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Bangladesh's Ready-made Garment Industry in the Era of Sustainable Development: A Triple Bottom Line Appraisal

Branża gotowych wyrobów odzieżowych w Bangladeszu w erze zrównoważonego rozwoju – ocena potrójnej linii wyników (TBL)

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Abstract: Bangladesh's Ready-Made Garment (RMG) industry, the world's second-largest apparel exporter, stands at the forefront of both economic transformation and sustainability crises. This study critically investigates the multidimensional sustainability landscape of the Bangladeshi RMG sector through the integrated lens of the Triple Bottom Line (TBL) framework, encompassing economic, environmental, and social dimensions. Employing a qualitative-dominant mixed-methods case study, the research draws on thematic content analysis of secondary sources, including peer-reviewed literature, policy documents, audit reports, and national statistics from 2010 to 2024. Findings reveal structural contradictions in the sector's development trajectory. While Bangladesh leads globally in green factory certifications and contributes over 84% to national exports, these advancements are unevenly distributed and heavily concentrated among elite exporters. The study identifies persistent wage stagnation, union suppression, and environmental non-compliance among SMEs and subcontractors, despite post-Rana Plaza reforms. It also uncovers limited adoption of circular economy models and technological innovation, underscoring the sector's vulnerability to global market volatility and supply chain pressures.

Keywords: Ready-Made Garment (RMG), Bangladesh, Sustainability, SDGs, Triple Bottom Line, Labour Rights, Circular Economy, Green Manufacturing, Global Supply Chains

Streszczenie: Bangladeski przemysł odzieżowy (RMG), drugi co do wielkości eksporter odzieży na świecie, znajduje się na czele transformacji gospodarczej jednocześnie mierząc się z wyzwaniami związanymi ze zrównoważonym rozwojem. W niniejszym artykule przeprowadzono krytyczną analizę wieloaspektowych uwarunkowań zrównoważonego rozwoju w bangladeskim sektorze RMG, z perspektywy modelu potrójnej linii wyników (Triple Bottom Line, TBL), obejmującego wymiary ekonomiczny, środowiskowy i społeczny. Badanie zostało oparte na studium przypadku, w którym główny nacisk położono na analizę jakościową, uzupełnioną elementami ilościowymi. Wykorzystano analizę treści dostępnych materiałów, takich jak publikacje naukowe, dokumenty strategiczne, raporty z audytów i statystyki krajowe z lat 2010-2024. Wyniki ujawniają strukturalne sprzeczności w trajektorii rozwoju tego sektora. Pomimo że Bangladesz jest światowym liderem w zakresie certyfikacji zielonych fabryk i odpowiada za ponad 84% krajowego eksportu, osiągnięcia te są nierównomiernie rozłożone i silnie skoncentrowane wśród największych eksporterów. Badanie wskazuje na utrzymującą się stagnację płac, ograniczanie działalności związków zawodowych oraz nieprzestrzeganie regulacji środowiskowych wśród MŚP i podwykonawców – mimo reform wdrożonych po katastrofie Rana Plaza. Ponadto ujawniono, że w bangladeskim sektorze odzieżowym tylko w ograniczonym stopniu wdraża się modele gospodarki o obiegu zamkniętym oraz innowacje

technologiczne. Powoduje to większą podatność branży na zmiany zachodzące na rynkach światowych oraz na presję związaną z funkcjonowaniem w globalnych łańcuchach dostaw.

Słowa kluczowe: gotowe wyroby odzieżowe (RMG), Bangladesz, zrównoważony rozwój, SDGs, potrójna linia wyników (Triple Bottom Line, TBL), prawa pracownicze, gospodarka o obiegu zamkniętym, zielona produkcja, globalne łańcuchy dostaw

Introduction

Bangladesh's garment industry sector plays a pivotal role in boosting its economic growth and overall development. This sector helped Bangladesh develop a global reputation and image over the years (Haque and Azmat 2015). The garment industry of the country, the second-largest exporter of ready-made garments (RMG) products after China, employs over 5 million people, mostly women, enhancing economic growth, gender equality, poverty reduction, and rural development (Chowdhury et al. 2024). The late 1970s-founded garment sector of Bangladesh has evolved into one of the world's top textile and garment exporters. The industry accounts for 84.58% of Bangladesh's export earnings, around \$43 billion in 2023-2024. This high export performance has helped preserve gross domestic product (GDP) growth despite global obstacles, including the COVID-19 pandemic, the Russia-Ukraine war, and inflation. The primary textile sector (PTS) meets 85-90% of knit RMG and 35-40% of woven RMG yarn demands, contributing approximately 13% to Bangladesh's GDP. However, Bangladesh's garment sector, with over \$15 billion invested, faces challenges in R&D, sustainable production, automation, and high-value textile manufacture (FICCI 2025). In this regard, Bangladesh University of Textiles (BUTEX), Ahsanullah University of Science and Technology (AUST), and Centre for Policy Dialogue (CPD) have been working more on eco-friendly garment manufacturing and supply chain efficiency, but financing, technology, and skills hinder large-scale innovation (Chowdhury et al. 2024).

However, the fast expansion of the garment industry in Bangladesh has revealed deep-seated flaws, throwing doubt on the industry's sustainability and business ethics (Reinecke and Donaghey 2015). This contradiction was highlighted by the 2013 Rana Plaza garment factory collapse, which killed over 1,100 and injured hundreds (Frenkel et al. 2022). The Rana Plaza accident exposed the industry's profit-driven disdain for workers and environmental welfare, prompting demands for structural adjustments to address moral and operational flaws (Siddiqui and Uddin 2016). The Accord on Fire and Building Safety in Bangladesh and the Alliance for Bangladesh Worker Safety have changed the industry's corporate social responsibility (CSR) approach to prioritize inspections, corrective plans, and worker training to increase workplace safety and fairness (Chowdhury et al. 2024). Global brands like H&M, Zara, and Primark now also prioritize sustainable supply chains, eco-friendly garments, and circular economy principles (Sadika and Zhonghua 2024).

Prior studies claimed that Bangladesh has paved the way for the garment industry worldwide and established a benchmark for them with regard to sustainable development, i.e., ensuring energy efficiency, waste management, and employee wellbeing (Hossain et al. 2021). However, capital costs, technological limitations, and worker social justice issues make greener manufacturing complicated (Saha, Akhter, and Hassan 2021). With river pollution, excessive water consumption, and greenhouse gas emissions, the garment industry in Bangladesh is a major environment polluter

(Uddin et al. 2023). To bring about changes in the sector, better industrial technologies, more environmental laws, and textile recycling and upcycling are needed to overcome these concerns (Bagdadee et al. 2024). In this respect, the government of Bangladesh also provides strategic guidance to the garment industry with a view to maintaining sustainable development of the sector. Given these recent developments, the following research questions are particularly relevant for scrutiny:

1. *To what extent has the garment industry in Bangladesh ensured its multidimensional sustainability amidst the challenge of competition in the international marketplaces (See Figure 1)?*
2. *How can adopting sustainability practices be a means to create a competitive advantage for Bangladesh's garment industry?*

With a view to discussing and rummaging through the answers to the questions, the study provides the readers with an overview of the garment industry in Bangladesh. The findings of the study offer an in-depth analysis of the current status and conditions of the economic, environmental, and social sustainability in the RMG sector. The article also highlights the challenges and sheds

light on the ways forward. The key findings suggest that while the policy discourse and regulatory framework have evolved significantly since 2013, the implementation remains fragmented and unequal.

1. Sustainability in Bangladesh's RMG Sector: A Literature Review

Sustainability is both a necessity and a strategic advantage for developing countries engaged in global value chains. Moon (2014) and Perry & Towers (2013) argue that sustainability practices in the apparel industry are increasingly dictated by global buyer pressure, and adoption of these practices is now a determinant of market survival. Accordingly, developing countries that align their industries with sustainable practices enjoy improved access to trade, branding power, and long-term resilience. However, Kabeer and Mahmud (2004) argue that normative sustainability frameworks (e.g., TBL or SDGs) often reflect Western-centric assumptions and ignore structural inequalities embedded in global supply chains. Moreover, the capacity of developing countries like Bangladesh to enforce sustainability norms is often limited by governance deficiencies, capital scarcity, and competing economic imperatives (Islam and Deegan 2010; Donaghey and Reinecke 2018). For

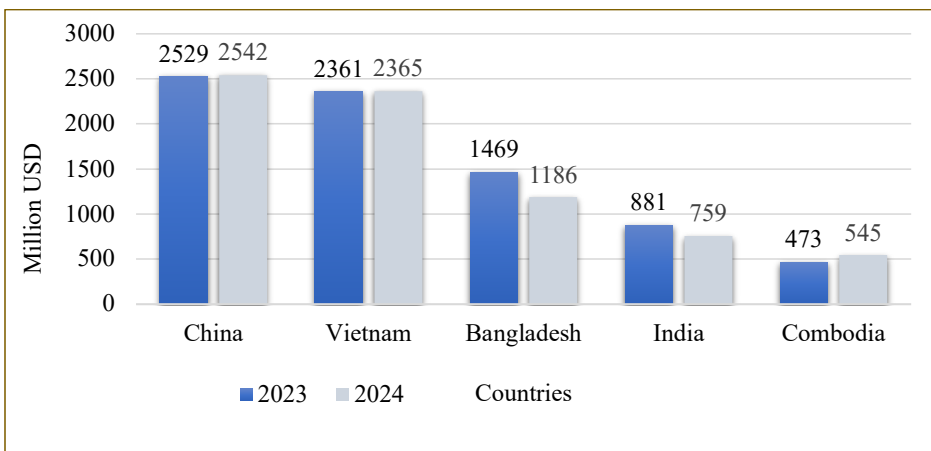


Figure 1: Bangladesh's competition in garment exports in the international market

Data source: (Haque 2024). Prepared by the authors.

many producers, sustainability remains aspirational, not operational.

The economic performance of the RMG industry is central to Bangladesh's national development. Contributing over 80% of export earnings, the sector is hailed for its resilience and contribution to GDP (Chowdhury et al. 2024). Proponents argue that profitability enables reinvestment in sustainability and facilitates transition to higher value-added production. However, critiques note the externalized costs of such growth: environmental degradation, stagnant wages, and dependency on low-margin production (Karim 2015; Reinecke and Donaghey 2015). The price squeeze by global brands prevents firms from fully investing in R&D or worker welfare. Moreover, overdependence on a single industry increases macroeconomic risk and hampers diversification. Thus, Economic sustainability must be viewed not just in terms of revenue but also resilience and redistribution. A critical literature gap lies in exploring how the RMG sector can pivot from low-cost manufacturing toward innovative, ethical, and high-value production, ensuring both firm survival and inclusive development.

Environmental sustainability has emerged as a non-negotiable criterion for apparel manufacturing globally. Studies across Vietnam, India, and Sri Lanka indicate that firms adopting energy-efficient processes, LEED certification, or Zero Discharge of Hazardous Chemicals (ZDHC) policies are more likely to retain major Western clients. In Bangladesh, LEED-certified factories have proven energy-efficient and pollution-reducing, aligning with climate commitments and branding strategies (Farhana et al., 2022). However, adoption is uneven and often limited to large, export-oriented firms. Scholars such as Sadika and Zhonghua (2024) note that over 3,000 small and subcontracted factories in Bangladesh lack the capacity or incentive to invest in green infrastructure. Furthermore, greenwashing, misaligned regulatory incentives, and the high cost of clean technologies pose real barriers (Khan et al.

2024). Environmental upgrades thus remain market-driven, not systemically embedded. Thus, Environmental transformation in Bangladesh's garment industry cannot be interpreted through a one-size-fits-all lens. While some firms strategically adopt green practices, a vast section of the sector remains excluded from this transition. This duality—between modern green factories and informal polluting units—demands differentiated policy and scholarly treatment, highlighting a key research gap in evaluating sectoral heterogeneity in sustainability uptake.

Moreover, from the social sustainability perspective, the RMG sector has been lauded as a vehicle for female empowerment, rural development, and poverty alleviation. Empirical studies show that garment employment has shifted gender norms, increased household incomes, and promoted women's labour force participation in patriarchal societies (Heath and Mobarak 2015). Multinational campaigns such as HERproject and the Accord have advanced worker health, safety, and voice. However, these advances are uneven and fragile. Frenkel and Rahman (2022) argue that empowerment is often superficial, constrained by gendered labour segmentation, wage suppression, and violence. Union repression, long hours, and insufficient healthcare undermine the claim that the RMG sector ensures social sustainability (Siddiqui and Uddin 2016; Islam and Stringer 2020). Bangladesh's wage floor remains among the lowest globally, and the Rana Plaza collapse revealed systemic neglect of worker safety. Thus, while the RMG sector has undoubtedly opened economic opportunities, its labour governance architecture remains weak. The tension between global codes of conduct and local enforcement capacity persists. A rigorous sustainability model must move beyond employment metrics to incorporate indicators of voice, equity, and dignity. This necessitates empirical work to understand how social sustainability initiatives are perceived and experienced by

different actors—owners, workers, unions, and regulators in Bangladesh.

Despite the growing body of literature on sustainability in the global garment industry, the following research gaps remain underexplored in the context of Bangladesh. Most studies treat sustainability as a monolith. There is a lack of disaggregated analysis across firm size, ownership type, and regional variation within Bangladesh. Existing research rarely applies a holistic TBL lens with equal weight on environmental, social, and economic dimensions (See Figure 2). The lived experiences of workers and small factory owners in negotiating sustainability transitions are missing from much of the literature. While recycling and textile reuse are discussed globally, they remain marginal in Bangladeshi sustainability research. Little has been done to evaluate how sustainability practices have evolved in the post-Rana Plaza regulatory ecosystem. This study aims to fill these gaps by offering a multi-dimensional, empirically grounded, and policy-relevant analysis of the sustainability transitions in Bangladesh's garment industry. By doing so, it contributes to both academic debates and practical pathways

for sustainable industrial transformation in the Global South.

2. Methodology

2.1. Research design

A qualitative-dominant mixed-methods case study of Bangladesh's RMG sector has been adopted by integrating documentary content analysis with secondary quantitative indicators (e.g., wage trajectories; LEED growth) to interrogate the Triple Bottom Line (TBL) pillars over 2010-2024 (Creswell & Plano Clark 2017). In this regard, the RMG sector of Bangladesh is the main case; factories, worker collectives, and industry associations are embedded units (Yin 2018).

2.2. Data Collection Method

The researchers searched Scopus and Web of Science, journal portals, government sites, and NGO portals; publicly available worker testimonials were drawn from NGO/media reports. Sources included peer-reviewed studies, ILO/ Accord/Alliance, policy texts, World Bank/UN Comtrade statistics, BGMEA materials, and sector datasets (e.g., wages, LEED time series).

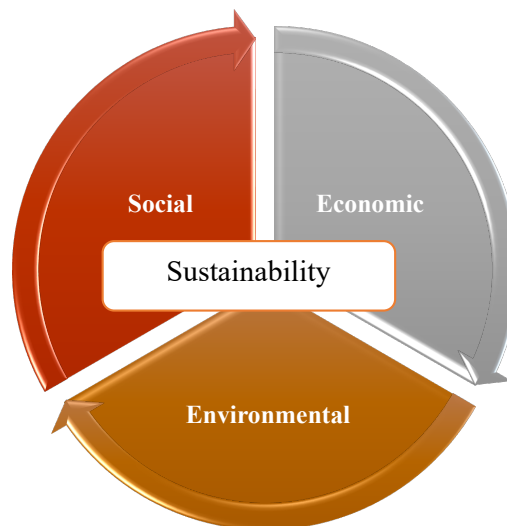


Figure 2: Triple Bottom Line (TBL) framework for sustainability in the RMG sector

Source: Prepared by the authors

The researchers purposively prioritized documents using a five-criterion hierarchy:

1. explicit TBL relevance in title/abstract/keywords;
2. recency weighting, with emphasis on post-2013 reforms;
3. scholarly/venue signal (citations, journal rank) for academic items;
4. perspective balance across industry, state, labour/NGO, and academia; and
5. coverage of sectoral heterogeneity (lead exporters vs. SMEs/subcontractors). BGMEA releases were included as industry perspectives but flagged for corroboration.

Inclusion criteria have been: (i) relevance to ≥ 1 TBL dimension; (ii) publication years 2010–2024; (iii) source authenticity (multilateral agencies, established NGOs, recognized industry bodies). Screening proceeded from title and abstract to full text. On the other hand, reasons for exclusion were logged using a controlled list (out of range, not Bangladesh RMG; no explicit TBL link; low credibility; insufficient extractable data; duplicate).

2.3. Data Analysis Method

Data analysis of this research followed thematic content analysis method with a priori TBL-aligned codebook, allowing inductive sub-codes when warranted (Braun & Clarke 2006). The codebook schema captured: *dimension* \rightarrow *theme* \rightarrow *operational indicator* \rightarrow *exemplar quotation* \rightarrow *source type (academic/NGO/industry/government)* \rightarrow *evidence polarity (supports/contradicts/neutral)*. Top-level codes included:

- *Economic*: buyer price pressure; export concentration; wage trajectory vs. inflation; value-addition/automation; upgrading.
- *Environmental*: water-use intensity; ETP/ZDHC compliance; effluent violations; energy mix/LEED adoption; waste/circularity.
- *Social*: minimum vs. living wage; hours/overtime; union density/

collective bargaining; GBVH; OSH remediation; access to health.

Quantitative indicators (e.g., LEED growth; wage series), descriptive statistics, and graphical presentation through Microsoft Excel were used for pattern triangulation to assess the stability of qualitative themes. The themes were validated through the data triangulation method, which crossed (a) academic and multilateral reports, (b) worker testimonials (NGO/media transcripts) for ground-level corroboration of social themes, and (c) secondary quantitative series for convergent validity. Recognizing potential favourability bias in industry sources (e.g., BGMEA communications on “green” achievements), the researchers implemented four safeguards: (1) source triangulation—no industry claim was used inferentially without independent support from peer-reviewed or multilateral/NGO evidence; (2) weighting—industry documents informed description but were down-weighted in interpretation unless corroborated; (3) AACODS (Authority, Accuracy, Coverage, Objectivity, Date, Significance) appraisal for all grey literature; and (4) negative-case analysis, actively searching for contradictory evidence (e.g., SME/subcontractor non-compliance) to test theme robustness.

3. Findings and Discussion

3.1. Overview of the Garment Industry in Bangladesh

Bangladesh’s ready-made garment industry emerged in the late 1970s–1990s under quota-era protections, building export capacity and female employment. In the late 1970s, Bangladesh’s garment industry began when visionary entrepreneurs saw the global textile market’s potential (Junayed and Akter 2023). The 1978 partnership between South Korea’s Daewoo Group and Bangladesh’s Desh Garments was crucial, teaching Bangladeshi workers and management modern garment manufacturing processes (Rahman 2023). The Multi-Fibre Arrangement (MFA) was a framework that governed the world trade in textiles and garments

from 1974 through 1994, imposing quotas on the amount developing countries could export to developed countries (Raihan 2024). It opened doors for developing countries like Bangladesh to provide low-cost manufacturing, fulfilling demand from established nations, particularly in Europe and North America (Chowdhury et al. 2024). The 2005 abolition of the Multi-Fibre Arrangement under the World Trade Organization Agreement on Textiles and Clothing catalysed rapid export expansion through cost competitiveness and buyer consolidation (Swazan and Das 2022). The 2013 Rana Plaza collapse reconfigured governance via the legally binding Accord on Fire and Building Safety in Bangladesh and the Alliance for Bangladesh Worker Safety, intensifying inspections and remediation (Bair et al., 2020). Importers temporarily reallocated sourcing before growth resumed, while social and environmental concerns persisted (See Table 1) (Koenig and Poncet 2022).

In recent decades, Bangladesh has made economic improvements with \$460 billion in GDP and \$2,800 per capita by 2023 (World Bank 2023). The economy is driven primarily by the RMG industry, which constitutes about 84.58% of total exports (\$42.6 billion in 2022). Moreover, trade with the EU and US is vital because of duty-free access under the Generalized System

of Preferences, though Bangladesh exports relatively less to EU countries (See Figure 3).

Bangladesh's garment industry's success is attributed to its cost and quality, with most of the factories in Dhaka, Chittagong, and Khulna serving as logistical hubs for exporting commodities. Duty-free access to European markets maintains cost advantages for Bangladesh's garment industry than other garment-focused nations (Yap 2015). Knitwear, a more versatile fabric, has grown due to worldwide demand for casual and utilitarian clothing. Bangladesh's spinning, dyeing, and finishing operations have built a self-sufficient supply chain, reducing costs and manufacturing time. The backward linking industries' emergence has augmented the supply chain, and enabled the manufacturers to accomplish economies of scale, quality control, as well as efficiency (Mallik et al. 2025). Ancillary sectors, such as packaging, logistics, and chemical industries, support Bangladesh's garment producers, ensuring effective production, transportation, and distribution (Junayed and Akter 2023). Eco-friendly and organic fabrics have changed customer expectations, forcing producers to embrace sustainable processes. Bangladeshi factories have invested in Global Organic Textile Standard and Fair-Trade certificates to attract ethically minded consumers (Hossain 2020).

Table 1: Key milestones in the industry and their implications for economic, environmental, and social dimensions. Data source: Authors' compilation (Junayed and Akter 2023; Rahman 2023; Raihan 2024; Chowdhury et al. 2024; Swazan and Dasc2022; Bair et al. 2020; Koenig and Poncet 2022)

Period	Milestone	Implications for economic, environmental, and social dimensions
Late 1970s-1990s	Export-oriented emergence under a quota regime (Multi-Fibre Arrangement)	Employment growth, limited compliance capacity
2005	Abolition of the Multi-Fibre Arrangement under the World Trade Organization agreement	Heightened price competition, scaling, and pressure on upgrading
2012	Tazreen Fashions factory fire	Exposed fire-safety failures
2013	Rana Plaza building collapse	Binding Accord and Alliance; inspections and remediation
2013-present	Ongoing reforms and environmental claims	Mixed progress on wages, association rights, and resource efficiency

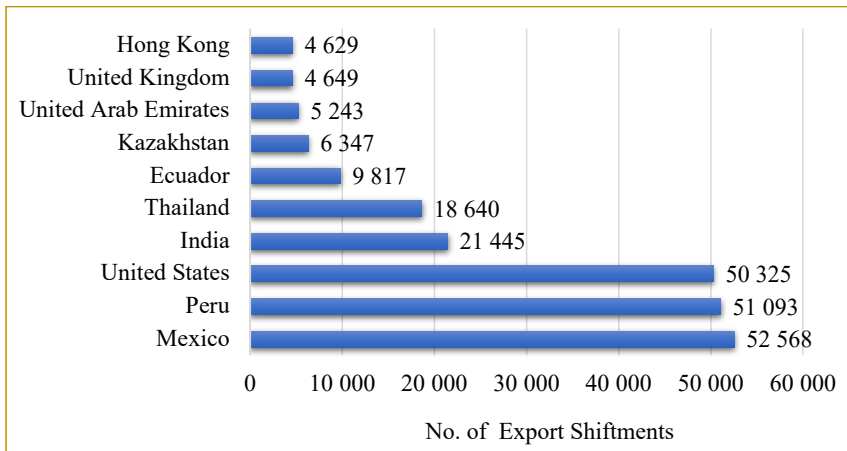


Figure 3: Top ten countries to which Bangladesh exports garments (March 2023 – February 2024)

Data source: (Volza 2024). Prepared by the authors.

3.2. Economic Sustainability in Bangladesh's Garment Industry

The garment industry in Bangladesh grew exponentially in the 1990s, with clothing making up over 50% of the total exports of the nation (Mallik et al. 2025). The sector's development was fuelled by a large, cost-effective labour force, mostly rural women, giving firms an edge in a competitive global market. Bangladesh faced challenges and opportunities when the MFA was abolished in 2005 (Karim 2015). The abolition of quotas increased competition from Vietnam and China, but Bangladesh's infrastructure and trained labour kept it competitive (Saxena, 2014). Studies demonstrated that over 5 million direct employments, 16% of GDP, and 81% of foreign currency income came from the Bangladesh garment industry (Chowdhury et al. 2024). Moreover, sustainability has become a top focus due to customer demand for eco-friendly goods and importing country regulations (Sobuj et al. 2021).

Bangladesh's RMG has transformed from a small industry in the late 20th century into its largest economic engine, contributing to job creation, foreign currency profits, poverty reduction, and infrastructure development (Chowdhury et al. 2024). The large foreign money influx by the garment industry has built strong financial

reserves, reduced dependence on foreign assistance, and funded vital development initiatives (Junayed and Akter 2023). The garment industry has driven industrial expansion through Export Processing Zones, modern roads, electricity, and logistical facilities (Chowdhury et al. 2024). However, the labour problems remain, with minimum pay falling short of living wage requirements, and international advocacy organizations criticizing dangerous working conditions and incomplete labour rights. The 2013 Rana Plaza accident highlighted the need for enhanced safety and corporate responsibility (Ahmed, Greenleaf, and Sacks 2014). Due to this, Bangladesh's garment export growth has not performed that much outstanding as it was expected in the deceleration of global economic expansion to 24.4% in 2022, shaving US\$1.5 billion off and slicing 0.80 percentage points off GDP growth (See Figure 4).

3.3. Environmental Sustainability in Bangladesh's Garment Industry

Bangladesh's garment sector's quick expansion and high production demands have caused energy-intensive operations, unsustainable water consumption, and hazardous chemical management. The garment industry utilizes natural gas and coal for power,

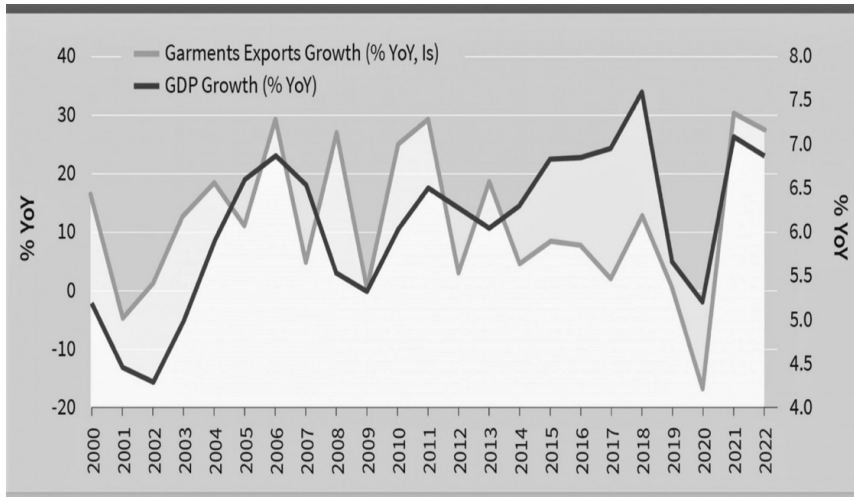


Figure 4: Garment industry slowdown in Bangladesh in 2023

Data source: (Shukla 2023; Bloomberg).

increasing greenhouse gas emissions and straining its energy infrastructure (Farhana et al. 2022). The industry's fossil fuels, hazardous chemicals, and resource-intensive processes deplete resources, pollute water, and degrade the environment. It uses 5 times more water per textile than global standards, stressing the country's freshwater reserves, as cotton fabric requires 10,000 litres of fresh water per kilogram (Haque 2024). Hence, Bangladesh's freshwater resources are stressed, notably in industrial Dhaka and Gazipur. Groundwater levels in important garment manufacturing locations have plummeted 2-3 meters a year due to huge exploitation. Metals, azo dyes, and sulphates from garment dyeing pollute rivers and streams, worsening environmental degradation and water shortages. Bangladesh's garment sector is driven by Natural gas and coal, straining the energy supply and increasing greenhouse gas emissions. Old factories release more greenhouse gases than green-certified ones, and the garment industry uses 10% of the nation's electricity (Parvez 2024). Lighting, solar panels, and efficient heating systems make green-certified garment businesses more energy efficient than traditional ones. On the other

hand, industrial water contamination comes mostly from chemical and garment waste. Bangladesh contributed considerably to 20% of worldwide industrial water pollution in 2021-22 (Chowdhury et al. 2024).

Bangladesh now has 233 Leadership in Energy and Environmental Design (LEED)-certified garment manufacturers from the U.S. Green Building Council. Bangladesh has 62 of the top 100 green garment manufacturers, and 500 additional factories are pursuing LEED certification (BGMEA 2025). Bangladesh Garment Manufacturers and Exporters Association (BGMEA) proudly announced its progress toward sustainable industrialization in a press release (Islam et al. 2024). This achievement shows Bangladesh's dedication to environmental protection, economic progress, and global competitiveness (See Figure 5). LEED certification reduces energy, water, and greenhouse gas emissions, benefiting businesses and the environment. However, LEED certification is still too costly for Small and Medium Enterprises (SMEs), requiring government incentives and cheap financing (Hossain 2020).

Before recycling industrial wastewater, Bangladesh's garment industry needs water

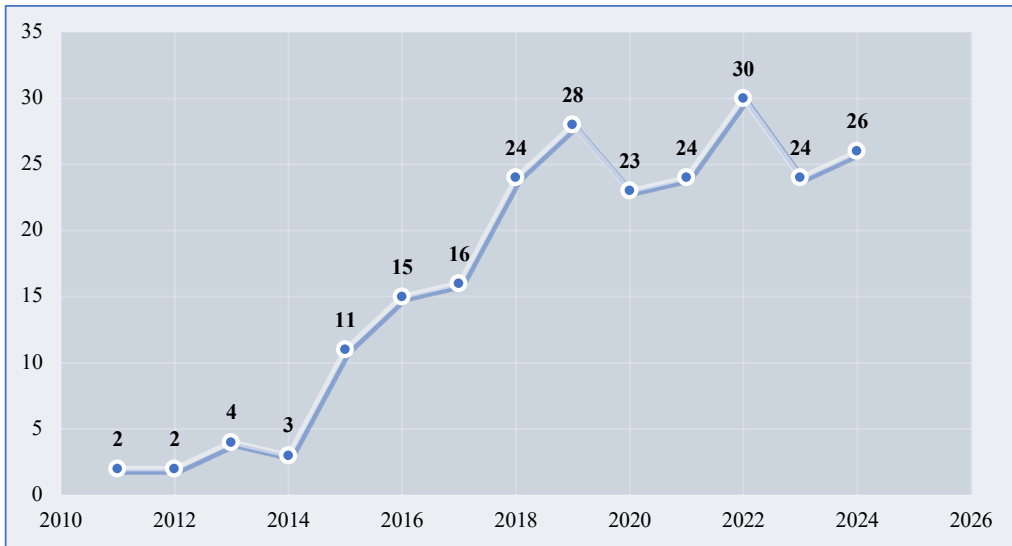


Figure 5: Bangladesh's RMG sector advancing environmental sustainability through the number of new green factories

Data source: (DF News Desk 2025). Prepared by the authors.

recycling systems to remove harmful chemicals, dyes, and other contaminants. Zero liquid discharge, reverse osmosis, and decentralized wastewater treatment systems are water recycling innovations in Bangladesh's garment industry (Nahiun et al. 2021). By reducing freshwater extraction and wastewater discharge, these technologies protect Bangladesh's rivers and groundwater, biodiversity, and agricultural and domestic water sources. Energy efficiency strategies optimize energy use, minimize emissions, and boost operational efficiency to lower carbon footprints. Energy efficiency projects include replacing outdated equipment with energy-efficient solutions, standardizing Light-Emitting Diode (LED) lighting, integrating renewable energy sources like solar panels and wind turbines, and adopting modern energy management systems. Research demonstrates that energy-efficient firms lowered energy use by 30%, lowering prices and Greenhouse Gas (GHG) emissions by decarbonizing industry, meeting global climate action goals through renewable energy integration (Bagdadee, Hossain, and Zhang 2024).

Bangladesh's garment industry is heavily influenced by global clients, particularly from the EU and the US, who prioritize environmental sustainability in procurement (Haque 2024). To meet these standards, international brands and merchants require strong environmental compliance terms in procurement contracts, including adhering to environmental standards like ISO 14001 or the Zero Discharge of Hazardous Chemicals (ZDHC) procedure (Sharpe and Berry 2021). Leading global customers like H&M and Marks & Spencer use sustainability scorecards to assess manufacturers' environmental performance, risking non-compliant factories losing contracts and market access. Noncompliance can lead to reputational damage, negative media coverage, and supply chain exclusion, negatively impacting industrial income and workers' lives. Thus, market pressure drives change in Bangladesh's clothing sector, with many firms adopting green practices to meet customer expectations. Global brands have implemented capacity-building initiatives to enhance suppliers' environmental performance, providing training, technical help,

and resources (Kumar Saha, Ng, and Fung 2024).

Bangladesh's national regulatory frameworks and global stakeholder demands have created a dynamic garment sector sustainability environment, with environmental compliance based on local laws and global buyer expectations adding responsibility. For instance, eco-friendly dyeing has reduced water pollution by 70%, improved aquatic habitats, and increased marketability (Akteer et al. 2023). Cost obstacles, lack of understanding among plant owners and workers, and the need for subsidies, low-interest loans, and training make eco-friendly dyeing procedures difficult to proliferate. Research found that just 68% of Bangladeshi garment workers got training before starting work, out of whom 44% received only one day (Rabbi et al., 2024). Dhaka, Gazipur, and Chattogram companies employ rooftop solar panels to generate clean energy from sunlight. Solar-powered activities include rooftop solar, battery storage, and GHG reduction (Chowdhury et al. 2024).

Sustainable garment production in Bangladesh has benefited the environment, and the green practices and certifications boost the industry's worldwide competitiveness and resilience (Fahim et al. 2024). Bangladesh's garment industry has reduced water and energy usage by 40%, improved community health, and gained worldwide competitiveness (Farhana et al. 2022). Sustainability-friendly regulations in Bangladesh enable green industrialization. The government is expanding green technology subsidies, streamlining certification, and providing technical and financial assistance to certified green enterprises (Bagdadee et al. 2024). Sustainable garment industry transformation in Bangladesh requires much more rigorous empirical research and innovation. Biodegradable and eco-friendly materials should be integrated to minimize synthetic fibres and hazardous chemicals in business. Circular economic concepts like clothes recycling and reuse are changing linear production to closed-loop operations.

To reduce waste and resource usage, factories are investing in technologies to recycle fabric scraps and repurpose clothing. Green funding, skills development, and policy framework improvement are needed to encourage SMEs to invest in sustainable technologies (Khan et al. 2024).

3.4. Social Sustainability in Bangladesh's Garment Industry

Sultana, Endut, and Hussain argued that Bangladesh's garment industry prioritizes social sustainability to balance economic growth, equitable social development, ethical work, and inclusiveness (Sultana, Endut, and Hussain 2021). Social sustainability in the garment industry of Bangladesh requires labour rights, welfare, community development, and ethical production to help the industry flourish socially and sustainably, benefitting workers, communities, and society (Saha, Akhter, and Hassan 2021). However, we observe a different scenario in this regard. Many garment workers earn below the living level, with the minimum monthly pay of approximately 113 USD being inadequate for basic sustenance (See Figure 6) (The Daily Star 2023).

Excessive working hours and overtime are also prevalent among Bangladesh's garment workers, with 90% working 10-12 hours per day, and 42% working more than 60 hours each week (Al Mamun and Hoque 2022). This has led to health issues and decreased productivity, bringing about long-term economic losses. In this respect, unionization and collective bargaining are crucial for labour rights. However, Bangladesh's garment industry opposes them. The trade unions help the workers negotiate fair salaries, improve working conditions, and ensure job security for the garment workers. Research found that only 10% of garment firms in Bangladesh have functioning trade unions, and legal limitations related to union registration hinder formation (Hossain and Akter 2022). Despite legal challenges and business hostility, the trade unions strive to enforce labour laws and promote worker

safety. Nevertheless, the garment workers in Bangladesh still have excessive hours, with the lowest wage rate among the top exporting countries (See Figure 7).

The garment industry in Bangladesh faced criticism after the 2013 Rana Plaza disaster. This led to significant changes in workplace safety and health standards (Frenkel, Rahman, and Rahman 2022). International efforts, such as the 2013 Bangladesh Accord on Fire and Building Safety (“the Accord”), have focused on industrial safety, resulting in large-scale inspections aimed at reducing risks to workers. By October 2018, Accord engineers had uncovered over 122,000 safety

violations across covered factories; 90% of these identified hazards had been confirmed as remediated. More than 470 facilities achieved full compliance, and 934 factories completed at least 90% of the required improvements. To sustain worker engagement, over 300 joint labour-management Safety Committees were established and trained, while the Accord’s grievance system resolved upwards of 290 complaints. These achievements underlined the Accord’s transformative impact on industry safety standards and worker empowerment in Bangladesh (WSR 2023).

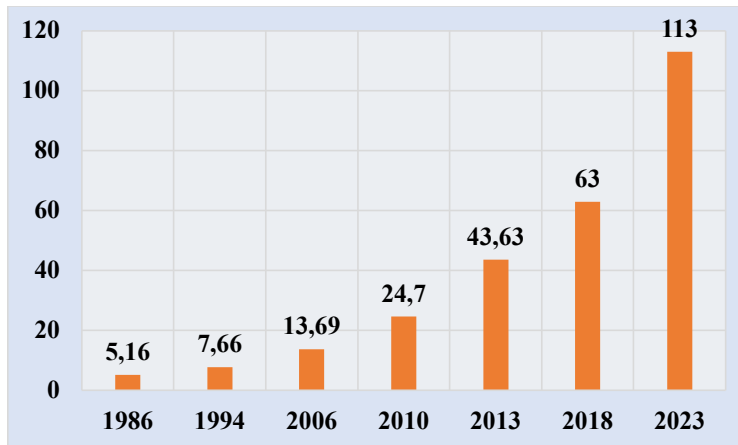


Figure 6: Minimum monthly wage for garment workers in Bangladesh in 2023 (USD)
 Data source: (The Daily Star 2023). Prepared by the authors.



Figure 7: Minimum monthly wage (USD) of garment workers in the top exporting countries 2023
 Data source: (Muhammad 2023). Prepared by the authors.

Since the International Accord's remit ended in mid-2021 and oversight transitioned to the RMG Sustainability Council (RSC) and government inspectors, data indicate an initial decline in fatal accidents followed by a worrying resurgence. Worker deaths in Accord-covered factories fell from 15 in 2017 to just 1 in 2020, reflecting intensive inspection and remediation efforts; however, fatalities rebounded to 13 in 2021, the first year of the Accord's exit. Similarly, non-fatal incident reports dropped by 72% between 2018 (4,528) and 2020 (1,275) in Accord-affiliated factories but then rose by 18% in 2022 as independent monitoring diminished and the RSC's audit capacity lagged.

In addition, smaller factories remain largely outside both Accord and RSC scrutiny. The Centre for Policy Dialogue (CPD) found that only 42% of these units had any formal safety committee in 2023, compared with 94% among larger, export-league members. Without the Accord's independent, worker-led grievance mechanisms, many of these small sites reverted to minimal compliance (CPD 2024). Thus, enforcement consistency has proven illusory. Government inspections in 2024 covered just 28% of registered factories, down from 67% under Accord auspices. Rural and peri-urban workshops were most frequently bypassed. Long-term safety outcomes, therefore, hinge on extending the Accord's core accountability mechanisms—third-party audits, worker participation in safety committees, and public disclosure of remediation status—to all tiers of suppliers (Haque 2024).

Furthermore, access to healthcare is a major occupational health issue in garment manufacturers, with workers without employer-sponsored health benefits being more susceptible to injuries and chronic diseases. Garment workers often face respiratory, musculoskeletal, and mental health difficulties due to insufficient ventilation, repetitive jobs, and high-stress settings. In 2024, 67% of workers faced a lack of access to first-aid facilities or on-site

medical professionals (Syed and Karim 2024). Employer-led health initiatives have been launched to address these gaps, such as HERhealth offering prenatal care, dietary assistance, and awareness campaigns to female workers. In this regard, it is also important to note that Brand-NGO collaborations like CARE Bangladesh provided basic health care at factory-based clinics, helping 15% of workers (Sultana, Endut, and Hussain 2021).

In addition, the garment industry in Bangladesh has significantly impacted gender equality by employing millions of women. It led to financial independence and challenging traditional gender roles. Women make up 80% of the industry, accounting for four million out of five million workers (Akter, Teicher, and Alam 2024). This has led to economic empowerment, reduced gender gaps, and social change, with a shift in family attitudes towards women working outside the home. However, women are underrepresented in higher-paying, technical, and management occupations, primarily as sewing machine operators. The industry's "glass ceiling" significantly inhibits women's job advancement, with 5-10% of managers and supervisors being women (Macchiavello et al. 2024). Gender-based violence and harassment (GBVH) in the garment industry undermine workplace safety and women's empowerment. In 2022, 50% of female garment workers experienced workplace harassment, including verbal abuse, intimidation, and physical assault (Nath and Tomisra 2024).

The garment industry sector has a substantial impact on rural and peri-urban areas of Bangladesh, driving economic and social growth. Garment manufacturing often boosts local economies through infrastructure development, healthcare facilities, economic multiplier effects, and social infrastructure investments. Despite the challenges of underage labour, focused projects and changes have shown promise. UNICEF predicted that 4.30% of informal garment manufacturing workers in Bangladesh were

under 14, mostly in small, unregistered sub-contractor facilities (Ondekova 2021). Government and NGO collaborations have promoted children's transition from job to school, with initiatives like the Child Labor Elimination Project enrolling 12,000 former child labourers in school and conditional cash transfer programs lowering dropout rates in garment-dependent areas by 18% (Ouchi and Reza 2022).

The global garment supply chain is increasingly focusing on ethical sourcing and customer responsibility due to consumer awareness and demand for socially responsible manufacture. Global certifications help set ethical standards, such as Fair Trade, SA8000, and GOTS certifications (Das and Das 2024). Consumer demand for transparency has been increasing, with 67% of global clothes buyers considering ethics in 2021 (Haque 2024). Ethical sourcing now includes environmental sustainability, with over 200 Bangladeshi manufacturers adopting eco-friendly sourcing techniques. Global brand pressure enforces strict social sustainability standards on Bangladeshi garment companies, influencing their ethical behaviour. In 2022, 85% of big garment manufacturers in Bangladesh needed ethical audits to maintain contracts with prominent global brands (Haque 2024).

Despite progress in recruiting marginalized groups like slum dwellers and ethnic minorities, language and cultural hurdles hinder the integration of minority workers into the workforce (Nahar 2024). The slum dwellers are the urban poor who are deprived of access to basic needs and lead a very impoverished life, being stuck in the poverty cycle (Rahman and Hill 2019). In the meantime, the ethnic minorities across the country are also striving to ensure a better life by getting engaged in employment, generating activities like garment work. In this regard, industry initiatives include diversity-focused recruiting drives, factory awareness initiatives, and hiring of marginalized workers (Hoque et al. 2022). However, fewer than 1% of Bangladesh's garment

industry workforce are people with physical disabilities, most of whom are employed in non-production roles due to limited manufacturing space (Akter et al. 2024). Barriers to inclusion include physical accessibility issues and limited training programs for differently abled persons. Micronational businesses have implemented pilot initiatives to encourage the inclusion of differently abled personnel, such as hiring 150 differently abled workers in 2021 (Macchiavello et al. 2024). Government programs like the "National Action Plan for Persons with Disabilities" aim to raise employment rates for physically challenged people in all industries, including garments. Moreover, Bangladesh's garment industry's inclusivity policies have led to beneficial results in factories, with the businesses employing physically challenged personnel having greater employee satisfaction and better team chemistry (Karanikas and Hasan 2022).

Notwithstanding over a decade of pressure from the international community, legal frameworks, and reform initiatives following the Rana Plaza collapse, Bangladesh's RMG sector still grapples with deep-rooted social sustainability issues. The most palpable social issues lie in the stark disconnect between worker wages and living costs. Although Bangladesh increased the minimum wage from BDT 8,000 to BDT 12,500 (\$113) in December 2023—the first increase in five years—this adjustment falls catastrophically short of addressing workers' basic needs.

The Global Living Wage Coalition estimates that a living wage for Dhaka requires BDT 27,900 (\$238) per month, meaning current wages provide only 38% of what workers need for decent living standards (Industrial Union 2024). Also, research by the Bangladesh Institute of Labour Studies finds that 68% of garment workers have no family savings, whereas 42% are burdened with long-term debt. Workers consistently report being incapable of affording basic necessities without overtime work (Swed-watch 2024). This dependency on excessive

overtime—averaging 12-16-hour shifts, seven days a week—shows the way poverty wages systematically dent workers' bargaining power, causing exploitative labour practices (Swedwatch 2024).

The systematic suppression of trade union activities is perhaps the most critical barrier to social sustainability reform. The 2023-2024 wage protests revealed the violent extremes of union suppression, with four workers killed, over 160 arrested, and approximately 40,000 facing criminal charges. Many were through "open and nameless warrants" that allow factory owners to intimidate any worker who speaks out. The Clean Clothes Campaign reports that 30,000 workers remain under arbitrary charges that could result in life imprisonment, creating a climate of fear that effectively silences labour organising. This systematic criminalization of worker protest is an instance of how the state apparatus collaborates with capital to maintain exploitative conditions (Cleanclothes 2023).

Also, the failure of reforms to address fundamental social issues is the political economy of Bangladesh's export-dependent development model. The blurring of lines between the garment owners and state power, i.e., state-business nexus, has created "regulatory capture" in which industry interests systematically override worker welfare concerns (Sultana 2023). Moreover, the reduction in female employment from 80% to 60% over recent years, attributed to automation and "re-masculinisation" of production, lets us comprehend how change can deepen gender-based exclusion (Kabir, Maple, and Usher 2025). However, the persistence of social issues in Bangladesh's RMG sector is with the limitations of compliance-based approaches that fail to address structural power imbalances in global supply chains. Meaningful social sustainability necessitates the transformation of the fundamental architecture of apparel production, with labour law enforcement and workers' collective bargaining power.

4. Challenges Ahead and Ways Forward

Bangladesh's export-driven RMG sector now faces six interlocking obstacles that could stall its sustainability transition.

1. Labour rights and decent work. Real wages remain below subsistence, and union density is below 10 %, especially in subcontracted plants (The Daily Star 2023).

Ways Forward: Enacting ILO-aligned livingwage legislation, streamlining union registration, and requiring buyer co-investment in wageescalator clauses.

2. Environmental stewardship. SMEs still discharge untreated effluent and consume up to 10,000 L of water per kg of cotton fabric.

Ways Forward: Applying tiered compliance rules, pair them with subsidised greentech-nology loans, and build cluster-level CETPs through public-private partnerships.

3. Competitive squeeze. Price pressure from brands and rivalry with Vietnam, Cambodia, and Ethiopia depress margins and deter R&D (Reinecke & Donaghey 2015).

Ways Forward: Shifting from cutmaketrim to fullpackage and designtodelivery services, join RCEP/GSP+ platforms, and negotiate ethical pricepremia tied to verified ESG metrics.

4. Political and trade volatility. Labor unrest and tariff uncertainty erode buyer confidence (Huq 2023).

Ways Forward: Institutionalizing social-dialogue forums, enforcing labour law predictably, and strengthening trade diplomacy to protect preferential access.

5. Technological lag. Automation, CAD/CAM, and data analytics are limited to a handful of lead firms (Tiwari & Roy 2024).

Ways Forward: Scaling the "Smart Garments Vision 2030" via industry–university innovation hubs, tax credits, and concessional finance for Industry 4.0 upgrades.

6. Linear production logic. Circularity and textile recycling remain embryonic (Khan et al. 2024).

Ways Forward: Offering fiscal rebates for recycled fibre, mandating take-back

schemes, and developing reverse logistics clusters to valorise fabric waste.

Thus, tackling these challenges can transform sustainability from a compliance burden into a durable source of competitive advantage for Bangladesh's RMG industry.

Conclusion

This study has explored the sustainability trajectory of Bangladesh's Ready-Made Garment (RMG) industry through the integrated lens of the Triple Bottom Line (TBL) framework, encompassing economic, environmental, and social sustainability. Economically, the RMG sector remains the linchpin of Bangladesh's export economy, contributing over 84% of national foreign exchange earnings. However, this growth is underpinned by a low-value, labour-intensive model that leaves the country exposed to supply chain volatility and buyer-driven price suppression. Innovation and automation remain nascent, especially among small and medium enterprises. Environmentally, Bangladesh has made notable progress with the highest number of LEED-certified green factories globally. Yet, environmental sustainability is asymmetrically adopted, with thousands of unregulated subcontractors continuing to pollute water systems, over-consume groundwater, and emit greenhouse gases. Green transformation has largely remained compliance-driven rather than systemically embedded. Socially, the sector's massive female workforce has contributed to transformative shifts in gender roles and rural livelihoods. However, low wages, excessive hours, weak unionization, and harassment continue to undermine the rights and dignity of workers. The post-Rana Plaza safety architecture has improved compliance in registered factories but remains limited in scope and enforcement capacity. Taken together, these findings suggest that Bangladesh's garment sector stands at a sustainability crossroads. While the policy discourse and regulatory framework have evolved significantly since 2013, the implementation remains fragmented and unequal across firm

sizes, regions, and stakeholder tiers. Thus, without coordinated reforms and equitable interventions, the RMG industry risks falling short of both global expectations and its domestic development promise.

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