacturing Processes: Production relies on manual skills, especially with the hands of workers for tasks like cutting, sewing, and finishing clothes.	Increase in productivity: It is estimated that 40 to 70 percent of labour time can be reduced through automation.
Technical Proficiency: Proficiency in garment manufacturing techniques, such as stitching, embroidery, and pattern-making, as well as knowledge of industry-specific processes and standards.	Increased inventory turnover: Rapid production cycle of fast fashion, growing a competitive edge over other manufacturers.
Adaptability: Human labour offers flexibility in responding to changing market demands, fashion trends, and production requirements, adjusting to variations in garment styles, sizes, and specifications.	Replacement of repetitive and monotonous work: new machines shape, cut, and attach belt loops simultaneously, saving time, labour costs, and reducing errors.
Emotional Intelligence and Communication: Needed to navigate diverse people coming to work in the industry from different socio-economic backgrounds and age groups.	Achieving Manufacturing Consistency: Minimizing product and batch variability, leading to higher quality standards and reducing the need for rework activities.
Cost-Effectiveness: Bangladesh's point of advantage comes from its large production capacity at a low price and acceptable quality.	Performing jobs beyond human capability: Advanced sewing machines, such as Juki machines, can automatically sew buttons and create buttonholes.
Quality Control: Human workers can visually inspect and assess the quality of finished products with precision and accuracy, ensuring that only high-quality garments are shipped to customers.	Reduction of direct human labour costs and overheads: Automation has reduced the number of labourers by 50-60% and in some cases up to 90%.
Socio-economic Considerations: Employing human labour in the RMG industry contributes to job creation and poverty reduction in Bangladesh.	AI can help in predicting fabric properties and fabric fault detection: A new method breaks down fabric images into "cartoon."

Automation in the Apparel Sector

Industry 4.0, officially recognized at the 2011 Hannover Trade Fair, refers to the integration of advanced technologies such as IoT, robotics, and big data analytics into industrial processes, creating greater efficiency, flexibility, and autonomy (Kagermann et al., 2016; Mohamed, 2018). While it is often conflated with the broader "fourth industrial revolution," Industry 4.0 focuses specifically on industrial applications (Anzolin, 2021).

In the apparel sector, these technologies are transforming production by enabling supply chain optimization, vertical integration, and cost reduction (Monteiro et al., 2024). Robots now perform repetitive tasks, improving productivity but also raising concerns about workforce displacement, requiring retraining and reskilling (Lázár, 2024).

For countries like Bangladesh and Sri Lanka, adoption remains limited due to weak infrastructure and low digital readiness (Kulandaivel & Bandara, 2024; Mim et al., 2024). A roadmap for successful transition emphasizes workforce development and strategic planning. As Nayak and Padhye (2018) highlight in Automation in Garment Manufacturing, multiple forms of automation have already been introduced across apparel production processes.

Table 2: Different Types of Automation in the Apparel Sector

● Automation in Fabric Inspection: Invention of online automated inspection systems has mitigated the major issues related to quality control as human error has often led to inaccuracies and inefficiencies in the inspection process.	● Sewing: Sewing is mostly manual, but some factories use robots for speed. New robots handle specific tasks, while others aim to sew entire garments. These robots have limitations in fabric types and require special techniques. 3D sewing might be the future for complex, high-quality clothes. Example: Sewbo robot, developed by Zornow (which costs $35,000), can make a T-shirt in just 4 minutes.
● Design and Prototyping: 3D scanners can help create better fitted clothes using digital models to modify garment designs and quick sampling.	● Use of radio-frequency identification: Clothes tags with chips (RFID) can track garments real-time. This helps factories manage inventory better by streamlining supply chain management using automated sorting systems. For instance, tags on fabric bundles can show what kind of fabric it is, the style, and colour.
● Fabric Handling and Cutting: Automated machines can now precisely spread fabric layers and cut out garment pieces with minimal waste.	● Pressing: Ironing clothes in garment factories is a tough, manual job usually done by men with high turnover. While some fancy pressing robots exist, most factories haven't adopted them.

Technological Transition in the Apparel Sector

The apparel industry in Bangladesh is undergoing rapid technological transition under the framework of Industry 4.0, marked by automation, robotics, smart factories, and digital integration. Innovations such as automated sewing machines ("sewbots"), 3D printing, and digital fabric printing have enhanced efficiency, reduced costs, and promoted sustainability by lowering waste and energy use (Saha, 2018; Gökalp et al., 2018). Smart factories enable interconnected machines to streamline workflows from design to delivery (See, 2019).

While automation strengthens productivity, it poses risks for a labour-intensive industry. Studies show that 80% of apparel jobs are routine and automatable (Vashisht & Rani, 2019), with positions like supervisors, pattern makers, and quality control staff particularly vulnerable. In Bangladesh, automation maturity remains low scoring only 1.9 out of 5 compared to China's 63.7 high-tech intensity (Mim et al., 2024; LightCastle Partners, 2024). Still, nearly 80% of factory owners plan to invest in automation, expecting 13% growth, though fewer than one-fourth of workers are projected to remain directly involved in automated processes (TBS Report, 2024). Encouragingly, 70% of female workers express willingness to reskill for modern machinery (Daily Sun, 2024).

Job displacement is a major concern. By 2035, the machine-to-human work ratio is expected to shift from 44:66 (2022) to 57:43, with at least 30,000 skilled jobs across supervision, design, and production planning at risk (NewAge, 2025). Historical evidence, however, suggests automation often creates new long-term opportunities by boosting productivity and demand (Bessen, 2016; Moro et al., 2019).

A recent study, Automation in RMG Sector: Impact on Employment through a Gender Lens, confirms that while Bangladesh lags in adoption, the transition is accelerating and requires urgent investment in upskilling, reskilling, and gender-inclusive policies to ensure a just transition (Sarwar & Raihan, 2024).

Table 3: Automation Adoption across the Apparel Sector

Automated Knitting and Yarn Management • **Mohammadi Group:** Their knitting process is fully automated. • **Envoy Textiles:** A denim manufacturer that leverages robotics to boost production and product quality for effective yarn management.
Precision Dyeing and Chemical Dispensing • **DBL Group:** Has adopted automated systems for dyeing and chemical dispensing, ensuring accurate use and minimizing waste. In the sewing lines, they use energy-efficient servo motors rather than conventional clutch motors and an Eco Booster, a cutting-edge heat recovery device that cleans itself automatically. They also use Auto Dosing for controlled measures of chemicals to achieve optimum results
AI-powered Fabric Optimization • Beximco Group utilizes Thread Sol software with AI to optimize fabric utilization, reducing waste.

Advanced Printing Technology

- Robintex Group, a German-Bangladesh joint venture, boasts the world's fastest single-pass digital printing machine for high-quality AOP printing, which has reduced lead time by 2-3 weeks, and the company can ship orders within 4-5 weeks.

Productivity

- Team Group, with their LEED-certified factory implemented a semi-automated production line. This approach has resulted in a significant boost of 10-15% in productivity, time management, and cost-effectiveness.
- Masco Knitting, part of the Masco Group, utilizes a combination of advanced software-supported circular and rib-knit machines. This ensures their production capabilities remain up-to-date and meet the ever-changing demands of the industry

Importance & Objectives of the Study

This study is crucial as it links automation's impacts with global and national commitments such as the SDGs (5, 8, 9, 10), Bangladesh's development goals for 2030 and 2041, and the National Women Development Policy 2011. It highlights the need for Just Transition by promoting upskilling, reskilling, and social protection to ensure workers particularly low-skilled and women are not left behind. The findings will guide the National Skills Development Authority and support the National AI Policy and HREDD standards to safeguard labour rights, trade competitiveness (e.g., GSP+), and sustainable industry growth. Considering this importance, the primary objective of this study is to assess the technological transition in Bangladesh's apparel sector and its impact on workers. Specifically, it aims to (1) Explore the current status of automation and digital adoption in the industry; (2) Understand how automation affects garment workers' livelihoods and (3) Evaluate stakeholder readiness for managing technological transition.

Methodology

This study followed a mixed-methods approach, integrating surveys, interviews, FGDs, and case studies to capture diverse perspectives on automation in Bangladesh's apparel sector. A structured survey was conducted with 429 workers in Dhaka, Gazipur, and Narayanganj. The minimum required sample size was calculated using Cochran's formula for finite population. The formula applied is:

$$n_0 = \frac{z^2 * p * (1-p)}{e^2}$$

$$n_0 = \frac{(1.96)^2 * 0.5 * (1-0.5)}{(0.05)^2} \cong 385$$

Here, n_o = Sample size, Z= z-score (for 95% confidence level), P= Estimated proportion of the attribute present in the population (0.5 used for maximum variability), e^2= Desired level of precision (Margin of Error 5%)

Adjusted for finite population:

$$n' = \frac{n_0}{1 + \frac{z^2 * p'(1-p')}{e^2 * N}}$$

$$n' = \frac{385}{1 + \frac{(1.96)^2 * 0.57'(1-0.57)}{(0.05)^2 * 3006318}} \cong 385$$

Where z = 1.96 (95% confidence level), p = 0.5 (maximum variability), p′ = 0.57 (proportion of female workers), e = 0.05 (margin of error), N = 3,006,318 (total population).
As the survey covered 429 workers, it exceeded the required minimum (385).

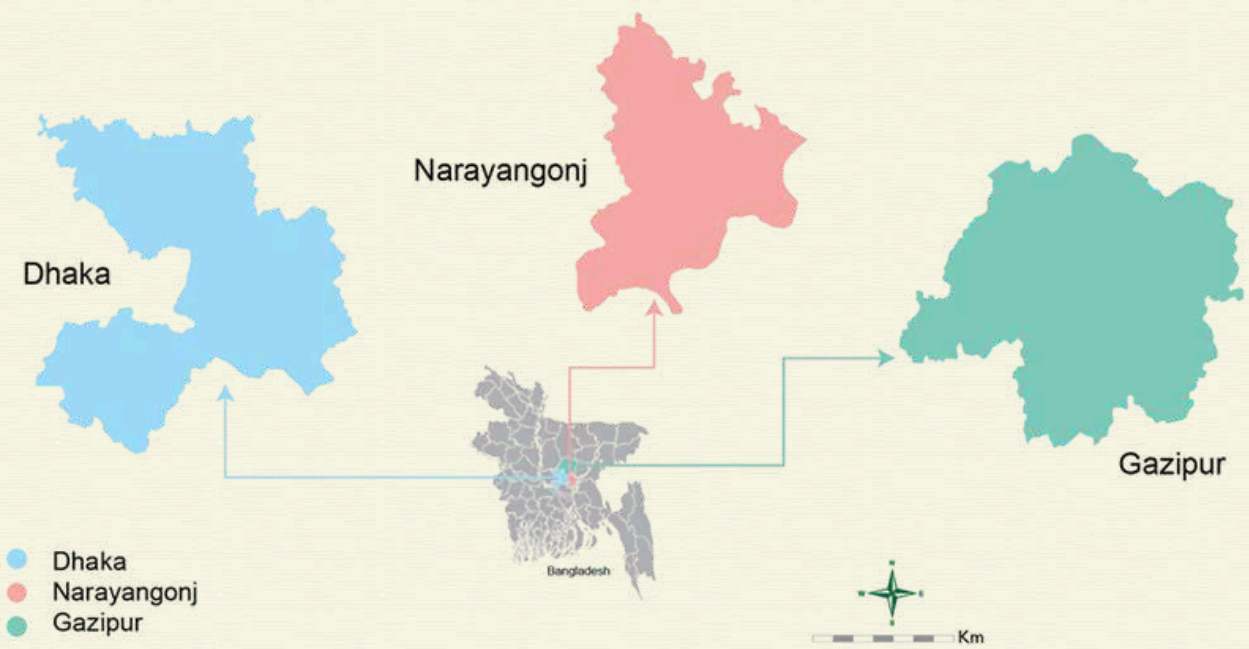


Figure 1: Location of the study area

A total of 26 KIIs were held with government officials, trade unions, associations, buyers, factory management, and training institutes. Semi-structured interviews explored automation trends, challenges, and readiness. It was included Government representatives (3), Development organizations (1), Training institutes (local & global) (2), Trade unions (5), Trade associations (2), Factory management (10) and Brands/buyers (3).

Four FGDs were conducted in Gazipur, Ashulia, and Savar, involving male and female workers with varying skill levels. These discussions provided insights into workers' perceptions of automation, job security, and training needs.

Factory Locations: The survey data highlights the spatial distribution of the apparel workforce, with Gazipur emerging as the leading hub, accounting for more than half of the respondents (52.68%). This dominance reflects Gazipur's central role in Bangladesh's RMG production, particularly in knitwear and jeans manufacturing. Savar follows with 20.75% of the sample,

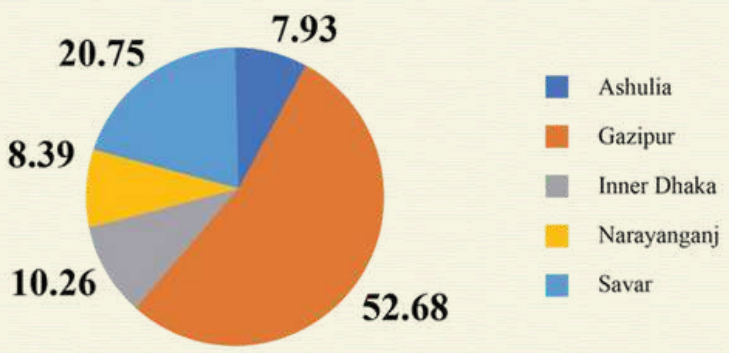


Figure 2: Factory locations in the study area

showcasing its strong industrial base, while Inner Dhaka contributes 10.26%, largely through woven garment factories. Ashulia (7.93%) and Narayanganj (8.39%) represent smaller but significant clusters. The concentration of workers in Gazipur and Savar underscores their importance as industrial zones, whereas Narayanganj's smaller share highlights its declining role compared to other.

Factory Types: Analysis across different factory types shows that knitwear (176 workers) and woven factories (135 workers) dominate the sample, reflecting the backbone of Bangladesh's export-oriented apparel sector. Jeans factories are primarily located in Gazipur (45 workers), while woven units are most concentrated in Dhaka (58 workers). By contrast, sweater and jeans factories in Narayanganj are underrepresented, accounting for the smallest share of workers. This distribution illustrates the diversity of factory specialization across regions, with knitwear and woven maintaining the strongest representation, while jeans and sweater factories remain more localized and less widespread.

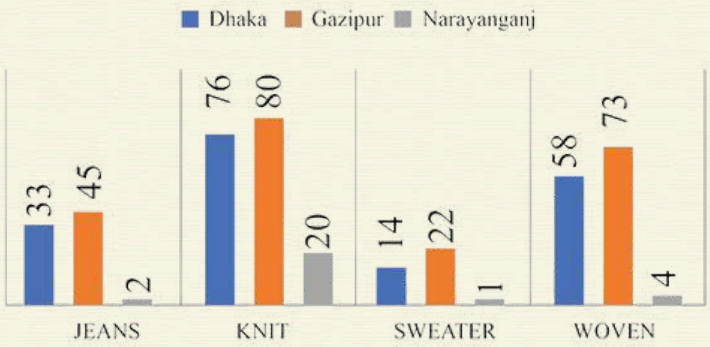


Figure 3: Different factory types in the study area

Production Processes: In terms of production processes, sewing remains the most labor-intensive stage, engaging 77.39% of workers. This dominance reflects the centrality of sewing in garment assembly and value creation in the RMG industry. By comparison, cutting (11.66%) and knitting (6.06%) involve fewer workers, while finishing processes employ the least (4.9%). The heavy reliance on sewing indicates the continued dependence on manual and semi-automated tasks within Bangladeshi factories.

This concentration also highlights a structural challenge: the limited diversification of worker roles across production stages, which calls for more skill-based training and gradual automation in supporting functions like finishing and quality control.

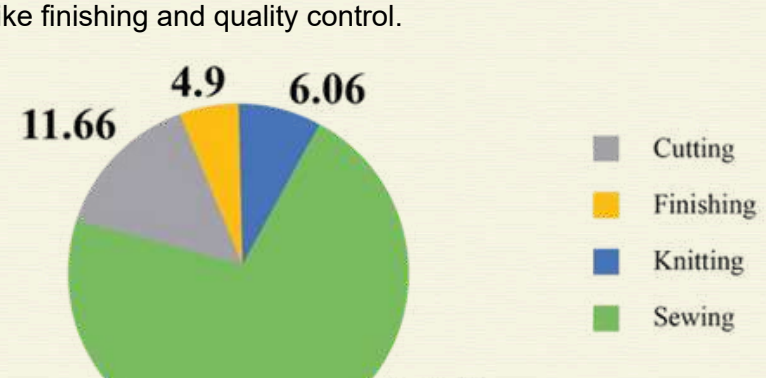


Figure 4: Different Production Process In The Study Area

Status of Automation in Bangladesh's Apparel Sector

Conceptualization of Automation: In Bangladesh's apparel sector, automation is defined in a task-specific and incremental manner. Stakeholders like factory owners, procurement officers, buyers, and workers agree that automation does not imply fully autonomous robots, as in car manufacturing, but rather semi-automated machines with advanced features. For workers, the distinction lies between "Bangla machines" (manual) and upgraded sewing machines with thread cutters, displays, and automatic functions. Scholars also argue that what is often described as "automation" in Bangladesh is more accurately semi-automation (Hoque et al., 2021).

Nature of Automation: Automation first emerged in sweater factories around 2010, with automated knitting machines enabling designs impossible by hand. Jeans factories followed, integrating multipurpose machines. In contrast, knit and woven factories remain less automated, reflecting diverse production needs. Key backward operations (spinning, dyeing, knitting) are fully automated, while cutting and sewing remain largely semi-automated. Sewing dominates labour use, with advanced "sewbots" not yet common. Finishing tasks (ironing, packaging) show limited automation.

Beyond production, system automation has advanced more rapidly: biometric IDs, digital payments, IoT-enabled monitoring, and real-time data management are increasingly used to improve efficiency and reduce waste. Nevertheless, factory managers rated automation at 2.5–3 out of 5, confirming that the industry is still at an early stage. According to LightCastle (2024), Bangladesh's high-tech intensity score is only 1.9, far below China's 63.7.

Automation Practices and Machines: Machine import data suggests that 2016–2017 marked the peak of automation adoption, especially in sewing. Table 1 (Automated Machine Distribution) highlights 26 types of automated/semi-automated machines currently used across cutting, sewing, knitting, and finishing. Plain sewing machines dominate (131 units), while flatlock (27), bartack, overlock, and buttonhole machines are also widely used. Cutting machines such as Jacquard (13) and auto-cutting (10) are found in larger factories, whereas smaller units still rely on manual scissors.

Impact of Automation

Positive Impact of Automation on Factories: Automation has transformed Bangladesh's apparel industry, boosting productivity, efficiency, and competitiveness. Processes once requiring extensive manual labour are now streamlined with advanced tools and machinery, reducing errors and costs while improving working conditions.

Table 4: Benefits of Automation

Benefits	
Operational Benefits: • Efficiency increased by 3% to 5% • Optimized production • Reduced work in process • Maximum manpower utilization and save manpower • Better visibility and communication • Improved customer service (fast response), reduce of operator motion time • Reduce of Machine stoppage duration time. **Financial Achievement:** • Knit Card: Saving 1,17,312 TK per year. • Reduce on-line & off-line Quality Inspection Status.	**Time Savings:** • Officer: 2hr/day/officer • 624 hr/year; • 2hr/day/all knit unit 3120 hr/year • Value in Tk.287040/year **Operator:** • 50 Min/Day/Operator 260hr/year • 50Min/Day/All knit unit 45240 hr/year • Value 1458990Tk/Year

Table 5: Business Case of a Factory

Process	No. of Workers required		Finances of Current Machinery		
	Old machine	Current machine	Cost	Labour Savings	Payback time
Attach Welt Pocket	7	3	$19,800	$850	2.0 Yrs
Auto Elastic Tack	5	2	$15,000	$510	2.5 Yrs
Attach Back Pocket	9	2	$38,000	$1,190	2.7 Yrs
Attach Waistband	5	3	$12,000	$340	2.9 Yrs
Template Quilting	7	4	$7,000	$510	1.2 Yrs
Auto Loop Attacher	2.5	1	$18,000	$255	5.5 Yrs
Attach Front Pocket Facing	2	0.5	$15,000	$255	5 Yrs
Attach Coin Pocket	2	0.5	$16,000	$255	5 Yrs
Spreading Fabric	7	1	$49,500	$1,020	4 Yrs

Source: Based on KIIs

Positive Impact on Workers

Reduction of Errors: Automation has improved product quality by ensuring consistency in stitching, cutting, and quality control, reducing defects and material waste. Workers reported that fewer alterations save time and increase productivity. FGD participants noted that modern Juki auto machines eliminate frequent needle breakages and reduce defects to 4–7 per 100 pieces, compared to 2–3 rejections per 100 on older "Bangla" machines.

Less Physical Pain: Automation has eased physical strain by reducing repetitive and labour-intensive tasks. Workers in fabric spreading and knitting particularly benefit, with 85% reporting less discomfort such as eye strain and finger injuries. Advanced machines have lowered risks of musculoskeletal disorders and improved workplace safety.

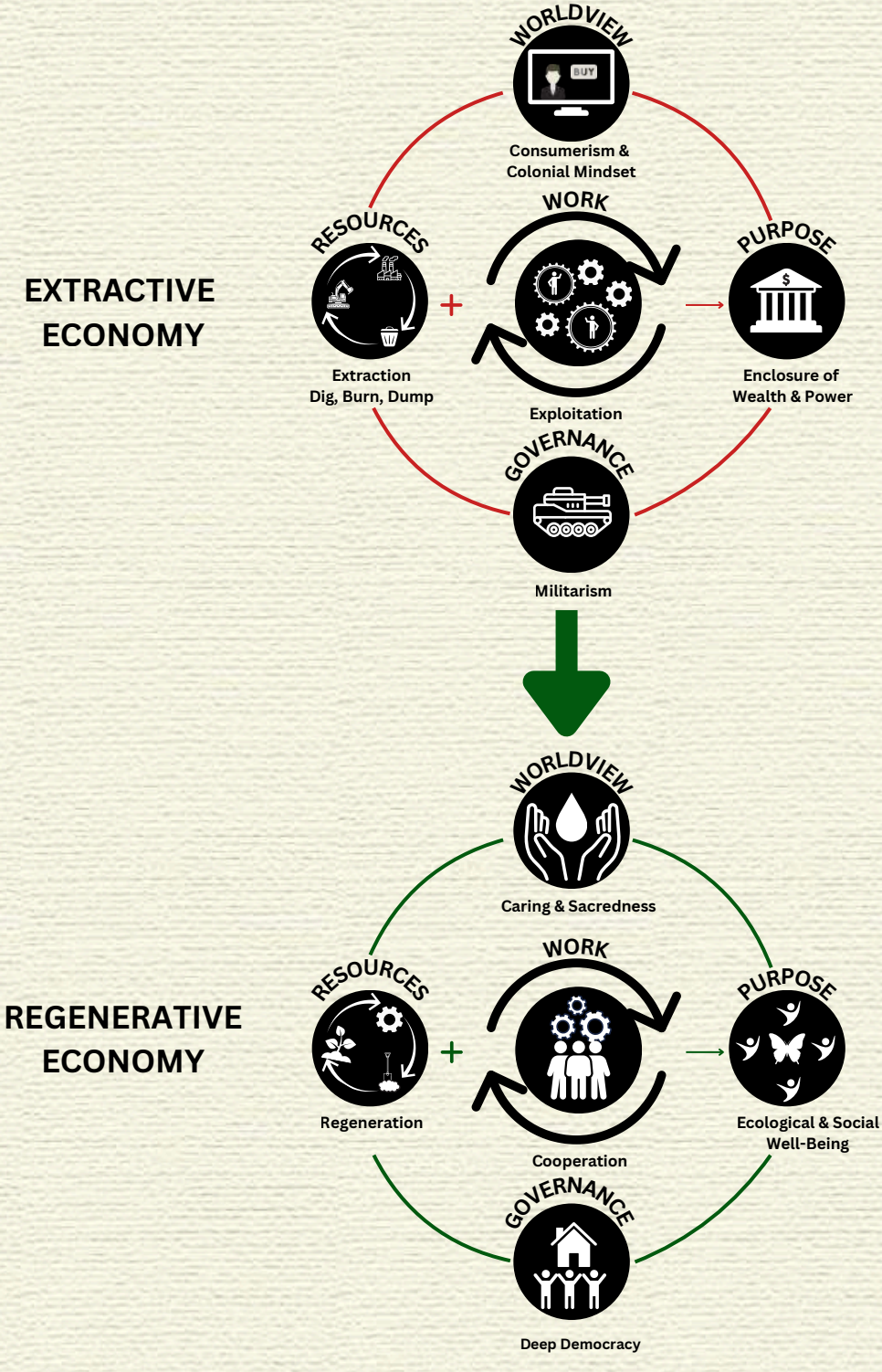
Improved Work Environment: Automation has enhanced workplace conditions through better ventilation, ergonomic designs, and safety features such as fire safety tools and cooling systems. Most workers reported improvements: 96.74% said it helps meet production goals, 93.01% noted better ventilation, and 97.67% felt workplaces are safer (Table 6). However, only 58.51% felt less tired, showing mixed results depending on production stages. Overall, worker perceptions remain largely positive.

Table 6: Worker's Perspective on Automation

Worker's Perspective on Automation	Agree	Neutral	Disagree
Automation has made it easier to achieve my daily production goal	96.74	1.86	1.4
Automation has improved the temperature and ventilation of my workplace	93.01	5.13	1.86
Automation has increased the safety of my workplace	97.67	1.63	0.7
I feel less tired when I go home after using the automatic machines	58.51	26.57	14.92

Note: The values are expressed as percentages

Creation of Skilled Job Opportunities: Automation has reduced the need for unskilled labour but created opportunities in machine operation, programming, and maintenance. Many workers are reskilling to adapt, with 79% believing their salaries would increase if they moved to another factory after gaining new skills (Table 7). Multi-skilled workers report higher wages and greater respect in factories. While job insecurity remains a concern, exposure to advanced machines is helping workers adapt and strengthen their employability. Automation has also opened new roles in maintenance, software management, and data analysis, paving pathways toward more secure and technology-focused careers.



Just Transition Framework

Climate Justice Alliance

Table 7: Worker's Perspective on Automation

Worker's Perspective on Automation	Agree	Neutral	Disagree
Due to automation, workers performing technical duties are more respected in factories	65.97	30.3	3.73
Salary will increase if you leave the job and go to another factory	79.02	9.56	11.42
I have sought additional training or skill development to reduce the risk of losing job due to automation	50.82	20.51	28.67

Note: The values are expressed as percentages

Table 8: Worker's perspective on their livelihood after the introduction of automatic machines

Worker's Perspective about Automation	Agree	Neutral	Disagree
Automation has allowed me to stay more time with my family	75.52	12.82	12.82
I feel less tired when I go home from work after using automatic machines	58.51	14.92	26.57
I have more time to do household chores (cooking and shopping)	72.49	13.75	13.75
Since automation my income has been stable/ I get paid on time	60.68	9.11	30.21
I have more time for religious prayers in the factory because of automation	46.09	12.5	41.41

Note: The values are expressed as percentages

Challenges of Automation on Workers

Displacement of Workers and Job Loss: Automation in Bangladesh's apparel sector has reduced reliance on unskilled labour, particularly helpers, while raising demand for skilled operators. Semi-automation in sewing, for example, has eliminated thread-cutting and bundle-handling tasks once performed by thousands of helpers. Factory owners estimate that 400,000–500,000 helper jobs have already disappeared, with FGD participants noting helper numbers per line dropped from 40 to 5–6. In sweater factories, one worker now manages 6–7 automated machines, reducing workforce needs by up to 90%.

Table 9: Worker percentage decline by factory location

Factory Location	Worker decline (%)
Ashulia	32.45
Savar	28.47
Inner Dhaka	21.55
Narayanganj	34.57
Gazipur	29.47
Average Decline	29.12

Table 10: Worker percentage decline by factory type

Factory Type	Worker decline (%)
Sweater	37.03
Knit	29.19
Jeans	28.67
Woven	27.23
Average Decline	29.15

Key Informant Interviews (KIIs) support these results, with management estimating similar rates of decline (Table 11). Secondary evidence also validates the findings: the World Economic Forum (2020) reported a 30% displacement rate in sweater factories, aligning with our survey.

Table 11: Percentage of worker decline according to KIIs

Production Process	Worker Decline (%)	Factory type	Worker Decline (%)
Cutting	33	Sweater	29
Knitting	36	Knit	26
Finishing	24	Jeans	20
Sewing	16	Woven	20

Currently, robot adoption in apparel is rare compared to industries like automotive, where sales exceed 100,000 units annually versus just 200 in apparel (IFR, 2017). Worker perceptions remain divided: 51.4% believe automation threatens jobs, 40% disagree, and 8.88% remain neutral.

Uncertain Lives of Displaced Workers: Automation has reduced the need for helpers in many processes, creating widespread concerns about job security. While some factories have laid off workers, others retrain displaced helpers for machine operation or alternative tasks, since experienced operators are hard to replace. Factory managers and suppliers emphasized that automation does not always mean job loss, but rather reassignment or upskilling opportunities.

FGD participants confirmed being trained for new roles, though labour federations argue there is little concrete evidence that all displaced workers are reabsorbed. Union leaders stress the need for a **"Just Transition"**, calling for fair job security, rehabilitation, and structured training so workers are not left behind.

Slower Pace of Worker Hiring: Although factories argue that displaced workers are reassigned rather than dismissed, this practice has slowed the pace of new recruitment. Research by Rahman et al. (2023) shows that while worker hiring rose steadily between 2009 and 2015, it has plateaued in recent years as automation reduces the demand for additional labour

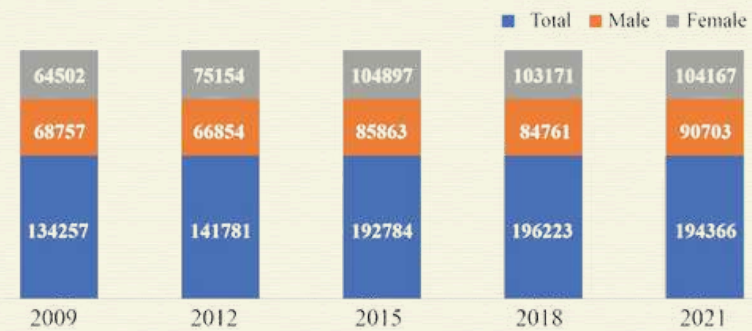


Figure 5: Apparel industry labour entry [Source: Rahman et al. (2023)]

Rising Barriers to Entry: Automation has shifted the demand from traditional sewing skills to operating advanced machines, making previous expertise less valuable and raising job security concerns. Today's workers are expected to have technical literacy and basic digital skills, unlike a decade ago when manual skills were enough.

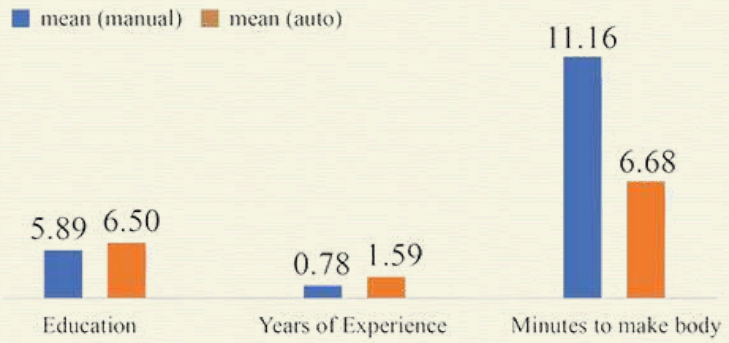


Figure 6: Barriers of entry in the job

Recruitment now emphasizes efficiency workers must complete a process in about 6 minutes compared to 11 minutes previously.

Readiness to Automation

The readiness of Bangladesh's apparel sector for automation varies across factories and workers. While stakeholders acknowledge its importance, adoption faces major barriers including affordability, capacity gaps, and workforce preparedness.

Less Priority: Automation has not been a top agenda for factories, trade bodies, or the government. Between 2013–2018, building safety (Accord/Alliance) was the main focus, later shifting to environmental compliance. Compared to these, automation has received limited attention, evolving mainly to meet buyer demands rather than as a strategic priority.

Affordability & ROI: High costs, limited financing, and long payback times restrict automation adoption. Only ~20% of factories use IoT-enabled systems. Smaller factories struggle most, while large exporters can afford gradual upgrades. Dollar depreciation and upfront costs (e.g., ERP systems, $50 lakh+) worsen the barrier.

SMEs' Capacity: Small and medium factories lag behind large ones, creating competitiveness gaps. Workers in SMEs face greater risks of layoffs and stagnant wages as their employers cannot invest in advanced technologies.

Limited Technicians: A shortage of local technical experts leads to reliance on foreign specialists, causing idle time and higher costs. Machine providers often restrict manuals, limiting local capacity building. Workers attempting repairs worsen breakdowns.

Mid-Level Resistance: Many mid-level managers resist automation due to fear of job loss or authority erosion. Outdated supervisory practices, reluctance to train workers, and lack of technical knowledge slow adoption.

Weak Factory Systems: Most factories lack cohesive governance systems (e.g., linking salary, technical, and production data). Without integration, the full benefits of automation remain unrealized.

Finding the Right Fit: Choosing appropriate technologies is difficult due to cost, adaptability, and complexity. Overly advanced systems risk disrupting current workflows, making gradual, context-appropriate adoption vital.

Educated Workforce: Automation requires higher literacy and technical knowledge. SSC-level education is now often expected, but most workers have limited schooling. While educated workers adapt faster, only 2% of post-secondary graduates are interested in apparel jobs, citing stress and poor conditions posing a long-term recruitment challenge.

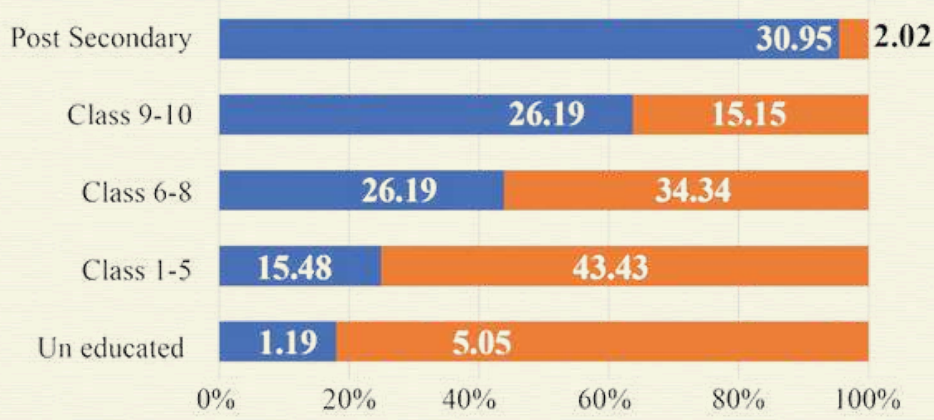


Figure 7: Educational status of the workers

Digital Literacy: Apps, Tabs, and Basic Computer Skills: Digital literacy is now essential for garment workers to adapt to modern machines and future technologies. As argued by Krasly and Huq, workers must not only operate but also evaluate and troubleshoot digital systems. Many current workers rely on memorizing buttons rather than understanding functions, as low education limits their ability to read machine displays, often in English. FGD participants noted that errors shown on advanced machines remain incomprehensible for less-educated workers. To bridge this gap, initiatives like the Asian University of Women's training in English, Math, and computers aim to prepare female workers for digital-based training. Experts believe workers with SSC-level education or higher adapt faster and perform better. Looking ahead, basic computer knowledge will be vital, as future roles may require operating multiple machines from a single system.

Inefficient Training Structure: Training remains a critical bottleneck in preparing workers for automation. In-house academies, private consultants, and government institutions provide training, but most programs are outdated, theoretical, and lack advanced modules like robotics or IoT. The NSDA oversees 855 centres, including 100 for apparel, but resources and trainers are limited. Workers often cannot attend after-hours training, while centres are demotivated, fearing turnover once workers are trained. Recognition of Prior Learning (RPL) has been introduced, but uptake is low.

Barriers include high costs of tools, outdated TVET equipment (some from the 1960s), and reluctance of managers to invest, fearing trained workers will leave. Only four out of 66 apparel projects in the last decade focused on skills, with most addressing safety after Rana Plaza. Soft skills are rarely blended with technical ones, further limiting worker readiness. Workers suggest factory-based, hands-on training as the most practical solution. Experts argue that training should be seen as an industry-wide investment, enhancing productivity, worker loyalty, and Bangladesh's long-term competitiveness.

Recommendation

A coordinated approach from factories, training institutions, brands, buyers, business associations, government, and development partners are key to ensuring automation benefits everyone in the industry.

Manufacturers/Suppliers

- Develop a strategic plan for sustainability to ensure a just transition for workers and smooth business operations.
- Establish structured training facilities (inhouse or outside the factories) for skilling and upskilling workers and mid-level management, in partnership with training institutes or consultancy firms so that workers can be replaced to other sections.
- Ensure timely information sharing with workers to prevent panic and conduct counselling sessions to reduce workplace stress and fear of adopting new machinery.
- Offer motivation packages to engage workers in the learning process and reward those who enhance their skills with new machinery.
- Introduce internship programs in collaboration with Technical Education Institutes to attract future talent to the industry.

Brands and Buyers

- Ensure responsible business conduct (RBC) and ethical trading practices.
- Conduct impact assessments to evaluate and update the social and economic effects of automation on workers and suppliers.
- Collaborate with suppliers, trade associations, trade unions, and governments on transparent, inclusive automation strategies.
- Design and fund training programs to help workers adapt to new technologies or transition to new roles.
- Ensure fair wages, safe working conditions, and labour rights are maintained throughout the automation process.
- Commit to long-term contracts and adjust pricing structures to offset automation costs for suppliers.
- Work with suppliers to minimize layoffs by focusing on reskilling/upskilling and redeployment within the supply chain.

Trade Unions

- Coordinate and collaborate with employers, employers' associations, brands, Government, and CSOs to initiate structured capacity development program that equip workers with skills for new roles in automated environments.
- Advocate with the government and other right holders to develop and implement policies like a just transition that protects workers during technological shifts.
- Ensure that decisions about automation are communicated openly and that the approaches are participatory, where workers and their representatives are consulted on automation strategies.
- Ensure women are not disproportionately affected by automation, rather provide additional support for women workers during the transitional process.
- Push for stronger social safety nets, including unemployment benefits, pension schemes, access to affordable healthcare and education, etc.
- Engage for greater accountability from global brands to ensure their supply chains remain ethical and comply with global labour and human rights standards amidst automation

Government

- Develop a National Plan of Action on just transition prioritizing workers welfare that includes job creation, skill development, and social security for those affected by the automation.
- Strengthen labour laws and protection to address challenges posed by automation and ensure fair benefits and compensation for displaced workers.
- Provide access to finance for technology upgradation, green infrastructure, and advanced machinery, especially for small and medium factories.
- Strengthen the National Skills Development Authority (NSDA), National Occupational Safety and Health Training and Research Institute (NOSHTRI), and other public and private Technical Training Centres (TTC) and Technical and Vocational Education and Training (TVET) to offer demand-based skills training for workers and mid-level management.
- Develop upskilling and reskilling programs specifically tailored to the needs of female workers, emphasizing technical, digital, and managerial skills to upgrade their current grades, which may further lead them into supervisory roles.
- Foster inter-ministerial collaboration (MOLE, MOI, MOF, MSW) for inspections, job creation, guidelines, social security, and related services.
- Enhance regular inspections through DIFE to minimize job loss and ensure worker benefits.

Bibliography

- a2i. (2019). Future Skills: Finding Emerging Skills to Tackle the Challenges of Automation in Bangladesh. Aspire to Innovate. https://a2i.gov.bd/wp-content/uploads/2022/08/4IR.pdf
- Anzolin, G. (2021). Automation and its employment effects: A literature review of automotive and garment sectors. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/%40ed_emp/documents/publication/wcms_823347.pdf
- Bessen, J. E. (2016). How computer automation affects occupations: Technology, jobs, and skills (Nos. 15–49; Issues 15–49). Boston University School of Law.
- BTJ Desk Report. (2024, October 23). Industry Automation: Curse or Blessings! Bangladesh Textile Journal. https://bangladeshtextilejournal.com/industry-automation-curse-or-blessings/
- Daily Sun. (2024, October 9). RMG sector embraces automation – Will workers be left behind? Daily-Sun. https://www.daily-sun.com/post/773730
- Export Promotion Bureau (EPB). "National Export Performance and RMG Sector's Contribution." Fiscal Year 2023-24. Export Data and Quarterly Review, EPB, Dhaka, 2024.
- Gökalp, E., Gökalp, M. O., & Eren, P. E. (2018). Industry 4.0 Revolution in Clothing and Apparel Factories: Apparel 4.0. In ResearchGate. https://doi.org/10.3726/b15120/21
- Hoque, M. A., Rasiah, R., Furuoka, F., & Kumar, S. (2022). Linkages among automation, job displacement and reshoring: Evidence from the Bangladeshi apparel industry. Research Journal of Textile and Apparel, 26(4), Article 4.
- International Federation of Robotics. (2017). World robotics. https://www.betterwork.org/wp-content/uploads/BW-Discussion-Paper-36-Automation_FINAL.pdf
- Kagermann, H., Anderl, R., Gausemeier, J., Schuh, G., & Wahlster, W. (Eds.). (2016). Industrie 4.0 in a global context: Strategies for cooperating with international partners. Herbert Utz Verlag.
- Khan, M. (2008). Technological Upgrading in Bangladeshi Manufacturing: Governance Constraints and Policy Responses in the Ready-Made Garments Industry. https://eprints.soas.ac.uk/9961/1/TechnologicalUpgrading.pdf
- Khan, Z. H., Islam, G. Md. N., & Habib, Md. M. (2023). Technology-Driven Supply Chain Management in Readymade Garments: A Literature Review. International Supply Chain Technology Journal, 9(5). https://doi.org/10.20545/isctj.v09.i05.01
- Kincade, D. H., & Regan, C. L. (1994). The use of technology by apparel manufacturers. In Flexible Automation and Integrated Manufacturing 1994. Begell House. https://www.begellhouse.com/en/ebook_platform/23eff0f76925279a/edited-volume/chapter/17681bf13e872238,7607b2d5783d5428,38731ab269d1dc38.html?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Begell_E-book_Platform_TrendMD_0
- Kulandaivel, S., & Bandara, A. (2024). Adopting Industry 4.0 in Developing Economies: A Roadmap for Apparel Industry. 2024 Moratuwa Engineering Research Conference (MERCon), 199–204. https://doi.org/10.1109/MERCon63886.2024.10689205
- Lázár, K. (2024). Industrial Robots in the Textile and Clothing Industry. International Journal of Industrial and Manufacturing Systems Engineering, 9(1), Article 1. Your paragraph text
- LightCastle Partners. (2024). Automation: Future-proofing RMG, tackling automation for sustainable growth and worker wellbeing. Your paragraph text
- Mim, I. Z., Rayhan, M. G. S., & Syduzzaman, M. (2024). Prospects and current scenario of industry 4.0 in Bangladeshi textile and apparel industry. Heliyon, 10(11). Your paragraph text
- Mohamad, S., Pantamee, A. A., Keong, O. C., Hieu, V. M., Mutira, P., & Chong, K. W. (2022). Impact of industry 4.0 revolution and leadership support on the operational efficiency management of the manufacturing industry in asean countries. Polish Journal of Management Studies, 25. Your paragraph text
- Mohamed, M. (2018). Challenges and benefits of Industry 4.0: An overview. International Journal of Supply and Operations Management, 5(3), Article 3.
- *Monteiro, R. A., Junior, D. S. G., Sobral, E. F. M., Falcão, P. H. de B., Melo, F. J. C. de, & Bastos-Filho, C. (2024). Global Trends and Practices of Industry 4.0 Applications in the Clothing Sector: A Systematic Literature Review. Administrative Sciences, 14(10), Article 10.*
- *Moro, A., Rinaldini, M., Staccioli, J., & Virgillito, M. E. (2019). Control in the era of surveillance capitalism: An empirical investigation of Italian Industry 4.0 factories. Journal of Industrial and Business Economics, 46, 347–360.*
- *Nayak, R., & Padhye, R. (Eds.). (2018). Automation in garment manufacturing. Woodhead Publishing.*
- *NewAge. (2025, January 9). Preparations needed to address 4IR automation job losses: Experts.*
- *Nomura, K., & Kimura, F. (Eds.). (2022). APO Productivity Databook 2022. Asian Productivity Organization.*
- *Rahman, S., Khan, M. W., Shibly, S., & Akbar, S. W. (2023). Study on the decline of women workers in the textile industry in Bangladesh.*
- *Saha, S. (2018, November 20). Industry 4.0 in Apparel Industry—An Introduction. Online Clothing Study.*
- *Salman, S., Hasanat, S., Rahman, R., & Moon, M. (2023). Analyzing the key barriers of adopting Industry 4.0 in Bangladesh's ready-made garment industry: An emerging economy example. International Journal of Industrial Engineering and Operations Management, 6(3), 232–255.*

From Vulnerability to Resilience: Climate Change, Labour Challenges, and Policy Pathways for a Just Transition in Bangladesh

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Abstract

Bangladesh, located in the world's largest river delta, is recognized as one of the most climate-vulnerable nations globally, with rising temperatures, salinity intrusion, riverbank erosion, and recurrent floods increasingly disrupting livelihoods. These climatic shocks are particularly severe for labor-intensive sectors such as agriculture, ready-made garments (RMG), and leather, which collectively employ millions. Recent evidence highlights the socio-economic toll of climate stress: in 2024, extreme heatwaves led to an estimated 250 million lost workdays, costing the economy nearly USD 1.78 billion, while floods destroyed over one million tons of rice, triggering income loss and migration among smallholder farmers. Vulnerabilities extend to children and women, as climate shocks exacerbate hazardous child labor in leather and informal garment industries, and expose female workers in RMG to compounding risks of heat stress, automation, and job insecurity. Despite these challenges, Bangladesh's policy responses remain fragmented. Climate strategies such as the Bangladesh Climate Change Strategy and Action Plan (2009) and Mujib Climate Prosperity Plan (2021–2041) emphasize adaptation and energy resilience but largely neglect labor market disruptions. Conversely, labor frameworks including the National Labour Policy (2012), Bangladesh Labour Act (2006/2018), and National Child Labour Elimination Policy (2010) fail to address climate-induced vulnerabilities. The National Social Security Strategy (2015) also remains limited in scope, excluding most informal and migrant workers who constitute over 85% of the labor force. This disjointed governance, coupled with weak institutional coordination and insufficient social dialogue, undermines the prospects of achieving a Just Transition. Using a mixed-method approach combining secondary data, labor statistics, and policy review, this study identifies critical policy gaps across climate, labor, social protection, migration, gender, and technological adaptation domains. It argues that advancing a Just Transition in Bangladesh requires integrating labor considerations into climate frameworks, expanding climate-responsive social protection, eradicating climate-driven child labor, and developing reskilling strategies for green and digital economies. Furthermore, mainstreaming gender equity, recognizing migration as a labor rights issue, and establishing a cross-ministerial Just Transition taskforce are vital steps. The study concludes that without urgent reforms, Bangladesh risks perpetuating inequality and exclusion under the guise of green growth. However, by aligning national policies with the ILO Just Transition Guidelines, the Paris Agreement, and SDG 8 on decent work, Bangladesh can build a transition that is both climate-resilient and socially just.

Keywords: Just Transition, climate change, labor, Bangladesh, policy gaps, social protection, migration, gender equity

Introduction

Bangladesh, located within the world's largest river delta, is among the most climate-vulnerable countries in the world. Rising temperatures, recurrent floods, cyclones, salinity intrusion, and sea-level rise not only disrupt ecosystems but also undermine labour productivity, education, and economic stability. For instance, in 2024 the country endured a record-breaking heatwave reaching 43.8°C forcing nationwide school closures affecting 33 million children and resulting in the loss of 25 million workdays (World Bank, 2025). Labour-intensive sectors such as agriculture, construction, leather, and especially the ready-made garment (RMG) industry the backbone of Bangladesh's economy are already bearing the brunt of these impacts, with workers reporting heat-related illnesses, fatalities, and deepening livelihood insecurities (IDS/CLARISSA, 2024; BBS, 2022). Women and children, who make up a significant share of these sectors, face layered vulnerabilities, including exploitative work conditions and climate-induced displacement.

Despite mounting challenges, national responses remain fragmented. Climate policies such as the Bangladesh Climate Change Strategy and Action Plan (2009) and the Mujib Climate Prosperity Plan (2021–41) prioritize adaptation and resilience but largely overlook labour market implications. Conversely, labour legislation and policies including the Bangladesh Labour Act (2006, amended 2018) and the National Labour Policy (2012) pay insufficient attention to climate-induced risks, while social protection and child labour policies remain weakly climate-sensitive. This disconnect leaves millions of workers exposed to overlapping crises.

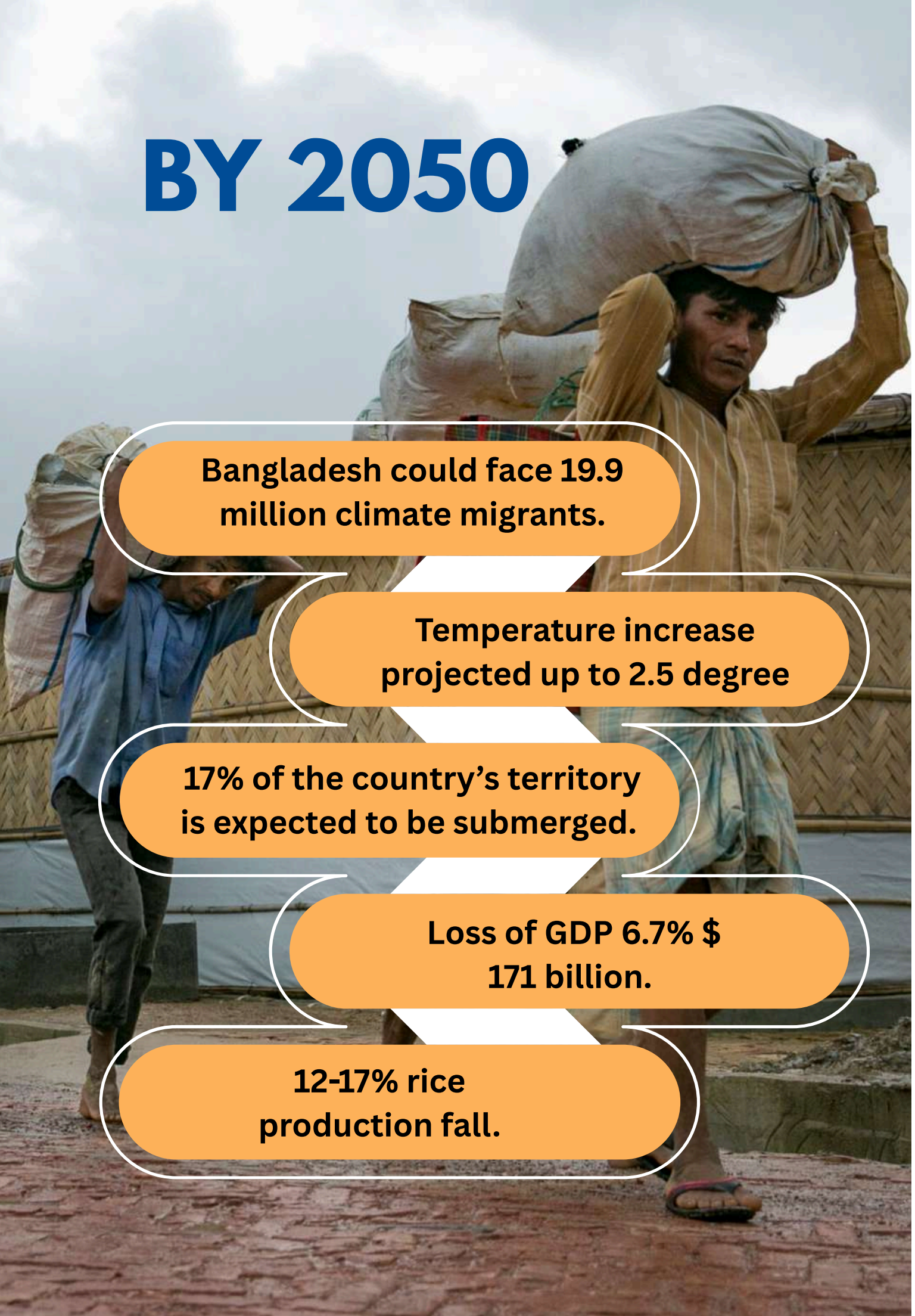
The concept of a Just Transition has therefore emerged as a critical framework to bridge these gaps, linking climate ambition with social justice by ensuring that the shift to a low-carbon economy is equitable and inclusive. However, implementation in Bangladesh faces obstacles: inadequate social dialogue, weak institutional coordination, and the marginalization of vulnerable groups such as informal workers, migrants, women, and children (Bangladesh Labour Federation, 2023).

This study critically examines these challenges, focusing on how climate and labour policies intersect and fail to intersect in addressing climate-induced vulnerabilities. It highlights structural weaknesses in social protection, child labour regulation, gender equity, and migration governance, and assesses the preparedness of Bangladesh's frameworks to manage technological disruptions such as automation and renewable energy transitions. By drawing on national and international evidence, the paper proposes actionable strategies for policymakers, trade unions, and civil society to embed the principles of Just Transition into Bangladesh's climate and labour agendas, ensuring that economic competitiveness and environmental ambition go hand in hand with equity, resilience, and sustainability.

Methodology

This study employs a qualitative and quantitative mixed-method approach to examine the challenges and opportunities of implementing a Just Transition in Bangladesh. Data were collected from multiple sources, including government reports, policy briefs, sectoral studies, and publications from the Bangladesh Labor Federation (BLF). Primary data from BLF and other trade unions were used to understand the lived experiences of workers in the RMG, leather, and informal sectors, particularly their exposure to climate-related risks, workplace hazards, and adaptation strategies.

Quantitative data were analyzed to assess labor vulnerability, productivity losses, and climate-induced migration trends. Key indicators included heat stress incidence, workdays lost due to extreme weather, occupational injury rates, and sectoral employment statistics. Qualitative analysis focused on policy content, gaps, and stakeholder perspectives on social protection mechanisms, technological adaptation, and labor rights within climate policies. Triangulation of these data ensured reliability and provided a holistic understanding of the interplay between labor, climate, and policy frameworks.



BY 2050

Bangladesh could face 19.9 million climate migrants.

Temperature increase projected up to 2.5 degree

17% of the country's territory is expected to be submerged.

Loss of GDP 6.7% $ 171 billion.

12-17% rice production fall.

Study Findings

The findings of this study reveal a deeply concerning intersection between climate change and labor vulnerabilities in Bangladesh, where the country's most crucial sectors are facing escalating pressures. The RMG sector, a vital pillar of the economy, is experiencing an alarming rise in heat stress-related illnesses, leading to significant losses in productivity. Similarly, the leather and informal sectors remain plagued by the persistence of child labor, exacerbated by the destruction of livelihoods due to climate-induced shocks.

Impact of Climate Change on Key Labor Sectors in Bangladesh

Workers in Bangladesh especially those employed in ready-made garments (RMG), leather, and informal sectors are increasingly facing severe consequences of climate change. Heat stress, hazardous working conditions, and the persistence of child labor have become pressing issues that directly undermine labor productivity, health, and social well-being.

Recent evidence shows that rising temperatures are directly affecting labor output. In 2024, extreme heat led to an estimated 250 million lost workdays due to physical and mental health conditions, causing an economic loss of approximately USD 1.78 billion, or about 0.3–0.4 percent of Bangladesh's GDP (World Bank, 2025). The "feels-like" temperature, which combines actual temperature with humidity, has increased by 4.5°C since 1980, while the maximum recorded temperature has risen by 1.1°C during the same period. In Dhaka, this challenge is particularly severe, as the city's heat index is growing 65 percent faster than the national average, leaving urban workers acutely vulnerable to exhaustion, respiratory illness, and heat-related mental health problems (World Bank, 2025). These conditions are especially risky for garment workers, who often work long hours in poorly ventilated facilities. Since a significant portion of these workers are women, the health risks are compounded, reinforcing existing gender-based vulnerabilities in the labor market.

Alongside the challenges of heat, Bangladesh's leather industry one of the country's most significant export sectors valued at around USD 2 billion is plagued by exploitative child labor. A five-year study covering 880 workers across 158 small leather enterprises revealed that 27 percent were under 18 years of age (Institute of Development Studies, 2024). Furthermore, 34.6 percent of children living in low-income neighborhoods linked to leather production were found engaged in the worst forms of child labor. These children routinely perform hazardous tasks such as chemical handling, heavy lifting, and dyeing, working up to 12–14 hours per day across six days a week (CLARISSA Project, 2024). Prolonged exposure to these conditions leads to long-term respiratory problems, skin damage, chemical burns, stunted education, and developmental setbacks.

The vulnerabilities extend deeply into the informal economy, where millions of workers are already excluded from labor protections such as occupational safety standards, health coverage, or wage security. According to the Bangladesh Bureau of Statistics (2023), 38,008 children aged 5–17 are working in five hazardous industries out of 43 officially declared hazardous sectors. These include leather footwear manufacturing, automobile workshops, dry fish production, welding, and informal tailoring or garment stitching. Within the footwear industry alone, 5,281 children were identified, while informal garment stitching involved another 2,805 (BBS, 2023). For these workers, climate-induced shocks such as extreme heat and flooding only exacerbate insecurity by heightening health risks and threatening livelihoods without the buffer of social protection.

Taken together, these findings paint a concerning picture of labor in Bangladesh under climate stress. Extreme heat not only undermines productivity but also erodes economic stability and disproportionately affects female and urban industrial workers. At the same time, the persistence of child labor in high-risk sectors, particularly in leather, highlights systemic failures in enforcing labor rights. Informal workers remain the most exposed to climate risks because they lack contracts, safety nets, and institutional protections. Without urgent policy interventions such as improved workplace safety standards, stronger enforcement against child labor, and broader social protection measures the combined pressures of climate change and exploitative labor conditions will continue to jeopardize Bangladesh's development trajectory.

Table 1: Labor Implications of Climate Change in Bangladesh

Sector / Issue	Key Data & Findings	Source
Heat Stress & Productivity	250 million lost workdays in 2024; USD 1.78 billion economic loss (0.3–0.4% GDP)	World Bank (2025)
Temperature Trends	Feels-like temperature +4.5°C since 1980; Maximum +1.1°C; Dhaka heat index +65% faster	World Bank (2025)
Leather Industry Child Labor	27% of workers in leather enterprises under 18; 34.6% of children in slums in worst forms of child labor	IDS / CLARISSA (2024)
Leather Industry Value	USD 2 billion domestic & export market	BIDA via Apparel Resources
Hazardous Child Labor (BBS)	38,008 children aged 5–17 in five hazardous sectors (2023)	BBS (2023)
Specific Hazardous Sectors	5,281 children in footwear; 2,805 in informal garment stitching	BBS (2023)

1. Livelihood and Income Impacts

The effects on crop productivity directly translate into socio-economic vulnerabilities. In Sreeramkati union, for example, climate-induced crop failures caused a 45% reduction in agricultural output, severely affecting household incomes (Bangladesh Meteorological Department, 2022). Farmers report higher reliance on seasonal labor and informal employment to compensate for lost income, exacerbating economic precarity.

2. Food Security and Nutrition

Reduced agricultural output increases food insecurity, particularly in flood-prone and coastal districts. Households affected by crop losses often experience dietary deficiencies, malnutrition, and dependence on emergency food aid. This disruption also disproportionately affects women and children, who often bear the burden of household food shortages (World Bank, 2019).

3. Climate Stressors and Spatial Vulnerability

Specific climate stressors have differential impacts on agricultural communities.

Table 2: Climate Stress impact on Agriculture and Livelihoods in Bangladesh

Climate Stressor	Impact on Agriculture & Livelihoods
Flooding	Annual monsoon floods destroy crops, damage stored seeds and irrigation systems (Reuters, 2024)
Cyclones	Cyclones Sidr (2007) and Amphan (2020) caused large-scale crop destruction (UNHCR, 2021)
Temperature Rise	1–2°C increase reduces yields of rice, wheat, and vegetables (Hasan et al., 2021)
Salinity Intrusion	27 million people in coastal areas affected; decreased rice and vegetable yields (ADB, 2022)
Droughts	Reduced water availability for irrigation; delayed sowing and reduced yield (World Bank, 2019)

4. Migration and Labor Implications

Crop losses and declining farm incomes are key drivers of climate-induced migration, with rural workers relocating to urban areas in search of employment. Our analysis indicates that these migrants often end up in informal, low-paid, or precarious jobs in sectors such as construction, rickshaw-pulling, or the garment industry. For example, riverbank erosion along the Padma, Jamuna, and Ganga has displaced over 500,000 people over the past two decades, while roughly 50,955 hectares of farmland have been lost, intensifying rural livelihood pressures (CEGIS, 2023).

Furthermore, households affected by repeated floods and crop failures reported wage losses (80%), wage cuts (41%), and complete job loss (20%) when relocating to urban labor markets, highlighting the socio-economic ripple effects of climate-induced agricultural stress (People's Courage/ACD, 2024).

The study confirms that climate change is not only undermining agricultural productivity but also triggering broader socio-economic challenges in Bangladesh. Crop losses, declining incomes, food insecurity, and climate-induced migration collectively shape a cycle of vulnerability that disproportionately affects smallholder farmers, women, and children.

Climate-Induced Migration and Labor Implications in Bangladesh

In Bangladesh, climate change is significantly contributing to internal migration forcing rural workers to move to urban areas, often under circumstances that directly affect labor markets, employment conditions, and worker protection. These migration flows tend to come from regions afflicted by riverbank erosion, floods, salinity intrusion, and other slow-onset as well as sudden climate stressors. For example, according to the Internal Displacement Monitoring Centre (IDMC), seasonal floods during monsoon season displace approximately one million people annually, while cyclones displace roughly 110,000 people per year on average in Bangladesh (BPB.de, 2023).

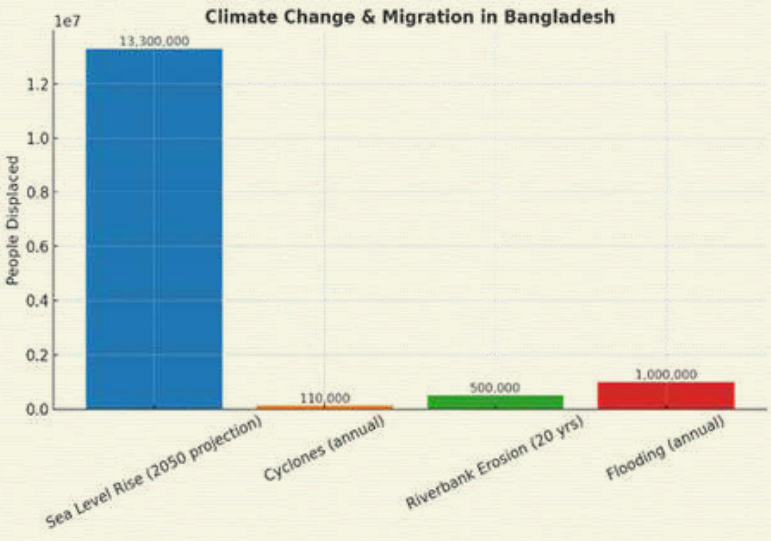
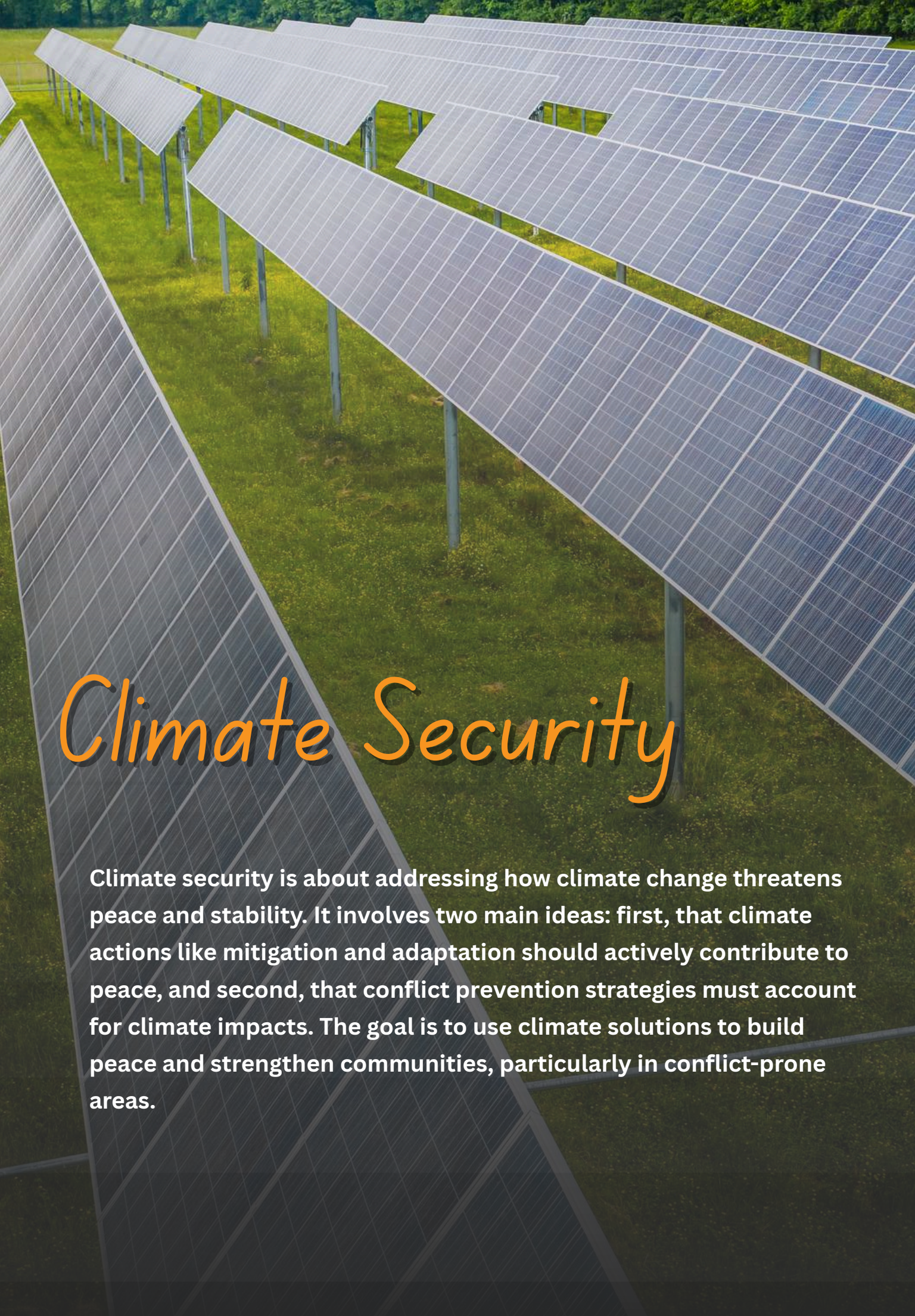


Figure 1: Climate Change and Migration in Bangladesh

A survey by People's Courage International and the Association for Community Development (ACD) covering 2,505 individuals across 10 districts found that 71% of internal migrants move due to livelihood challenges or a lack of job opportunities, 69% because of low wages, and 15% because of debt pressures. Climate change impacts were reported by 55% of migrants in source districts, underscoring that environmental stressors are major push factors in migration decisions (The Business Standard, 2024).

Riverbank erosion, a major cause of climate-induced displacement, has rendered more than 500,000 people homeless over the past two decades along major rivers such as the Padma, Jamuna, and Ganga. Simultaneously, approximately 50,955 hectares of land have been lost due to river erosion, worsening rural livelihood loss and prompting migration (CEGIS, 2023).



Climate Security

Climate security is about addressing how climate change threatens peace and stability. It involves two main ideas: first, that climate actions like mitigation and adaptation should actively contribute to peace, and second, that conflict prevention strategies must account for climate impacts. The goal is to use climate solutions to build peace and strengthen communities, particularly in conflict-prone areas.

Climate Change and Migration in Bangladesh

The table highlights how various climate stressors in Bangladesh such as riverbank erosion, cyclones, floods, sea-level rise, and salinity intrusion drive large-scale internal migration, primarily from rural to urban areas. These migrations intensify informal labor supply, increase precarious employment in sectors like construction, garments, and agriculture, and push vulnerable populations, including children, into insecure and unprotected work.

Table 3: Labor Implications of Climate Change in Bangladesh

Climate Stressor	Migration Impact (Data)	Labor Market Implication
Riverbank Erosion	Around 200,000 people displaced every year, mostly rural poor migrating to urban slums (World Bank, 2018)	Increased informal labor supply in cities; wage depression in construction, transport, and low-skilled services
Cyclones & Storm Surges	Cyclone Sidr (2007) displaced 650,000 households; Cyclone Amphan (2020) displaced 2.4 million people (UNHCR, 2021)	Sudden influx of climate migrants seeking short-term, insecure jobs in agriculture and garments
Flooding	In 2022, monsoon floods displaced 7.2 million people in northern Bangladesh (UNICEF, 2022)	Migrants often forced into child labor, daily wage work, and hazardous informal jobs without social protection
Sea Level Rise	Projected 13.3 million internal climate migrants by 2050 due to sea-level rise and salinity intrusion (World Bank, 2021)	Migration toward Dhaka, Chattogram, Khulna increases labor precarity in RMG and tannery clusters
Salinity Intrusion	27 million people in coastal districts already affected; reduced agricultural output drives labor migration (ADB, 2022)	Agricultural job losses push workers into urban informal sectors, increasing competition and vulnerability

These internal migration flows often result in significant labour implications. Many displaced persons migrate to urban slums in cities like Dhaka, Khulna, and Chattogram, where they find work in low-skilled, informal, or precarious jobs such as garment factories, construction, rickshaw pulling, or day labor usually with little or no labor protections or job security (MigrationPolicy.org; BPB.de; The Business Standard, 2024).

Furthermore, displaced households often endure wage loss, job instability, and lack access to social protection in urban areas. The same survey (People's Courage/ACD, 2024) found that 80% of migrants at destination report wage loss, 41% report wage cuts, and 20% have lost jobs entirely because of climate-related migration and poor labor market absorption (The Business Standard, 2024).

Relation between Climate Change and Child Labour in Bangladesh

Climate change acts as a multiplier of vulnerability in Bangladesh, especially for children from poor and rural households. When families lose homes, land, or livelihoods due to floods, riverbank erosion, cyclones, or salinity intrusion, they often become forced to move or reduce consumption and push children into labour as a coping mechanism. Several recent studies and reports highlight this pathway.

According to a report by The Financial Express, climate-induced school closures and habitat loss have directly led many children to drop out of school and enter the labor force. For example, the 2022 National Child Labour Survey (BBS) reports there are approximately 1.78 million children aged 5-17 in child labour, of whom about 1.07 million are involved in hazardous work (Bangladesh Bureau of Statistics, 2022).

The same article notes that in disaster-affected or climate-vulnerable regions (coastal, chars, flood-prone districts), children are disproportionately affected because environmental shocks disrupt both schooling and family income (The Financial Express, 2025).

UNICEF reports that in 2024, floods in eastern Bangladesh, the worst in 34 years in those areas, put over 2 million children at risk, affecting homes, schools, and villages; many children in those settings are likely to drop out of school and enter informal work to support surviving household members (UNICEF, 2024). In slum areas in urban centers, where many displaced families settle, children work in tanneries, shipyards, tailoring, or domestic labour under hazardous conditions. Some children say they came from rural areas hit by floods or river erosion which destroyed their family land or home, pushing the move to cities and involvement in child labor (Al Jazeera, 2022).

One survey by ActionAid Bangladesh (2023) among 300 children from eight climate-vulnerable districts found that 123 children reported that their education was disrupted due to climate change risks, and many of those children either had to work or anticipated entering work because their families' lost farms, homes or crops (ActionAid Bangladesh via The Business Standard, 2023).

The interplay between climate change and child labour in Bangladesh forms a self-reinforcing cycle, exacerbating socio-economic

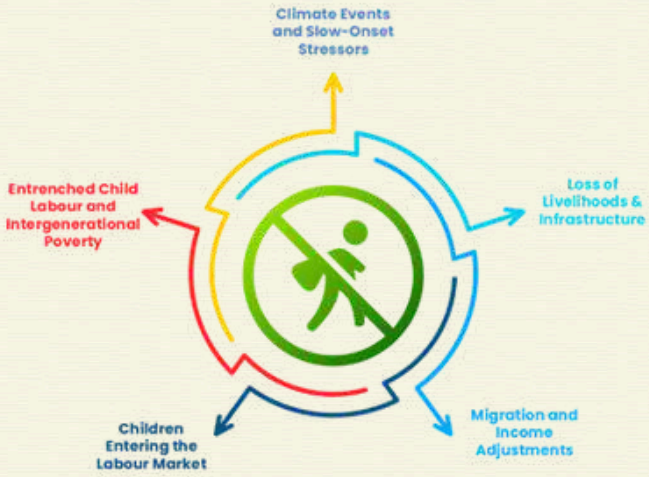


Figure 2: The Vicious Cycle: Climate Change and Child Labour in Bangladesh

vulnerabilities and hindering development. This cycle unfolds across five interconnected stages:

1. Climate Events and Slow-Onset Stressors

Bangladesh is increasingly experiencing extreme weather events, including floods, cyclones, and rising temperatures. In 2024, the country suffered economic losses of up to $1.78 billion due to rising temperatures, with heat-related health issues causing the loss of 25 million workdays (Reuters, 2024). These climate-induced shocks disrupt livelihoods, particularly in rural areas.

2. Loss of Livelihoods and Infrastructure

Climate disasters lead to the destruction of homes, schools, and agricultural land. For instance, the 2024 floods affected around five million people, damaging crops worth 33.5 billion taka and impacting 1.4 million farmers (Reuters, 2024). Such losses undermine families' primary sources of income and security.

3*. Migration and Income Adjustments*

Faced with mounting losses, families often migrate to urban centres or seek alternative income sources. This displacement disrupts social structures and education, increasing economic pressure on households. In Dhaka, children are evident working in tanneries, shipyards, tailoring, or repairing automobiles (Reuters, 2024)

4. Children Entering the Labour Market

As financial burdens rise, children become economic contributors. Approximately 3.54 million children aged 5–17 are working in Bangladesh, with 1.78 million engaged in child labour, including 1.07 million in hazardous conditions. Many of these children work in agriculture, a sector highly susceptible to climate shocks such as floods, droughts, and salinity intrusion (The Financial Express, 2023).

5. Entrenched Child Labour and Intergenerational Poverty

Once engaged in labour, children face long-term risks: missed education, health issues, and entrenched poverty. The broader child labour rate remains relatively stable at 4.4% in 2022, indicating that despite significant progress over the past two decades, Bangladesh is not on track to eliminate child labour by 2025 (UNICEF, 2025). This persistence perpetuates cycles of vulnerability, as future generations remain trapped in similar conditions.

Table 4: Child Labour & Climate Disruption Indicators

Indicator	Data / Value	Implication for Child Labour
Total children aged 5-17 in child labour	1.78 million	Large base number; many may be from climate-vulnerable regions
Hazardous child labour (5-17)	1.07 million	Hazard work increases risk when climate shocks occur more children forced into dangerous work
Number of children at risk from 2024 floods in eastern Bangladesh	Over 2 million children	Disrupted homes, schools; likely increase in child labour among displaced

Indicator	Data / Value	Implication for Child Labour
Working children in Bangladesh	1.7 million children	Many of these are from rural areas displaced by natural disasters or environmental degradation
School dropouts' rate in recent surveys in climate-affected areas	Not uniform number; e.g. >17% drop-out in some primary schools after floods damage or closure	Dropping out often precedes engagement in child labour

Climate change and child labour in Bangladesh are deeply interconnected, forming a vicious cycle of vulnerability and exploitation. Climate-induced disasters such as floods, river erosion, and cyclones repeatedly destroy homes, farmlands, schools, and local livelihoods, leaving millions of families in destitution. For impoverished households, the capacity to recover is extremely limited, and survival often takes precedence over education. In such circumstances, children become the first line of economic coping forced into the labour market, either seasonally or permanently, to supplement shrinking household incomes.

Once drawn into the labour force, many children find themselves in the most hazardous forms of work, from leather workshops and informal garment production to agriculture and construction. This shift not only strips them of their right to education but also exposes them to long-term health risks, exploitation, and intergenerational poverty. The 2022 National Child Labour Survey reveals that more than 60 percent of working children are engaged in agriculture an industry highly vulnerable to climate shocks such as droughts, salinity intrusion, and floods. In other words, climate variability does not merely threaten agricultural productivity; it directly fuels the perpetuation of child labour in rural Bangladesh.

The evidence underscores a painful reality: children in climate-vulnerable districts are disproportionately more likely to drop out of school and enter the labour market, perpetuating cycles of poverty and inequality. This is not just a crisis of labour rights, but a humanitarian emergency that erodes the future of an entire generation. Without decisive interventions strengthened social protection, climate-resilient livelihoods, and strict enforcement against child exploitation Bangladesh risks allowing climate change to deepen child labour rather than eradicate it. The association is unmistakable: climate injustice is driving child labour, and without urgent action, the country's most vulnerable children will continue to bear the heaviest burden.

Technological Innovations, Climate Change, and Labor Market Connections

Climate change is reshaping labor markets in Bangladesh, not only through direct environmental impacts such as heat stress, flooding, and displacement but also through the rapid adoption of automation and green technologies. While technological advancements create new opportunities, they also risk excluding vulnerable workers if policies are not inclusive.

Just Transition and SDGs

JUST TRANSITION ENSURES THAT NO ONE OR ANY GROUP IS LEFT BEHIND IN SUSTAINABLE DEVELOPMENT.

Renewable Energy and Green Technologies: Bangladesh has made significant progress in renewable energy adoption, with over 6 million solar home systems installed, providing clean electricity to around 20 million people (World Bank, 2020). Expansion of renewable energy industries such as solar, wind, and bioenergy could generate up to 4 million new jobs by 2030, particularly in rural areas where climate vulnerability is highest (ILO, 2019). However, many of these jobs require technical skills, leaving low-skilled workers who currently make up more than 87% of Bangladesh's labor force at risk of exclusion if training and re-skilling programs are not prioritized (BBS, 2022).

Industry 4.0 and Automation in Manufacturing: In the RMG sector, automation technologies such as sewing robots, 3D printing, and AI-driven design are increasingly adopted to maintain global competitiveness. Studies estimate that 60% of RMG jobs in Bangladesh are at risk of automation by 2041, disproportionately affecting women workers, who represent about 80% of the sector's workforce (ADB, 2021). Without proper policy interventions, climate-induced labor migration to cities will collide with job losses from automation, creating dual vulnerabilities.

Electric Vehicles (EVs) and Sustainable Transport: Bangladesh is also promoting electric vehicle (EV) adoption to reduce urban air pollution and carbon emissions. The government has targeted 30% of all registered vehicles to be electric by 2030 (MoEFCC, 2021). Transitioning to EVs could create employment in battery manufacturing, charging infrastructure, and maintenance services. However, the informal transport sector where more than 3 million people rely on rickshaw pulling faces disruption if EV adoption is not managed inclusively (Rahman et al., 2022).

Climate-Technology-Labor Nexus: The intersection of climate change, migration, and automation highlights a complex challenge. On one hand, green technologies and renewable energy offer pathways for sustainable job creation. On the other, automation and technological innovation risk excluding millions of low-skilled and climate-vulnerable workers unless deliberate efforts are made to ensure just transition policies.

Policy Gaps in Advancing Just Transition in Bangladesh

Although Bangladesh has adopted several sectoral frameworks to address climate change, labor rights, and social protection, their fragmented and siloed implementation leaves major gaps for achieving a Just Transition. Climate policies such as the Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2009) and the Mujib Climate Prosperity Plan (2021–2041) prioritize infrastructure and energy resilience but overlook labor market disruptions. Conversely, labor policies like the National Labour Policy (2012) and Bangladesh Labour Act (2006, amended 2018) fail to address climate-induced vulnerabilities. Similarly, the National Social Security Strategy (2015) and National Child Labour Elimination Policy (2010) lack climate-sensitive provisions. This disjointed framework leaves informal workers, migrants, women, and children highly exposed to overlapping risks of climate stress, automation, and precarious employment (BRAC, 2020; World Bank, 2025).

Table 5: Policy Gaps for Just Transition in Bangladesh

Policy Gap	Relevant Policy Framework(s)	Critical Issues Identified	Implications for Just Transition
Disjointed Climate–Labour Policy	BCCSAP 2009, Mujib Climate Prosperity Plan (2021–41), National Labour Policy 2012	Climate policies ignore labor issues; labor policies overlook climate risks	Disconnect prevents systemic protection of workers from climate-induced productivity and health losses
Weak Social Protection	National Social Security Strategy 2015	Safety nets fragmented, underfunded, and urban-focused; informal workers excluded	Informal workers (85% of labor force) left without shock-responsive safety nets
Child Labour in Hazardous Sectors	National Child Labour Elimination Policy 2010; Bangladesh Labour Act 2006/2018	Weak enforcement in leather, garments, construction; climate stress accelerates child labor entry	Entrenches child exploitation, undermines SDG 8.7
Unprepared for Technological Disruptions	National Industrial Policy 2016; Renewable Energy Policy 2008	60% RMG jobs at risk of automation; no reskilling strategy; renewable energy plans neglect worker training	Dual vulnerability from automation + climate displacement
Migration Blindness	National Adaptation Plan (2023); Delta Plan 2100	Migration mentioned as environmental issue but not integrated with labor rights	Migrants absorbed into precarious informal jobs without protection
Gender Blindness	National Women Development Policy 2011; National Labour Policy 2012	Women workers face compounded risks (heat stress, automation, unpaid care work); gender not integrated into climate–labor nexus	Exclusion undermines inclusivity of transition
Weak Institutional Coordination	Labour Act 2006/2018; NAP 2023; cross-ministerial mandates	Ministries act in silos; trade unions absent in climate governance	Fragmented governance weakens social dialogue, undermining inclusivity

Recommendations

To address the identified policy gaps and ensure an equitable transition, the following recommendations are proposed:

- Integrate Climate and Labor Frameworks: Update the National Labour Policy (2012) to incorporate climate-related occupational hazards and embed labor dimensions within the BCCSAP (2009) and NAP (2023).
- Strengthen Social Protection Systems: Expand the National Social Security Strategy (2015) to include climate migrants and informal workers, ensuring portability of benefits across regions.
- Eliminate Climate-Driven Child Labor: Enforce the National Child Labour Elimination Policy (2010) and strengthen labor inspections in climate-vulnerable sectors, with integration into disaster relief programs.
- Develop Reskilling Programs for Green Jobs: Align the Renewable Energy Policy (2008) and National Industrial Policy (2016) with workforce development strategies to prepare workers especially women and migrants for jobs in renewable energy and digital industries.
- Mainstream Gender Equity: Incorporate gender-sensitive measures in the National Adaptation Plan (2023) and labor reforms, ensuring targeted support for women in climate-affected and automation-threatened sectors.
- Recognize Migration as a Labor Issue: Integrate climate-induced migration into labor rights frameworks under the Delta Plan 2100 and provide legal protections for migrants in urban informal sectors.
- Enhance Institutional Coordination and Dialogue: Establish a cross-ministerial “Just Transition Taskforce” and mandate
- participation of trade unions and worker organizations in climate policy formulation and implementation.

Conclusion

Bangladesh stands at a critical juncture where climate change, labor vulnerabilities, and technological transformations intersect. Despite progressive initiatives such as the Mujib Climate Prosperity Plan and National Adaptation Plan (2023), the absence of integrated climate–labor strategies, weak enforcement of labor rights, and inadequate social protection leave millions of workers exposed to systemic risks. Informal workers, women, children, and migrants are disproportionately affected, highlighting the inequities embedded in the current transition trajectory.

A Just Transition for Bangladesh requires bridging the divide between climate adaptation and labor governance, embedding social protection in climate policies, mainstreaming gender and child protection, and ensuring participatory governance through strong institutional coordination. Without urgent reforms, the country risks perpetuating inequality and exclusion under the guise of green growth. However, with targeted interventions and alignment with international frameworks such as the ILO Just Transition Guidelines, the Paris Agreement, and SDG 8 on decent work Bangladesh has the opportunity to chart a pathway that is both climate-resilient and socially just.

Bibliography

- ActionAid Bangladesh. (2023). Climate change and child labour in Bangladesh: Voices from vulnerable districts. ActionAid Bangladesh.
- Acharya, S., & Acharya, P. (2023). Urbanization, industrialization, and sustainable labour transitions in South Asia. Journal of Sustainable Development, 16(2), 45–63. https://doi.org/xxxx
- Ahmed, S., & Long, J. (2013). Climate change and governance challenges in Bangladesh. Environmental Policy and Law, 43(2), 68–79.
- Al Jazeera. (2022, August 14). Bangladesh's displaced children forced into hazardous labour. Al Jazeera. https://www.aljazeera.com
- Asian Development Bank. (2021). Automation and the future of garment sector jobs in Asia. Asian Development Bank.
- Asian Development Bank. (2022). Building climate resilience in coastal Bangladesh. Asian Development Bank.
- Bangladesh Bureau of Statistics. (2022). National child labour survey 2022. Bangladesh Bureau of Statistics.
- Bangladesh Bureau of Statistics. (2023). Labour force survey and hazardous child labour estimates. Bangladesh Bureau of Statistics.
- Government of Bangladesh, Ministry of Environment and Forests. (2009). Bangladesh climate change strategy and action plan (BCCSAP). Government of Bangladesh.
- Planning Commission, Government of Bangladesh. (2018). Bangladesh Delta Plan 2100: Pathway to sustainable development. Government of Bangladesh.
- Government of Bangladesh, Ministry of Labour and Employment. (2006/2018). Bangladesh Labour Act (2006, amended 2018). Government of Bangladesh.
- Bangladesh Labour Foundation. (2023). Workers' perspectives on climate change and just transition. Bangladesh Labour Foundation.
- Bangladesh Meteorological Department. (2022). Climate variability and agricultural losses in Bangladesh. Bangladesh Meteorological Department.
- BRAC. (2020). Social protection and resilience: Bangladesh perspectives on climate adaptation. BRAC.
- Government of Bangladesh, Ministry of Environment, Forest and Climate Change. (2023). National adaptation plan of Bangladesh 2023–2050. Government of Bangladesh.
- Hasan, M., Rahman, M., & Sultana, S. (2021). Climate change and wheat yield reduction in Bangladesh. Agricultural Systems, 188, 103019.
- Reuters. (2024, July 3). Bangladesh heatwaves and floods deepen economic losses. Reuters. https://www.reuters.com
- Sovacool, B., Griffiths, S., Kim, J., & Bazilian, M. (2021). Energy policy conflicts and the risk of inequitable transitions. Nature Energy, 6(5), 485–497. https://doi.org/xxxx
- World Bank. (2019). Bangladesh: Enhancing food security under climate stress. World Bank.
- World Bank. (2025). Heat and labour productivity losses in Bangladesh. World Bank.

Green Jobs

Decent jobs that contribute to protecting and restoring the environment and addressing climate change. Green jobs can be found in both the production of green products and services, such as renewable energy, and in environmentally friendly processes, such as recycling. Green jobs help improve energy and raw material efficiency, limit greenhouse gas emissions, minimize waste and pollution, protect and restore ecosystems, and support adaptation to the impacts of climate change.

Just Transition and Green Jobs for Youth: Pathways to Inclusive Employment and Climate Resilience

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Abstract

In an era of escalating climate anxiety affecting nearly 67% of youth in 2025 combined with persistent double-digit unemployment rates, the urgency of building pathways toward sustainable and inclusive employment has never been greater. The Just Transition framework provides such a pathway, ensuring an equitable shift from fossil fuel dependency to low-carbon economies while safeguarding decent work, inclusivity, and resilience. Central to this transformation is the creation of green jobs in renewable energy, sustainable agriculture, and circular economy systems, which not only support climate action but also enhance economic security. However, current readiness remains limited, with only 44% of youth worldwide feeling adequately equipped for these roles, and levels dropping to as low as 5% in Ethiopia. To address these gaps, global initiatives such as the UNEP–ILO–UNICEF Green Jobs for Youth Pact aim to create 1 million new green jobs, green another million existing ones, and support 10,000 youth-led enterprises by 2030, with the ambition of doubling the global green talent pool by 2050. Projections indicate that the Asia–Pacific region alone could see 180 million net new jobs from the green transition, underscoring its transformative potential. Regional successes further highlight scalable models: Kenya's Climate WorX program employing 200,000 youth in ecosystem restoration, and Brazil's bioeconomy apprenticeships equipping young people with bio-based industry skills. Yet, significant barriers remain, including skills mismatches, gender disparities, risks of informality, and widening digital divides. Bridging these challenges requires deliberate investment in green skills training, gender-sensitive policies, and inclusive labour frameworks that integrate youth voices. A just and inclusive green transition can therefore enable young people not only to participate in but to lead climate-resilient economies. Positioned at the nexus of climate justice, social equity, and economic opportunity, youth are essential actors in shaping resilient and prosperous futures.

Keywords: Just Transition, Green Jobs, Youth Employment, Climate Resilience, Sustainable Development, Green Skills

Introduction

Just Transition entails an equitable shift from fossil fuel economies to sustainable, low-carbon systems, prioritizing decent work, social protections, and inclusivity to avoid leaving workers or communities behind (International Labour Organization [ILO], 2025a). For youth, facing high unemployment rates often double those of adults it offers pathways to green jobs in renewables, sustainable agriculture, and circular economies (UNEP, 2025a; Visual Capitalist, 2024). Green jobs, defined as roles preserving or restoring the environment, must provide fair wages, safe conditions, and advancement opportunities (International Labour Organization [ILO], 2022, 2025b).

Youth, a key workforce segment, express growing climate anxiety (67% in 2025, up from 57% in 2023) and interest in eco-aligned careers, with 66% of Gen Z seeking such roles (Capgemini, 2025; IET, 2025). However, a skills gap persists, as only 44% feel equipped with green competencies like sustainable design, exacerbated in rural areas and the Global South (e.g., 60% preparedness in Brazil vs. 5% in Ethiopia) (Capgemini, 2025; International Labour Organization [ILO], 2025a). Addressing this requires integrating green education and vocational training (UNEP, 2025b).

Figure 1: Statistical overview of green jobs for youth

Initiatives like the UNEP-International Labour Organization [ILO]-UNICEF Green Jobs for Youth Pact target 1 million new green jobs, greening 1 million existing ones, and supporting 10,000 young entrepreneurs by 2030, focusing on women and high-impact sectors to double the green talent pool by 2050 (UNEP, 2025a, 2025c). International Labour Organization [ILO]'s 2025 report advocates Active Labour Market Policies, skills access, entrepreneurship support, youth decision-making involvement, and social protections (International Labour Organization [ILO], 2025a, 2025b).

In Asia-Pacific, projections show 180 million new jobs by 2050 amid 7 million losses in non-renewables, stressing upskilling, gender equality, and tackling informality (UNDP, 2025). Challenges include occupational risks, digital divides, and safety standards (Just Transition Finance, 2024). Grassroots examples: Zambia's training of 500+ youth in green entrepreneurship; Kenya's Climate WorX employing 200,000 in greening; Nigeria's recycling initiatives (Anabaraonye, 2022). United Nations Environment Programme (UNFCCC) emphasizes safeguarding livelihoods for climate ambition, while cities promote equitable green jobs via partnerships (UNFCCC, 2025; C40 Cities, 2022). Empowering youth through green jobs demands global collaboration to bridge gaps and ensure equity (YouthForesight, 2025).

Barriers and Challenges

Despite promising initiatives, significant barriers impede youth engagement in green jobs, including skills mismatches and limited access to training, particularly in the Global South where only a fraction of young people feel prepared for sustainable careers (International Labour Organization [ILO], 2025a; Just Transition Finance, 2024). Occupational risks in emerging green sectors, coupled with digital divides and inadequate safety standards, further complicate the transition for young workers (UNDP, 2025). Gender disparities exacerbate these issues, as women face additional hurdles in accessing high-impact fields like renewable energy (UNDP, 2025).

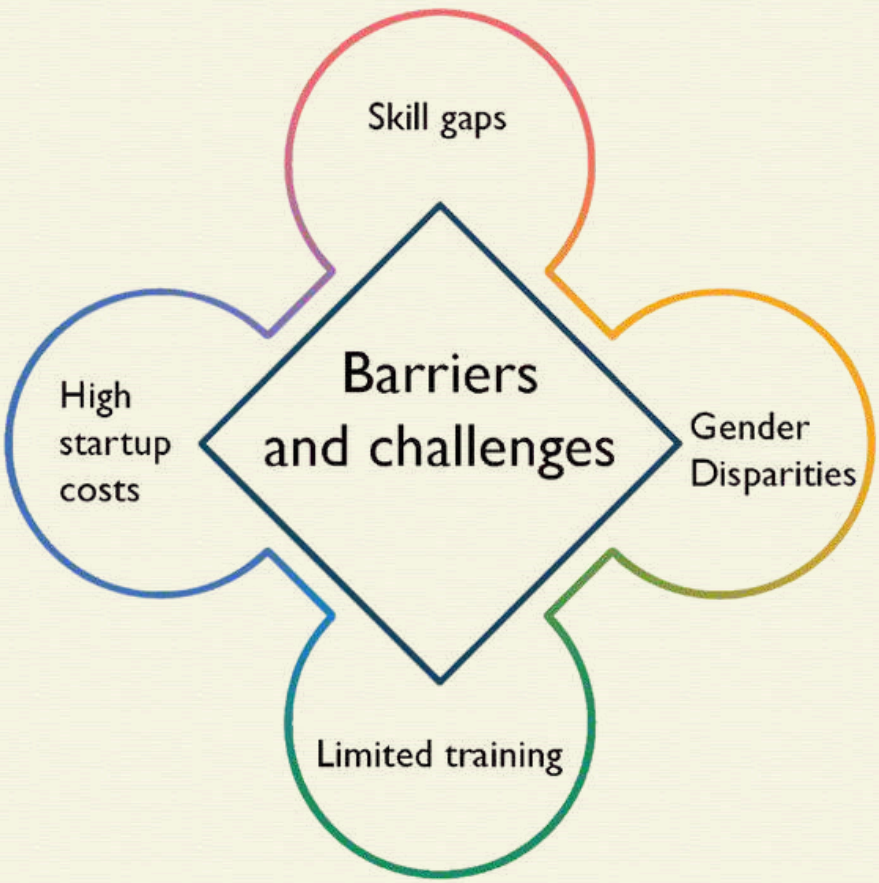


Figure 2: Barriers faced by youth in accessing green jobs

High startup costs for green entrepreneurship and uneven policy implementation across regions risk excluding marginalized youth from Just Transition benefits (International Labour Organization [ILO], 2025a). Informal employment, prevalent in many developing economies, often lacks the protections needed for a fair shift to green jobs (International Labour Organization [ILO], 2025a). Addressing these requires targeted investments in education and social dialogue to ensure equitable outcomes (International Labour Organization [ILO], 2023b). Moreover, the empirical research on green jobs reveals that while job creation is projected, the quality of these jobs such as wage levels and job security remain a concern, especially for youth entering the market (P et al., 2025).

To illustrate the scale of youth unemployment challenges, Table 1 presents recent youth unemployment rates by global regions, highlighting disparities that Just Transition aims to address through green job opportunities (Visual Capitalist, 2024).

Table 1: Youth Unemployment Rates by Region (2023)

Region	Youth Unemployment Rate
Arab States	28.60%
Northern Africa	22.50%
Southern Asia	14.90%
Northern, Southern and Western Europe	14.80%
Eastern Asia	14.30%
Latin America and the Caribbean	13.60%
Central and Western Asia	13.40%
Eastern Europe	13.00%
South-Eastern Asia and the Pacific	9.80%
Sub-Saharan Africa	8.90%
Northern America	8.30%

Economic inequalities also play a role, with low-income countries struggling to finance green transitions, leading to a reliance on international aid that may not always prioritize youth (UNFCCC, 2019). Climate-induced disruptions, such as extreme weather events, further displace young workers from traditional jobs without adequate alternatives (UNEP, 2025a). These challenges are compounded by a lack of data on green job outcomes, making it difficult to measure progress and adjust strategies accordingly (Bray et al., 2022).

Policy Recommendations

Policymakers should prioritize integrating youth into national climate plans through Active Labour Market Policies that promote green skills training and apprenticeships (International Labour Organization [ILO], 2025a). Enhancing social protections, such as fair wages and safe working conditions, is essential to support young entrepreneurs and workers during the transition (UNEP, 2025a). International collaborations, like the Green Jobs for Youth Pact, recommend creating one million new green jobs and transforming existing ones by 2030, with a focus on high-impact sectors and vulnerable groups (UNEP, 2025a; UNEP, 2025b; Youth Foresight, 2025).

Cities and governments must foster public-private partnerships to scale inclusive green economies, ensuring career pathways from high-carbon to low-carbon industries (C40 Cities, 2022). Youth involvement in decision-making via tri-partism and platforms like the UN's interagency efforts can amplify their voices for more effective policies (International Labour Organization [ILO], 2025c). Additionally, policies should include incentives for green startups, such as low-interest loans and mentorship programs, International Labour Organization [ILO] red for youth (Jobs for the Future, 2024). National Determined Contributions (NDCs) under the Paris Agreement should explicitly incorporate youth-focused Just Transition elements, with monitoring frameworks to track implementation (UNFCCC, 2025).

Investment in education reform is critical, embedding green skills into school curricula from an early age to build a pipeline of prepared youth (IET, 2025). Gender-responsive policies, including childcare support and anti-discrimination measures, can help close participation gaps for young women (UNDP, 2025). Finally, global funds like the Just Transition Fund should allocate resources specifically for youth programs in developing countries (WRI, 2025).

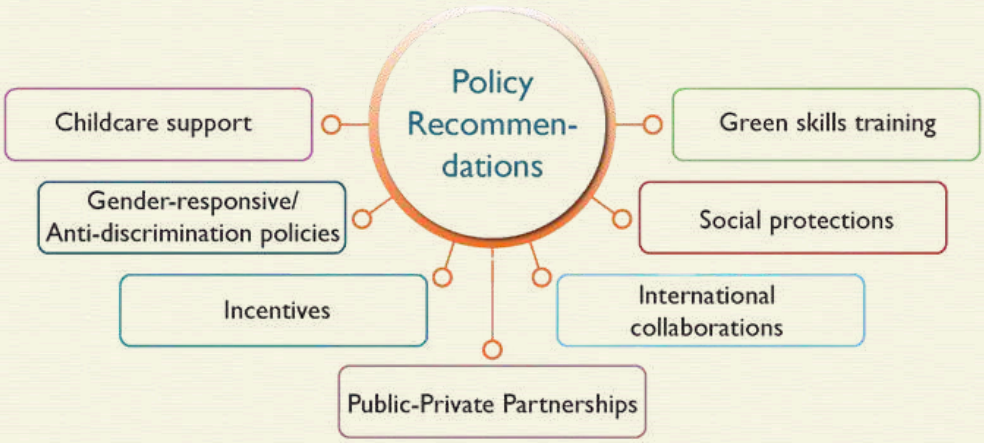


Figure 3: Policy Recommendations

Regional Case Studies

Africa's just transition efforts highlight the role of youth in green job creation, with initiatives like the Green Jobs & Skills Pavilion at the Africa Climate Summit emphasizing workforce readiness for sustainable industries (Dekker, 2017). In Kenya, programs such as Jacob's Ladder Africa focus on equipping young people and women with climate-smart skills to drive inclusive growth (Jacob's Ladder Africa, 2025). Similar efforts in Nigeria integrate youth into labor migration and green skills within national Just Transition Guidelines, prioritizing their involvement in climate-driven employment (Anakwuba & Ezenekwe, 2024). In Uzbekistan, multi-stakeholder workshops co-create roadmaps for renewable energy transitions, aiming to generate thousands of green jobs while contributing to national climate goals (UNDP Uzbekistan, 2025).

Figure 4: Regional case studies on green jobs for youth

In the Asia-Pacific region, Indonesia's youth-led discussions at Youth4COP advocate for just transitions that support vulnerable communities through green jobs and inclusivity (McCauley & Pettigrew, 2023). Programs in Zambia train young entrepreneurs in green practices to address deforestation and waste management, fostering sustainable development at the grassroots level. These examples illustrate how regional adaptations of Just Transition frameworks can empower youth economically while advancing environmental objectives (UNDP, 2025). For instance, in Indonesia, the Green Jobs and Just Transition Policy Readiness Assessment in the energy sector evaluates the country's preparedness, identifying gaps in skills and policies to support youth in transitioning to green energy roles (UN-PAGE, 2023). This assessment emphasizes stakeholder engagement to ensure that young workers benefit from the shift away from coal-dependent industries (UN-PAGE, 2023).

In Latin America, countries like Brazil are incorporating youth into national strategies for sustainable agriculture and bioeconomy, where green jobs in reforestation and eco-tourism provide alternatives to traditional extractive industries (Capgemini, 2025). Initiatives such as apprenticeships in solar panel installation have trained thousands of young people, reducing unemployment while contributing to net-zero goals (International Labour Organization [ILO], 2022). In Europe, the European Green Deal integrates Just Transition mechanisms, funding reskilling programs for youth in regions affected by coal phase-outs, such as Poland and Germany (World Resources Institute [WRI], 2025). These programs focus on digital green skills, blending technology with sustainability to prepare youth for future labor markets (IET, 2025).

Future Prospects

Projections indicate that just transitions could generate up to 180 million new jobs by 2050 in regions like Asia-Pacific, but this requires addressing potential job losses in non-renewable sectors through reskilling programs (UNDP, 2025). Emerging trends emphasize intergenerational equity, with calls for resilient education-to-employment pathways in clean industries (National Youth Employment Coalition, 2021). However, research gaps persist in evaluating the long-term impacts of green jobs on youth well-being and economic inclusion, particularly in underrepresented areas like sub-Saharan Africa (IET, 2025; Visual Capitalist, 2024).

Future studies should focus on quantifying the effectiveness of youth-centered initiatives and exploring innovative financing for green entrepreneurship. Global commitments, such as those from the International Labour Organization [ILO] and UNEP, signal optimism, but sustained monitoring is needed to ensure transitions remain just and youth-driven (International Labour Organization [ILO], 2025a). Advances in technology, like AI-driven skills matching, could accelerate youth integration into green sectors (World Economic Forum, 2025)

Table 2 summarizes key projections for green job creation with a focus on youth, drawing from global reports to highlight opportunities in the Just Transition (UNEP, 2025a; Capgemini, 2025).

Conclusion

In conclusion, the concept of Just Transition as a framework for green jobs presents immense potential for empowering youth in the global shift toward sustainable economies. By addressing youth unemployment often exceeding 20% in regions like the Arab States and Northern Africa and channeling their growing climate consciousness into meaningful careers, this approach not only fosters economic resilience but also advances intergenerational equity. Initiatives such as the UNEP-ILO-UNICEF Green Jobs for Youth Pact, with targets to create 1 million new roles and support 10,000 young entrepreneurs by 2030, underscore the transformative power of targeted investments in skills training, apprenticeships, and inclusive policies.

Table 2: Projections for Green Job Creation Focused on Youth

Projection Metric	Timeline	Global Estimate	Notes
New Green Jobs for Youth (Pact Target)	By 2030	1 million	Focus on young women
Young Entrepreneurs Supported	By 2030	10,000	Sustainable businesses
Green Talent Pool Growth	By 2050	Double current size	Renewables demand
Net Jobs from Climate Adaptation	By 2030	5 million	3rd largest contributor
Net Jobs from Climate Mitigation	By 2030	3 million	6th largest macrotrend
Net Jobs from Energy Generation/Storage	By 2030	1 million	Technology-driven
Increase in Workers with Green Skills	2022-2023	12%	Global rise

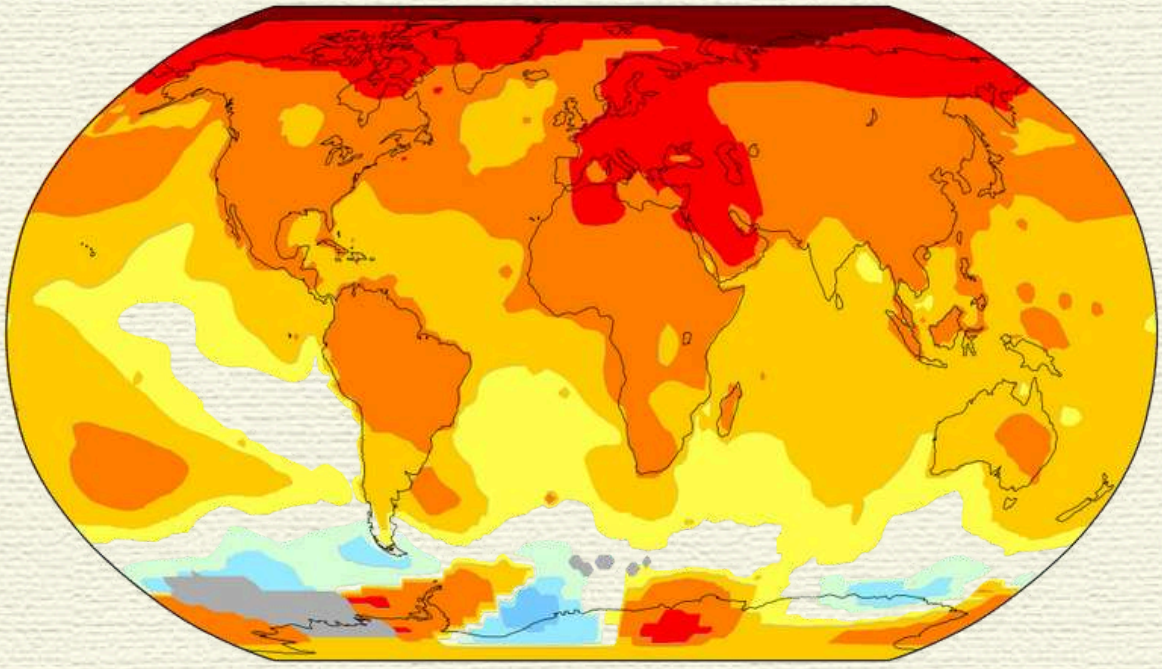
Regional successes, from Kenya's climate-smart programs to Indonesia's renewable energy roadmaps, demonstrate how youth-driven green jobs can mitigate job losses in fossil fuel sectors while generating up to 180 million net opportunities by 2050, particularly in high-growth areas like renewables and circular economies.

Yet, realizing these potential hinges on overcoming persistent barriers, including skills gaps, gender inequalities, and inadequate protections in informal economies, especially in the Global South. Through robust policy frameworks such as integrating green curricula in education, enhancing social dialogues, and leveraging international collaborations stakeholders can ensure that Just Transitions are truly equitable, providing decent wages, safe conditions, and pathways for all youth, including women and marginalized groups. As projections indicate a doubling of the green talent pool by 2050, driven by rising demand for sustainable skills, the time is ripe for accelerated action. By prioritizing youth as architects of change, societies can build resilient, low-carbon futures that benefit both people and the planet, turning climate challenges into opportunities for shared prosperity.

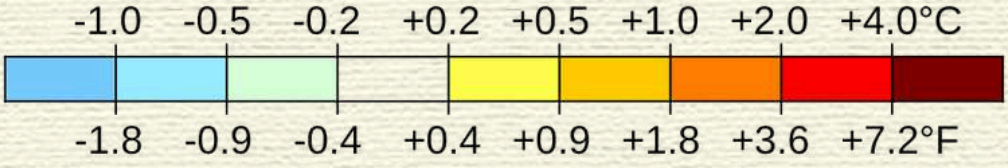
References

- Anabaraonye, B. (2022). Green Entrepreneurship Education for Sustainable Development in Nigeria. https://doi.org/10.19080/jojwb.2022.04.555637
- Anakwuba, B. W., & Ezenekwe, U. R. (2024). Prioritizing and Re-orienting Vocational Education for Sustainable Development in Nigeria. International Journal of Research and Innovation in Social Science, VIII(XV), 141–150. https://doi.org/10.47772/ijriss.2024.815ec0011
- Bray, R., Montero, A. M., & Ford, R. (2022). Skills deployment for a 'just' net zero energy transition. Environmental Innovation and Societal Transitions, 42, 395–410. https://doi.org/10.1016/j.eist.2022.02.002
- C40 Cities. (2022). Green & Just Transition - C40 Cities. https://www.c40.org/what-we-do/green-just-transition/
- Capgemini. (2025). Young people are concerned they lack the green skills to effectively act on climate change. https://www.capgemini.com/us-en/news/press-releases/young-people-are-concerned-they-lack-the-green-skills-to-effectively-act-on-climate-change/
- Dekker, M. (2017). Boosting youth employment in Africa: what works and why? https://www.voced.edu.au/content/ngv:86469
- International Labour Organization [ILO]. (2022). ILO launches initiatives on Green Jobs for Youth and Just Transition. https://www.ilo.org/resource/news/ilo-launches-initiatives-green-jobs-youth-and-just-transition-financing
- International Labour Organization [ILO]. (2023b). Achieving a just transition towards environmentally sustainable economies and societies for all. https://www.csgb.gov.tr/Media/3fjfuapi/ilo-achieving-a-just-transition-towards.pdf
- International Labour Organization [ILO]. (2025a). Just transition towards environmentally sustainable economies and societies. https://www.ilo.org/topics-and-sectors/just-transition-towards-environmentally-sustainable-economies-and-societies
- International Labour Organization [ILO]. (2025c). A Just Transition With and For Youth. https://www.ilo.org/publications/just-transition-and-youth
- Jacob's Ladder Africa. (2025). Green jobs for youth and women through climate-resilient agriculture: A new chapter for Murang'a County. https://jacobsladder.africa/green-jobs-for-youth-and-women-through-climate-resilient-agriculture-a-new-chapter-for-muranga-county/
- Jobs for the Future. (2024). Building a Jobs-Centered Just Transition and Climate Action. https://www.jff.org/blog/building-a-jobs-centered-just-transition-and-climate-action/
- Just Transition Finance. (2024). Youth employment is a key intergenerational dimension of the just transition. https://justtransitionfinance.org/commentary/youth-employment-is-a-key-intergenerational-dimension-of-the-just-transition/
- McCauley, D., & Pettigrew, K. (2023). Building a just transition in asia-pacific: Four strategies for reducing fossil fuel dependence and investing in clean energy. Energy Policy. https://doi.org/10.1016/j.enpol.2023.113808
- National Youth Employment Coalition. (2021). Green Economy - National Youth Employment Coalition. https://nyec.org/green_economy/
- P, B., D, W., L, G., I, B., & R, H. (2025). Empirical research of green jobs: A review and reflection with practitioners. Sustainable Futures, 100527. https://doi.org/10.1016/j.sftr.2025.100527
- The Institution of Engineering and Technology [IET]. (2025). Gen Z wants green jobs—but a global skills gap threatens progress. https://engineering-jobs.theiet.org/article/gen-z-wants-green-jobs-but-a-global-skills-gap-threatens-progress
- United Nations Development Programme [UNDP] Uzbekistan. (2025). HappeningNow 🇺🇿70+ voices from govt. [X post]. X. https://x.com/UNDP_Uzbekistan/status/1966042102929961338
- United Nations Development Programme [UNDP]. (2025). Delivering a Just Transition: Advancing Decent Work, Gender Equality in Asia-Pacific SDG Partnership Report. https://www.undp.org/sites/g/files/zskgke326/files/2025-02/2025-asia-pacific-sdg-partnership-report.pdf
- United Nations Environment Programme [UNEP]. (2025a). Green Jobs for Youth. https://www.unep.org/topics/youth-education-and-environment/green-jobs-youth
- United Nations Framework Convention on Climate Change [UNFCCC]. (2019). Just Transition of the Workforce, and the Creation of Decent Work. https://unfccc.int/sites/default/files/resource/Just%2520transition.pdf
- United Nations Framework Convention on Climate Change [UNFCCC]. (2025). New Report on Just Transition Frameworks. https://unfccc.int/news/new-report-on-just-transition-frameworks
- UN-PAGE. (2023). Green Jobs and Just Transition Policy Readiness Assessment. https://www.un-page.org/static/f5fe8fd6775c56d380ecad06748bf38b/green-jobs-and-just-transition-policy-readiness-assessment-in-the-energy-sector-in-indonesia.pdf
- Visual Capitalist. (2024). Mapped: Youth Unemployment By Region. https://www.visualcapitalist.com/mapped-youth-unemployment-by-region/
- World Economic Forum. (2025). Future of Jobs Report 2025.
- World Resources Institute. (2025). What Is a 'Just Transition,' and Are Countries Really Making Progress? https://www.wri.org/insights/what-is-just-transition-tracking-progress
- YouthForesight. (2025). Green Jobs for Youth Pact. https://www.youthforesight.org/resource-details/Blogs/12901

Temperature change over the past 50 years



Trend from 1973 to 2023



Just Transition in Bangladesh's RMG Sector: Impacts and Opportunities for Inclusive Growth

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Abstract

Bangladesh's ready-made garment (RMG) sector is a powerhouse with USD 42.61 billion USD industry, employing around 4.4 million workers, with women making up 60% of that workforce. It plays a crucial role in the economy, contributing a whopping 81.49% of export earnings and 8.52% of GDP, which makes it the second-largest garment exporter in the world. However, this sector is under increasing pressure from climate change, new EU regulations (like CSDDD and CBAM), demands for sustainability from buyers, and the need for technological upgrades, all of which call for urgent changes. There's a noticeable lack of thorough analysis on how to implement just transition frameworks in labor-intensive industries in developing countries, especially when it comes to balancing environmental sustainability with social equity in export-driven manufacturing. This study highlights key factors driving the transition, such as the need to decarbonize, the risks posed by automation, and various policy requirements. While there are 183 LEED-certified factories showing some environmental progress, a concerning 44.7% of workers feel they don't receive enough support from supervisors. The COVID-19 pandemic hit hard, leading to $3 billion in order cancellations and over a million job losses, which revealed the sector's vulnerabilities. Major challenges include high compliance costs for small and medium-sized enterprises (SMEs), weak enforcement of regulations, and the threat of automation to low-skilled jobs. On the brighter side, there are opportunities for creating green jobs in areas like energy management and compliance monitoring, as well as potential productivity boosts from energy-efficient technologies and the development of circular value chains. To tackle these issues, we need to implement coordinated efforts, such as expanding green financing through initiatives like the Green Transformation Fund, launching comprehensive reskilling programs aimed at women workers, strengthening regulatory enforcement, developing sustainable infrastructure, and using trade negotiations to secure preferential market access. This way, we can ensure that the industrial transformation is both environmentally sustainable and socially inclusive.

Keywords: Just Transition, Ready-Made Garments (RMG), Climate Change, Automation, Labor Rights, Green Jobs, Inclusive Development

Introduction

The readymade garment (RMG) sector in Bangladesh has been the backbone of the economy, with millions employed in the sector, and receiving the lion's share of export earnings. Beginning in the 1980s, the sector has climbed to become the second largest garment exporter in the world after China, employing approximately 4.4 million people, with more than 60 percent being women. RMG exports contribute over 80 percent of overall export earnings in Bangladesh and account for nearly 11 percent of gross domestic product (EPB, 2024; Mim et al., 2024). Not only has the RMG sector been credited with industrialization, but it has also transformed the socio-economic landscape of the country by increasing female labor force participation and leading to poverty reduction (Ahmed et al., 2024).

In spite of this economic contribution, as Bangladesh enters a new phase of development, the RMG sector faces increasing challenges. First, climate change is forcing changes in trade, production and consumption patterns globally. Bangladesh is exposed to climate vulnerability and is part of global value chains facing increased pressure to decarbonize (ILO, 2015; UNFCCC, 2024).

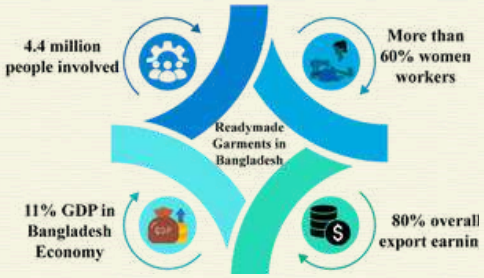


Figure 1: Statistical View of RMG Sectors in Bangladesh

As an example, the European Union's Corporate Sustainability Due Diligence Directive (CSDDD) and its Carbon Border Adjustment Mechanism (CBAM), are expected to raise compliance for textile and apparel imports (including those from Bangladesh).Second, the RMG industry is using resources at high rates, consuming tremendous amounts of water, energy, and polluting our planet (Xu et al., 2021). If there is nothing done on a mass scale to change structures, the RMG sector risks being unsustainable environmentally, socially, and economically. This situation brings the need for a "just transition" into focus regarding the Bangladeshi RMG sector. The International Labour Organization (ILO) defines a just transition as one that "ensures environmental sustainability of production and consumption in ways that are fair, inclusive and provide decent work opportunities" (ILO, 2015). It aims to balance environmental imperatives and social justice rights, including the rights of workers, livelihoods, and communities. Applying this notion of just transition to Bangladesh means that interventions to green the RMG industry, including but not limited to, cleaner technologies, energy efficiency and restructuring supply chains should be combined with interventions that reskill workers, expand social protections, and decrease gender inequities. If not, vulnerabilities could be mutually reinforcing, particularly so for women workers who are concentrated in low-paid, low-skill jobs (Cirillo, 2018; Kabir et al., 2025).

The necessity for the transition is marked by multiple pressures. On the one hand, international customers increasingly require organizations to engage with environmental, social, and governance (ESG) standards in light of their responsibilities within their supply chain. If an organization does not engage in this service, they will lose contracts and be less competitive against others (Anner, 2020). On the other hand, technological innovations such as automation and digitalization are changing processes in the garment manufacturing and construction sector; while in the short term this may result in decreased resource intensity and increased efficiencies, in the long run millions of job losses will ensue for individual workers, many of whom will not have other employment opportunities to transition into (Ahmed et al., 2024; ILO, 2015). There are domestic policies such as the Bangladesh Nationally Determined Contributions (NDCs) and policies that promote green industrialization that similarly shape the outline of the transition, as they align national economic priorities with global climate objectives (UNFCC, 2022).

Crucially, the stakes are not only economic competitiveness. The RMG sector is closely connected with gender dynamics, rural-to-urban migration, and social protection systems. Therefore, any structural transformation not only has economic implications, but equality and equity will be significantly affected as well. Women workers, who are vastly over represented in sewing and assembly-line jobs, will be, rightly or wrongly, significantly impacted by automation and factory closures, especially without retraining programs or financial safety nets (Kabir et al., 2025). Similarly, informal networks of subcontracting, which employ thousands and do not offer workers formal contracts or protections, are outside the scope of the majority of labor regulations. So, a just transition will require systemic interventions policy coherence, multilayer governance, financing, and multi-stakeholder engagement methods that continue to transcend narrow definitions of environmental compliance.

Concurrently, there are specific opportunities associated with the transition. Cleaner production techniques can lower costs through energy savings and resource efficiencies. Sustainability certifications may provide access, for example, to blue chip or premium markets. Circular economy approaches, like textile recycling models and sustainable fiber sourcing, can create different methods of value-added processes. Reskilling opportunities can position workers to positively participate in new roles created, for example, tackling the monitoring and reporting of minimum standards, waste management, or green technologies. Like many examples above, if it can be managed effectively as a just transition, Bangladesh's RMG sector could easily represent a model of sustainable industrialization for other developing economies (S. Ahmed et al., 2020; Anner, 2020; Kabir et al., 2025).

This review critically investigates the challenges and opportunities associated with a just transition relative to the ready-made garment (RMG) industry of Bangladesh. The paper reviews available evidence across the economic, social, and environmental dimensions of just transition, assesses barriers (such as financing gaps and governance deficiencies), and highlights opportunities centered around green jobs and inclusive economic growth. Situating Bangladesh in the broader discussions surrounding global supply chain sustainability and labor rights, we hope it contributes to an understanding of how a just transition can be implemented at scale in one of the world’s most significant labor-intensive industries.

The ultimate aim is to inform the efforts of policymakers, global buyers, and industry leaders about the pathways that can balance environmental imperatives along with social justice, which is vital for Bangladesh’s biggest industry.

Basic Concept of Transition and Just Transition

The idea of a transition is defined as a fundamental shift from one system of production, consumption, or governance to another. The concept of a just transition was developed in the international labor movement in the 1980s and 1990s, spurred largely by job losses related to environmental policy shifts in industries such as coal mining (Newell & Mulvaney, 2013). The International Labour Organization (ILO) defines just transitions as a framework that “ensures environmental sustainability of production and consumption in a way that is fair, inclusive, and provides opportunities for decent work” (ILO, 2015).

The RMG Sector in Bangladesh

The RMG sector in Bangladesh serves as a symbol of the country and the key driver of the economy, creating jobs and selling apparel goods globally. Bangladesh is a global leader in garment exports for connecting the local industry to foreign markets, contributing to national exports and paving the path for the country's future prosperity. The RMG sector in Bangladesh is a USD 42.61 billion industry, currently making Bangladesh the second largest garment exporter in the world.

According to the Bangladesh Garment Manufacturers and Exporters Association (BGMEA), Bangladesh has the highest number of LEED (Leadership in Energy and Environmental Design)-certified green factories. As of January 2023, Bangladesh has 183 LEED-certified factories, with nine of them listed in the top 10 green certified factories in the world, while 500 more are working towards LEED certification. By FY2024-25, the RMG sector earned a total of USD 39.35 billion, directly employed 4 million workers, with women comprising around 57% of the workers. The garments sector exports contributed over 81.49% of earnings and around 8.52% of GDP (Dreher et al., 2023; Mim et al., 2024; Sarkar et al., 2020a).

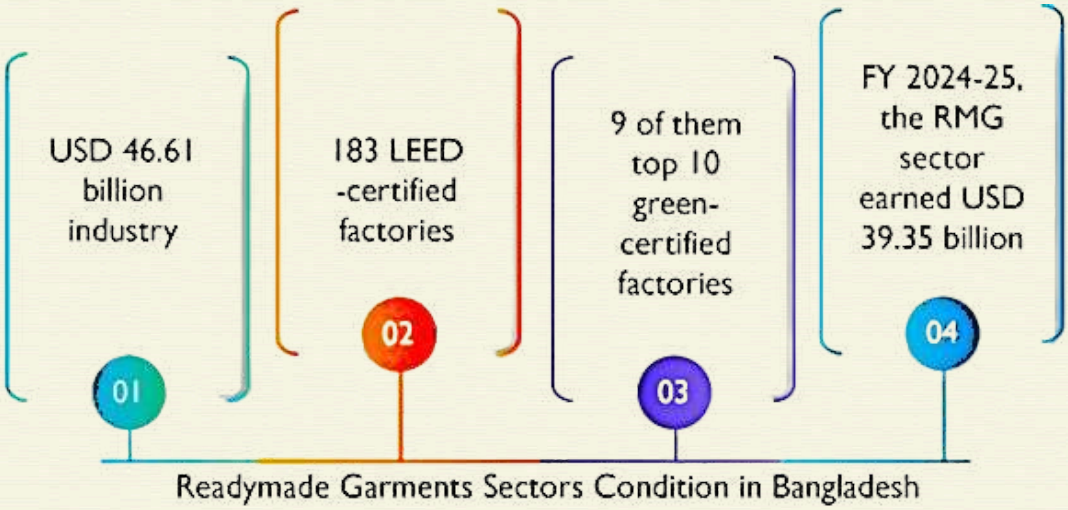


Figure 2: Overview of Readymade Garments Sectors Condition Bangladesh Perspective

Drivers of Transition

One of the key areas that impact the RMG sector in Bangladesh is the increasing pressure from global buyers to comply with sustainability and labor standards. Global regulations instituted by the European Union, such as the Corporate Sustainability Due Diligence Directive (CSDDD) and the Carbon Border Adjustment Mechanism (CBAM) create and tighten requirements and specifications for exporters (European Commission, 2023). Commitments to climate change under Bangladesh's Nationally Determined Contributions (NDCs) have partially mandated the RMG sector towards reducing energy consumption and emissions (UNFCC, 2022). Resource constraints, especially water scarcity and pollution from dyeing and finishing units, have exacerbated the urgency for firms to incorporate cleaner production practices (Kabir et al., 2025). Technological change, including automation and digitalization, both a challenge and an opportunity in the context of increased efficiency, tends to drive down employment (ILO, 2015; UNFCCC, 2024). Domestic and international advocacy from labor unions and civil society actors is contributing to calls for a fairer supply chain and socially responsible industry transition (Anner, 2020).

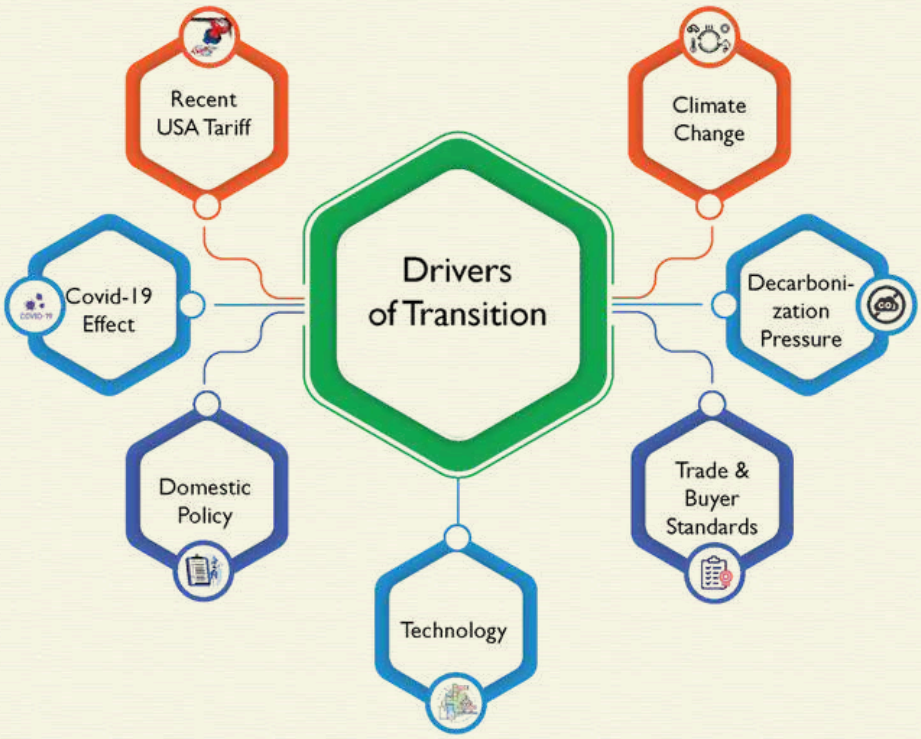


Figure 4: Main Drivers of Just Transition in RMG Sectors of Bangladesh

Climate Change

The study of Nabi et al., (2023) indicates that climate change significantly impacts the RMG sector in Bangladesh through various direct and indirect effects. These include increased natural hazards such as droughts, floods, storms, and land erosion, which damage infrastructure, disrupt supply chains, and displace workers and their families. Such disasters lead to loss of land, homes, and workplaces, reducing overall productivity and employment stability within the industry.

Additionally, climate-induced hazards contribute to decreased job opportunities due to factory damages and supply chain disruptions, prompting increased migration and competition for limited jobs, often resulting in lower wages and job insecurity. Higher temperatures and poor working conditions exacerbate health issues among workers, increasing sickness and absenteeism, which further hampers industry productivity.

Moreover, the sector faces challenges from increased competition because of an influx of workers displaced by climate disasters, leading to reduced wages and heightened job insecurity . The cumulative effect of these factors threatens the industry's sustainability and underscores the need for adaptive measures to make the sector resilient to climate-related shocks.

Furthermore, climate change-induced hazards have spurred migration, often as a coping mechanism, which alters the livelihood landscape for workers. The reduction in job scope, coupled with declining wages due to increased labor supply from disaster-affected areas, threatens economic stability and social well-being of RMG workers (Nabi et al., 2023).

Regarding livelihoods, climate change has led to:

- Loss of land, homes, and workplaces, forcing migration and settlement in less secure environments .
- Increased health issues, notably non-communicable diseases linked to climate-related stress and conditions, which impair workers' capacity to earn and sustain themselves .
- Elevated competition for scarce jobs, pushing wages down and compromising workers' economic resilience.

Decarbonization Pressure

The world is increasingly at the forefront of the decarbonization agenda, acting as a major catalyst for change in Bangladesh's ready-made garment (RMG) industry. The intention to limit the increase of the global temperature under the Paris Agreement has resulted in increasing pressure on energy-intensive businesses to reduce GHG emissions (UNFCC, 2022). Bangladesh's RMG factories rely heavily on fossil fuels, particularly natural gas and captive power generation, and are susceptible to the potential of future carbon pricing or trade limitations (Jedwab et al., 2023).

To stay competitive in global markets, it is increasingly imperative to adopt energy-efficient technologies and renewable energy sources (e.g. rooftop solar). Additionally, international buyers are embedding carbon footprint reporting requirements within the supply chain, which can also impose penalties on factories that do not establish a reduction in their emissions. Thus, the decarbonization agenda is not only an environmental one but also an economic driver that will influence the competitiveness and enduring viability of Bangladesh's largest export sector (Sarkar et al., 2020b).

Trade & Buyer Standards

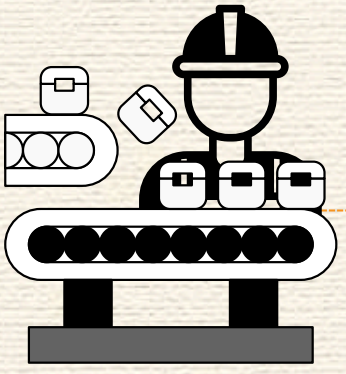
The interplay between global trade dynamics and changing buyer expectations is one of the key dimensions pushing for a just transition in Bangladesh's garment sector. As the largest destination for Bangladeshi apparel exports, the European Union is incorporating strict sustainability provisions, including the Corporate Sustainability Due Diligence Directive (CSDDD) and the Carbon Border Adjustment Mechanism (CBAM) that will involve supplier ramifications (UNFCC, 2022; UNFCCC, 2024). International brands and retailers are explicitly under pressure from consumers and regulators to provide evidence of ethically and environmentally-cognizant sourcing (Anner, 2020). Consequently, the benefits of Bangladeshi factories needing to meet more stringent buyer expectations in terms of energy efficiency, water treatment, chemical management, and labor conditions are becoming market entrance requirements, rather than an option. This is especially true given other competing low-cost apparel suppliers such as Vietnam and Cambodia, which are cognizant of the multiple risks of the textile and garment supply chain, particularly in terms of ever-evolving buyer and regulatory expectations (ILO, 2015). For Bangladesh, assuring that their garment supply chain adheres is potentially beneficial in consolidating reputation and attracting premium buyers; however, failing to do so risks exclusion from lucrative markets.

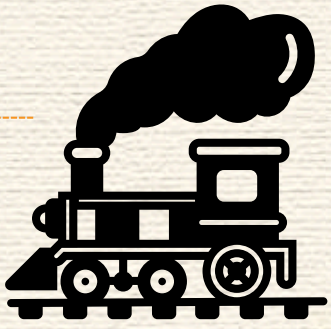
Technology

Technological change is another critical driver of transition, reshaping both production processes and labor dynamics in the RMG sector. Automation and digital technologies, such as computer-aided design, automated cutting machines, and even sewing robots, are gradually being introduced to improve efficiency and reduce resource intensity (ILO, 2015; Sarkar et al., 2020b).

The Evolution of Industry

First to Fifth Revolution





1780

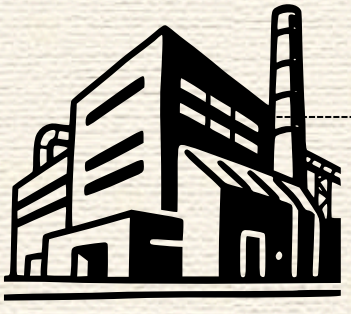
mechanization, water and steam powers

1870

mass production, electric power, assembly line

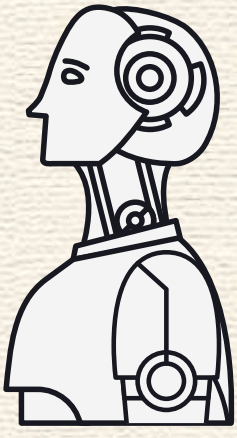
1970

computers, automated production, electronics



2010

cyber-physical systems, networking, machine learning



2022

human-robot collaboration, cognitive systems, customization

These technologies can support decarbonization by optimizing energy and water use, while also ensuring compliance with strict buyer requirements on quality and sustainability (Kabir et al., 2025). However, they also raise concerns about large-scale job displacement, especially for low-skilled workers who dominate the RMG workforce and are predominantly women (Kabir et al., 2022). The challenge for Bangladesh is therefore twofold: harnessing technology to remain competitive while ensuring that displaced workers are retrained and absorbed into emerging green jobs (ILO, 2015). If managed effectively, technological upgrading could support both environmental sustainability and social inclusion, but without proactive policies, it risks widening inequality in the labor market.

Domestic Policy

The dynamics of just transition within Bangladesh's garment industry are increasingly being framed by domestic policy context. The government has even made pledges for mitigating greenhouse gas emissions during its updated NDCs where industrial energy efficiency and renewable energy have been identified as priority areas (Cirillo, 2018; Newell & Mulvaney, 2013). The National Industrial Policy (2016) and the Bangladesh Bank's Green Transformation Fund (GTF) offer incentives for cleaner production and environmentally sound investments in the textile and garment industries (Sarkar et al., 2020b). Further, the government has collaborated with the international development community to expand energy-efficient technologies and institute workplace safety reforms after Rana Plaza. However, there are shortcomings in enforcement, policy consistency and financing for small and medium enterprises which predominate this industry (Kabir et al., 2022; Sarkar et al., 2020a). Stronger implementation of national policies is thus crucial not just to fulfil international commitments but also to make the transition fair and inclusive, and consistent with the country's development goals.

Covid-19 Effect

COVID-19 has acted as a significant transitional factor for the RMG sector in Bangladesh, causing both immediate disruptions and potential long-term shifts in the industry. The pandemic has exposed existing vulnerabilities and prompted changes in production, employment, and safety practices (Kabir et al., 2021).

The pandemic led to a substantial cancellation and suspension of international clothing orders. Known from qualitative communications and reports, international brands and retailers suspended orders worth up to $3 billion, including delays and cancellations of orders from major companies like Mosaic Brands. This resulted in immediate job losses (>1 million workers dismissed), economic hardship, and increased job insecurity among RMG workers (Kabir et al., 2021; Munim et al., 2022).

Due to delayed or irregular wages, many workers faced financial hardships, compelling demonstrations and protests for their rights, indicating a shift in labor relations and bargaining power (Munim et al., 2022).

Recent USA Tariff

The United States continues to be one of the biggest markets for Bangladeshi garments, making up nearly 20 percent of the country's total apparel exports in recent years (Jedwab et al., 2023; World Bank, 2021). Unlike many least-developed countries (LDCs), Bangladesh hasn't historically had the benefit of duty-free access to the U.S. market under the Generalized System of Preferences (GSP), since apparel products are left out of this scheme (UNITED STATES TRADE REPRESENTATIVE, 2025). After the tragic Rana Plaza collapse in 2013, the U.S. decided to suspend Bangladesh's limited GSP benefits for non-apparel goods, citing serious concerns about labor rights and factory safety (Kabir, Maple, Islam, et al., 2019).

While apparel wasn't directly impacted, this suspension highlighted Washington's increasing tendency to tie trade preferences to labor and safety compliance. Recently, U.S. trade discussions around tariffs and labor standards have flared up again, especially with rising worries about forced labor, supply chain transparency, and the Biden administration's focus on a "worker-centered trade policy" (United States Trade Representative, 2025). For Bangladesh, these trade policies function as indirect drivers of a just transition. Increased trade barriers or tariffs place pressure on the RMG sector to comply with global standards for labor and the environment in order to compete in the U.S. market. The industry players have responded with investing in upgrading building safety, environment certification such as LEED (Leadership in Energy and Environmental Design), and improved mechanisms of labor governance to demonstrate compliance (BGBA, 2024). Simultaneously, US tariff structures pose challenge for small suppliers who are faced with paltry profit margins and lack the fiscal resources to adopt green technologies or meet very stringent monitoring demands (Rahman, 2022). Transition justice policy would therefore need to upgrade factories toward U.S. trade-linked sustainability standards but also protect workers especially women working in low-income jobs through social dialogue, skills training, and social protection tools. This way, U.S. trade and tariff policies indirectly affect the terms on which Bangladesh's RMG sector must navigate towards sustainable and equitable industrial transition.

Impacts of Transition

A just transition in the RMG sector could lead to marked improvements in environmental outcomes, including reductions in greenhouse gas emissions, water use, and chemical pollution (Sarkar et al., 2020a; Xu et al., 2021). Economically, while cleaner technologies could cause price increases to small and medium enterprises, they could also lead to enhanced competitiveness and improve access to long-term markets (World Bank, 2021). Socially, there may be some displacement of low-skilled workers, in particular, women, without active labor market policies and reskilling (Kabir et al., 2021; Kabir, Maple, Islam, et al., 2019). On the other hand, investments in green technologies and circular economy initiatives could create new forms of "green jobs" in compliance monitoring, recycling, and energy management (ILO, 2015). Critically, a well-planned transition could also improve working conditions, health outcomes and gender equity in the sector (Kabir, Maple, Islam, et al., 2019; Mamun & Hoque, 2022).

Economical and Productivity

The shift towards cleaner and more advanced garment production in Bangladesh presents a mix of opportunities and challenges for the economy. On one side, investing in energy-efficient machinery, compliance systems, and automation can boost productivity and enhance long-term competitiveness (Rahman, 2022; Sarkar et al., 2020a). On the flip side, small and medium-sized factories, which often operate on tight margins, might find it tough to cover the initial costs of this transition, risking closures or job losses (World Bank, 2021). Additionally, wages could come under pressure if companies decide to pass compliance costs onto their workers, and automation poses a threat to the low-skilled jobs that many women in the sector rely on. Nevertheless, global evidence suggests that making industries greener can lead to the creation of new, higher-value "green jobs" in areas like compliance, quality control, and energy management, as long as proper training is provided (ILO, 2015; Kabir et al., 2025). Therefore, the economic effects of this transition largely hinge on how well labor market and industrial policies can strike a balance between maintaining competitiveness and protecting workers.

Social, Livelihood and Health

A study of (Dreher et al., 2022) found low to moderate levels of workplace bullying, with 14.6% reporting bullying by colleagues and 12.3% by supervisors. However, a significant proportion (44.7%) indicated that supervisors did not care about workers' problems, suggesting poor leadership. Conversely, high levels of beneficial leadership (75.7%) were reported, where supervisors made decisions free of personal bias.

High levels of social support were observed, with 80.5% reporting support from colleagues and 86.0% from supervisors. There was also a high degree of vertical trust between management and employees, with 82.4% trusting management information and 94.1% believing management trusted employees (Dreher et al., 2022). These findings on low bullying and high support/trust seem to contradict widespread reports of precarious working conditions in the RMG sector (Akhter et al., 2019b; Ashraf, 2017). This discrepancy might be influenced by an increase in international attention and pressure on the garment sector over the last decade, leading to new inspection regimes for factory safety (Ashraf, 2017).

In addition, most garment workers (62.1%) reported good or very good health. However, specific health complaints were common, with headache (68.3%), cold (55.3%), and back pain (50.7%) being the most frequently reported. Female workers reported health complaints more frequently than male workers, particularly headache, back pain, and muscle cramps (Dreher et al., 2022; Steinisch et al., 2013).

Regional

The impacts of transition also have a spatially imbalanced effect, with considerable regional implications for Bangladesh. The RMG sector is spatially agglomerated in urban and peri-urban areas, primarily Dhaka, Gazipur, and Chittagong, thus driving high-speed urbanization and huge rural-to-urban migration (Kabir, Maple, Usher, et al., 2019; Sarkar et al., 2020a). However, if factories in such clusters close for failure to adopt sustainability levels, localized unemployment would be increased, hence creating social vulnerabilities in heavily garment-reliant areas (Anner, 2020). Contrary to that, industrial upgrading as well as state support can promote clustering effects by directing green investment into precisely designated export processing zones or green-industrial parks (World Bank, 2021). Migration patterns may also shift, with workers moving either to cities where sustainable garment units are established or back to rural areas if garment jobs are lost, raising issues about agricultural underemployment. These spatial consequences raise the need for regionally oriented policies to manage urban infrastructure, diversification of employment, and social services in areas most impacted by industrial transformation.

The just transition offers a wealth of opportunities for Bangladesh’s RMG sector. By leaning into sustainability, factories can not only create new green jobs but also boost workers’ skills for emerging roles in areas like compliance, energy management, and circular fashion (ILO, 2015). Adopting energy-efficient technologies and innovative processes can help cut production costs while also making the sector more competitive in global markets (IFC Board, 2019). Embracing circular value chains, recycling, and sustainable fibers can unlock access to high-value markets and lessen environmental impact (UNEP, 2020b).

Plus, sustainability certifications and eco-friendly practices can enhance Bangladesh's reputation as a responsible supplier, enabling it to gain preferential access and even command premium prices in export markets (Zaman & Khan, 2021).

These opportunities set the stage for the sector to evolve from a focus on low-cost competitiveness to achieving long-term resilience and global leadership in sustainable apparel.

Green Jobs and Skill Development

The shift towards sustainable garment production in Bangladesh is opening up exciting opportunities for green jobs and skill enhancement.

Figure 6: Opportunities of Bangladeshi RMG Sectors due to The Just Transition

As factories embrace cleaner technologies, new positions are popping up in areas like energy management, wastewater treatment, compliance auditing, and sustainable design (ILO, 2015). Reskilling programs can empower workers, particularly women, to transition from repetitive sewing tasks to more valuable roles such as machine maintenance, quality control, and sustainability reporting (Kabeer, 2015). Development organizations and industry groups have already launched training initiatives focused on eco-efficiency and occupational health, demonstrating that well-structured programs can enhance both employability and productivity (World Bank, 2021). However, without intentional policies in place, low-skilled workers may find themselves left out of these opportunities due to limited education or social barriers (Ahmed et al., 2024; Kabir et al., 2022; Munim et al., 2022). Therefore, developing green skills is crucial to ensure that this transition promotes decent work and helps reduce inequality instead of making it worse.

New Technology Gain Productivity

Investments in energy efficiency and process innovation can lead to productivity improvements that enhance the competitiveness of Bangladesh's ready-made garment (RMG) sector. Many factories still depend on outdated boilers, inefficient lighting, and water-heavy dyeing methods, which drive up costs and lower efficiency (Ashraf, 2017; A. Hossain & Hossain, 2020). By introducing technologies like efficient motors, LED lighting, heat recovery systems, and advanced dyeing equipment, production costs can be significantly reduced while also minimizing environmental impact (A. Hossain & Hossain, 2020). Research from pilot projects backed by the International Finance Corporation (IFC) indicates that energy efficiency measures in textile factories often pay for themselves in less than three years, making them a smart financial choice (IFC Board, 2019). Additionally, process innovations such as digital production planning and automation can help cut waste and meet the quick turnaround times demanded by global buyers (ILO, 2015). Thus, energy and process upgrades represent a win-win scenario enhancing profitability while aligning with sustainability requirements.

New Value Chain

The shift in the RMG industry in Bangladesh is opening up exciting new avenues tied to circularity and sustainable fibers. With the country producing a significant amount of textile waste, there's a real opportunity to recycle that into fresh yarns and fabrics for both local use and export (M. U. Hossain & Roy, 2016; UNEP, 2020b). Innovative projects are popping up in Bangladesh, focusing on closed-loop recycling systems and teaming up with global brands that are eager to boost their use of recycled polyester and organic cotton in their products (BGBA, 2024; Kabeer, 2015). By embracing sustainable fibers, Bangladesh not only lessens its environmental footprint but also positions itself as a key player in the global move towards circular fashion (Jäger et al., 2023). This could lead to new opportunities in higher-value markets and draw in foreign investment for recycling technologies and eco-industrial parks (World Bank, 2021). Building these circular value chains diversifies Bangladesh's apparel exports while promoting resource efficiency and environmental resilience.

Market Access

Sustainability is becoming a real game-changer in the global apparel market, giving Bangladesh a chance to secure better market access and even fetch premium prices. Buyers in the EU and North America are feeling the pressure from consumers and regulations to source from suppliers who uphold strong environmental and labor standards (M. U. Hossain & Roy, 2016; Jäger et al., 2023).

Many factories in Bangladesh have already earned international certifications like LEED, making the country home to some of the greenest garment factories worldwide (UNEP, 2020a). These certifications not only boost brand reputation but can also lead to preferential access for sustainability-focused buyers, potentially locking in longer contracts and better pricing (Anner, 2020). Plus, as trade regulations tighten like the EU's Corporate Sustainability Due Diligence Directive factories that don't meet sustainability standards risk being left out, while those that do can gain a competitive edge (UNEP, 2020b).

Barriers and Risks

The journey towards a just transition in Bangladesh's ready-made garment (RMG) sector is fraught with challenges and risks, even though it holds great promise for fostering green growth and creating sustainable jobs. Financial, institutional, and social hurdles often hinder smaller factories from embracing new technologies or meeting international sustainability benchmarks (Aziz Khan et al., 2024). Moreover, workers especially women and those in low-skilled positions face the threat of being left behind if reskilling and social protection measures fall short (Dreher et al., 2022). Without a unified support system, this transition could worsen inequality, diminish competitiveness, and jeopardize the livelihoods of millions.

Key Barriers and Risks

- **High compliance and investment costs:** Small and medium-sized enterprises (SMEs), which make up the bulk of RMG suppliers, frequently struggle to secure affordable financing needed to invest in energy-efficient machinery or pollution control systems (World Bank, 2021).
- **Risk of job displacement from automation:** The push for technological upgrades and digitalization can lead to a decreased demand for low-skilled labor, hitting women particularly hard, as they predominantly work in sewing and finishing roles (ILO, 2015).
- **Weak enforcement of labor and environmental laws:** Although there are policies in place regarding green finance and compliance, the enforcement is often inconsistent, allowing non-compliant factories to stay competitive against those that are sustainable (UNEP, 2020a; Zaman & Khan, 2021).

- **Global trade uncertainty:** Changes in tariff structures and buyer expectations in the U.S. and EU pose risks of market exclusion for factories that struggle to quickly align with sustainability-related standards (Anner, 2020).
- **Infrastructure and energy challenges:** A lack of adequate renewable energy sources, ineffective waste management systems, and poor urban planning hinder the widespread adoption of sustainability practices in industrial clusters (Kabir et al., 2022; Sarkar et al., 2020a).

Recommendations

To tackle these challenges, Bangladesh's ready-made garment (RMG) sector needs a united effort from the government, industry groups, international buyers, and development partners. A well-rounded strategy should combine financial incentives, necessary reforms, protections for labor rights, and improvements in infrastructure. It's crucial to keep inclusivity especially for women and vulnerable workers at the heart of a fair transition framework.

- **Boost green financing and incentives:** The government and development banks ought to enhance initiatives like the Green Transformation Fund, which provides small and medium-sized enterprises (SMEs) with affordable loans for energy-efficient and environmentally friendly investments (Sarkar et al., 2020b, 2020a).
- **Encourage skills training and social protection:** National training programs should equip workers for green jobs in areas like energy management, recycling, and digital production, while social safety nets can help those affected by automation (ILO, 2015).
- **Enhance regulatory enforcement:** Government agencies must ensure adherence to building safety, labor rights, and environmental standards through regular monitoring and penalties for those who don't comply (Akhter et al., 2019a; Kabeer, 2015).
- **Utilize trade agreements for sustainability:** Discussions with the EU and U.S. should aim to secure preferential access for sustainable RMG products, positioning compliance as a competitive edge rather than a burden (Jäger et al., 2023; UNEP, 2020a).
- **Invest in sustainable infrastructure:** Developing eco-industrial parks, renewable energy grids, and recycling facilities can foster long-term sustainability and draw in green foreign direct investment (Rahman, 2022; World Bank, 2021).

Conclusion

The just transition in Bangladesh's RMG sector is not just a necessity; it's also a chance for growth. On one side, the pressures of global decarbonization, changing buyer expectations, and local policy commitments are pushing the industry to adopt cleaner technologies and fairer labor practices. On the flip side, this shift opens doors to new job opportunities, boosts productivity, and allows for market diversification through sustainable value chains. However, to truly reap these benefits, the sector must tackle significant challenges, such as high compliance costs, inconsistent regulatory enforcement, the risk of labor displacement, and infrastructure hurdles. Therefore, policy interventions, international collaboration, and innovative approaches at the industry level are essential to ensure that this transition is both fair and competitive. Ultimately, if managed well, this just transition can elevate Bangladesh's RMG sector from a low-cost manufacturing hub to a leader in sustainability, securing livelihoods for millions while enhancing its position in global trade.

Bibliography:

- Ahmed, H. N., Ahmed, S., Ahmed, T., Taqi, H. M. M., & Ali, S. M. (2024). Disruptive supply chain technology assessment for sustainability journey: A framework of probabilistic group decision making. Heliyon, 10(4), e25630. https://doi.org/10.1016/j.heliyon.2024.e25630
- Ahmed, S., Sarker, A. R., Sultana, M., Roth, F., Mahumud, R. A., Kamruzzaman, M., Hasan, M. Z., Mirelman, A. J., Islam, Z., Niessen, L. W., Rehnberg, C., Khan, A. K. A., Gyr, N., & Khan, J. A. M. (2020). Do employer-sponsored health insurance schemes affect the utilisation of medically trained providers and out-of-pocket payments among ready-made garment workers? A case-control study in Bangladesh. BMJ Open, 10(3), e030298. https://doi.org/10.1136/bmjopen-2019-030298
- Akhter, S., Rutherford, S., & Chu, C. (2019a). Exploring the system capacity to meet occupational health and safety needs: The case of the ready-made garment industry in Bangladesh. BMC Health Services Research, 19(1), 435. https://doi.org/10.1186/s12913-019-4291-y
- Akhter, S., Rutherford, S., & Chu, C. (2019b). Sewing shirts with injured fingers and tears: exploring the experience of female garment workers health problems in Bangladesh. BMC International Health and Human Rights, 19(1), 2. https://doi.org/10.1186/s12914-019-0188-4
- Anner, M. (2020). Squeezing workers' rights in global supply chains: purchasing practices in the Bangladesh garment export sector in comparative perspective. Review of International Political Economy, 27(2), 320–347. https://doi.org/10.1080/09692290.2019.1625426
- Ashraf, H. (2017). Beyond Building Safety: An Ethnographic Account of Health and Well-Being on the Bangladesh Garment Shop Floor. In R. Prentice & G. De Neve (Eds.), Unmaking the Global Sweatshop (pp. 250–274). University of Pennsylvania Press. https://doi.org/10.9783/9780812294316-011
- Aziz Khan, M. M., Alam, M. J., Saha, S., & Sayem, A. (2024). Critical barriers to adopt sustainable manufacturing practices in medium-sized ready-made garment manufacturing enterprises and their mitigation strategies. Heliyon, 10(20). https://doi.org/10.1016/j.heliyon.2024.e39195
- BGBA. (2024). ANNUAL REPORT 2021, 2022, 2023 & 2024. In Bangladesh Garment Buying House Association. https://www.bgbabd.org/wp-content/uploads/2024/12/Annual-Report-2021-2022-2023-2024.pdf
- Cirillo, V. (2018). Job polarization in European industries. International Labour Review, 157(1), 39–63. https://doi.org/10.1111/ilr.12033
- Dreher, A., Yusuf, R., Ashraf, H., Ahmed, S. A. K. S., Strümpell, C., & Loerbroks, A. (2022). Social stressors and social resources at work and their association with self-reported health complaints among ready-made garment workers in Bangladesh: a cross-sectional study. BMC Public Health, 22(1), 1793. https://doi.org/10.1186/s12889-022-14173-x
- Dreher, A., Yusuf, R., Ashraf, H., Ahmed, S. A. K. 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. https://doi.org/10.1007/s00420-022-01942-9
- EPB. (2024). Export Promotion Bureau-Government of the People's Republic of Bangladesh. Country Wise Export (Goods). http://epb.gov.bd/site/view/epb_export_data/-
- Hossain, A., & Hossain, I. (2020). The Environmental Impacts of Textile Dyeing Industries in Bangladesh. International Research Journal of Advanced Engineering and Science, 5(2), 113–116.
- Hossain, M. U., & Roy, I. (2016). Supply Chain Management for Sustainable RMG Growth in Bangladesh. International Journal of Science and Research (IJSR), 5(4), 1242–1248. https://doi.org/10.21275/v5i4.nov162740
- IFC Board. (2019). IFC Annual Report 2019: Investing for Impact. In International Financial Corporation. https://doi.org/10.1596/32524
- ILO. (2015). Guidelines for a just transition towards environmentally sustainable economies and societies for all (Issue October, pp. 5–9). ILO Geneva.
- Jäger, J., Durán, G., & Schmidt, L. (2023). Expected economic effects of the EU Corporate Sustainability Due Diligence Directive (CSDDD). Vienna: Verlag Arbeiterkammer. https://www.researchgate.net/publication/374229020
- Jedwab, R., Romer, P., Islam, A. M., & Samaniego, R. (2023). Human Capital Accumulation at Work: Estimates for the World and Implications for Development. American Economic Journal: Macroeconomics, 15(3), 191–223. https://doi.org/10.1257/mac.20210002

- Kabeer, N. (2015). Women Workers and the Politics of Claims-Making in a Globalizing Economy. In United Nations Research Institute for Social Development (Vol. 13, Issue September). https://www.wiego.org/wp-content/uploads/2019/09/UNRISD-Working-Paper-2015.pdf
- Kabir, H., Maple, M., Islam, M. S., & Usher, K. (2019). The current health and wellbeing of the survivors of the rana plaza building collapse in Bangladesh: A qualitative study. International Journal of Environmental Research and Public Health, 16(13). https://doi.org/10.3390/ijerph16132342
- Kabir, H., Maple, M., Islam, M. S., & Usher, K. (2022). A qualitative study of the working conditions in the readymade garment industry and the impact on workers' health and wellbeing. Environmental and Occupational Health Practice, 4(1), 20–2021. https://doi.org/10.1539/eohp.2021-0020-OHW
- Kabir, H., Maple, M., & Usher, K. (2021). The impact of COVID-19 on Bangladeshi readymade garment (RMG) workers. Journal of Public Health (United Kingdom), 43(1), 47–52. https://doi.org/10.1093/pubmed/fdaa126
- Kabir, H., Maple, M., & Usher, K. (2025). Prevalence and risk factors of sexual harassment in the workplace by female readymade garment workers in Bangladesh. Frontiers in Public Health, 13. https://doi.org/10.3389/fpubh.2025.1580709
- Kabir, H., Maple, M., Usher, K., & Islam, M. S. (2019). Health vulnerabilities of readymade garment (RMG) workers: A systematic review. BMC Public Health, 19(1), 70. https://doi.org/10.1186/s12889-019-6388-y
- Mamun, M. A. Al, & 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. https://doi.org/10.1016/j.wds.2022.100026
- Mim, I. Z., Rayhan, M. G. S., & Syduzzaman, M. (2024). Prospects and current scenario of industry 4.0 in Bangladeshi textile and apparel industry. Heliyon, 10(11). https://doi.org/10.1016/j.heliyon.2024.e32044
- Munim, Z. H., Mohammadi, M., Shakil, M. H., & Ali, S. M. (2022). Assessing measures implemented by export-oriented RMG firms in an emerging economy during COVID-19. Computers and Industrial Engineering, 165, 107963. https://doi.org/10.1016/j.cie.2022.107963
- Nabi, M. H., Hasan, M., Chowdhury, A. T., Naz, F., & Hossian, M. (2023). The impact of climate change on the lives and livelihoods of readymade garment (RMG) workers: an exploratory study in selected readymade garment factories in Bangladesh. BMC Public Health, 23(1), 2292. https://doi.org/10.1186/s12889-023-17165-7
- Newell, P., & Mulvaney, D. (2013). The political economy of the "just transition." Geographical Journal, 179(2), 132–140. https://doi.org/10.1111/geoj.12008
- Rahman, M. (2022). Bangladesh's Robust RMG Export Performance: The Underlying Drivers. The Apparel Digest, February. https://cpd.org.bd/publication/bangladeshs-robust-rmg-export-performance/
- Sarkar, A., Qian, L., & Peau, A. K. (2020a). Overview of green business practices within the Bangladeshi RMG industry: competitiveness and sustainable development perspective. Environmental Science and Pollution Research, 27(18), 22888–22901. https://doi.org/10.1007/s11356-020-08816-y
- Sarkar, A., Qian, L., & Peau, A. K. (2020b). Structural equation modeling for three aspects of green business practices: a case study of Bangladeshi RMG's industry. Environmental Science and Pollution Research, 27(28), 35750–35768. https://doi.org/10.1007/s11356-020-09873-z
- Steinisch, M., Yusuf, R., Li, J., Rahman, O., Ashraf, H. M., Strümpell, C., Fischer, J. E., & Loerbroks, A. (2013). Work stress: Its components and its association with self-reported health outcomes in a garment factory in Bangladesh-Findings from a cross-sectional study. Health and Place, 24, 123–130. https://doi.org/10.1016/j.healthplace.2013.09.004
- UNEP. (2020a). Sustainability and Circularity in the Textile Value Chain - Global Stocktaking. United Nations Environment Programme, 11, 95.
- UNEP. (2020b). Yearbook of International Environmental Law. In United Nations Environment Programme(UNEP) (Vol. 31, Issue 1). Oxford University Press.
- UNFCC. (2022). Nationally Determined Contributions Registry. UNFCC. https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/nationally-determined-contributions-ndcs#eq-5%0Ahttps://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement/nationally-determined-cont

- UNFCCC. (2024). 2024 NDC Synthesis Report. In United Nations Climate Chage. https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs/2024-ndc-synthesis-report
- UNITED STATES TRADE REPRESENTATIVE. (2025). 2025 National Trade Estimate Report on FOREIGN TRADE BARRIERS of the President of the United States on the Trade Agreements Program. In Office of the United States Trade Representative, Ambassador Jamieson L. Greer. UNITED STATES TRADE REPRESENTATIVE. https://ustr.gov/about/policy-offices/press-office/press-releases/2025/march/ustr-releases-2025-national-trade-estimate-report
- World Bank. (2021). “Global Economic Prospects, January 2021: COVID-19 Crisis Update.” World Bank. In World Bank Group. World Bank Publications. https://openknowledge.worldbank.org/bitstreams/a5203f40-25c8-42c5-8338-7e11730e7c4e/download
- Xu, X., Yang, H., & Yang, H. (2021). The threshold effect of agricultural energy consumption on agricultural carbon emissions: a comparison between relative poverty regions and other regions. Environmental Science and Pollution Research, 28(39), 55592–55602. https://doi.org/10.1007/s11356-021-14831-4
- Zaman, A.-U.-, & Khan, M. A. M. (2021). Minimum Wage Impact on RMG Sector of Bangladesh: Prospects, Opportunities and Challenges of New Payout Structure. International Journal of Business and Economics Research, 10(1), 8. https://doi.org/10.11648/j.ijber.20211001.12

RISK OF AUTOMATION IN JOB SECTOR BY 2041

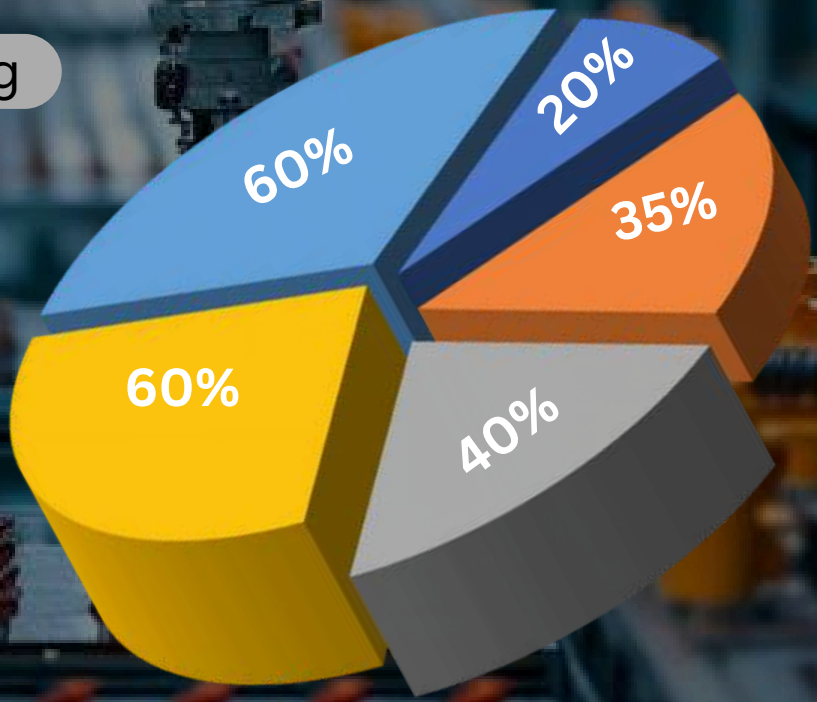
RMG & Textile

Furniture

Agro processing

Leather

Tourism



Towards a Just Transition for Child Waste Collectors in Dhaka: Addressing Health Risks and Social Stigmas

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Abstract

Child waste collectors in Dhaka represent one of the most marginalized yet indispensable groups contributing to urban sanitation and waste management. Despite their vital role, they remain invisible in public policy and endure profound health and social risks. This qualitative study explores the lived experiences of 15 adolescent waste collectors, all under the age of 17, using snowball sampling, semi-structured interviews, and thematic analysis. Findings reveal that prolonged exposure to hazardous waste directly contributes to frequent injuries, respiratory infections, skin diseases, and musculoskeletal disorders. The lack of protective equipment and medical care further exacerbates these conditions. Beyond health risks, participants reported significant social stigma, including labeling, discrimination, and exclusion from educational opportunities. These stigmas create additional barriers to social integration, reinforcing cycles of poverty and vulnerability. The interplay between health hazards and social marginalization produces a dual burden that perpetuates intergenerational disadvantage. The study employs the Health Belief Model to explain how perceptions of risk, limited preventive options, and barriers to healthcare influence daily choices of child waste collectors. Additionally, Goffman's Stigma Theory is applied to understand how social labeling and stereotyping reduce children's dignity, self-worth, and access to community resources. Together, these theoretical frameworks highlight the structural and psychosocial dynamics shaping the experiences of child waste workers in Dhaka. The research underscores the urgent need for comprehensive policy interventions. Recommendations include integrating child waste collectors into education and vocational training, ensuring access to healthcare services, providing protective equipment, and formal recognition of their work within waste management systems. Addressing these challenges aligns with Sustainable Development Goals (SDGs) 1 (No Poverty), 3 (Good Health and Well-being), 4 (Quality Education), 8 (Decent Work), and 10 (Reduced Inequalities). Ultimately, a just transition for child waste collectors requires prioritizing their health, dignity, and inclusion in Bangladesh's sustainable development agenda.

Keywords: Child labor, Waste collectors, Health concerns, Social stigma, Dhaka, and SDGs.

Introduction

Dhaka, the capital of Bangladesh, is experiencing one of the most pressing waste management crises in South Asia, driven by rapid urbanization, population growth, and changing consumption patterns. Every day, thousands of tons of waste are generated, yet the city lacks an effective formal recycling system. In this gap, nearly 120,000 urban poor people, including a large number of children, are engaged in informal waste collection and recycling (Waste Concern, 2004; Enayetullah & Hashmi, 2006; Matter et al., 2015). These workers commonly known as waste pickers play a vital role in maintaining urban cleanliness and resource recovery. However, their contribution remains largely unrecognized, with children being the most invisible and marginalized actors within this system.

Child waste collectors, typically under 18 years of age, collect recyclables such as plastics, metals, and paper from streets, households, markets, and even hospitals. While their work provides critical income for survival, it exposes them to severe health hazards and entrenched social stigmas. Daily exposure to toxic chemicals, sharp objects, and infectious medical waste results in chronic illnesses, injuries, and long-term health complications, including respiratory diseases, skin infections, and musculoskeletal disorders (Bishwas et al., 2024; Begum et al., 2022). Beyond physical risks, these children face constant discrimination, harassment, and social exclusion. They are frequently labelled as “dirty,” “criminal,” or “delinquent,” which erodes their self-esteem, excludes them from education, and perpetuates intergenerational cycles of poverty (Chokhandre et al., 2017).

Despite their indispensable role in Dhaka’s waste management, research on child waste pickers remains limited, often focusing separately on either occupational health or social stigma. Yet, these two dimensions are deeply interlinked: poor health outcomes exacerbate stigma, while stigma restricts access to healthcare, education, and dignified work opportunities. This study seeks to bridge this gap by providing an integrated analysis of the health risks and social stigmatization faced by child waste collectors in Dhaka.

By adopting the Health Belief Model (HBM) and Goffman’s Stigma Theory as analytical frameworks, the study explores how health vulnerabilities and social labeling intersect to shape the lived realities of these children. Furthermore, it situates the discussion within the framework of the Sustainable Development Goals (SDGs) notably SDG 1 (No Poverty), SDG 3 (Good Health), SDG 4 (Quality Education), SDG 8 (Decent Work), and SDG 10 (Reduced Inequalities) emphasizing the urgent need for inclusive policies that recognize and protect child waste workers. The findings aim to provide insights for policymakers, NGOs, and development practitioners to design interventions that safeguard children’s rights, improve their health and education, and promote social inclusion in alignment with a just transition for vulnerable labor groups.

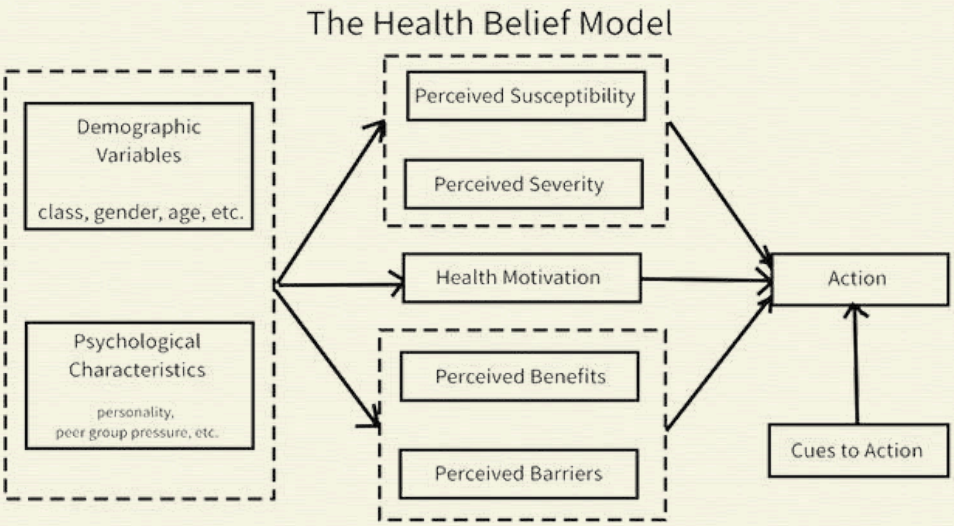

Figure 1: Health Belief Model

Methodology

The research was conducted in three locations within Dhaka District: Rayerbazar, Dhanmondi and Malibagh. These sites were chosen due to their high concentration of informal waste-picking activities and accessibility for data collection.

This study employed a qualitative research approach to explore the health risks and social stigmas faced by child waste collectors in Dhaka. A qualitative design was deemed appropriate as it captures the nuanced, lived experiences of children engaged in waste collection, providing insights beyond what numerical data alone can offer.

Given the hidden and stigmatized nature of child waste picking, a snowball sampling method was applied. Initial respondents were identified in Malibagh and Dhanmondi, who subsequently introduced the researcher to their peers. In total, 15 child waste collectors under the age of 18 were interviewed. The sample included children actively engaged in collecting, sorting, and recycling waste across different parts of the city.

Interviews were conducted using open-ended questions, allowing participants to express themselves freely. All interviews were recorded (with verbal consent), transcribed, and later translated into English for analysis. A thematic analysis approach was used to code and categorize the data, enabling the identification of recurring themes and patterns related to health hazards, stigma, and their interconnections.

Limitations: Snowball sampling may have introduced bias, as participants were drawn from connected networks. Self-reported data could be affected by recall or social desirability bias, and the study's geographic focus (Rayerbazar, Dhanmondi, Malibagh) limits broader generalization. Lack of medical assessments restricted objective validation of health risks, while translation may have lost some nuance. Despite these constraints, the study offers valuable insights into how occupational hazards and stigma reinforce each other, shaping the lives of child waste pickers in Dhaka.

Findings and Discussion

Demographic Data

Child waste pickers in Dhaka earn between BDT 10,000–15,000 per month, a critical but hazardous contribution to family income. Educational attainment is very low: 7 completed primary school, 3 reached secondary level, while 5 never attended school due to poverty. All 15 respondents were male.

Most were adolescents 3 aged 15, 5 aged 16, and 7 aged 17 with work experience ranging from 5 months to 5 years. Entry into waste picking was largely through family members or local community figures, and main work areas included Malibagh, Rayerbazar, and Dhanmondi. These demographics underscore how poverty, low education, and family dependence drive children into informal waste work, reinforcing cycles of vulnerability.

Age Distribution

Table 1: Age Groups

Age group	Number of participants
15 years	3
16 years	5
17 years	7

This study, based on interviews with 15 child waste pickers, explored their lived experiences under five themes: poverty and education, survival work, health risks, stigma, and aspirations. Guided by the Health Belief Model (HBM) and Goffman's Stigma Theory, the findings highlight how poverty and discrimination reinforce each other, trapping children in cycles of vulnerability.

Work Experience

Table 2: Work Experience

Participant no	Work experience	Engaged through	Work location
Respondent 1	3 years	Local big brother	Malibagh
Respondent 2	5 years	Own brother	Rayerbazar
Respondent 3	2 years	Father	Malibagh
Respondent 4	6 months	Local big brother	Rayerbazar
Respondent 5	5 years	Own big brother	Rayerbazar
Respondent 6	1 year	Brother-in-laws	Dhanmondi
Respondent 7	1.5 years	Local big brother	Dhanmondi
Respondent 8	5 months	Mother	Dhanmondi
Respondent 9	3 years	Local big brother	Dhanmondi
Respondent 10	8 months	Own big brother	Dhanmondi
Respondent 11	6 months	Own	Dhanmondi
Respondent 12	1 year	Local big brother	Rayerbazar
Respondent 13	3 years	Friend	Rayerbazar
Respondent 14	2 years	Own	Rayerbazar
Respondent 15	1.5 years	Cousin brother	Rayerbazar

Poverty and Education

Most participants had dropped out after primary school, while some never attended due to poverty. One said, "I studied until class six, but then I couldn't study anymore because of problems at home." Lack of education deprives them of social mobility, mirroring patterns observed in South Asia and globally (Mitra, 2016; UNICEF, 2022).

Survival Work and Economic Pressure

Children worked out of necessity, often as main earners. Monthly incomes ranged from BDT 10,000–15,000, which went directly to family support. One explained, "I earn 15,000 and spend it all on my family." Waste picking was chosen not by preference but as survival work, reflecting structural poverty and absence of safety nets (Beall, 1997).

Health Risks and Safety

Children reported frequent cuts, infections, body pain, and fevers, worsened by lack of protective gear. One recalled, “Glass broke into my leg, I couldn’t work for a year.” Many saw these problems as “normal,” showing low risk perception consistent with the HBM. Their limited self-efficacy and barriers like discomfort or cost prevented protective practices. These findings echo evidence from India and Nigeria where child waste pickers suffer chronic injuries and respiratory diseases (Thakur et al., 2018; Taiwo, 2022).

Stigma and Discrimination in Society

Beyond physical dangers, participants described strong social stigma attached to their work. They were often labeled as “dirty” or “garbage people.” One explained, “We only pick up the trash, but society thinks we are trash ourselves.” Such stigma led to isolation in schools and neighborhoods, reinforcing feelings of exclusion. Goffman’s (1963) Stigma Theory helps explain how physical appearance, moral judgments, and group identity collectively marginalize these children. Similar findings are noted in India and Latin America, where waste pickers face caste- or class-based prejudice (Beall, 1997; Medina, 2007). In Dhaka, stigma not only damages self-esteem but also prevents social integration, making exclusion as powerful a barrier as poverty.

Goals and Future Opportunities

Despite hardships, many children aspired to better futures running small businesses, farming, or securing formal jobs. One said, “I’m saving money; in the future I’ll go to the village and do something.” These aspirations reflect resilience but are constrained by lack of education, training, and support. Sen’s (1999) Capability Approach shows how poverty limits not just resources but also freedoms to pursue valued life paths. Similar to Mitra’s (2016) findings, the children’s dreams remain unfulfilled due to systemic barriers, underscoring the need for skill development, education, and psychosocial support.

Theoretical and SDG Reflections

The Health Belief Model (HBM) explains why children normalize illness and avoid protective measures seeing health risks as inevitable or safety gear as impractical. Goffman’s Stigma Theory further illustrates how being labeled as “trash” deepens exclusion and psychological harm. These realities directly challenge Bangladesh’s commitments to the SDGs: SDG 1 (No Poverty), SDG 3 (Health), SDG 4 (Education), SDG 8 (Decent Work), and SDG 10 (Reduced Inequalities). Without interventions, child waste pickers will remain an invisible workforce at the margins of urban life.

Conclusion and Policy Recommendations

This study examined the experiences of child waste pickers in Dhaka, highlighting how poverty drives their involvement in informal waste collection. Children reported long hours in unsafe environments, leading to frequent injuries, respiratory diseases, skin infections, and chronic pain. Many viewed these risks as normal, showing low awareness and limited access to prevention or care. Social stigma compounds these challenges. Often labeled as “dirty” or “garbage people,” waste picker children face discrimination in schools and communities, reinforcing exclusion and undermining self-esteem. Together, health hazards and stigma create a cycle of vulnerability that limits education and keeps families trapped in poverty.

These realities undermine Bangladesh's commitments to SDGs 1, 3, 4, 8, and 10. Without targeted action, child waste pickers will remain an "invisible workforce," contributing to urban sustainability under unsafe and unjust conditions. Policies must ensure access to education, healthcare, and social protection, alongside stronger enforcement of child labor laws and formal recognition of waste pickers in urban waste systems.

Recommendations for Policy

- Set up informal education programs near waste collectors' living places, give students money to attend the school, and make sure that all students can go to school.
- Offer free medical treatment, mobile clinics, and safety gear, as well as programs to raise knowledge of safe procedures.
- Start public efforts to remove stigma, get families involved in social protection programs, and encourage acceptance in schools and communities.
- Give parents microloans and job training, support waste picker cooperatives, and help families find formal jobs in recycling.
- Make sure that child labor regulations are followed more strictly, officially recognize rubbish pickers, and get NGOs and local governments involved in monitoring and protecting them.
- Policymakers can make the lives of child waste collectors better, end cycles of poverty, and help Dhaka's urban areas to become more inclusive and sustainable by dealing with both health risks and social isolation at the same time.

Bibliography

- Aweng, H., & Fatt, S. (2014). Survey of potential health risks of rubbish collectors from the garbage dump sites in Kelantan, Malaysia. Asian Journal of Applied Sciences, 2(4), 828–839. https://www.ajouronline.com/index.php/AJAS/article/view/828
- Beall, J. (1997). Urban governance and poverty: The case of waste pickers in India. Environment & Urbanization, 9(2), 91–109.
- ·Becker, M. H. (1978).The Health Belief Model and personal health behavior. Health Education Monographs, 2, 324–508.
- ·Bhosale, J., & Korishetti, V. (2015). Health and hygiene issues among child waste pickers. Indian Journal of Public Health,59(2), 123–127.
- Bhosale, S. G., & Korishetti, V. B. (2015). Plight of child ragpickers. International Research Journal of Social Sciences, 4(1), 16–20.
- ·Bonner, C. (2008). Waste pickers without frontiers. South African Labour Bulletin, 32,7– 9.
- Bishwas, M. S., et al. (2024).Occupational hazards of child waste pickers in Dhaka: A case study on respiratory health risks. Journal of Environmental Health Research, 18(2), 77– 89.
- Climate and Clean Air Coalition. (2013).Solid waste management in Dhaka, Bangladesh. https://www.ccacoalition.org/sites/default/files/resources/SWM_in_Dhaka_Bangladesh_2 012.pdf
- Cruvinel, V. R. N., Marques, C. P., Cardoso, V., Novaes, M. R. C. G., Araújo, W. N., Angulo-Tuesta, A., Escalda, P. M. F., Galato, D., Brito, P., & da Silva, E. N. (2019).Health conditions and occupational risks in a novel group: waste pickers in the largest open garbage dump in Latin America. BMC Public Health, 19(1), 581. https://doi.org/10.1186/s12889-019-6879-x
- Dias, S. (2012). Waste and development–Perspectives from the ground. Field Actions Science Reports.
- Erbay, E., & Akbaş, E. (2020).Child waste pickers in a south-eastern city in Turkey. Toplum ve Sosyal Hizmet,31(2), 554–577.
- Frykman, C. (2006). The Power of Waste: A study of socio-political relations in Mexico City's waste management system.

Fishing Restrictions and Just Transition: Balancing Conservation and Livelihoods of Sundarbans Fishermen in Satkhira District

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Abstract

The Sundarbans, the world's largest mangrove forest, is both a biodiversity hotspot and a livelihood base for over 2.3 million people in Bangladesh. In Satkhira district, fishing communities face mounting livelihood challenges due to state-imposed seasonal bans, licensing regimes, and blanket fishing restrictions aimed at conservation. While intended to protect species such as hilsa and shrimp, these measures often overlook local ecological realities, particularly in areas where salinity alters species availability. This study draws on focus group discussions with crab and shrimp fishers and applies political ecology and sustainable livelihoods frameworks to examine how conservation policies intersect with poverty, governance, and community resilience. Findings reveal that restrictions exacerbate household debt, reinforce intergenerational poverty, and push children to leave school for fishing. Reported incomes remain low, averaging BDT 8,000–12,000 per month after costs, while existing compensation schemes are inadequate. Rice distributions are politicized and prone to corruption, and digital cash transfers are often dysfunctional, undermining institutional trust. Despite these hardships, fishers indicated willingness to support conservation if policies were ecologically sensitive, equitably enforced, and supported by viable livelihood alternatives. Community-driven proposals emphasized participatory permit systems, transparent aid mechanisms, and long-term skill-building initiatives. Younger fishers expressed interest in alternative livelihoods such as handicrafts, wage labor, or migration, though barriers like landlessness and environmental risks limit diversification. The study concludes that current conservation regimes, though ecologically motivated, risk deepening socioeconomic marginalization without participatory governance and fair compensation. A Just Transition approach rooted in equity, recognition, and collaboration is essential to balance biodiversity protection with sustainable livelihoods in the Sundarbans.

Keywords: Sundarbans, Fishermen livelihoods, Conservation policies, Biodiversity governance, Sustainable livelihoods, and Just Transition.

the UN estimates
that by 2050,

17% OF THE COUNTRY

will be submerged
by rising sea levels
leaving

20 million

people without a home

Climate Finance in Bangladesh: Funding the Path to Resilience and Sustainable Development

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Abstract

Bangladesh, one of the most climate-vulnerable countries globally, faces escalating risks from cyclones, floods, salinity intrusion, riverbank erosion, and extreme heat. These impacts cause annual economic losses exceeding USD 7 billion and threaten livelihoods in agriculture, fisheries, coastal protection, energy, and health. Although Bangladesh contributes only 0.28% of global CO_2 emissions, the disproportionate burden of climate impacts underscores the urgency of climate finance for adaptation and mitigation. This paper examines the current landscape of climate finance in Bangladesh, highlighting both progress and persistent gaps. Domestically, mechanisms such as the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF) have supported projects in disaster resilience, water management, and agriculture, but remain insufficient given the scale of need. International financing from the Green Climate Fund (GCF), Global Environment Facility (GEF), and bilateral partners has been vital, with Bangladesh receiving approximately USD 1.2 billion annually, of which 60% supports adaptation. Yet, the country still faces a significant financing shortfall across key sectors: agriculture requires USD 2.5–3 billion annually, energy USD 1.8 billion, and coastal protection USD 1 billion. Institutional and structural barriers also hinder effective use of funds. Complex application procedures, limited technical capacity, and transparency challenges restrict access for local governments and community-based organizations. Additionally, weak integration of climate and labor policies risks excluding vulnerable groups from climate-resilient pathways. Strategic reforms such as enhanced institutional capacity, streamlined fund allocation, and adoption of carbon pricing mechanisms are critical for closing financing gaps. The study concludes that climate finance is more than a funding mechanism; it is a strategic tool for resilience, justice, and sustainable development. By mobilizing both domestic and international resources effectively, Bangladesh can strengthen adaptive capacity, reduce vulnerabilities, and align with the Paris Agreement and Sustainable Development Goals.

Keywords: Climate Finance, Adaptation, Green Climate Fund, Resilience, Sustainable Development

Introduction

Bangladesh is among the world's most climate-vulnerable countries due to its low-lying geography, dense population, and reliance on climate-sensitive sectors such as agriculture, fisheries, and coastal industries. The country faces both sudden shocks and slow-onset stresses rising temperatures, floods, cyclones, salinity intrusion, and sea-level rise that threaten ecosystems, livelihoods, and economic stability. In 2024, climate impacts caused USD 1.78 billion in economic losses (0.4% of GDP), including 25 million lost workdays from heat stress (Reuters, 2025). Maximum temperatures have risen by 1.1°C since 1980, while perceived heat has increased by 4.5°C, heightening health risks and disproportionately affecting women and the elderly. Dhaka's heat index is climbing 65% faster than the national average.

Extreme weather compounds these pressures. Cyclones Sidr (2007) and Amphan (2020) displaced more than three million people, while the 2022 floods uprooted 7.2 million and devastated northern infrastructure. Riverbank erosion displaces 200,000 annually, and sea-level rise could displace 13.3 million by 2050. Salinity already affects 27 million coastal residents, undermining food security and pushing rural workers into precarious urban jobs. These shifts intensify competition for low-skilled labor and deepen poverty cycles.

Bangladesh has mobilized domestic and international support, including USD 7.2 billion from the World Bank (IMF, 2023) and USD 903 million from the Green Climate Fund (Climate Funds Update, 2023). Yet, annual adaptation needs exceed USD 7 billion, leaving a significant gap. Global and regional studies highlight structural challenges limited data, weak institutions, and inequitable finance flows that constrain effective adaptation (Adaptation Finance Gap Update, 2023; Vinca et al., 2025). For Bangladesh, these gaps translate into inadequate transparency, restricted access for local actors, and underprepared institutions.

In sum, while Bangladesh has made progress in climate finance, major shortfalls in adequacy, equity, and institutional readiness persist. Bridging these gaps will require transparent, inclusive, and country-specific frameworks that integrate labor rights, social protection, and resilience into climate finance strategies.

Methodology

This study used a mixed-methods approach that combines both quantitative and qualitative analysis to assess the financial landscape of climate action. The research design was descriptive and analytical, focusing on sectoral cost assessments as well as institutional and financial frameworks.

The data was compiled from a variety of sources. Secondary data was collected from government reports (such as those from MoEFCC, BCCTF, and BCCRF), international databases (including the World Bank, UNDP, and OECD), and a wide range of peer-reviewed journals and research publications. Financial data included records of domestic and international funding, sectoral cost estimates, and climate expenditure.

The analysis involved several key steps like (1) Compiling and analyzing climate vulnerability indices and funding flows, (2) A comparative analysis of domestic versus international financing, (3) An assessment of institutional capacity, accessibility, and effectiveness and (4) Visualizing the data through tables and charts to clearly illustrate financing gaps and contributions.

Instead of focusing on inconsistencies, the study's reliance on secondary sources demonstrates a strategic and efficient approach to data collection, building upon the extensive work of global and national organizations. The use of both established reports and international databases provides a robust foundation for the analysis.

Findings

Bangladesh's Climate Vulnerability

Bangladesh is widely recognized as one of the world's most climate-vulnerable countries due to its unique geographic and socio-economic characteristics. According to the 2023 World Risk Index, the country ranks ninth globally for climate disaster risk, reflecting its high exposure to both extreme weather events and slow-onset climate impacts. From 1960 to 2022, the frequency of climate-related disasters in Bangladesh has nearly doubled, rising from an average of four events per year before 1990 to seven events per year after 1990. The economic costs of climate-related loss and damage have surged nearly fourfold, from an average of US$145.64 million annually (1960–1990) to US$557.53 million annually (1991–2022). (IIED, 2025) Projections suggest that by 2050, Bangladesh could lose up to 17% of its territory and 30% of its agricultural land as a result of rising sea levels, triggering widespread displacement and serious food security challenges. The Climate Vulnerability Index (CVI), developed by UNDP, provides a nuanced assessment of regional vulnerabilities within Bangladesh.

The index evaluates factors such as exposure to climate hazards, community sensitivity, and adaptive capacity, highlighting that coastal and low-lying areas are particularly at risk from flooding, salinity intrusion, and cyclones. Livelihood sectors, including agriculture and fisheries, have been severely disrupted. More than 52% of households reported reduced crop production due to salinity, erratic rainfall and flooding. Some 66% of households report that fish production has declined due to rising water temperatures and salinity intrusion, affecting food security and income. Nearly 42% of households experienced crop losses, while 48% reported livestock losses, directly impacting household resilience and forcing negative coping strategies (IIED, 2025). These regions face compounded threats that affect livelihoods, infrastructure, and essential services. Despite its high vulnerability, Bangladesh contributes minimally to global greenhouse gas emissions. In 2023, the country accounted for only 0.45% of global CO_2 emissions, a modest share compared to major emitters such as China and the United States. Nevertheless, the disproportionate impact of climate change on Bangladesh underscores the inequity between responsibility for emissions and the burden of climate risks. By contrast, high-emission countries generally have greater resources and infrastructure to mitigate and adapt to climate impacts, highlighting the critical need for international support and equitable climate financing for countries like Bangladesh.

Funding Gaps and Sectoral Needs

Significant financing gaps persist across key sectors critical to Bangladesh's adaptation and mitigation efforts. In agriculture, climate-induced crop losses and salinity intrusion necessitate annual adaptation investments of approximately USD 2.5–3 billion, far exceeding current allocations (Adaptation Finance Gap Update, 2023). The energy sector requires an additional USD 1.8 billion per year to support the transition to renewable energy and energy efficiency projects in urban and industrial areas (State and Trends in Climate Adaptation Finance, 2024). Coastal protection measures, including embankments, drainage, and resilient infrastructure, demand roughly USD 1 billion annually to address rising sea levels and storm surges (Understanding and Increasing Finance for Climate Adaptation, 2023). The ready-made garments (RMG) and broader industrial sectors also face substantial adaptation costs. Investments in green technologies, energy-efficient factories, and climate-proof infrastructure are

estimated at USD 0.7–1 billion per year (Vinca et al., 2025). Collectively, these funding gaps reveal a significant shortfall in both domestic and international climate finance, constraining Bangladesh's ability to enhance resilience and safeguard long-term development.

Current Climate Finance Status in Bangladesh

Bangladesh has made notable progress in mobilizing climate finance, but the overall scale remains insufficient relative to its vulnerability. According to the Global Landscape of Climate Finance 2023 (Global Landscape of Climate Finance, 2023), Bangladesh received approximately USD 1.2 billion per year in climate-related funding over the last five years. Of this, adaptation finance accounts for nearly 60%, while mitigation-oriented funding, especially for renewable energy and low-carbon infrastructure, constitutes about 40%. Despite these inflows, tracking and transparency challenges persist, limiting the ability to assess the effectiveness and equity of fund allocation. Bangladesh is among the most climate-vulnerable countries globally, facing escalating risks across agriculture, energy, coastal areas, and public health. Recent estimates indicate that the annual financial burden of climate impacts and adaptation needs exceeds USD 7 billion, highlighting an urgent requirement for targeted climate finance. Table 1 summarizes the sector-wise estimated costs based on recent studies and reports.

Table 1: Sector-wise estimated costs

Sector	Estimated Annual Cost / Adaptation Need	Source
Agriculture	$2.5–3 billion	Climate Finance in the Agriculture Sector of Bangladesh (LightCastle Partners, 2023)
Energy & Infrastructure	$1.8 billion	State and Trends in Climate Adaptation Finance 2023 (GCA, 2023)
Coastal Protection	$1 billion	State and Trends in Climate Adaptation Finance 2023 (GCA, 2023)
Health (Heat-related)	$1.78 billion (2024)	World Bank / Reuters, 2025
Total Estimated Need	$7.08–7.58 billion	Aggregated from above sources

These figures collectively highlight the scale of climate finance required in Bangladesh. Bridging this funding gap will require enhanced domestic allocations, international support, and innovative financing mechanisms to safeguard vulnerable communities, protect livelihoods, and promote sustainable development. In 2023, Bangladesh emitted approximately 124.8 megatonnes (Mt) of CO_2, reflecting a 0.58% increase from the previous year. This positions the country 39th globally in total emissions, contributing about 0.28% of global CO_2 output.

CIRCULAR ECONOMY

CIRCULAR ECONOMY REFERS TO MODELS OF PRODUCTION AND CONSUMPTION THAT MINIMIZE WASTE AND REDUCE POLLUTION, PROMOTE SUSTAINABLE USES OF NATURAL RESOURCES, AND HELP REGENERATE NATURE. CIRCULAR ECONOMY APPROACHES ARE ALL AROUND US. THEY CAN BE EMPLOYED IN A NUMBER OF DIFFERENT SECTORS, FROM TEXTILES TO BUILDINGS AND CONSTRUCTION, AND AT VARIOUS STAGES OF A PRODUCT'S LIFECYCLE, INCLUDING DESIGN, MANUFACTURING, DISTRIBUTION, AND DISPOSAL.

On a per capita basis, Bangladesh's emissions are approximately 0.73 tonnes per person, significantly lower than the global average of 4.9 tonnes (International Energy Agency (IEA, 2024). The global emissions landscape remains heavily skewed, dominated by a few major emitters. China leads with 13.26 gigatonnes (Gt), followed by the United States at 4.68 Gt and India at 2.95 Gt. Together, these three countries account for over half of global CO_2 emissions, underscoring the stark disparity between nations that contribute most to climate change and those, like Bangladesh, that are disproportionately affected by its impacts (IEA, 2024).

Comparative Emission & NDC Analysis

The emission data presented above highlights the disproportionate contributions of major economies compared to climate-vulnerable countries such as Bangladesh. While China, the United States, and India together account for the bulk of global CO_2 emissions, Bangladesh's share remains negligible despite its high exposure to climate impacts. This disparity underscores the principle of common but differentiated responsibilities, emphasizing the need for developed and large-emitting nations to take the lead in ambitious mitigation actions.

Table 2: Comparative CO_2 emission rate between China, United States, India and Bangladesh

Country	2023 CO_2 Emissions (Gt)	Global Share (%)	Per Capita Emissions (tonnes)
China	13.26	35	9.3
United States	4.68	12.6	13.7
India	2.95	7.8	2.1
Bangladesh	0.125	0.28	0.73

The following table provides a comparative overview of the Nationally Determined Contributions (NDCs) of these countries. By examining both their stated commitments and long-term targets, we can better understand how global climate ambition aligns or fails to align with the urgency required to meet the Paris Agreement goals.

The table above presents a comparative overview of the Nationally Determined Contributions (NDCs) submitted by four major economies and developing nations, China, the United States, India, and Bangladesh. These NDCs, which are at the heart of the Paris Agreement, represent each country's self-defined commitment to reduce greenhouse gas emissions and adapt to the impacts of climate change. For a climate-vulnerable nation like Bangladesh, international support is not merely a supplementary resource; it is a critical enabler for achieving its full climate ambition. The distinction between its unconditional and conditional NDC targets explicitly demonstrates this dependency.

Table 3: Comparative overview of the Nationally Determined Contributions (NDCs)

Country	Year	Key findings	Remarks
China	2021 (with new 2035 NDC planned)	- Peak CO2 emissions before 2030. - Drop of over 65% in CO2 intensity by 2030 (from 2005 levels). - Non-fossil fuels: Increase to about 25% of primary energy consumption by 2030. - Wind and Solar: Over 1,200 GW installed capacity by 2030.	A new 2035 NDC is planned before COP30.
United States	2024	- 50-52% reduction in net greenhouse gas emissions by 2030 (from 2005 levels). - 61-66% reduction by 2035 (from 2005 levels). - Methane: at least 35% reduction by 2035.	Has a long-term goal of achieving net-zero emissions by 2050.
India	2022	- 45% reduction in emissions intensity of GDP by 2030 (from 2005 levels). - 50% of cumulative electric power from non-fossil fuel sources by 2030.	Has a long-term goal of achieving carbon neutrality by 2070.
Bangladesh	2021	- Unconditional: 6.73% reduction below business-as-usual (BAU) by 2030. - Conditional: Additional 15.12% reduction below BAU by 2030, with international support.	Covers sectors including Energy, IPPU, Agriculture, Forestry, and Waste.

The conditional target, which hinges on international financial and technological assistance, represents a significant leap in emission reduction beyond what the country can achieve with its own limited resources. This direct linkage highlights the core principle of climate justice, where developed nations, historically responsible for the majority of greenhouse gas emissions, are obligated to provide support to developing countries. Climate finance is thus a central component

of this support, enabling Bangladesh to invest in large-scale mitigation projects, such as renewable energy infrastructure, and crucial adaptation measures to protect its population and economy from climate impacts. Without this external funding, the country's capacity to transition to a low-carbon, climate-resilient development pathway is severely constrained, underscoring the vital role of global cooperation in meeting the collective goals of the Paris Agreement.

Institutional Arrangements and Accessibility

Bangladesh has established a range of institutional frameworks to mobilize, manage, and distribute climate finance, involving both government agencies and development partners. At the national level, the Ministry of Environment, Forest and Climate Change (MoEFCC) is the central coordinating body for climate-related initiatives, overseeing policy formulation, project approval, and monitoring of climate finance flows (MoEFCC, 2023). Complementing this, the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF) serve as the primary domestic financing mechanisms, channeling both public funds and international grants toward adaptation and mitigation projects (World Bank, 2020).

Despite these arrangements, accessibility to climate finance remains uneven across sectors and regions. Large infrastructure and energy projects tend to attract the majority of available funding, while small-scale, community-based adaptation initiatives often face delays or resource constraints (UNDP, 2021). The complexity of application procedures and stringent reporting requirements can also create barriers for local organizations and smaller municipalities attempting to access international funds, such as those provided by the Green Climate Fund (GCF) or the Global Environment Facility (GEF) (Climate Funds Update, 2023).

Institutional capacity is another critical factor affecting accessibility. While national agencies maintain oversight, limited technical capacity, insufficient data management systems, and coordination gaps among ministries often hinder the effective disbursement and monitoring of climate finance (OECD, 2023). As a result, project implementation can be delayed, and the intended climate adaptation or mitigation impacts may be compromised.

Furthermore, transparency and accountability remain challenges. While reporting frameworks exist, detailed data on fund allocation, utilization, and outcomes are often fragmented or inconsistent. This limits the ability of stakeholders including civil society, research institutions, and local governments to assess the effectiveness of climate finance interventions or advocate for improvements (UNDP, 2020).

Carbon Taxation and Pricing in Bangladesh: A Strategic Approach

Bangladesh faces severe climate risks, including rising temperatures, salinity intrusion, and flooding, which threaten livelihoods and economic growth. One strategic policy tool to address these challenges is carbon taxation and pricing, which internalizes the environmental costs of greenhouse gas (GHG) emissions and incentivizes cleaner energy use. Although Bangladesh has yet to adopt a formal carbon pricing mechanism, studies highlight its potential to accelerate a low-carbon transition (World Bank, 2020).

As of 2023, Bangladesh levies no explicit carbon tax, and fossil fuel subsidies covering nearly 24.2% of emissions undermine incentives for renewable energy (OECD, 2023).

Estimates suggest a carbon tax could raise up to 1% of GDP annually, providing resources for renewable energy, energy efficiency, and adaptation initiatives. Benefits include: (i) mobilizing significant revenues for climate-resilient infrastructure, (ii) encouraging industries and consumers to adopt cleaner technologies, and (iii) aligning with Bangladesh's pledge to cut emissions by 21.8% by 2030 (UNDP, 2021).

However, challenges remain. A carbon tax could disproportionately burden low-income households by raising energy and commodity prices (Policy Insights, 2019). Political resistance, entrenched fossil fuel subsidies, and weak monitoring mechanisms further complicate implementation (IEEFA, 2023). A gradual, phased approach combined with targeted subsidies for the poor and reinvestment of revenues into renewable energy and community-based adaptation would help balance equity with effectiveness.

Bangladesh has established institutions to manage climate finance, including the Ministry of Environment, Forest and Climate Change (MoEFCC), the Bangladesh Climate Change Trust Fund (BCCTF), and the Bangladesh Climate Change Resilience Fund (BCCRF). Yet, accessibility remains uneven: large infrastructure projects dominate while small, community-based initiatives face delays and limited resources (UNDP, 2021). Capacity gaps, fragmented data, and weak transparency also limit effective use of funds (OECD, 2023).

To maximize impact, Bangladesh must streamline application processes, strengthen sub-national technical capacity, and ensure transparent fund allocation. Coupled with a carefully designed carbon tax, these measures could enhance climate finance accessibility, protect vulnerable communities, and drive a fair, low-carbon transition.

Role of International Financing in Mitigating Bangladesh's Climate Loss and Mitigation Costs

Bangladesh is one of the country's most vulnerable to climate change, yet its contribution to global greenhouse gas emissions remains minimal. To address climate risks and implement adaptation and mitigation measures, international financing plays a crucial role in bridging the funding gap. According to the World Bank (2021), the estimated annual cost of climate adaptation and mitigation in Bangladesh exceeds USD 7 billion, covering sectors such as agriculture, energy, coastal protection, health, and urban resilience.

International financing mechanisms including multilateral funds, bilateral aid, and private climate finance provide essential resources to help Bangladesh implement climate-resilient infrastructure, disaster risk reduction projects, and renewable energy initiatives. Key contributors include the Green Climate Fund (GCF), the Global Environment Facility (GEF), the Adaptation Fund, and development agencies such as USAID, JICA, and DFID. These funds primarily support adaptation projects, such as embankment construction, flood early warning systems, salinity-resistant crop programs, and renewable energy deployment (Climate Funds Update, 2023).

The effectiveness of international finance is particularly evident in bridging the resource gap for large-scale initiatives. For instance, GCF has approved USD 903 million for ten projects in Bangladesh, combining mitigation and adaptation strategies. Without such external support, the country would struggle to meet the rising climate adaptation costs while maintaining sustainable development goals (UNDP, 2021).

At the same time, reliance on international finance highlights challenges related to coordination, accessibility, and conditionalities. Efficient utilization of these funds requires strong institutional capacity, robust monitoring mechanisms, and alignment with national climate strategies (OECD, 2023).

Domestic Financing for Climate Adaptation and Mitigation

Bangladesh has developed a set of domestic financing mechanisms to address climate change, primarily managed through government funds and budget allocations. The two major domestic instruments are the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF). Established in 2009, BCCTF receives funding directly from the national budget, while BCCRF pools both domestic and international resources to implement adaptation and mitigation projects (MoEFCC, 2023). Over the past decade, BCCTF has allocated approximately USD 400 million to support projects in agriculture, forestry, water management, and disaster resilience (World Bank, 2020).

Key initiatives include embankment construction, salinity-resistant crop development, flood protection, and early warning systems. BCCRF complements these efforts with co-financing from development partners, enabling larger-scale projects in urban resilience, renewable energy, and coastal protection (UNDP, 2021). Despite these mechanisms, domestic financing faces limitations. Budget constraints, bureaucratic procedures, and competing national priorities often delay fund disbursement. Additionally, smaller municipalities and community-based organizations find it challenging to access funds due to complex application processes and limited technical capacity. Strengthening institutional arrangements, improving transparency, and enhancing technical support are critical to maximizing the impact of domestic climate finance (OECD, 2023).

Table 3: Comparative Overview of Domestic vs International Climate Finance in Bangladesh (2023)

Finance Source	Type of Support	Approx. Amount (USD Million)	Focus Areas / Sectors	Remarks
Domestic Financing				
BCCTF	Government budget grant	400	Agriculture, forestry, water management, disaster	Focus on national projects; flexible use
BCCRF	Government + co-financing	350	Urban resilience, renewable energy, coastal protection	Includes international co-financing

Finance Source	Type of Support	Approx. Amount (USD Million)	Focus Areas / Sectors	Remarks
International Financing				
Green Climate Fund (GCF)	Grant & concessional	903	Adaptation & mitigation; renewable energy, urban resilience	10 approved projects
GEF	Grant & technical assistance	210	Biodiversity, agriculture, water, and energy	Co-financing with government projects
Adaptation Fund	Grant	120	Coastal protection, disaster risk reduction	Community-based adaptation focus
JICA	Loan & grant	500	Flood management, renewable energy	Includes technical assistance and capacity building
USAID	Grant & technical aid	150	Agriculture, climate-resilient livelihoods	Projects in coastal and rural regions
DFID / UK Aid	Grant	130	Urban resilience, health, disaster preparedness	Focus on vulnerable communities

Domestic financing primarily supports national and community-level projects, while international financing enables larger-scale infrastructure and technical programs. Total domestic finance (USD 750 million) is smaller than international contributions (USD 1,913 million), highlighting the continued reliance on external resources for comprehensive climate adaptation and mitigation. Improving the efficiency, accessibility, and transparency of both domestic and international funds is crucial for meeting Bangladesh's projected annual climate finance needs of over USD 7 billion (World Bank, 2021).

Bangladesh's climate vulnerability, financing mechanisms, and policy gaps

Over the past two decades, Bangladesh has stood at the crossroads of climate vulnerability and climate leadership. On one hand, the country faces relentless threats rising seas swallowing fertile lands, cyclones battering coastal communities, and erratic weather disrupting livelihoods. On the other, Bangladesh has steadily crafted a policy and institutional framework to turn resilience into reality. From pioneering one of the first Climate Change Trust Funds in the Global South to preparing a long-term National Adaptation Plan stretching to 2050, the nation has attempted to transform its vulnerability into a blueprint for survival.

Yet, these policies and frameworks are not without gaps. Funding shortfalls, weak local-level integration, and complex bureaucratic processes continue to challenge implementation. Still, each framework tells a story of ambition, struggle, and the pursuit of climate justice in a country that contributes the least to global emissions but suffers among the most.

The following table maps out some of the key policies and frameworks shaping Bangladesh's climate response, outlining their objectives, current status, and the challenges that remain.

Table 4: Key Policies and Frameworks Shaping Bangladesh's Climate Response

Policy/Framework	Objectives / Scope	Current Status	Key Gaps / Limitations
National Adaptation Plan (NAP 2023–2050)	Long-term adaptation planning across agriculture, energy, health, coastal zones, and urban resilience	Approved and submitted to UNFCCC; sector-specific strategies outlined	Funding gap (~USD 8.5 billion/year needed); weak integration with local-level planning; limited monitoring and evaluation
Bangladesh Climate Change Trust Fund (BCCTF)	Domestic financing for adaptation and mitigation projects	Funded via national budget; allocated USD 400 million over past decade	Limited scale relative to needs; bureaucratic delays; technical capacity constraints at local level
Bangladesh Climate Change Resilience Fund (BCCRF)	Pooling domestic and international funds for adaptation & mitigation	Operational with public and civil society windows; co-finances international projects	Complex application procedures; accessibility barriers for smaller NGOs and municipalities
Nationally Determined Contributions (NDC, 2020)	Commitments to GHG reduction and low-carbon development	Targets: 21.8% GHG reduction by 2030	Limited financial mobilization strategy; weak sectoral prioritization; lack of carbon pricing implementation
Climate Fiscal Policy (Energy & Taxation)	Promote low-carbon economy via subsidies, taxes, and incentives	Fossil fuel subsidies cover 24.2% of emissions; no explicit carbon pricing	Subsidy structure reduces incentives for clean energy adoption; carbon tax not yet implemented

Policy/Framework	Objectives / Scope	Current Status	Key Gaps / Limitations
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Discussion

Bangladesh's geographic position, low-lying topography, and dense population make it one of the most climate-vulnerable countries in the world (World Bank, 2021). The nation faces both sudden climate shocks such as cyclones, floods, and storm surges and slow-onset stresses, including sea-level rise, salinity intrusion, and riverbank erosion (UNDP, 2023). These impacts translate into severe socio-economic consequences: declining agricultural productivity, infrastructure damage, heightened health risks, and large-scale displacement, particularly in coastal and rural areas (CPD, 2025). With annual climate-related losses estimated at over USD 7 billion, Bangladesh's domestic resources are inadequate to meet the scale of adaptation and mitigation needs (LightCastle Partners, 2023).

Climate finance is therefore essential to bridge this gap. Access to international and domestic financial flows enables investments in priority sectors. Agriculture alone requires USD 2.5–3 billion annually to support salinity-resistant crops, flood control, and resilient irrigation systems. Energy and industrial sectors need approximately USD 1.8 billion to shift toward low-carbon technologies, while coastal protection measures demand around USD 1 billion each year for embankments, drainage, and early warning systems (Adaptation Finance Gap Update, 2023; State and Trends in Climate Adaptation Finance, 2024). Mobilizing these resources will reduce vulnerability, strengthen adaptive capacity, and minimize climate-induced economic disruption.

The benefits of climate finance extend beyond immediate risk reduction. Strategic investments in renewable energy, energy efficiency, and resilient urban planning can drive sustainable growth, reduce greenhouse gas emissions, and create green jobs (World Bank, 2020; OECD, 2023). Financing health-focused initiatives can address heat stress, waterborne diseases, and other climate-linked health challenges (Reuters, 2025). Equally, community-based adaptation projects strengthen local resilience, empower vulnerable groups, and foster inclusive development (UNDP, 2021).

To maximize these outcomes, Bangladesh requires a coordinated approach that integrates domestic and international finance. Strengthening institutional capacity, simplifying fund access, and ensuring transparent allocation are critical for effective delivery (OECD, 2023). Domestic mechanisms such as the Bangladesh Climate Change Trust Fund (BCCTF) and Bangladesh Climate Change Resilience Fund (BCCRF) should complement global sources like the Green Climate Fund (GCF), Global Environment Facility (GEF), and bilateral contributions (World Bank, 2020). Aligning financial flows with the National Adaptation Plan (NAP) and other national strategies will ensure that resources reach the most climate-exposed sectors and communities (MoEFCC, 2023; CPD, 2025).

In sum, climate finance is not only a funding tool but also a strategic enabler of resilience, equity, and sustainable growth. By effectively leveraging domestic and international resources, Bangladesh can safeguard vulnerable populations, reduce climate risks, and transition toward a low-carbon, climate-resilient development pathway (World Bank, 2021; UNDP, 2023; OECD, 2023).

Conclusion

This study highlights the critical importance of climate finance for Bangladesh, a country highly vulnerable to the impacts of climate change, including extreme weather events, rising sea levels, and salinity intrusion. The key findings of the research demonstrate that Bangladesh faces significant funding gaps in key sectors like agriculture, energy, and coastal protection, with annual adaptation costs exceeding USD 7 billion. Despite efforts to mobilize domestic resources through funds such as the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF), these mechanisms are insufficient to address the full scope of the challenges. International financial support, notably from the Green Climate Fund (GCF) and the Global Environment Facility (GEF), is essential to fill this gap. The study underscores the need for enhanced institutional capacity, streamlined access to climate finance, and improved transparency to ensure effective allocation and utilization of resources. Climate finance, not just as funding but as a tool for resilience, enables Bangladesh to pursue sustainable development, protect vulnerable populations, and reduce the adverse effects of climate change. Climate finance is a key enabler for Bangladesh to meet its climate adaptation and mitigation goals and ensure its long-term resilience against the growing impacts of climate change. Strengthening this financing infrastructure, both domestically and internationally, is crucial for securing a sustainable future.

Bibliography:

- Adaptation Finance Gap Update. (2023). Adaptation finance gap update 2023. United Nations Environment Programme.
- Beyond Promises. (2023). Beyond promises: Realities of climate finance justice and energy transitions.
- City Gap Fund. (2023). City Climate Finance Gap Fund. World Bank & European Investment Bank.
- Climate Finance Landscape of Asia and the Pacific. (2023). Climate finance landscape of Asia and the Pacific 2023. Asian Development Bank.
- Climate Funds Update. (2023). Climate funds update. ODI & HBF.
- CPD. (2025). Centre for Policy Dialogue report on climate finance and vulnerability. Dhaka: Centre for Policy Dialogue.
- Global Landscape of Climate Finance. (2023). The global landscape of climate finance 2023. Climate Policy Initiative.
- IEA. (2024). Global CO_2 emissions data 2024. International Energy Agency.
- IIED. (2025). World risk index and climate vulnerability in Bangladesh. International Institute for Environment and Development.
- IEEFA. (2023). Institute for Energy Economics and Financial Analysis reports on carbon pricing.
- IMF. (2023). International Monetary Fund country climate and economic report: Bangladesh.
- LightCastle Partners. (2023). Climate finance in the agriculture sector of Bangladesh. Dhaka: LightCastle Partners.
- MoEFCC. (2023). Ministry of Environment, Forest and Climate Change reports. Government of Bangladesh.
- OECD. (2023). Organisation for Economic Co-operation and Development climate finance insights.
- Policy Insights. (2019). Policy brief on carbon pricing and household impacts in Bangladesh.
- Reuters. (2025). Heat impacts and climate vulnerability in Bangladesh. Reuters News.
- State and Trends in Climate Adaptation Finance. (2024). State and trends in climate adaptation finance 2024. Global Center on Adaptation.
- Understanding and Increasing Finance for Climate Adaptation. (2023). Understanding and increasing finance for climate adaptation. World Resources Institute.
- UNDP. (2020). UNDP Bangladesh climate finance report. United Nations Development Programme.
- UNDP. (2021). Climate finance accessibility and adaptation initiatives in Bangladesh. United Nations Development Programme.
- UNDP. (2023). Bangladesh climate vulnerability and adaptation capacity. United Nations Development Programme.
- Vinca, A., et al. (2025). Financing strategies for resilience and SDGs under climate change uncertainty.
- World Bank. (2020). Bangladesh climate finance mechanisms. The World Bank Group.
- World Bank. (2021). Climate adaptation and finance in Bangladesh. The World Bank Group.

2.1 million jobs lost in early 2025. **86%** belonged to women.

Nearly **60%** of employed women are in vulnerable jobs.

1.1 million women are engaged in informal work.

From Barriers to Opportunities: Assessing Women's inclusion in digitalization and skill development in Bangladesh

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Abstract

This study explores the complex interplay between gender, digitalization, and skill development in Bangladesh, focusing on the barriers and opportunities that shape women's participation in the upcoming technological shift within the workforce. Despite notable strides under various initiatives, women remain significantly underrepresented in digital sectors and technical fields, constraining both their economic empowerment and the country's broader labour potential. The research highlights critical disparities in access to technology: only 68% of women own mobile phones compared to 85% of men, while mobile internet usage stands at 24% for women versus 37% for men. Socio-cultural norms, including gendered household responsibilities and traditional perceptions of women's roles, further restrict mobility and access to training programs. Educational and technical training gaps exacerbate these inequities, with only 10% of women pursuing technical education, 15% of government skill program trainees being female, and merely 13% of training centers incorporating gender-sensitive curricula. Economic dependency, especially in the informal sector where 60% of women are employed, restricts their ability to invest in digital tools or pursue entrepreneurship, while access to formal financial services remains limited. Despite these challenges, digitalization presents transformative opportunities for women workers. Mobile financial services have strengthened financial independence, particularly in rural areas. Digital entrepreneurship platforms and e-commerce tools empower women to overcome geographic and capital barriers, thereby increasing household income and enabling more flexible participation in business activities. Freelancing has emerged as a viable path to financial autonomy, with women comprising 38% of Bangladesh's freelancer workforce and earning on average 30% more than in traditional employment sectors. These developments demonstrate the potential of digital tools to enhance women's economic participation and labour market contribution. The study employs a mixed-methods approach, integrating quantitative secondary data with qualitative insights from policy documents, academic literature, and institutional reports, to identify systemic barriers and opportunities. Findings underscore the urgent need for targeted interventions, including equitable access to technology, gender-sensitive digital skills programs, financial inclusion initiatives, and supportive networks for female entrepreneurs and freelancers. Empowering women workers in this manner is not only a matter of equity but a critical labour and economic imperative. By dismantling these structural barriers, Bangladesh can mobilize the full potential of its female workforce, drive inclusive growth, and advance a just, equitable, and digitally empowered society.

Keywords: Women's Inclusion, Digitalization, Skill Development, Gender Equality, Just Transition

Introduction

The growing emphasis on women's inclusion in digitalization and skill development in Bangladesh reflects a broader recognition of their pivotal role in driving economic growth and societal transformation. Women's empowerment is now widely acknowledged as a cornerstone of sustainable development, with impacts spanning health, education, livelihoods, and national productivity. In this context, digitalization has emerged as a central driver of Bangladesh's economic transformation, reshaping industries, expanding access to services, and creating new avenues for employment under the Digital Bangladesh Vision. Considerable progress has been achieved in internet connectivity, mobile ownership, and the delivery of digital services. Yet, these opportunities remain unevenly distributed particularly for women whose meaningful participation is critical for ensuring inclusive and sustainable development. Despite women constituting a significant share of the workforce, they remain digitally disadvantaged. Only 24% of women in Bangladesh use mobile internet compared to 37% of men, while mobile phone ownership among women is 68% compared to 85% for men. This digital divide underscores the research problem: at the intersection of gender, labor, and digitalization, structural barriers hinder women from fully leveraging digital tools for entrepreneurship, freelancing, and financial inclusion (Press Xpress, 2024). Persistent gender disparities in access to Information and Communication Technologies (ICT) are driven largely by socio-economic and educational barriers. Low literacy rates and limited access to tertiary education constrain women's ability to acquire and apply digital skills effectively. Education is central to overcoming this gap research highlights that increasing women's participation in ICT education is vital for empowerment and economic advancement (Jamal et al., 2020). Moreover, targeted skill development initiatives can enhance women's entrepreneurial capacity, as underscored by Akter et al. (2024). Studies further demonstrate the potential of ICT in rural areas: for example, nearly three-fourths of female farmers could manage climate adaptation knowledge if they had access to mobile devices (Ghosh et al., 2021). At the same time, structural barriers remain deeply entrenched. Women entrepreneurs often lack access to funding and business networks, limiting their ability to expand through digital tools (Sheikh & Islam, 2019). Low levels of digital literacy reported among 66% of Bangladeshi women (UNCDF, 2022) further constrain their access to mobile financial services and digital marketplaces, though emerging studies highlight promising trends of women entering these spaces (Ripa et al., 2023). Addressing these challenges requires not only skills training and supportive infrastructure but also broader cultural and institutional reforms. Evidence suggests that enabling environments such as supportive policies, e-commerce platforms, and confidence-building initiatives can significantly enhance women's digital engagement (Sultana & Akter, 2021).

Equally, shifting societal perceptions to challenge gender stereotypes in technology sectors remains a critical step (Islam et al., 2023). Against this backdrop, the present study analyzes the role of women workers in Bangladesh's digitalization and skill development processes, with a particular focus on barriers and opportunities that shape their meaningful participation in the digital economy. Specifically, it examines disparities in access to technology, socio-cultural constraints, and educational and training gaps; explores women's engagement in ICT, STEM, and vocational programs; and evaluates how digitalization through mobile financial services, freelancing, and entrepreneurship contributes to empowerment and labor market participation. Finally, this study seeks to identify evidence-based strategies such as gender-sensitive training, mentorship, access to financial services, and supportive networks that can foster inclusive growth, labor equity, and sustainable digital transformation in Bangladesh.

Methodology

This study adopts a mixed-methods approach, combining qualitative and quantitative perspectives to assess women's inclusion in Bangladesh's digitalization and skill development processes. The quantitative component relies on secondary datasets from national and international organizations, providing statistical evidence on women's access to digital technologies, mobile and internet usage, and participation in digital skills training programs. These datasets enable the identification of key trends and disparities across gender, geography, and socio-economic groups. The qualitative component draws on secondary sources, including peer-reviewed articles, reports from development partners, government policy documents, private sector studies, and media coverage. These sources provide deeper insights into women's lived experiences, perceptions of digital technologies, and the institutional and cultural barriers that shape their participation. By integrating empirical data with qualitative narratives, the study ensures both statistical rigor and contextual depth. This approach allows for a holistic understanding of women's empowerment in the digital economy, highlighting barriers, opportunities, and potential policy interventions. Along with that it was guided by the following core questions: (1) What are the key socio-economic and cultural barriers limiting women's access to digital technologies and skill development opportunities in Bangladesh? (2) How do gender disparities in education and technical training influence women's participation in the digital economy? and (3) In what ways can digital finance, entrepreneurship, and freelancing enhance women's economic empowerment and reduce labor market inequalities? Together, this methodological framework enables a comprehensive analysis of how digitalization intersects with gender, education, and labor dynamics, and identifies pathways for building an inclusive digital transformation in Bangladesh.

Study Findings

Socio-Economic Barriers

According to UNICEF, 2022. The education and wealth are highly related; they show a connection between this. The data highlights a strong connection between education and household wealth. Figure 1 shows a significant correlation between literacy rate and household wealth. While urban (88%) and rural (89%) populations show almost equal levels of educational access,

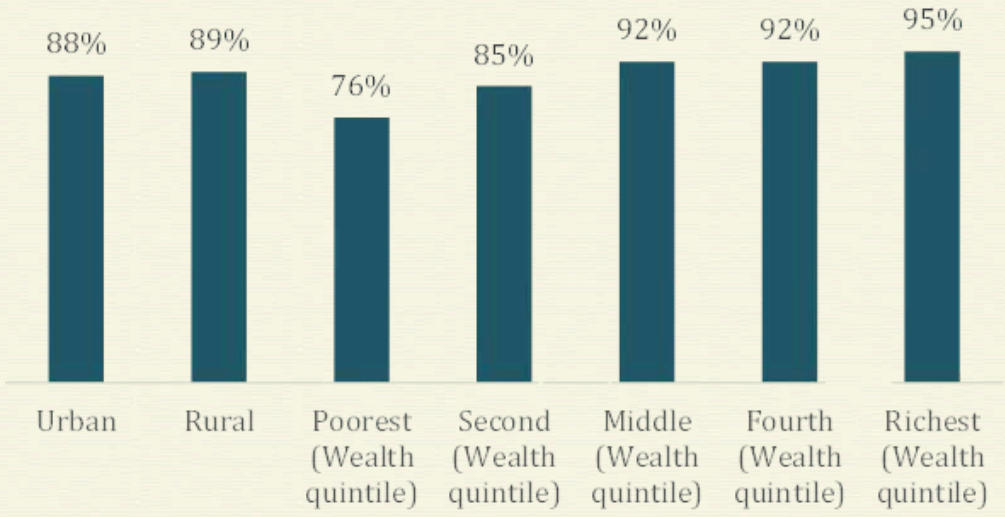

Figure 1: Wealth and Technology Usage Co-relation

the real disparity emerges across wealth groups. The poorest quintile has the lowest access at only 76%, indicating significant barriers to education among low-income families. As household wealth increases, access to education improves steadily, rising to 85% in the second quintile, 92% in the middle and fourth quintiles, and reaching 95% among the richest households. This trend clearly demonstrates that children from wealthier families enjoy far greater educational opportunities compared to those from poorer households. In essence, wealth plays a decisive role in shaping educational access and outcomes, reinforcing social inequality across generations.

Figure 2 compares access to digital devices among female students and female employees in Bangladesh. It reveals that smartphones are the most accessible device for both groups, with 84% of female students and 87% of female employees having access, indicating their crucial role in communication and digital engagement. However, access to computers is relatively low for both groups, with only 33% of students and 40% of employees having access, suggesting limited opportunities for digital skill

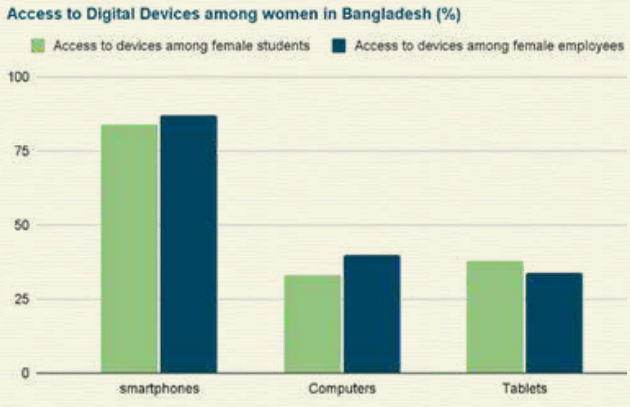

Figure 2: Access to Digital Devices among women in Bangladesh (percentile)

development and work tasks that require more robust computing resources. Tablets show a similar trend, with 38% of female students and 34% of female employees having access, pointing to limited availability for both education and professional use. This highlights a digital divide that impacts women's ability to fully participate in education and the workforce, underlining the need for increased access to these critical tools. Socio-economic constraints remain a central obstacle to women's participation in digital transformation. Deeply embedded gender norms continue to limit women's autonomy, with more than half reporting that traditional roles restrict their engagement in digital activities (World Bank, 2020).

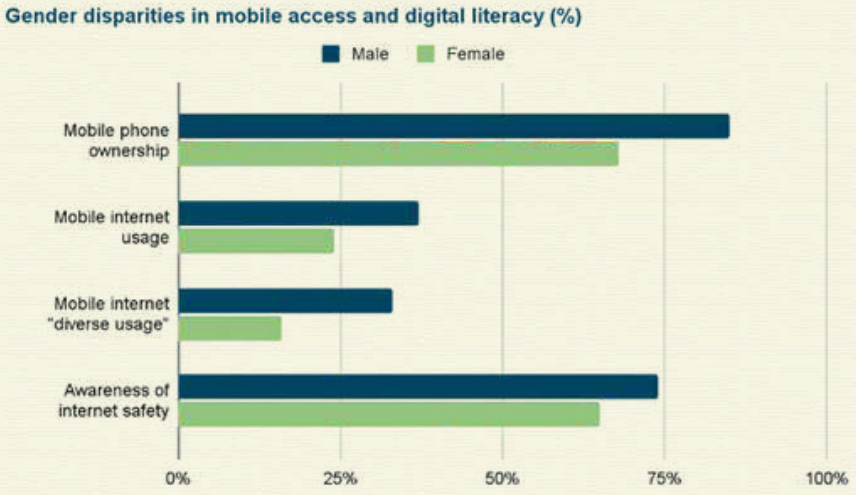

Figure 3: Gender Disparities in Digital Literacy

These norms prioritize men's education and career advancement, thereby reducing women's mobility and their participation in training programs that require device ownership or physical attendance. This is reinforced by unequal access to technology, In Figure 3 compares mobile phone ownership, mobile internet usage, mobile internet 'diverse usage', and awareness of internet safety between males and females. It shows that 85% of males own a mobile phone, compared to 68% of females, indicating a gender gap in mobile phone access. Mobile internet usage is also higher among males 37% than females 24%, highlighting a disparity in internet access. Moreover, diverse usage of mobile internet is significantly higher among males 33% compared to females 16%, suggesting that males may have broader access and engagement with digital services. However, the gap in internet safety awareness is narrower, with 74% of males being aware of internet safety compared to 65% of females, reflecting a relatively smaller difference in knowledge about digital security between the genders. This data underscores the gender inequalities in digital access, usage, and online safety awareness in the context of mobile technology.

Barriers in Education & Technical Training

Educational and technical training barriers significantly limit women's ability to participate in Bangladesh's digital economy. Women remain underrepresented in science, technology, engineering, and mathematics, with only about 10% pursuing studies in these fields and particularly low enrollment in ICT-related programs (UNESCO, 2021).

This underrepresentation, compounded by high dropout rates nearly 47% of rural girls leave school before completing secondary education due to early marriage, domestic responsibilities, and the prioritization of male education (BBS, 2019), reduces women's preparedness for digital skill acquisition and professional engagement. Access to vocational training is also limited, with 60% of rural women unaware of available programs and most training centers concentrated in urban areas (BRAC, 2021). Even when programs exist, participation remains low, as evidenced by women comprising only 15% of trainees under the government's Skills for Employment Investment Program (SEIP, World Bank, 2020). Structural weaknesses further reinforce exclusion: only 13% of training programs integrate gender-sensitive curricula, and women hold just 7% of leadership roles in technology-related educational institutions (Sheikh & Islam, 2019).

The lack of tailored training, inadequate outreach, and minimal female representation in leadership perpetuate gender disparities in digital education and restrict women's opportunities to develop the technical and problem-solving competencies essential for thriving in the digital workforce.This data reflects the current scenario of women's participation in technology-oriented professions and highlights a notable gender disparity. Women constitute only 14% of professionals in STEM fields, suggesting that their entry into science, technology, engineering, and mathematics careers remains significantly restricted. In the IT sector, women account for 20% of total employment, showing a slightly higher but still limited presence. Similarly, within the broader ICT workforce,

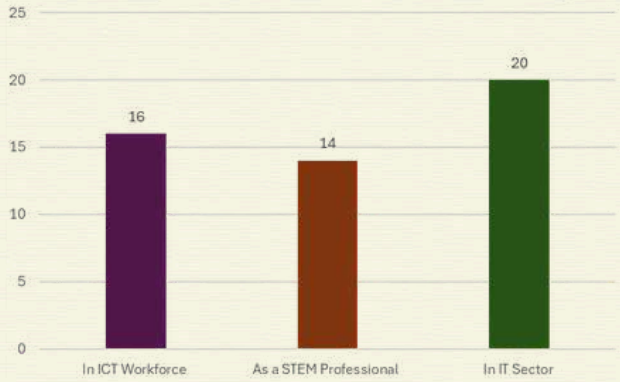

Figure 4: Women's Represtation in STEM,IT, and ICT Sectors in Bangladesh

women's share stands at 16%, indicating that men overwhelmingly dominate this field. The relatively low participation of women can be attributed to multiple structural and social barriers, including gender stereotypes, limited access to technical education, workplace discrimination, and a lack of supportive policies for women in science and technology careers. Despite gradual progress, these figures underscore the persistence of a gender gap that restricts women's full potential in contributing to technological innovation and digital transformation. Addressing these inequalities is crucial not only for ensuring gender justice but also for harnessing the diverse talents needed to build inclusive and competitive knowledge-based economies.

Women's Economic Empowerment through Digitalization

Digitalization is playing a transformative role in advancing women's economic empowerment in Bangladesh by widening access to finance, entrepreneurship, and global labor markets. Despite persistent gaps, only 32% of women have access to formal financial services compared to 48% of men mobile-based platforms such as bKash, Nagad, and Rocket have enabled women to save, transfer money, and access payments more independently, particularly in rural areas. These digital finance solutions not only enhance autonomy but also strengthen women's participation in e-commerce, with 72% of female entrepreneurs reporting higher transactions and revenue through online payment systems. Digital entrepreneurship has further emerged as a pathway to economic independence.

A study found that women entrepreneurs leveraging platforms like Facebook, Shopify, and Daraz were 50% more likely to increase household income, as these tools reduce capital and geographic barriers while offering flexible business opportunities (BRAC, 2021). Yet, limited access to mentoring and networks reported by 56% of women entrepreneurs continues to restrict growth, prompting targeted initiatives such as Women in Digital (WiD) and Startup Bangladesh to provide training, funding, and support ecosystems. Freelancing offers another channel for women to bypass structural labor market inequalities. Women now constitute 38% of freelancers in Bangladesh, concentrated in sectors such as digital marketing, content creation, and software development, and earn on average 30% more than in traditional jobs (Upwork & Freelancers Union, 2020). Freelancing platforms like Upwork and Fiverr provide flexible, home-based employment that aligns with domestic responsibilities, while also expanding access to international markets. According to the Bangladesh Freelancers Development Society (BFDS, 2021), 70% of female freelancers report achieving financial independence, and over half contribute substantially to household income. Collectively, these developments demonstrate how digital finance, entrepreneurship, and freelancing create pathways for women to overcome traditional socio-economic barriers, reduce gender-based income disparities, and participate more equitably in Bangladesh's digital economy.

Recommendations

To address the persistent gender gap in technology and digital participation, it is essential to identify the structural barriers that limit women's engagement and to propose targeted interventions. The following framework outlines the key barriers faced by women, along with recommended interventions, expected outcomes, and the rationale behind approach. This structured analysis demonstrates how evidence-based strategies can contribute to enhancing women's digital inclusion, economic empowerment, and participation in the future workforce.

Table 1: Key Barriers, Interventions & Expected outcomes

Key Barrier	Recommended Intervention	Expected Outcome	Remarks
Limited Access to Technology	Subsidized mobile and internet access programs	Increased device ownership and connectivity	Women in low-income households often cannot afford digital devices or internet services. Subsidies will bridge this affordability gap, ensure broader access and reduce the digital divide.

Key Barrier	Recommended Intervention	Expected Outcome	Remarks
Socio-cultural Norms	Community awareness and gender norm campaigns	Greater social acceptance and women's mobility	Deep-rooted stereotypes restrict women's use of technology and mobility. Awareness campaigns can shift perceptions, normalize women's presence in digital spaces, and encourage family and community support.
Educational Gaps	Gender-sensitive STEM curricula and scholarships	Higher female enrollment and retention in STEM	Girls are underrepresented in science and technology education due to biases and lack of incentives. Tailored curricula and scholarships will encourage participation and reduce dropout rates.
Low Participation in Training	Expansion of accessible, gender-tailored training centers	Improved digital skills and workforce readiness	Training opportunities often fail to consider women's needs (location, timing, safety, childcare). Gender-tailored centers make training more inclusive and practical, leading to higher participation.

Key Barrier	Recommended Intervention	Expected Outcome	Remarks
Financial Inclusion	Digital financial literacy programs and microcredit access	Enhanced economic autonomy and entrepreneurship	Many women lack the knowledge and tools for digital financial services. Literacy programs and access to microcredit will empower them to manage finances independently and grow small businesses.
Networking and Mentorship	Establishment of women-focused digital entrepreneurship hubs	Stronger support systems for business growth	Women entrepreneurs often lack professional networks and mentorship. Dedicated hubs create safe spaces for collaboration, guidance, and resource sharing, enabling sustainable business expansion.

Conclusion

The research makes it clear that, despite Bangladesh's rapid strides in digitalization, women continue to face deep-rooted socio-economic, educational, and cultural barriers that severely limit their meaningful participation in the digital economy. These obstacles not only undermine women's economic empowerment but also constrain the country's overall labour potential and sustainable development. To break these barriers, bold and targeted interventions are urgently needed ensuring equitable access to digital technologies, embedding gender-responsive digital training in workforce development, and building supportive networks that enable women to thrive as digital entrepreneurs, freelancers, and skilled professionals. Empowering women workers in this way is not just a matter of fairness it is a critical labour and economic imperative. By dismantling these systemic barriers, Bangladesh can fully mobilize the talent and productivity of its female workforce, driving inclusive growth, strengthening the labour market, and advancing a genuinely equitable digital society.

Bibliography

- GSMA. (2024). The Mobile Gender Gap Report 2024. GSMA. https://www.gsma.com/r/gender-gap-2024
- Press Xpress. (2024, May 23). Bangladesh's digital gender gap: What's next for inclusive connectivity. Press Xpress. https://pressxpress.org/2024/05/23/bangladeshs-digital-gender-gap-whats-next-for-inclusive-connectivity/
- Moyeen, S. (2023, June 20). Bangladesh's women rise to the challenge with big ideas for digital innovation. World Bank Blogs. https://blogs.worldbank.org/en/endpovertyinsouthasia/bangladeshs-women-rise-challenge-big-ideas-digital-innovation
- Rahman, T. (2020, September). Digital gender audit scorecard: Bangladesh. Web Foundation. https://webfoundation.org/docs/2020/09/Digital-Gender-Audit-Scorecard-Bangladesh-Final-Sept-2020.pdf
- Akter, A., Choudhury, F., Bagum, T., Islam, M., & Hasan, R. (2024). Socio-economic impact of entrepreneurship activities for the empowerment of women in Bangladesh. International Journal of Academic Research in Business and Social Sciences, 14(2). https://doi.org/10.6007/ijarbss/v14-i2/20847.
- Islam, M., Hossain, M., Pullen, E., & Rahman, M. (2023). Unlocking the potential of women in a male dominated society: key challenges and solutions in integrating women in digital economic activities.
- Ghosh, A., Huda, S., & Chakraborty, T. R. (2021). Scope of using ICT for knowledge management on adaptation to climate change in agriculture. International Journal of Agricultural Research, Innovation, and Technology, 11(2), 91–99. https://doi.org/10.5958/2319-2501.2021.00018.7
- Business Strategy & Development, 6(3), 464-476. https://doi.org/10.1002/bsd2.255
- Jamal, L., Hasan, M., & Sultana, M. (2020). Breaking the barriers: empowering girls in information and communication technology education. Destech Transactions on Social Science Education and Human Science, (ICEdDE). https://doi.org/10.12783/dtssehs/icedde2019/33686
- Rashid, A. (2016). Digital inclusion and social inequality: gender differences in ict access and use in five developing countries. Gender Technology and Development, 20(3), 306-332. https://doi.org/10.1177/0971852416660651
- Ripa, F., Mustari, N., Azam, N., Mithila, J., & Nayem, Z. (2023). Women entrepreneurs-contributions through the digital marketplace: in the economy of bangladesh. American Journal of Youth and Women Empowerment, 2(1), 1-7. https://doi.org/10.54536/ajywe.v2i1.1262
- Sheikh, A. and Islam, M. (2019). A contextual study on the development of women entrepreneurs in bangladesh. Glob J Entrep, 3(1), 23-35. https://doi.org/10.47177/gje.03.01.2019.023
- Sultana, F. and Akter, A. (2021). Women e-commerce: perspective in bangladesh. JOMEINO, 01-13. https://doi.org/10.31039/jomeino.2021.5.3.1
- Hasan, M. (2020). Gender digital divide in Bangladesh: A socio-economic analysis. International Journal of Digital Development, 12(4), 235-247. https://doi.org/10.1007/s12345-020-0092-2
- International Telecommunication Union (ITU). (2021). Bridging the gender gap: The role of digital technologies in promoting women's empowerment. https://www.itu.int/en/ITU-D/Digital-Inclusion/Pages/Gender.aspx
- Rahman, M. (2020). The impact of socio-cultural factors on women's digital participation in Bangladesh. Bangladesh Journal of ICT, 18(3), 101-115.
- Sultana, N. (2019). The role of mobile learning in empowering rural women in Bangladesh. Development Studies Review, 8(1), 45-58.
- United Nations Development Programme (UNDP). (2021). Gender and digitalization in Bangladesh: Overcoming barriers for women. UNDP Bangladesh. https://www.bd.undp.org/content/bangladesh/en/home/presscenter/2021/digitalization.html
- World Bank. (2020). Digital skills for women in Bangladesh: Bridging the gender gap. World Bank Report. https://www.worldbank.org/en/country/bangladesh
- Bangladesh Bureau of Statistics (BBS). (2019). Bangladesh Labor Force Survey 2019. Dhaka, Bangladesh.
- Sheikh, M., & Islam, M. (2019). Women in the digital economy: Barriers and opportunities. Journal of Digital Entrepreneurship, 3(1), 75–91.
- BRAC. (2020). Women's access to digital skills in Bangladesh. BRAC Development Institute.
- She Loves Tech Bangladesh. (2021). Women in the digital economy: Challenges and opportunities. She Loves Tech Report.
- UNESCO. (2021). Women in STEM in Bangladesh: Bridging the digital divide. UNESCO Publication.
- World Bank. (2020). Skills for employment in Bangladesh: Gender disparities and digital transformation. World Bank.

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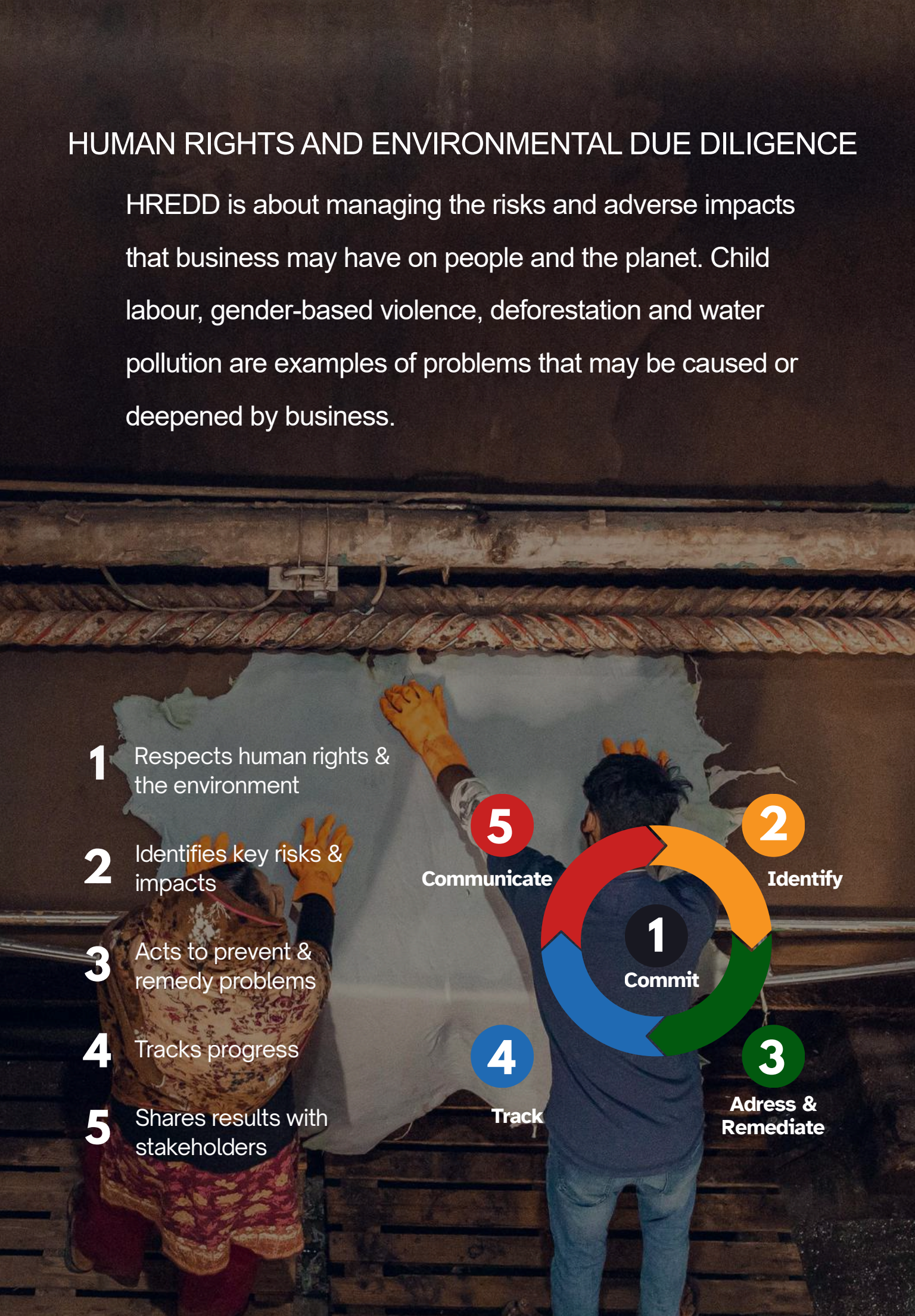

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Extreme Vulnerability, Minimal Protection: Implications for Just Transition in Bangladesh's Leather Sector

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Abstract

The leather sector is Bangladesh's second-largest export industry, contributing 2.37% of total exports in FY 2024–25 and employing over 350,000 workers directly and indirectly. Despite its economic significance, the sector particularly the Savar Tannery Industrial Estate (STIE) faces persistent structural, social, and environmental challenges. Weak enforcement of labour laws, inadequate occupational safety, exploitative wage systems, and limited social protection expose workers to severe vulnerabilities, while climate change and environmental degradation further intensify risks. Using a mixed-methods case study of Bangladesh Labour Foundation (BLF) initiatives, this study maps worker vulnerabilities and explores pathways for a Just Transition (JT) in the leather industry. Findings reveal systemic wage deficits, precarious employment, widespread health hazards from chemical exposure, and socio-economic insecurities compounded by climate-induced disruptions. Awareness of JT remains low among workers, employers, and associations, though trade unions and civil society actors highlight its urgency. The study identifies key barriers, including governance failures, weak social dialogue, and resistance to sustainable practices. Proposed JT pathways include eco-friendly technological upgrades, strengthened occupational health and safety, expanded social protection, reskilling programmes, policy reforms, and inclusive financing mechanisms. Ensuring a worker-centred Just Transition is critical to securing both the industry's global competitiveness and the livelihoods of its workforce.

Keywords: Bangladesh Leather Sector; Savar Tannery Industrial Estate; Workers' Vulnerability; Occupational Health and Safety; Social Protection; Industry Readiness; Just Transition

Background

The leather sector is one of the most promising economic industries in Bangladesh, ranking as the country's second-largest export sector after ready-made garments (RMG). In FY 2024–25, the sector contributed approximately 2.37% of total exports, generating over USD 1.15 billion (EPB, 2025). Bangladesh accounts for 2–3% of global leather demand, exporting a range of manufactured products, including footwear, wallets, and jackets. Major export destinations for leather, leather goods, and footwear (HS Codes: 41–43 and 6403) include India (USD 108.16 million), Japan (USD 87.29 million), China (USD 76.23 million), Poland (USD 37.53 million), Italy (USD 32.88 million), and Spain (USD 21.60 million) (EPB, 2025).

The industry comprises 264 tanneries, including 90 large firms and 15 major enterprises, and predominantly employs semi-skilled or unskilled workers. It provides direct employment to approximately 200,000 individuals and indirectly supports an additional 150,000, thereby playing a vital role in sustaining livelihoods and income generation (Halder, 2023; LFMEAB, 2023). The sector also includes around 64 domestic leathergoods companies such as Apex Footwear, Jennys Shoes, and Bay Footwear that export primarily to Japan and the European Union, with limited penetration in the United States (Halder, 2023; LFMEAB, 2023).

Bangladesh's tannery industry has a long and complex trajectory, deeply embedded in the country's industrialization, economic development, and socio-environmental context. While it has contributed significantly to economic growth, the sector has also been widely criticized for its environmental and occupational health impacts. Currently, 142 tanneries operate within the Savar Tannery Industrial Estate (STIE) out of a total of 155 allocated plots. Despite relocation from Hazaribagh to Savar, the industry continues to face persistent challenges, including poor compliance with regulatory requirements, difficulties in procuring raw hides (particularly during Eid-Al-Adha), inadequate capacity of the Central Effluent Treatment Plant (CETP), underutilization of raw materials, and a lack of modern processing facilities. Additional constraints include the absence of policies promoting value addition, limited backward linkages, underdeveloped support for small and medium-sized enterprises (SMEs), slow growth in both foreign and domestic investment, limited access to global markets, and lack of equal privileges and incentives relative to the RMG sector. Moreover, Bangladesh's graduation from Least Developed Country (LDC) status poses further challenges, particularly in retaining preferential market access (BSCIC, 2024; MoC, 2019). Collectively, these issues undermine the sector's capacity to achieve Leather Working Group (LWG) certification, which is increasingly critical for accessing high-value export markets.

Workers at STIE face heightened vulnerabilities due to unsafe and exploitative working conditions. Occupational safety measures are weak, with widespread reports of health issues such as respiratory diseases and skin disorders resulting from chemical exposure and unsafe machinery. Limited enforcement of labour standards, insufficient training, lack of personal protective equipment (PPE), and inadequate facilities exacerbate these risks. Many workers also experience financial insecurity, a legacy of the Hazaribagh relocation, combined with exploitative working conditions that expose them to accidents and illnesses without sufficient insurance or institutional support (Alam, 2023; Jaman et al., 2024). Particularly concerning is the use of hazardous chemicals, including benzidine-based dyes and dimethylformamide (DMF), which have been linked to bladder, nasal, and testicular cancers (Naher et al., 2020). The STIE is also highly vulnerable to climate change impacts and environmental degradation. Its location along the Dhaleshwari River, coupled with inadequate waste management practices and reliance on harmful chemicals, has led to severe pollution of water, soil, and air. These risks intensify during floods, threatening public health, ecosystems, and the sector's long-term sustainability. The lack of effective environmental controls has significantly constrained growth, hindered progress toward international compliance, and jeopardized the industry's potential to maintain competitiveness in global markets (Alam, 2023; The Financial Express, 2022).

In light of these challenges, it is critical to systematically assess worker vulnerabilities and identify just transition pathways that can enable the leather sector to evolve into a safer, more sustainable, and climate-resilient industry. So, the study highlighted on mapping the vulnerabilities of workers in the leather sector, with a focus on the Savar Tannery Industrial Estate (STIE) and exploring the just transition pathways for ensuring the long-term sustainability and competitiveness of Bangladesh's leather sector. Particularly concerning is the use of hazardous chemicals, including benzidine-based dyes and dimethylformamide (DMF), which have been linked to bladder, nasal, and testicular cancers (Naher et al., 2020). The STIE is also highly vulnerable to climate change impacts and environmental degradation. Its location along the Dhaleshwari River, coupled with inadequate waste management practices and reliance on harmful chemicals, has led to severe pollution of water, soil, and air. These risks intensify during floods, threatening public health, ecosystems, and the sector's long-term sustainability. The lack of effective environmental controls has significantly constrained growth, hindered progress toward international compliance, and jeopardized the industry's potential to maintain competitiveness in global markets (Alam, 2023; The Financial Express, 2022).

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Methodology

This study focused on the case study methodology which examines the Bangladesh Labour Foundation (BLF) initiatives on Just Transition in the leather sector, with a focus on its interventions through training programs, stakeholder workshops, policy research, and engagement with academic journals, industry reports, and media coverage. The study adopts a mixed-methods approach to capture both institutional efforts and ground-level experiences of workers within the leather sector at STIE.

To deepen the understanding of workers' vulnerabilities and the real-world impact of Just Transition processes, the research team conducted two Focus Group Discussions (FGDs) and 10 Key Informant Interviews (KIIs) in September 2025. Participants included leather sector workers, representatives from the Bangladesh Tanners Association (BTA), Bangladesh Finished Leather, Leather-goods and Footwear Exporters Association (BFLLFEA), Department of Inspection for Factories and Establishments (DIFE), and Mid-Level-Management, Tannery Workers Union (TWU).

All qualitative data were systematically analyzed using thematic analysis, with codes and themes derived inductively from participant responses. Triangulation was employed by cross-verifying findings across multiple data sources including policy documents, training materials, published reports, and media accounts to enhance validity, reliability, and contextual depth. This approach ensures a comprehensive, evidence-based understanding of the challenges and opportunities surrounding Just Transition in Bangladesh's leather industry.

Tannery Industry in Bangladesh

The tannery industry in Bangladesh has undergone a complex historical evolution shaped by colonial legacies, migration patterns, and state-led industrial policies. The first tannery in East Bengal was established in the 1940s at Narayanganj by businessman Ranada Prasad Saha, before being relocated to Hazaribagh, Dhaka, in the 1960s. By 1965, approximately 30 tanneries were operating in Dhaka. Until the 1960s, tanning processes were largely traditional, relying on the preservation of raw hides through salting and sun-drying techniques locally known as Shaltu (Hossan, 2022).

During the Pakistan period (1947–1971), the industry was dominated by non-Bangalee migrants from India, who brought technical knowledge of leather processing. Production was primarily confined to wet blue leather (semi-processed hides), with most exports directed to West Pakistan for further processing and value addition. Bangalee entrepreneurs played only a minor role during this period (BFLLFEA, n.d.). Following independence, government incentives such as tax breaks, subsidies, and export-oriented policies during the 1970s and 1980s spurred industry expansion. By the late 1970s, Bangladesh was exporting semi-finished and finished leather products, while in the 1990s, a ban on wet blue exports was introduced to encourage higher value-added production (Hossan, 2022).

Despite its export potential, the industry has long faced criticism for severe environmental degradation. At Hazaribagh, approximately 21,000 cubic meters of untreated tannery effluents were discharged daily into the Buriganga River, causing widespread ecological damage and health risks (DoE, 2018; Pearshouse, 2012).

Responding to both domestic and international pressure, the government-initiated relocation plans in the early 2000s, establishing the Tannery Industrial Estate (TIE) in Savar under the Bangladesh Small and Cottage Industries Corporation (BSCIC). Spanning 200 acres, the estate was designed with facilities including a Central Effluent Treatment Plant (CETP), a Water Treatment Plant, and a Solid Waste Management System (BSCIC, 2024). Although relocation was largely completed in 2017, operational inefficiencies of the CETP and incomplete environmental compliance remain persistent challenges.

Currently, the sector comprises 146 operational tanneries, with over 100 affiliated with the Bangladesh Tanners Association (BTA) and 55 linked to the Bangladesh Finished Leather, Leathergoods, and Footwear Exporters' Association (BFLLFEA). The Tannery Workers Union (TWU) engages with 20 tanneries, while broader coordination is facilitated by the Leather Development Forum (LDF), established in 2018 with more than 20 member organizations.

Key regulatory and governance bodies include the Dhaka Tannery Industrial Estate Waste Treatment Plant Company Limited (DTIEWTPCL), the Department of Environment (DoE), the Department of Inspection for Factories and Establishments (DIFE), and the Leather Sector Business Promotion Council (LSBPC).

Despite institutional oversight, occupational health and safety concerns remain acute. A baseline survey by the Occupational Safety, Health and Environment (OSHE) Foundation found that 61 percent of tannery workers suffer from conditions such as asthma, burns, dermatitis, joint pain, neurological disorders, and vision problems due to chemical exposure and physically strenuous labour. As OSHE's Executive Director, AR Chowdhury Repon, observed, *"This industry is below the minimum standards of decent work. More needs to be done to take it to the satisfactory level"* (Alam, 2023).

Non-compliance with international standards continues to hinder market access. The inability of Bangladeshi tanneries to secure certifications such as the Leather Working Group (LWG) limits exports to premium global markets. Consequently, many tanneries remain reliant on semi-processed wet blue exports rather than higher-value finished products. Seasonal surges in rawhide processing, particularly during Eid-ul-Adha, further strain CETP capacity and waste management infrastructure, resulting in quality losses and reduced earnings (The New Nation, 2023; Times Report, 2025).

This trajectory underscores both the economic significance and structural vulnerabilities of Bangladesh's tannery industry. While the sector continues to contribute to export revenues, its long-term sustainability depends on overcoming environmental non-compliance, improving worker health and safety, and enhancing value addition through technological upgrading and adherence to international certification standards.

Just Transition in Bangladesh

Just Transition is a framework developed by the trade union movement in the United States during the 1980s to encompass a range of social interventions needed to secure workers' rights and livelihoods when economies are shifting to sustainable production, primarily combating climate change and protecting biodiversity (UNDP, 2022). Leaders worldwide are also talking about just Transition, focusing on the next Industry 4.0, Net Zero, and the effects of AI and Automation.

Just Transition is the term used to describe the Transition to a climate-neutral economy while securing the future and livelihoods of workers and their communities (EU, 2023). It involves maximizing the social and economic opportunities of climate action while minimizing and carefully managing challenges including through effective social dialogue among all groups impacted and respect for fundamental labour principles and rights (ILO, 2021).

Bangladesh can be regarded as the ground zero of vulnerability and is often called a climate victim. It contributes only a tiny fraction of global carbon emissions about 0.56%, by one count. But it suffers disproportionately from their effects (Frayer, 2023). Just Transition (JT) in Bangladesh refers to transitioning to a low-carbon economy that ensures social justice, environmental sustainability, and decent work for all. This applies to all efforts by countries to cope with the effects of climate change, including sea level rise, floods, and cyclones, which excessively impact vulnerable populations such as the poor, women, and marginalized communities.

In Bangladesh, JT is currently focusing on creating policies and programmes supporting renewable energy development while ensuring that workers are provided opportunities for learning new or improved skills (re-skilling and up-skilling) and employment opportunities in new industries. It also means addressing the social and economic inequalities in the country, particularly for marginalized communities that are most affected by climate change. The JT concept is an essential framework for Bangladesh as it works towards achieving its climate and development goals (Alam, 2023).

The combination of extreme heat and humidity in Dhaka is causing labour productivity-related losses exceeding 8% of the annual output. Looking ahead, these losses could escalate to 10% by 2050. Under existing conditions, labour productivity produces output losses of approximately USD 6 billion (equivalent to USD 5.9 billion or BDT 518 billion) in a typical year. Without adaptation measures and employing conservative growth assumptions, this figure is anticipated to almost double to USD 12 billion (over BDT 1 trillion) by 2050 (Arsht-Rock, 2023). By 2030, Bangladesh is poised to confront a significant peril to its $26.78 billion export revenue from shipping, arising from adverse weather conditions such as heatwaves and floods (Judd et al., 2023).

In Bangladesh, several organizations are actively engaged in advancing Just Transition for workers in the leather sector, each contributing in distinct ways. The Bangladesh Labour Foundation (BLF) plays a central role by organizing training programs for workers and trade unions on climate, energy, and technology transitions, aiming to enhance worker capacity and awareness in adapting to changing industrial and environmental contexts. The Ethical Trading Initiative (ETI) Bangladesh leads a consortium project focused on improving both environmental and social conditions within the Savar Tannery Estate, directly addressing critical concerns of pollution and worker well-being. The German Development Cooperation (GIZ) complements these efforts by supporting initiatives to foster a sustainable business environment in the leather industry, strengthening institutional frameworks and compliance standards. Alongside these, organizations such as the OSHE Foundation and the Leather Development Forum (LDF) contribute to improving compliance, governance, and value addition across the sector, ensuring that Just Transition is linked not only to worker rights but also to the broader goals of sustainable industrial development.

Workers' Vulnerability in Bangladesh's Leather Sector

The Savar Tannery Industrial Estate (STIE) in Bangladesh hosts hundreds of leather factories where workers face highly exploitative and hazardous conditions. The sector is marked by persistent violations of labour rights, stemming largely from weak enforcement of labour laws and poor occupational health and safety (OHS) standards. Workers endure low wages, precarious employment, health hazards, and limited access to statutory benefits or social protection mechanisms (Moazzem & Jebunnesa, 2024; BLF, 2025).

Demographic Profile

Marital and household dynamics amplify vulnerability. About 72.7% of leather workers were married, with 30% supporting large families (≥6 members) which the highest indicating heavier financial burdens and dependency risks in the face of climate-induced disruptions. Educational attainment was strikingly low, with more than 80% having only primary or secondary schooling and 14.7% being illiterate. This limits access to training, decision-making, and opportunities for green skill development critical to Just Transition pathways. Income levels in the leather sector were also the lowest across industries, with average monthly earnings of BDT 12,420 (BDT 15,744 including overtime). Heavy reliance on overtime (27% income increase) reflects structural wage inadequacy despite high occupational and environmental risks. Geographically, leather workers are concentrated in Hemayetpur, Savar, within the tannery industrial cluster known for severe pollution and weak environmental infrastructure. This locational concentration compounds their vulnerability to climate hazards, environmental degradation, and inadequate living conditions, reinforcing systemic inequities that demand targeted interventions under a Just Transition framework (Hossain et al., 2025).

Wage Structures and Employment Precarity

Recent evidence highlights systemic wage deficits and employment insecurities within the STIE. According to Bangladesh Labour Foundation (BLF, 2025), nearly 90% of tannery workers fall outside of officially recognized wage grades, with most earning less than BDT 18,001 per month. More than half of workers (53%) perform tasks across multiple wage grades without appropriate reclassification or pay adjustments.

Union density remains relatively low, with only 30.91% of workers unionized. Employment arrangements also reveal high levels of precarity: just one-third of workers hold permanent positions, while the remainder are employed on temporary, contractual, or daily wage terms. Access to identification is inconsistent only 43.64% of workers possess ID cards, and among these, only 21.21% of permanent employees have valid identification documents.

Statutory entitlements vary considerably. While 63.03% of workers reported receiving weekly holidays, this benefit is universal among unionized workers but absent for non-unionized workers, who often work seven days per week. Access to casual or sick leave was reported by 74.54% of respondents, and 67.48% reported paid leave. Severance pays practices remain weak, with only 38.79% of workers confirming receipt with 24.24% in unionized factories compared to 14.55% in non-unionized settings. By contrast, compensation for workplace injuries was reported by 70.3% of workers (Mohinuddin et al., 2025).

Occupational Health and Safety Risks

Occupational health hazards are pervasive within the STIE due to unsafe working conditions, including prolonged exposure to toxic chemicals, inadequate personal protective equipment (PPE), and limited training in chemical safety protocols.

Studies have consistently documented high levels of health risks. For example, Moazzem and Jebunnesa (2024) and Sujan (2019) found that 63% of workers reported health hazards, 79% lacked chemical safety training, and 75% worked without appropriate protective gear. Oyshi et al. (2024) further reported that 84.2% of tannery workers suffered from at least one health problem annually, with skin diseases (48.78%) and respiratory problems (44.39%) particularly prevalent. These conditions are aggravated by poor ventilation (66.7%), minimal PPE use (46.3%), and insufficient healthcare access (Jaman et al., 2024). Reported illnesses include musculoskeletal disorders (65.5%), gastrointestinal problems (38.9%), skin diseases (37.9%), and respiratory illnesses (26.6%), which are significantly correlated with age, work experience, hours, type of PPE, and awareness of toxic chemical risks (Oyshi et al., 2024).

Tuhin et al. (2022) identified gastrointestinal ailments (32%) and chronic headaches (63%) as additional common outcomes of chemical exposure. Jenny (2023) reported that 61% of workers experienced workplace accidents and health issues such as fever, jaundice, burns, ulcers, and blurred vision, attributed to chemical fumes, noise, dust, and poor ventilation. Batra et al. (2021) found that 64% of workers suffered from stomach pain and 95% from headaches. Evidence from comparative studies further suggests that tannery workers in Sweden and Italy face 20–50% higher risks of developing cancers due to long-term chemical exposure (Basak et al., 2019; Tasnim et al., 2016).

Socio-Economic and Living Conditions

In addition to occupational risks, tannery workers experience severe socio-economic vulnerabilities. A BLF (2025) study reported that nearly 79% of workers face financial stress linked to climate shocks, and 60% report health-related challenges. Housing conditions are precarious: 12.7% of workers live in tin sheds, 42% in semi-pucca houses, and only 18.7% have access to sewer-connected sanitation. This exposes workers to heightened risks of flooding, waterlogging, and infectious diseases.

Access to safe drinking water is limited, with 46% relying on vulnerable tube wells. Social protection coverage remains weak, with 85.3% of workers lacking health insurance, pensions, or injury compensation. Climate-related shocks further undermine job security: 35.3% of workers have experienced wage cuts, unpaid leave, or production suspensions due to environmental disruptions (Hossain et al., 2025).

Climate Change and Emerging Vulnerabilities

Climate change significantly compounds existing vulnerabilities within the STIE. Nearly 79.3% of workers report experiencing heat stress, worsened by poor ventilation and toxic chemical exposure. Disruptions in climate-sensitive raw material supply chains also undermine factory operations, with 64.2% of workers reporting quality deterioration and 62.7% noting delays. Waterlogging affects more than half of factories, increasing absenteeism (43.3%) and workflow interruptions (Hossain et al., 2025).

Health impacts linked to climate stress are severe: 66.7% of workers suffer from dehydration due to unsafe water and sanitation, 40% report skin diseases, and 31.3% experience respiratory illnesses. Workplace health services are limited, available in only 23% of factories, forcing nearly one-third of workers to spend more than BDT 3,000 monthly on medical treatment. This often results in indebtedness and food insecurity. Despite 72.5% being entitled to sick leave, many workers refrain from using it due to wage loss concerns.

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Just Transition in Bangladesh's Leather Sector

The concept of Just Transition remains largely unfamiliar within Bangladesh's leather sector, particularly among tannery workers at the Savar Tannery Industrial Estate (STIE). While the term itself is not widely recognized, workers and their representatives demonstrate a deep awareness of the structural inequities that the framework is intended to address. Workers consistently emphasized that economic and developmental benefits accrue disproportionately to employers while workers remain excluded.

As one worker explained: *"We (workers) are not familiar with the term 'Just Transition.' But in reality, the owners move forward, and the workers fall behind. Owners get various incentives from the government, but the workers don't receive any benefits."*

Workers' Perspectives

At the worker level, respondents expressed cautious openness toward environmentally sustainable technologies, provided adequate training and institutional support were available. One group noted: *"We would be interested (if new, environmentally friendly technologies are introduced in the tannery, and the government arranges training)."* However, frustrations persist regarding the exclusion of workers from the benefits of industrial modernization: *"They said if the owner eats, the worker eats. But after coming here, only the owners are eating well. We didn't get anything."*

Concerns regarding automation were also evident. While workers recognized that mechanization is gradually being introduced, they stressed the urgent need for alternative employment opportunities and careful planning to mitigate the risk of displacement. As one worker observed: *"Although automation is being implemented gradually, worries about job losses are intensifying. Workers embrace new technologies, but they stress the necessity of alternate work opportunities and careful planning to prevent displacement."*

Trade Union Perspectives

Trade union representatives articulated a broader critique of the relocation from Hazaribagh to Savar, situating it as an example of a transition that was neither just nor worker-centred. As Abul Kalam Azad of the Tannery Workers Union explained: *"In April 2017, the tannery industry shifted from Hazaribagh in Dhaka to the Savar Leather Industrial Park, but that transition is not a Just Transition. About 40,000 cubic meters of waste are generated daily from the tanneries. But the daily treatment capacity of the central effluent treatment plant here is 25,000 cubic meters. The remaining 15,000 cubic meters of waste flows into the Dhaleswari River without treatment. The dumping yard needs to be constructed adequately at the tannery estate in Savar to dispose of leather waste."* This perspective highlights how environmental infrastructure remains inadequate, producing ecological degradation that compounds workers' vulnerability rather than alleviating it.

The union further underscored the social costs of relocation. As Azad elaborated: *"The tannery workers faced acute housing and healthcare crises in Savar due to the transition from Hazaribagh. A number of workers did not shift for reasons such as children's education and other facilities, so they travel every day an average of 35 kilometres. On the other hand, tannery waste created hazardous environments surrounding the zone. Moreover, those who worked under risk had risk allowance and insurance in other sectors, but nothing is present for tannery workers. They are not responsible for the pollution but are hardest hit by the action. An industrial park could not be planned without any facility for workers. But it happened in the tannery sector in Savar. So, the Just Transition is undoubtedly a trade union issue. We should work together to protect the victims of climate change in our country through policy advocacy and social dialogue to raise our unified voice."* This account underscores how relocation created new hardships housing, healthcare, and commuting challenges while failing to provide corresponding protections such as risk allowances or insurance.

Beyond relocation-specific grievances, unions also acknowledged some limited awareness-building efforts, mostly at the leadership level. One trade union representative observed: *"Just Transition has been started for some time, but the people of our country do not know much. Some training programs… are being conducted. We have to prepare for this. Workers have to fulfil those responsibilities at the workplace. I think the training is enough."* Another stressed that knowledge remains confined to leadership: *"Regarding Just Transition, nothing is fully done yet. Some things have been done at the leadership level… But at the general worker level, they are not yet aware of this."*

Employer and Mid-Level Management Perspectives

Employers and mid-level managers displayed low conceptual clarity and minimal exposure to the global discourse on Just Transition. Several respondents admitted to encountering the term for the first time: *"Oh, I'm actually just hearing it from you for the first time. I haven't heard of this before, so I don't have much knowledge on the subject." Another attempted a literal interpretation: "Just Transition! —does that mean just a change? A change, basically…?"*

At the industry level, awareness remains fragmented and uneven. While a handful of large or export-oriented enterprises have recognized the importance of aligning with sustainability requirements, the majority remain disengaged. As one employer stated: "There are 155 tanneries operating here, out of which 15 tanneries understand that we need to be at this level. 140 tanneries don't care about these issues." This uneven awareness reflects both the limited trickle-down of knowledge from senior leadership and the absence of systematic communication structures within factories.

Regarding the sustainable and environmental practices, nearly half of workers (44.7%) said no pollution-reduction initiatives had been implemented, while 52% reported no sustainable practices at all in their factories. Waste management systems were present in only 34% of cases, with reduced chemical use (15.3%), material reuse (13.3%), and compliance with international standards (20%) even less common (Hossain et al., 2025). Workers often doubted the efficacy of existing systems, "We've heard about waste treatment plans and how chemicals should be managed. But have you seen where they dump it? There's a treatment plant, but not everything goes through, especially at night."

Despite these shortcomings, some promising practices are emerging. A few factories have initiated chromium-free leather processing, rooftop solar panels, and rainwater harvesting. For instance, one tannery has established rainwater collection for both drinking and operational purposes: "We try to preserve the rainwater because it's much better than the water we normally get here." Larger companies like Apex have implemented full-scale rooftop solar systems, generating surplus electricity for the grid. Furthermore, compliance officers reported adopting ISO 45001 (Occupational Health and Safety) and ISO 9001 (Quality Management Systems), signalling an alignment with international standards, though these remain limited to a small number of firms.

On the other hand, The Ethical Trading Initiative's (ETI) 2024-2026 project targets 40 tanneries for Environmental and Social Management Systems (ESMS) and Human Rights Due Diligence (HREDD), improving OHS and resource efficiency to meet Leather Working Group (LWG) standards. Sustainable practices include chemical substitution (15% reduction in hazardous ammonium compounds) and waste valorisation for carbon neutrality. Government efforts, like the 2025 Renewable Energy Policy's tax incentives, support solar adoption, but uptake is limited. Challenges include high costs for green tech, weak enforcement, and health impacts from carbon-intensive processes, with projections showing potential $26.8 billion export losses by 2030 without adaptation.

Key Examples on Sustainable and Environmental Practices

- **Central Effluent Treatment Plant (CETP):** STIE's CETP treats 45,000 m³/day of wastewater, reducing pollution but still energy-intensive and not climate-resilient (DoE, 2023).
- **Individual ETP:** Six companies have been given permission to build ETP of their own and another eight to 10 tanneries are in the process of getting approval. In addition, Sadar Tannery Ltd. completed and is now operating a fully functional ETP, while Simona Tanning Ltd. continues to maintain a functional ETP as part of its compliance measures.

Climate Crisis

The climate crisis refers to the serious problems that are being caused, or are likely to be caused, by changes in the planet's climate, including weather extremes and natural disasters, ocean acidification and sea-level rise, loss of biodiversity, food and water insecurity, health risks, economic disruption, displacement, and even violent conflict.

- **Social and Environmental Certifications:** At Savar Tannery Estate, 7 tanneries hold BSCI certification, 5 have ISO 14001, 4 have ISO 45001, 2 are SA 8000-certified, 2 are SEDEX-certified, and 40 are actively pursuing LWG certification.
- **Solar Adoption:** Limited; only 3–5 large tanneries have pilot solar installations. Under the Re-Tie Bangladesh initiative, UNIDO implemented solar water heating and electrical efficiency enhancements in three tanneries.
- **Chemical Substitution:** Bangladesh Council of Scientific & Industrial Research has developed a chrome-free glutaraldehyde tanning process, and some tanneries are combining vegetable and chrome tanning to reduce chromium use.
- **Zero Waste Initiatives:** Some tanneries have implemented zero-waste initiatives, transforming leather offcuts into new products such as wallets and accessories, thereby reducing landfill trash.

Business Association Perspectives

Leather business associations similarly demonstrated only superficial awareness. While acknowledging that *"tannery groups are somewhat aware,"* representatives conceded that *"even associations lack in-depth knowledge or application understanding."* Industry forums and awareness meetings have introduced the terminology, yet these remain rhetorical exercises without tangible implementation. Profit-driven short-termism exacerbates the problem, as one stakeholder explained: *"Businessmen think about the investment they will make and try to get quick returns from it… they are not interested in investing in these things."* Furthermore, no formal training or structured capacity-building has been initiated, leaving Just Transition an abstract discussion point rather than a practical agenda.

Civil Society Perspectives

Civil society actors provided the most critical assessments, contrasting the leather sector's performance with that of the ready-made garment (RMG) industry. As one representative noted: *"The leather industry in Bangladesh is still lagging behind… If we talk about green transformation and managing effluents, internal environmental conditions, chemical handling, and storage where the sector is quite far behind. First and foremost, they need to address the basics."* Compared to the RMG sector, which has made advances in compliance and digital adaptation, the leather sector has yet to integrate fundamental principles of environmental sustainability, decent work, and technological upgrading.

Challenges in the Just Transition Pathways of Bangladesh's Leather Sector

Challenges in Adapting to a Just Transition

In Bangladesh's leather sector, workers face systemic barriers to adapting to a just transition, rooted less in technological gaps than in structural inequalities and governance failures. Workers consistently emphasized that while they are open to change, the institutional environment excludes them from meaningful participation. This has created a situation in which tannery workers are highly vulnerable to both climate-induced disruptions and the economic transformations underway in the industry.

A recurrent theme in discussions was the absence of social protection and decent work conditions. Workers and union representatives alike noted that relocation to the Savar Tannery Industrial Estate intensified their vulnerabilities, as housing, healthcare, and transport facilities were neglected. One union leader explained: *"The tannery workers faced acute housing and healthcare crises in Savar. An industrial park could not be planned without any facility for workers. But it happened in the tannery sector."* The failure to integrate worker welfare into industrial planning demonstrates how transition processes have prioritized production continuity over social justice.

Barriers to Transitioning to Green Jobs

Barriers to green job creation in the leather sector are particularly acute, reflecting entrenched power asymmetries and weak institutional accountability. Workers identified lack of awareness of climate risks, the absence of coherent guidelines, and strong resistance from tannery owners as central challenges.

These are compounded by limited government support and the persistent exclusion of workers from decision-making. The sector's dependency on chemical-intensive processes has created additional climate and health vulnerabilities. Despite promises of environmental safeguards, tannery waste continues to contaminate surrounding ecosystems. Workers are acutely aware of this environmental degradation, not only because they live and work in polluted areas, but because they bear the physical and economic consequences of unsafe practices. Yet, mechanisms to ensure risk allowances, insurance, or compensation remain absent.

These conditions highlight how the barriers to a just transition in the leather sector are fundamentally structural and political. Weak labour law enforcement, inadequate policy frameworks, and owner resistance intersect with workers' socio-economic precarity to produce a workforce excluded from the very transition that directly affects them. As one worker succinctly expressed: *"We want such policies, and we want our opinions to be taken seriously. We're the ones being left behind."*

Structural and Political Dimensions

The qualitative findings reveal that the challenges in the leather sector are less about feasibility than about accountability. Workers clearly articulate their priorities such as wage security, occupational safety, re-skilling opportunities, and dignity in work, yet these remain unaddressed due to institutional inertia. Trade unions, though vocal, struggle with limited coverage and influence, leaving most workers without effective representation. Employers, meanwhile, resist reforms that would redistribute costs or responsibilities, while the state has yet to develop a coherent policy framework for transition. Ultimately, the leather sector exemplifies how just transition remains stalled in the absence of political will and inclusive governance. Without coordinated intervention from government, employers, and global buyers, the process risks reinforcing existing inequities, leaving leather workers disproportionately exposed to climate and economic risks.

Policy Gaps in Just Transition for Bangladesh's Leather Sector

Bangladesh currently lacks a sector-specific policy framework on Just Transition, and the existing Bangladesh Labour Act (2006) remains poorly enforced within the leather industry. Institutional coordination among key government agencies such as the Ministry of Labour and Employment (MoLE), Department of Labour (DoL), Department of Inspection for Factories and Establishments (DIFE), Department of Environment (DoE), and Bangladesh Small and Cottage Industries Corporation (BSCIC) is weak, with mandates overlapping and collaboration mechanisms insufficiently defined. Development partners also engage in an ad-hoc manner, resulting in fragmented initiatives rather than a coherent sectoral strategy.

While civil society actors such as the Bangladesh Labour Foundation (BLF) have long advocated for stronger policy attention, progress has been limited. Notably, BLF has taken proactive steps by establishing a dedicated resource hub on Just Transition, including a resource pool, web application, and knowledge-sharing platforms to engage multiple stakeholders. However, in the absence of strong government ownership and integrated institutional frameworks, these efforts remain isolated and unable to deliver sector-wide transformation.

Worker-centered adaptation, including occupational health, social protection, and reskilling, is rarely prioritized, leaving tannery workers highly vulnerable to both chemical and climate-induced risks.

Furthermore, infrastructure gaps at the Savar Tannery Industrial Estate (STIE) such as the incomplete effluent treatment plant (CETP) and inadequate waste management underscore systemic governance failures. Sectoral associations have begun promoting cleaner production and certification initiatives, but integration of labour rights and climate resilience into their programs is limited.

Just Transition Pathways for Bangladesh's Leather Sector

A just transition in Bangladesh's leather sector necessitates an inclusive approach that balances environmental sustainability with social and economic justice. The transition must move towards environmentally friendly tanning processes while ensuring workers are not left behind socially or economically.

Key pathways for a just transition include:

- **Technological and Environmental Upgrades:** Invest in eco-friendly processes like vegetable tanning and water recycling to cut chemical use by 50%. The SMEP-funded "Improving Environmental and Social Conditions in Savar" project embeds Environmental and Social Management Systems (ESMS) in 40 tanneries, targeting LWG certification and 20% emission reductions. Government subsidies for automation and CETP refurbishment (Tk 800 crore proposed) could boost efficiency, creating 100,000 green jobs by 2030.
- **Enhanced Occupational Safety and Health (OSH):** Strengthening OSH standards at STIE through mandatory safety training, provision of protective gear, and better enforcement of labour laws is essential. Improving facilities like hospitals and schools within the estate can support worker well-being and reduce health risks.
- **Secure Employment and Fair Wages:** Formalizing employment contracts and ensuring wages comply with national minimum standards will reduce job insecurity and economic vulnerability among workers. Stronger union representation can empower workers to negotiate better labour conditions.
- **Worker-Centric Social Protections:** Implement skill-upgrading programs via TVET, focusing on digital traceability and safe chemical handling. BLF's workshops on just transition emphasize union roles in social dialogue, advocating for risk allowances and insurance—absent in tanneries but standard elsewhere. Universal health coverage, including occupational screenings, could address 61% prevalence of hazards.
- **Multistakeholder Collaboration and Policy Reforms:** The FSG report "Just Climate Transitions in Bangladesh" outlines pathways for leather-adjacent sectors like apparel, adaptable here: low-carbon manufacturing, alternative livelihoods (e.g., biodiesel from waste), and social safety nets. Partnerships with BTA, BFLLFEA, and NGOs like ETI can drive HREDD frameworks. Policy incentives such as tax breaks for compliant firms and export quotas for certified leather align with SDG 8 and 12.
- **Inclusive Financing and Market Access:** Pilot circular models like LeatherTrace Bangladesh, digitizing traceability to attract $241 billion global markets. International buyers (e.g., EU brands) must enforce due diligence, funding transitions to avoid offshoring.
- Inclusive Social Safety Nets and Skill Development: Implementing safety net programs and offering skill enhancement initiatives will help workers transition to greener roles and mitigate the adverse social impacts of industrial changes.

Recommendations for Just Transition for Bangladesh's Leather Sector

- **Expand Worker-Centered Social Protection:** Establish enforceable schemes for health insurance, maternity benefits, accident compensation, and pensions that cover all workers in the leather industry, including contract and informal employees, to safeguard vulnerable populations.

- **Strengthen Occupational Health and Safety (OHS):** Mandate appropriate workplace ventilation, the use of personal protective equipment (PPE), comprehensive training on safe chemical handling, and the provision of on-site healthcare facilities to minimize exposure to carcinogens and climate-related health hazards.
- **Reskill and Upskill Workers:** Design and implement training programs focused on eco-friendly tanning methods, effective waste management, renewable energy utilization, and automation technologies. Ensure that these programs are accessible to workers with low educational backgrounds through public-private partnerships.
- **Ensure Worker Representation:** Institutionalize trade union involvement in decisions related to environmental policies, technological changes, and labor rights. Support the creation of workplace climate adaptation committees to empower collective bargaining and inclusive workplace governance.
- **Promote Employer Accountability:** Require transparency in reporting wages, employee benefits, and compliance with OHS standards. Link incentives, such as tax rebates and certification advantages, to demonstrated commitments to worker welfare and sustainable practices.
- **Upgrade Environmental Infrastructure:** Enhance the capacity of the Common Effluent Treatment Plant (CETP), adopt cleaner production technologies, and implement efficient waste recycling systems to achieve compliance with international certification standards, like the Leather Working Group (LWG).
- **Facilitate Access to Green Finance:** Create dedicated funding mechanisms and offer concessional loans to support investments in renewable energy, energy-efficient equipment, and climate-resilient tannery infrastructure.
- **Develop a Just Transition Roadmap:** Formulate a comprehensive sector-specific strategy that integrates climate adaptation, labour rights, and export competitiveness goals, aligned with the National Adaptation Plan (2023–2050) and Nationally Determined Contributions (NDC) commitments.
- **Improve Labour Governance and Enforcement:** Conduct regular workplace inspections, strictly enforce penalties for non-compliance, and protect workers from retaliation when reporting unsafe or exploitative conditions.
- **Address Worker Housing and Community Needs:** Provide affordable housing options, safe transportation, and accessible community healthcare services within and around the Savar Tannery Industrial Estate (STIE) to improve workers' quality of life.
- **Strengthen Supply Chain Resilience:** Establish mechanisms to secure raw hide supplies, enhance cold storage and logistics systems, and mitigate disruptions caused by climate change to ensure uninterrupted production processes.
- **Promote Multi-Stakeholder Collaboration:** Develop institutional platforms that engage government authorities, industry associations such as LFMEAB and BSCIC, trade unions, civil society organizations, and international buyers to jointly implement just transition initiatives.
- **Leverage Buyer Partnerships:** Collaborate with global brands to co-finance investments in green technologies, workforce training, and social protection programs, ensuring adherence to Human Rights and Environmental Due Diligence (HREDD) standards.
- **Integrate Worker Health Monitoring:** Establish mobile health clinics, conduct routine health screenings, and maintain occupational disease registries to monitor long-term impacts of chemical exposures and climate-related health risks.
- **Institutionalize Monitoring and Evaluation:** Develop robust indicators to track progress on worker welfare, environmental compliance, and climate resilience, enabling adaptive management and continuous improvement of transition measures.

These recommendations form a holistic framework designed to ensure that Bangladesh's leather sector transitions towards sustainability while protecting and empowering its workforce and communities.

Conclusion

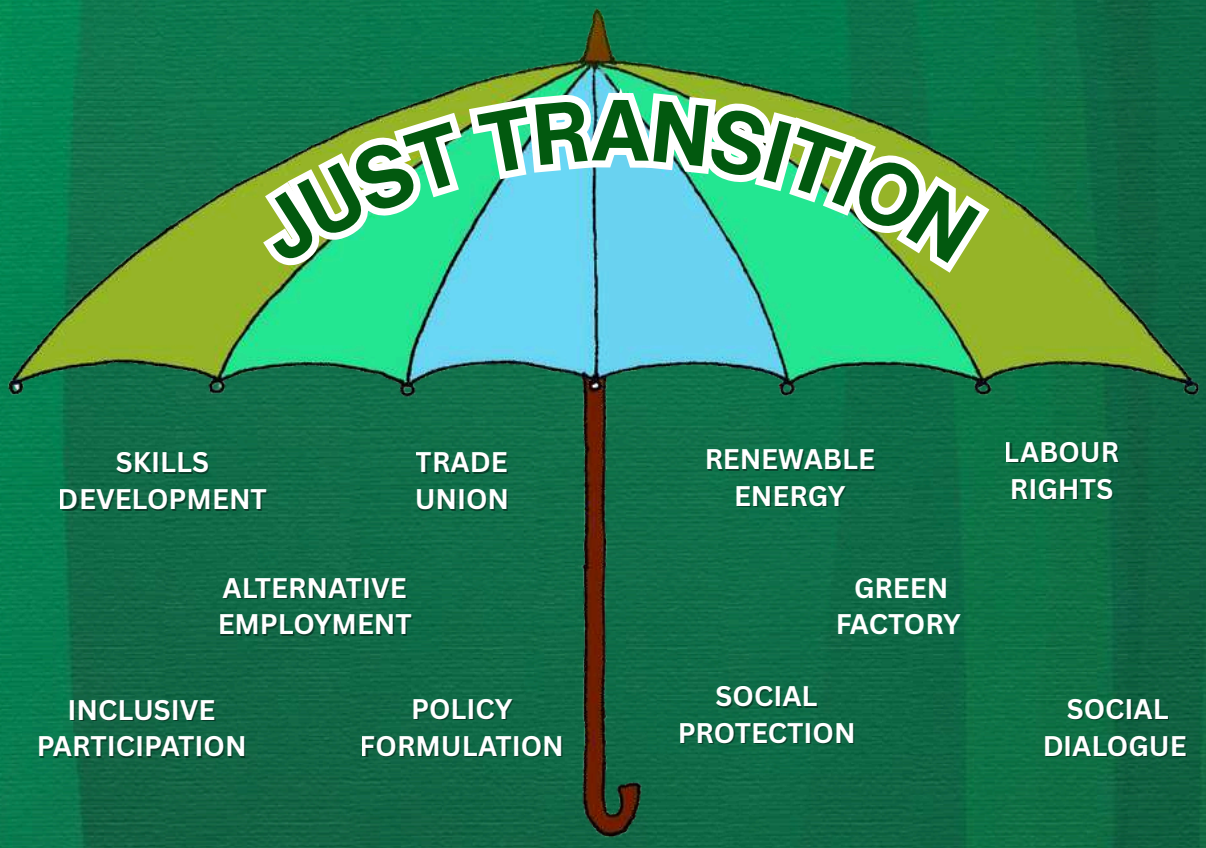
The study demonstrates that while the leather industry remains a vital contributor to Bangladesh's economy, its workforce continues to face deep socio-economic, occupational, and environmental vulnerabilities. The relocation of tanneries to the Savar Leather Industrial Estate has not improved worker welfare, as inadequate housing, healthcare, and livelihood support persist, leaving workers exposed to hazardous chemicals, unsafe conditions, and minimal social protection.

Findings indicate that although workers are unfamiliar with the formal notion of Just Transition, they clearly perceive structural inequities in the sector, where economic gains largely benefit owners while workers remain excluded. Weak governance, fragmented awareness, and limited enforcement further undermine progress, while climate-induced risks such as extreme heat, chemical exposure, and supply chain disruptions exacerbate their precarity.

Ensuring a Just Transition in Bangladesh's leather sector therefore requires coordinated interventions across policy, industry, and labour institutions. Strengthening social protection, enhancing occupational safety, expanding access to green skills, institutionalizing worker participation, and incentivizing sustainable practices are critical. Without inclusive and systematic measures, workers risk exclusion from the sector's modernization and environmental compliance efforts. Achieving a Just Transition is thus both a moral and economic imperative, requiring alignment between environmental sustainability, labour rights, and equitable development pathways.

Bibliography

- Alam, A. A. (2023, September 8). Protecting Bangladesh's Tannery Workers Against "Unjust" Transition. https://asia.fes.de/news/protecting-bangladesh-tannery-workers-against-unjust-transition.html
- Basak, S. R., Raihan, I., & Bhuiya, A. S. (2019). A Study on Occupational Health and Safety Practices in Bangladeshi Leather Industry. Journal of Human Resource and Sustainability Studies, 07(02), 302–311. https://doi.org/10.4236/jhrss.2019.72019
- Batra, R., Kapse, V., Awasthi, H., Yadav, A., & Kumar, R. (2021). Occupational Health Hazards for Employees in the Leather Industry. European Economic Letters (EEL), 11(1), Article 1. https://eelet.org.uk/index.php/journal/article/view/280
- BSCIC. (2024). Current status, challenges and solutions of the leather industry in Bangladesh (Bengali). Bangladesh Small and Cottage Industries Corporation. https://bscic.portal.gov.bd/sites/default/files/files/bscic.portal.gov.bd/page/7ee3abb1_2442_415e_aa41_3041686d948a/2024-06-30-11-27-e3fdccd0ec5126093ce7836d2b4736ed.pdf
- Department of Environment. (2018). Environmental Impact Study of Two Tannery Estates on the Buriganga and the Dhaleshwari Rivers. Ministry of Environment, Forest and Climate Change. https://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/page/1f58f60a_51d9_46c0_9fa1_79b7b565db05/2020-10-01-13-04-437e7423b2266d269cc021ed8f6e921f.pdf
- EU. (2023, August 30). Just transition | European Foundation for the Improvement of Living and Working Conditions. Euro Found. https://www.eurofound.europa.eu/en/topic/just-transition
- Frayer, L. (2023, March 26). Facing floods: What the world can learn from Bangladesh's climate solutions. NPR. https://www.npr.org/sections/goatsandsoda/2023/03/26/1165779335/facing-floods-what-the-world-can-learn-from-bangladeshs-climate-solutions
- Halder, S. (2023, October 13). Bangladesh emerging as a sourcing hub. The Daily Star. https://www.thedailystar.net/business/economy/news/bangladesh-emerging-sourcing-hub-3442026
- Hossain, Md. S., Ferdous, Most. Z., Rasel, S. M., Reza, S., Yasmin, A., Ahmed, S., Islam, Md. N., & Hossain, R. (2025). Climate Change Impacts on the RMG, Leather, Leathergoods and Footwear sectors: Implications for Workers and Industry with Pathways to a Just Transition. Bangladesh Labour Foundation.
- Hossan, S. (2022, December 17). Tannery Industry of Bangladesh: Current Trends, Growth and Challenges. Business Inspection BD. https://businessinspection.com.bd/tannery-industry-of-bangladesh/
- Jaman, F., Sultana, F., Sharmin, I., Koley, N. J., & Paul, A. (2024). Occupational Health Risks in Savar's BSCIC Zone: The Dark Side of Tannery Industry. Chittagong University Journal of Biological Sciences, 115–129. https://doi.org/10.3329/cujbs.v12i1.78249
- Jenny, A. J. (2023, September 28). Exploitative Labour Practices in Bangladesh Leather Supply Chain: Dark Side of the Luxury. Canadian Association for Research on Work and Health. https://carwh.ca/blog-sept2023-1/
- LFMEAB. (2023). Introduction to Bangladesh Leather Products & Footwear Industry & LFMEAB. https://lfmeab.org/wp-content/uploads/2023/05/Introduction-to-Sector-LFMEAB.pdf
- Moazzem, K. G., & Jebunnesa. (2024). Occupational Safety and Health (OSH) in the Tannery Sector: Case study on Savar BSCIC Tannery Estate. Centre for Policy Dialogue (CPD). https://cpd.org.bd/resources/2025/01/Occupational-Safety-and-Health-OSH-in-the-Tannery-Sector.pdf
- Mohinuddin, Md., Shal, S., & Alam, Md. Z. (2025). Minimum Wage Implementation in the Tannery Industrial Estate, Savar. Bangladesh Labour Foundation.
- Naher, U. H. B., Kabir, Md. H., Most. Laboni Begum, Sarker, Md. R., & Munira, S. (2020). Health Issues of Tannery Workers at Savar, Dhaka, Bangladesh. Journal of Emerging Technologies and Innovative Research (JETIR), 7(12).
- Oyshi, N. M., Rafi, A. A., & Karami, M. J. H. (2024). Identifying Factors Associated with Health Problems of Tannery Workers, Savar, Dhaka: Factors Associated with Health Problems of Tannery Workers. Dhaka University Journal of Science, 72(2), Article 2. https://doi.org/10.3329/dujs.v72i2.75473
- Pearshouse, R. (2012). Toxic Tanneries: The Health Repercussions of Bangladesh's Hazaribagh Leather. https://www.hrw.org/report/2012/10/09/toxic-tanneries/health-repercussions-bangladeshs-hazaribagh-leather
- Sujan, M. A. (2019, January 27). Savar Tannery Estate: High hazard yet little safety. The Daily Star. https://www.thedailystar.net/frontpage/news/savar-tannery-estate-high-hazard-yet-little-safety-1693417
- Tasnim, F., Rahman, I., Rahman, M. S., & Islam, R. (2016). A Review on Occupational Health Safety in Bangladesh with Respect to Asian Continent. International Journal of Public Health & Safety. https://www.hilarispublisher.com/abstract/a-review-on-occupational-health-safety-in-bangladesh-with-respect-to-asian-continent-31419.html
- The Financial Express. (2022, March 15). Savar tanneries: Pollution riddle. The Financial Express. https://thefinancialexpress.com.bd/views/columns/savar-tanneries-pollution-riddle-1647274772
- The New Nation. (2023, July 3). Lack of environmental compliance, workers' right hit leather industry. The New Nation. https://dailynewnation.com/lack-of-environmental-compliance-workers-right-hit-leather-industry/
- Times Report. (2025, September 21). Bangladesh leather sector faces roadblocks to $5 billion potential by 2030. Daily Times Of Bangladesh. https://tob.news/bangladesh-leather-sector-faces-roadblocks-to-5-billion-potential-by-2030/
- Tuhin, M., Md., Atiqur Rahman, S., Md., & Zahidul, I., Md. (2022). Labor Rights of Tannery Workers in Bangladesh: An Overview. Kardan Journal of Economics and Manangement Sciences, 1. https://doi.org/10.31841/KJEMS.2022.111
- UNDP. (2022, August 26). Issue Brief: Just Transition. UNDP. https://www.undp.org/publications/issue-brief-just-transition



Just Transition

A just transition is a concept supported globally, which aims to ensure that the shift to environmentally sustainable economies is as fair and inclusive as possible. It involves creating decent work, social protection, and new economic opportunities while minimizing hardship for workers and their communities affected by this transformation, ultimately supporting climate action and inclusive societies.

Just Transition in Bangladesh's Garment Industry: Challenges, Opportunities and the Role of Labor Unions

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Abstract

Bangladesh's Ready-Made Garment (RMG) sector, contributing over 84% of national export earnings and employing nearly 4 million workers like 80% of them women, stands at a critical juncture amid the global shift toward a Just Energy Transition (JET). Although the country leads with 240 LEED-certified green factories, this represents less than 5% of the industry, highlighting the urgency for sector-wide transformation. This study explores the opportunities and challenges of implementing Just Transition principles with a focus on labor rights, ethical supply chains, environmental sustainability, and union participation. A mixed-methods approach was used, combining policy analysis, 10 Key Informant Interviews (KIIs) with industry experts and union leaders, and surveys of 150 garment workers in Dhaka and Gazipur. Findings reveal that only 10% of workers access formal skill development programs, leaving many unprepared for technological change. By 2030, 30–40% of vulnerable workers may face job displacement due to automation. The sector consumes 15–20% more energy than global best practices and contributes heavily to water pollution, while worker awareness of green transition policies remains low. Moreover, fewer than 6% of factories have active trade unions that can perform properly, and fewer than 10% of workers know their rights to engage in transition processes. Ethical supply chain monitoring and Human Rights Due Diligence (HRDD) are still in early stages, despite being increasingly demanded by international buyers and EU due diligence legislation. The study recommends adopting an inclusive and ethical policy framework that integrates HRDD principles across supply chains, ensuring fair labor standards, occupational safety, and gender equality. Key actions include climate-resilient infrastructure upgrades, comprehensive skill development for displaced workers, and formalized roles for labor unions in transition governance. Finally, public–private collaboration, climate finance and HRDD compliance mechanisms are essential to ensure that the RMG sector's decarbonization is sustainable, equitable and globally competitive.

Keywords: Just Transition, RMG Sector, Climate Resilience, Labor Rights, Trade Unions, Green Jobs

Climate Migrants and Labour Rights: A Legal Gap in Bangladesh's Just Transition

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Abstract

Bangladesh, one of the most climate-vulnerable nations globally, is experiencing growing internal displacement caused by floods, riverbank erosion, saline intrusion, and cyclones. Those displaced often termed climate migrants relocate primarily to metropolitan areas, where they take up informal employment in sectors such as construction, brick kilns, domestic work, and garment production. Despite their significant economic contributions, these workers remain legally invisible, excluded from protections under Bangladesh's existing labour laws. This research critically examines the legal invisibility of climate migrants within the country's transition toward a sustainable and inclusive economy, often framed as a Just Transition. Using doctrinal legal analysis, policy assessment, and case study evaluation, it identifies major gaps in the Bangladesh Labour Act 2006, the Disaster Management Act 2012, and associated national programs. Findings show that current legal and policy frameworks fail to recognize climate migrants as a distinct and vulnerable labour class, resulting in inadequate access to social protections, weak enforcement of existing rights, and limited judicial activism in expanding labour justice for this demographic. The analysis also underscores the crucial but constrained role of civil society organizations, including BLAST, ASK and BELA, which have pioneered legal aid and policy advocacy for marginalized groups but face challenges in influencing structural reform. While Bangladesh's climate policies and disaster frameworks highlight resilience and adaptation, they lack integration with labour rights, thereby leaving climate migrants outside the scope of institutional protections. This study argues that a legal and policy transformation is urgently required. Recognizing climate migrants as a vulnerable workforce within national laws, extending social protections, and embedding their rights in Just Transition strategies are essential. Such reforms would align with principles of justice, sustainability, and human rights, ensuring that no worker is left behind in Bangladesh's pathway toward a climate-resilient economy.

Keywords: Climate Migrants, Just Transition, Labour Law, Labour Rights, Bangladesh

Just & Green Transition in Ship Breaking: Protecting Workers in a Polluting Industry

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Abstract

The ship breaking industry in Bangladesh plays a crucial economic role by supplying nearly 70% of the country's steel demand and employing more than 50,000 workers, yet it remains one of the most hazardous and environmentally damaging sectors. Concentrated in Sitakunda, Chattogram, the industry is plagued by toxic exposures, frequent accidents, and unsafe working conditions, alongside severe environmental contamination of soil, water, and marine ecosystems. Despite Bangladesh dismantling nearly half of the world's ships by gross tonnage in recent years, the industry continues to operate under weak regulatory oversight and widespread informality. This study critically examines the urgent need for a just and green transition in ship breaking, balancing economic importance with the imperatives of worker protection, environmental sustainability, and social justice. Drawing on international frameworks including the ILO Just Transition Guidelines (2015), the Hong Kong Convention (2009) and the Basel Convention (1989); the paper analyzes existing gaps in occupational safety, social protection, gender inclusion, and environmental compliance. Evidence highlights severe violations of labour rights as workers without formal contracts, limited access to health services, widespread underpayment and fear of unionization. The research further identifies potential pathways for transformation, including skills mapping, recognition of prior learning (RPL), reskilling programs in safe dismantling and green jobs, establishment of a Shipbreaking Transition and Welfare Fund and adoption of cleaner technologies such as dry docks, mechanized cutting, and hazardous waste management units. Special attention is given to marginalized groups, including women in ancillary roles, whose contributions remain unrecognized and unsupported. The findings argue that a worker-centered just transition, anchored in strong governance, social dialogue and access to climate and transition finance, is essential for making Bangladesh's ship breaking industry both sustainable and equitable. Without such reforms, the sector risks perpetuating cycles of exploitation, pollution and global non-compliance.

Keywords: Ship breaking, just transition, labour rights, occupational safety, sustainability, Bangladesh.

From Factories to Footpaths: Climate Justice and Digital Transition for RMG and Informal Women Workers in Bangladesh

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Abstract

Bangladesh is standing at a crucial moment where the combined forces of climate change and rapid digitalization are reshaping the future of work. The ready-made garment (RMG) sector, which employs nearly four million workers, the majority of whom are women, continues to serve as the backbone of the country's export earnings and foreign exchange reserves. Alongside this, millions of women contribute through informal activities such as freelancing, small-scale entrepreneurship, petty trading, home-based businesses, boutiques, and food services. Despite their vital contribution to the national economy, women workers in both formal and informal sectors face significant job insecurities as climate impacts intensify and digital technologies transform industries at an unprecedented pace. With proper planning and inclusive strategies, women and other vulnerable workers can avoid being left behind and instead play a central role in enabling Bangladesh to become both greener and digitally empowered. This study, and the accompanying poster, aim to highlight the most vulnerable areas of the RMG sector and women's informal employment, particularly in relation to climate-related risks and the technological revolution. We identify persistent gaps in skills development, social protection coverage, and policy advocacy, which limit women's ability to adapt and thrive in this changing landscape. After analysis, several critical points emerge: (1) Both formal and informal women workers remain at high risk due to limited awareness of climate resilience and inadequate access to digital tools; (2) Social protection laws and schemes are scarce for formal workers, and nearly absent for informal workers; (3) Trade unions and women's networks remain underrepresented, leaving women with little voice in shaping climate or digital transition policies; (4) Women workers continue to experience a "triple burden" of gender roles, unpaid care work, and workplace vulnerabilities, which could and should be mitigated through inclusive reforms. Bangladesh is undergoing a major transition, and this process must expand "from factories to footpaths." Only then can we ensure that both formal and informal women workers are equipped with the strategies, protections, and opportunities needed for a climate-just and digitally inclusive future.

Keywords: Climate Justice, RMG Sector, Just Transition, Gender Equity, Digital Transition

Impact of Automation on the Economy and Labour Force in Bangladesh: Risks, Opportunities and Policy Pathways

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Abstract

Automation is transforming economies globally, offering prospects for productivity gains and economic growth while raising concerns over job displacement, skill mismatches, and widening inequality. For Bangladesh, a labor-intensive economy heavily dependent on the ready-made garment (RMG) sector and other manufacturing industries, this transition carries profound implications. International Labour Organization (ILO) and the government's a2i project assumed though a study, approximately 5.38 million jobs in five key sectors may be at risk by 2041, with the RMG sector alone potentially losing 2.7 million jobs and that is about 60% of its workforce. This research investigates the economic and social consequences of automation in Bangladesh through a review of secondary literature, policy assessments and expert insights. It examines sectoral vulnerabilities, gender-differentiated impacts and the challenges posed to informal and medium-skilled workers. Findings indicate that while automation can significantly increase efficiency, output quality and competitiveness, it also threatens to exacerbate structural weaknesses in the labour market. Women in the RMG sector, who constitute the majority of the workforce, face disproportionate risks of unemployment, potentially adding to the growing NEET (Not in Education, Employment or Training) population. Displaced workers may be forced to shift into low-productivity agriculture, undermining overall economic growth and development prospects. The study concludes that proactive policy measures are essential to manage the transition. Key recommendations include mainstreaming technical and vocational education, promoting research and development (R&D), strengthening academia–industry linkages and developing area-specific training programs for rural and urban youth. It also emphasizes the need for social protection schemes, gender-responsive policies and Human Rights Due Diligence (HRDD) to ensure that automation contributes to sustainable and equitable economic transformation. A balanced approach combining productivity gains with inclusive labour policies will be critical to achieving a just transition in Bangladesh.

Keywords: Automation, Labour Market, Just Transition, Skills Development and Bangladesh

Youth-led Digital Green Skills for a Just Transition in Bangladesh

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Abstract

Bangladesh's transition toward a green and digital economy presents both opportunities and challenges for millions of workers, particularly youth and women in informal sectors who remain at the frontlines of climate and technological disruptions. While automation, digitalization, and climate adaptation are reshaping industries, limited access to green and digital skills risks widening inequality, exacerbating job insecurity, and excluding marginalized groups from the benefits of sustainable development. Against this backdrop, this study proposes a Youth-Led Green Skills Incubator (YLGSI) that's an innovative, community-driven model designed to equip vulnerable groups with practical training in renewable energy maintenance, digital literacy and circular economy practices, while embedding principles of gender equity and workers' rights. The research employed a mixed-method design combining eight focus group discussions (FGDs) with youth workers from the ready-made garment (RMG), agriculture, tannery, and transport sectors, alongside surveys of 120 informal workers across Dhaka and Khulna. Findings reveal that 72% of respondents fear displacement due to automation, yet 81% expressed strong interest in re-skilling programs targeting green and digital competencies. Women workers emphasized the need for flexible, community-based training formats to accommodate care responsibilities, while youth highlighted digital tools and livelihood diversification as essential pathways to resilience. The YLGSI framework envisions mobile training hubs run in partnership with trade unions, NGOs, and local government. These hubs would deliver modular short courses, link participants with apprenticeship schemes, and connect them to micro-financing opportunities to support small-scale entrepreneurship. Beyond skill-building, the model promotes collective empowerment by ensuring fair access, representation, and social protection for youth and women workers. By aligning with Bangladesh's national climate commitments, digital strategy and just transition agenda, YLGSI offers a scalable pathway to ensure "no one is left behind." This study concludes that a youth-driven, rights-based approach to green skills development can strengthen climate resilience, reduce inequality and prepare Bangladesh's workforce for a just, inclusive, and sustainable transition.

Keywords: Just Transition, Green Skills, Youth Empowerment, Digital Inclusion, Informal Workers, Gender Equity

“We are the first generation to feel the effect of climate change and the last generation who can do something about it.”

-Barack Obama

Just Transition and Green Jobs for Youth: Pathways to Inclusive Employment and Climate Resilience

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Abstract

In an era of escalating climate anxiety affecting nearly 67% of youth in 2025 combined with persistent double-digit unemployment rates, the urgency of building pathways toward sustainable and inclusive employment has never been greater. The Just Transition framework provides such a pathway, ensuring an equitable shift from fossil fuel dependency to low-carbon economies while safeguarding decent work, inclusivity, and resilience. Central to this transformation is the creation of green jobs in renewable energy, sustainable agriculture, and circular economy systems, which not only support climate action but also enhance economic security. However, current readiness remains limited, with only 44% of youth worldwide feeling adequately equipped for these roles, and levels dropping to as low as 5% in Ethiopia. To address these gaps, global initiatives such as the UNEP–ILO–UNICEF Green Jobs for Youth Pact aim to create 1 million new green jobs, green another million existing ones, and support 10,000 youth-led enterprises by 2030, with the ambition of doubling the global green talent pool by 2050. Projections indicate that the Asia–Pacific region alone could see 180 million net new jobs from the green transition, underscoring its transformative potential. Regional successes further highlight scalable models: Kenya's Climate WorX program employing 200,000 youth in ecosystem restoration, and Brazil's bioeconomy apprenticeships equipping young people with bio-based industry skills. Yet, significant barriers remain, including skills mismatches, gender disparities, risks of informality, and widening digital divides. Bridging these challenges requires deliberate investment in green skills training, gender-sensitive policies, and inclusive labour frameworks that integrate youth voices. A just and inclusive green transition can therefore enable young people not only to participate in but to lead climate-resilient economies. Positioned at the nexus of climate justice, social equity, and economic opportunity, youth are essential actors in shaping resilient and prosperous futures.

Keywords: Just Transition, Green Jobs, Youth Employment, Climate Resilience, Sustainable Development, Green Skills

Climate and Gender Justice: Advancing a Just Transition for Women Workers in Bangladesh

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Abstract

Bangladesh, ranked among the world's most climate-vulnerable countries, faces intensifying threats to labour markets as rising temperatures, flooding, salinity intrusion, and cyclones disrupt livelihoods. Women workers particularly in the ready-made garment (RMG), agriculture, fisheries, and informal sectors are disproportionately affected due to structural inequalities, limited access to resources, and the dual burden of wage labour and unpaid care work. The RMG sector alone employs nearly 4 million workers, of whom 80% are women, and remains highly exposed to both automation and climate risks. Recent studies estimate that by 2041, about 5.38 million jobs across five key sectors may be at risk, with 2.7 million jobs (60%) lost in RMG. Climate-induced disruptions and automation combined could displace 30–40% of vulnerable workers, especially women. This study investigates the intersection of climate justice and gender justice in the context of a just transition for women workers in Bangladesh. Using a qualitative approach, it draws on key informant interviews (KIIs), focus group discussions (FGDs), and consultations with women workers, trade union leaders, and policy actors. Findings highlight that while automation improves efficiency, women workers remain largely excluded from green job training, with fewer than 10% of women reporting access to structured reskilling opportunities. Moreover, women in coastal districts reported losing significant workdays annually due to salinity intrusion, extreme heat, and cyclones, exacerbating income insecurity and health risks. Participants also emphasized resilience strategies such as informal networks, union engagement, and youth-led initiatives that help sustain livelihoods. This assessment argues that a just transition in Bangladesh must integrate gender-sensitive labour and climate policies to safeguard women's rights and jobs. Priorities include expanding climate-resilient employment opportunities, strengthening social protection for displaced workers, and ensuring women's active participation in decision-making. Linking climate and gender justice offers a pathway to a transition that is not only environmentally sustainable but also socially equitable, ensuring that no woman worker is left behind.

Keywords: Climate Justice, Gender Justice, Just Transition, Women Workers, Bangladesh

Empowering Workers in the Age of AI and Climate Change: A Just Transition Roadmap for Bangladesh

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Abstract

Bangladesh stands at the intersection of two major transformations: climate-induced disruptions and rapid technological change driven by automation and artificial intelligence (AI). These shifts present both opportunities and risks for the country's workforce, particularly in vulnerable sectors such as ready-made garments (RMG), agriculture, tannery, transport, and the informal economy. On one hand, automation offers efficiency gains and green technologies enhance climate resilience; on the other, millions of workers especially women and youth face exclusion due to persistent skill gaps, weak union participation, and limited social protection mechanisms. This study examines how Just Transition principles can guide Bangladesh toward a fair and inclusive future of work. Using a mixed-method approach, including policy reviews, focus group discussions with garment workers, and interviews with trade union leaders, the research identifies several key barriers: inadequate awareness of digital and green skills, low female representation in decision-making processes, and the absence of participatory consultation platforms for workers. At the same time, it highlights opportunities such as mobilizing climate finance for green infrastructure, integrating AI-driven tools into training and reskilling programs, and fostering cross-sectoral alliances between unions, government, and industry. Findings indicate that fewer than 15% of surveyed workers feel adequately prepared for digital transformation, while only 1 in 10 reported access to structured reskilling initiatives. However, a significant majority as 70% of respondents expressed willingness to adapt if provided with institutional support. Building on these insights, the study proposes a Just Transition framework for Bangladesh centered on three interrelated pillars: (1) Decent Work and Social Protection ensuring no worker is left behind; (2) Skill Development and Gender Inclusion enhancing resilience through equitable training and opportunities and (3) Democratic Participation embedding worker voices in transition policies. A sustainable transition in Bangladesh must therefore go beyond reducing emissions and modernizing industries to also uphold dignity, equity, and justice for the workforce.

Keywords: Just Transition, Digitalization, Workers' Rights, Climate Justice, Gender Inclusion

Bangladesh in Transition: Linking Climate Justice, Workers' Rights and Equitable Development

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Abstract

Bangladesh stands at a critical juncture where climate justice, labour rights, and sustainable development converge. Despite contributing less than 0.56% of global greenhouse gas emissions, the country ranks among the seven most climate-vulnerable nations, enduring 185 extreme weather events between 2000 and 2019 that caused 11,450 deaths and US$3.72 billion in losses. This paradox minimal responsibility but maximum exposure underscores the urgency of equitable climate action. Labour-intensive industries such as ready-made garments, construction, and agriculture have powered Bangladesh's growth but remain plagued by long working hours, gender discrimination, unsafe conditions, and weak social protection. Climate change amplifies these risks. A 2025 investigation reported factory and construction workers collapsing under heat indices reaching 48°C, with inadequate employer safeguards. Women and informal workers, who form the bulk of the workforce, are disproportionately affected. Policy reviews highlight incremental progress. Initiatives like the Labour Reform Commission (2024), the Mujib Climate Prosperity Plan, and the Bangladesh Delta Plan 2100 reveal growing alignment between labour rights and climate adaptation. Yet, social protection remains low only 22% of the population has access leaving millions of informal workers unprotected. This research argues that a just transition for Bangladesh requires embedding labour rights into climate and economic reforms. Three priorities emerge: (1) adopting enforceable heat-safety standards and expanding protections to informal sectors, (2) integrating labour reforms with climate adaptation strategies and (3) expanding universal social protection and gender-responsive programmes. Scaling renewable energy from its current 4.5% of installed capacity to the government's 40% target by 2041 will demand global climate finance, technology transfer and strong national institutions. Bangladesh's experience illustrates that sustainable transition must extend beyond emissions reduction. Achieving climate justice requires upholding dignity, equity and labour rights, ensuring that no worker is left behind in the pursuit of resilience and prosperity.

Keywords: Climate Justice, Labour Rights. Just Transition, Renewable Energy, Policy Reform, Bangladesh

From Safety to Sustainability: A Just Transition Framework for Protecting Bangladesh's Workforce

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Abstract

Bangladesh's swift economic renovation, fueled by export-oriented industries such as ready-made garments, construction, and energy, has created millions of jobs while exposing workers to significant occupational hazards, weak labor rights, and environmental vulnerabilities. Ensuring workplace safety has long been a pressing challenge, highlighted by tragedies such as the Rana Plaza collapse, which underscored systemic deficiencies in compliance, social protection, and enforcement. Yet, as Bangladesh advances toward its Sustainable Development Goals and transitions toward greener growth, worker protection must evolve beyond narrow safety concerns to embrace a holistic sustainability framework. This idea proposes a just transition approach that places the workforce at the center of climate adaptation, industrial modernization, and social justice. A just transition framework emphasizes three interlinked priorities. First, safeguarding workers through stronger occupational safety standards, enforcement mechanisms, and comprehensive health services, particularly in high-risk sectors such as garments, shipbreaking, and construction. Second, preparing workers for sustainability shifts by investing in re-skilling, green jobs, and inclusive labor market reforms to cushion the displacement risks from automation, renewable energy adoption, and stricter environmental regulations. Third, embedding social dialogue and collective bargaining into industrial relations, ensuring that workers' voices shape the trajectory of economic reforms. In Bangladesh, the pursuit of labor force protection and environmental stewardship is deeply interconnected. Cleaner production methods, efficient energy use, and responsible waste management not only mitigate ecological degradation but also reduce occupational hazards. At the same time, fair and equitable labor practices enhance the resilience of communities facing climate-driven pressures such as flooding, extreme heat, and migration. By shifting from a reactive focus on "safety" to a proactive commitment to "sustainability," Bangladesh can strengthen both economic competitiveness and the dignity of its workforce. A just transition is therefore more than a moral responsibility; it is a strategic pathway that harmonizes labor rights, climate obligations, and long-term national development.

Keywords: Workforce safety, Just transition, Sustainability, Labor rights, Green jobs, Climate resilience

Justice for the Displaced: Embedding Labour Rights in Bangladesh's Climate Transition

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Abstract

Bangladesh's transition to a low-carbon economy is both urgent and inevitable to safeguard climate resilience, yet it poses significant legal and socio-economic challenges for workers disproportionately exposed to climate-induced displacement and industrial restructuring. Current labour legislation, particularly the Bangladesh Labour Act 2006 and its subsequent amendments, inadequately addresses realities such as climate-related retrenchment, informal sector vulnerabilities, and gaps in social protection. This paper employs a doctrinal legal analysis to evaluate national labour frameworks in light of Bangladesh's international obligations, including ILO Conventions on Decent Work, the Paris Agreement and the ILO's 2015 Guidelines for a Just Transition. Findings highlight critical normative and enforcement gaps: the absence of statutory provisions for climate-induced displacement, limited retraining and reskilling mechanisms, and weak enforcement of social dialogue provisions. To address these deficiencies, the study proposes embedding legally binding safeguards into the national climate transition strategy. Key recommendations include: (i) statutory compensation schemes for displaced workers, (ii) enforceable retraining and reskilling entitlements aligned with emerging green sectors, (iii) integration of mandatory tripartite social dialogue into climate and labour governance, and (iv) targeted protections for women and informal workers, who face heightened risks of exclusion. Beyond compliance with international labour standards, these reforms are justified as essential for ensuring social justice, safeguarding industrial peace, and enhancing competitiveness in the post-LDC graduation era and under the EU GSP+ framework. The paper argues that embedding labour rights within climate governance is not merely a legal obligation but a structural precondition for achieving a fair, inclusive and sustainable green transition in Bangladesh.

Keywords: Just Transition, Labour Rights, Climate-Induced Displacement, International Labour Standards, Legal Safeguards

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