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CBAM POLICY DEVELOPMENT, ADAPTATION AND COMPLIANCE: A CASE STUDY OF TEXTILE SECTOR IN PUNJAB

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INTRODUCTION – WHY THIS MATTERS

The European Union introduced the **Carbon Border Adjustment Mechanism (CBAM)** to prevent “carbon leakage.” It links import rules to the EU carbon pricing system, the EU Emissions Trading System.

- Imports must report and eventually pay for embedded carbon.
- Full financial obligations begin from 2026–27.
- Textiles are not yet covered, but may be included in future expansion.

Why Pakistan?

Textiles make up about 60% of Pakistan’s exports and 8.5% of GDP. Punjab hosts most textile production. Many firms rely on fossil fuels and lack strong carbon monitoring systems.

Risk: Higher costs, loss of EU market access, and reputational damage.

Opportunity: Access to climate finance, improved competitiveness, and integration into low-carbon global supply chains.

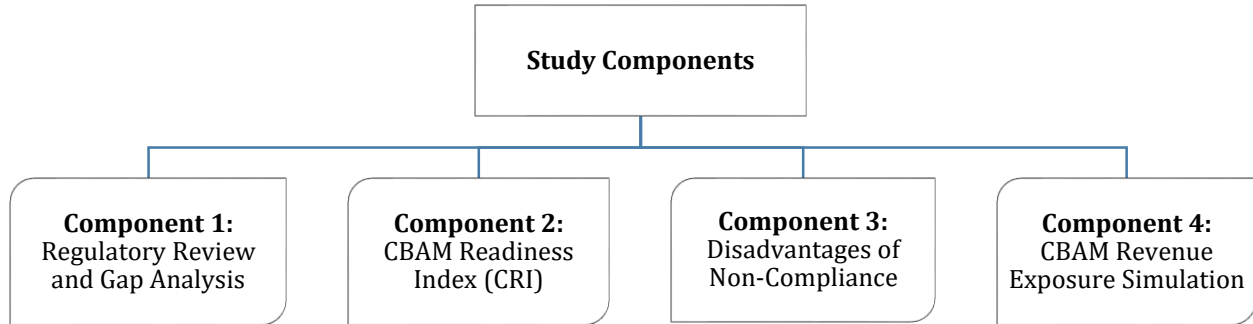
Across global studies, five clear points emerge:

1. CBAM is both climate and trade policy. It protects EU industry; pushing global decarbonization.
2. Developing countries are more exposed. Weak MRV systems and limited finance increase risk.
3. Energy policy consistency matters. Fossil fuel subsidies weaken incentives to decarbonize.
4. Finance is a key constraint. High upfront costs slow renewable and efficiency investments.
5. Measurement tools (indices) help policy targeting. Composite indices can benchmark readiness if designed transparently.

Figure 1 Study Design



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Source: Author's illustration.

COMPONENT 1 – REGULATORY REVIEW AND GAP ANALYSIS

Objective

To check whether Pakistan's climate and energy policies match CBAM requirements.

Specifically, it asks:

- Do Pakistan's rules support carbon reporting (MRV)?
- Are there carbon pricing or equivalent measures?
- Are energy efficiency and renewable supported?
- Is climate finance available for textiles?

The goal is to find **gaps** and identify **policy fixes**.

Method

- Reviewed official policy documents (2015–2025).
- Compared Pakistan's federal, Punjab, and industry rules with EU CBAM rules.
- Categorized findings as:
 - Full alignment
 - Partial alignment
 - Gap
- Cross-checked findings with stakeholder interviews and sector reports.

Key Findings

1. Strong Policy Intent – Weak Implementation

Pakistan has climate commitments and new carbon levy measures. It is preparing for carbon markets under Article 6.

- MRV systems are incomplete.
- Energy audits are limited.
- Verification capacity is weak.



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2. Major Policy Contradiction

There is a central tension:

- Pakistan introduces carbon levies.
- At the same time, it continues fossil fuel subsidies and unstable energy pricing.

This creates mixed signals. Firms delay investment because energy policy is unpredictable.

Short-term protection → Long-term trade risk.

3. Provincial Gaps (Punjab)

Punjab hosts most textile firms but shows:

- Low audit coverage among SMEs
- Limited accredited verifiers
- Weak cluster-level MRV systems

Provincial enforcement is uneven.

4. Industry Action (APTMA)

The All-Pakistan Textile Mills Association has:

- Created compliance centers
- Promoted energy audits
- Encouraged solar adoption

Large exporters show high awareness. But **awareness ≠ verified readiness**.

5. Energy Policy is the Biggest Barrier

Firms report:

- Uncertainty from captive power levies
- Changes in solar net billing rules
- Difficulty planning long-term investments

This slows renewable adoption, which is central to CBAM readiness.

Bottom Line for Policymakers

- Pakistan has climate policy direction.
- Implementation capacity is the weak point.
- Energy policy inconsistency is the main structural risk.
- SMEs are most vulnerable.

Without coordinated reform (energy pricing, MRV systems, green finance), Pakistan may face external carbon costs without being prepared.



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Table 1 Policy Alignments & Gaps

Policy area	Brief status	Key gap / implication
Carbon pricing / levies	Federal carbon levy in place (FY25–26)	No domestic ETS or crediting vs CBAM → risk of double charges and policy uncertainty
Emissions reporting (MRV)	NDC, national audit rules, APTMA support	Weak provincial enforcement, few accredited verifiers, low product-level footprints → default CBAM values risk
Energy efficiency & renewables	MEPS and 2030 renewables target; some solar uptake	Renewable share in textiles <7%; prosumer rule changes hurt solar bankability → firms delay clean energy investments
Green finance	NCFS and green windows exist	Textiles receive <3% of climate finance; large CAPEX gap → inadequate funding for MRV & renewables
Governance & equity	Social-protection measures and industry bodies active	Provincial capacity uneven; integrity and oversight gaps in new market instruments → implementation risk for clusters
Traceability & waste	EU DPP and Circular Strategy incoming; some industry pilots	Weak supplier tracing and recycling systems → exposure to DPP/EPR rules and trade disruption
Sector (textiles) – practical	Targeted audits, sustainability centres, APTMA initiatives	High fossil dependence (~64%) and SME lag on MRV → cluster solutions and SME support needed

Note: Table summarizes current policy instruments, the main implementation gaps, and the immediate implications for CBAM readiness in Pakistan’s textile sector.

Source: Author’s compilation.

COMPONENT 2 - CBAM READINESS INDEX (CRI)

Objective

- Measure how prepared textile exporters are for EU carbon and sustainability rules.
- Develop a firm-level CBAM Readiness Index (CRI).
- Classify firms into Low, Moderate, and High readiness.

Sample: 27 EU-exporting textile firms.

Method

Each readiness indicator was normalized to a 0–1 scale and grouped into ten pillars. Pillar scores were averaged and then combined into an overall CRI score (0–100).

To ensure robustness, three aggregation methods were used:

- 1) Expert-weighted (main specification),
- 2) Equal-weighted (neutral benchmark),
- 3) PCA-based (data-driven statistical weighting).

Firms were classified as:

- Low readiness (<50),
- Moderate readiness (50–74),
- High readiness (≥75).

This multi-method approach ensures that findings are not driven by subjective weight choices.

Two robustness checks were also computed: an equal-weighted CRI and a PCA-driven CRI, where data-derived loadings determine weights. All CRI scores were scaled to 0–100 and grouped into low, moderate, and high readiness bands. Reliability and sensitivity tests confirm that results are



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stable across methods, strengthening confidence in the CRI as a policy tool for identifying compliance gaps and prioritizing interventions.

Table 2 Summary Statistics for CRI Scores Across Methods

CRI Method	Observations	Mean	Std. Dev.	Min	Max	Mean band
Expert-weighted (main)	27	66.83	12.09	43.82	84.94	Moderate
Equal-weighted	27	64.21	10.93	43.60	83.05	Moderate
PCA-driven (data-driven)	27	55.40	29.04	0.00	100.00	Moderate

Notes: CRI scaled 0–100 (higher = more ready). Readiness bands: Low < 50; Moderate 50–75; High ≥ 75. Sample = 27 major/export-intensive textile firms (Punjab-focused). Missing pillar values imputed with pillar medians.

Expert-weighted CRI is the primary metric; equal- and PCA-driven versions are robustness checks (all show broadly consistent moderate readiness).

Source: Author’s estimations.

Table 3 Firm Counts and Percentages by Readiness Level

Readiness Level	Expert-Weighted	Equal-Weighted	PCA-Driven
Low (<50)	3 firms (11%)	2 firms (7%)	11 firms (41%)
Moderate (50-75)	15 firms (56%)	19 firms (70%)	7 firms (26%)
High (≥75)	9 firms (33%)	6 firms (22%)	9 firms (33%)

Source: Author’s estimations.

Structural Patterns

- Emissions and energy transition move together.
- Firms strong in MRV are also strong in governance.
- Financial readiness varies more across firms.
- Larger EU exporters tend to score higher.

Key Findings

- Most firms are moderately ready.
- One-third are highly ready.
- Only a small group remains low readiness.
- Rankings are statistically stable.
- Emissions and reporting capacity are improving.
- Financial and SME capacity gaps remain.
- Readiness is uneven but progressing.
- Leading exporters are not starting from zero.
- Policy support should now focus on scaling, not awareness.

COMPONENT 3 - DISADVANTAGES OF NON-COMPLIANCE

Objective

- Compare **Non-Compliance Cost (NCC)** with **Compliance Cost (CC)**.
- Check whether compliance is economically worth it.
- Use normalized index values (not exact monetary liabilities).

Sample: 27 textile exporters (Low = 3, Moderate = 15, High = 9).



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Main Equations Used

Table 4 Core Economic Framework

Concept	Simple Formula	What It Means
Non-Compliance Cost	$NCC_i = ETS_i + SL_i$	Total expected penalty from not complying
Short-Run NCC	$NCC_i(SR) = SL_i$	Only strategic losses (no carbon tariff yet)
Long-Run NCC	$NCC_i(LR) = ETS_i + SL_i$	Carbon price + strategic losses
ETS Shadow Exposure	$ETS_i = E_i \times S_i \times P$	Emissions \times EU share \times carbon price
Strategic Loss	$SL_i = SR_i \times \lambda_i$	Market & finance risk adjusted by readiness
Compliance Cost	$CC_i = CI_i \times R_i \times \theta$	Investment cost (1–3% of revenue)
Net Advantage of Compliance	$NAC_i = NCC_i - CC_i$	If positive \rightarrow compliance pays

Source: Author's estimations.

Where:

- E_i = emissions proxy
- S_i = EU export share
- P = assumed EU carbon price (€80–€120)
- λ_i = readiness weight
- θ = assumed compliance cost share (1–3%)

Main Aggregate Results

Table 5 Average Results Across ETS Scenarios

Scenario	Avg NCC	Avg CC	Avg NAC
Low ETS (€80)	1.70	0.03	1.67
Baseline (€95)	1.97	0.06	1.91
High ETS (€120)	2.42	0.10	2.32

Source: Author's estimations.

Clear Pattern:

- Non-compliance costs increase with carbon price.
- Compliance costs remain small.
- NAC is positive in all scenarios.

Table 6 Results by Readiness Tier (Baseline €95)

Tier	NCC	CC	NAC
Low	0.70	0.05	0.65
Moderate	1.31	0.06	1.24
High	3.51	0.07	3.44

Source: Author's estimations.

Table 7 What Drives Risk? (Baseline)

Tier	ETS Exposure	Strategic Loss	Main Risk Driver
Low	0.20	0.50	Strategic risk
Moderate	1.01	0.30	Mixed
High	3.35	0.16	Carbon price exposure

Source: Author's estimations.



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Table 8 percentage of Firms Where $NAC > 0$ (Does Compliance Pay?)

Tier	Firms Benefiting
Low	100%
Moderate	93%
High	100%

Source: Author's estimations.

Statistical Validation

- Tier differences are statistically significant ($p < 0.01$).
- Higher CRI → higher economic gain from compliance.
- EU export share is the strongest predictor of vulnerability.
- Model explains 87% of variation ($R^2 = 0.87$).

Key Findings

- Non-compliance is already costly; even before full carbon tariffs.
- Compliance costs are small compared to expected penalties.
- Higher carbon prices increase non-compliance losses sharply.
- 93–100% of firms benefit economically from compliance.
- EU export share drives vulnerability more than internal weakness.
- High-readiness firms face higher absolute risk because they export more to the EU.
- Low-readiness firms face capacity and strategic risk gaps.
- Delaying compliance increases long-term exposure.
- Compliance is economically justified for almost all firms.

COMPONENT 4 - CBAM REVENUE EXPOSURE SIMULATION

Objective

This simulation estimates the potential export revenue at risk if large Pakistani textile exporters fail to comply with the EU CBAM and consequently lose access to the European Union (EU) market.

Table 9 Main Equations used in Simulation

Step	Formula	What It Means
EU exposure per firm	$EU\ Exports_i = Export\ Value_i \times \alpha_{EU}$	Firm's exports × EU share (27.6%)
Total exposure (Top N)	$Total\ EU\ Exposure = \sum EU\ Exports_i$	Sum of EU exports of large firms
Revenue loss (no diversion)	$Loss_{100} = Total\ EU\ Exposure$	All EU sales lost
Revenue loss (50% diversion)	$Loss_{50} = Total\ EU\ Exposure \times 0.5$	Half of EU sales redirected
Revenue loss (75% diversion)	$Loss_{25} = Total\ EU\ Exposure \times 0.25$	Only 25% EU sales lost

Source: Author's estimations.



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Table 10 Results - Simulation

Scenario	Estimated Revenue at Risk (USD)
No diversion (100% lost)	1.38 billion
50% diversion	690 million
75% diversion	345 million

Source: Author's estimations.

Table 11 Sensitivity Results - Simulation

Assumption Change	Exposure Range
EU share 25%-35%	1.25-1.75 billion
Top 15-Top 30 firms	1.19-1.69 billion

Source: Author's estimations.

Key Findings

- EU exposure among the Top 20 firms is about USD 1.38 billion.
- These firms account for over 15% of Pakistan's total EU textile exports.
- Even if half of exports are redirected, USD 690 million remains at risk.
- Exposure remains high under all sensitivity tests.
- Risk is concentrated in a small number of large exporters.
- CBAM non-compliance is therefore a major export risk, not a minor regulatory issue.

Bottom Line: Between USD 0.35-1.75 billion in textile exports could be at risk depending on market diversion and EU dependence.

SYNTHESIS OF KEY FINDINGS

Taken together, the four components show a clear pattern: CBAM compliance is no longer just an environmental obligation but a competitiveness strategy. Pakistan has policy intent and growing firm-level awareness, but implementation gaps, energy policy instability, and financing constraints slow progress. The CRI confirms that readiness is measurable and uneven across firms, while the economic analysis shows that non-compliance already carries real and rising costs mainly through buyer loss and market access risk rather than tariffs alone. Simulations further demonstrate that delays will become increasingly expensive as EU climate policy tightens. In short, early, predictable, and well-supported transition policies can convert carbon risk into competitive advantage, whereas uncertainty and delayed adjustment increase both firm-level and national export vulnerability.

Policy Recommendations

To protect textile exports and prepare for possible CBAM expansion, Pakistan needs clear and stable policy action.

1. Stabilize Energy Policy (Immediate Priority)

- Freeze or stabilize the captive power levy for export industries (2026-2028).
- Link relief to verified renewable energy adoption.



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- Restore predictable net-metering or introduce a fair export tariff for large industrial solar users.

Goal: Give firms confidence to invest in clean energy.

2. Build Strong MRV Systems

- Create pooled MRV platforms for clusters (shared systems for SMEs).
- Expand accredited verifiers and transparent carbon registries.
- Subsidize product-level carbon footprinting and third-party verification for SMEs.

Goal: Move from awareness to verified compliance.

3. Develop a Clear Carbon Pricing Roadmap

- Design a domestic carbon pricing or crediting system aligned with EU principles.
- Avoid a “double burden” (domestic carbon levies + future CBAM charges).

Goal: Align trade and climate policy.

4. Expand Green Finance

- Scale concessional loans and blended finance under the National Climate Finance Strategy.
- Link export credit and trade finance to verified MRV adoption.
- Prioritize firms with high EU exposure but moderate readiness.

Goal: Reduce upfront compliance costs.

5. Use the CBAM Readiness Index (CRI) as a Policy Tool

- Adopt the CRI as a national benchmarking tool.
- Target support based on readiness tiers (low, moderate, high).
- Update CRI regularly (e.g., every two years).
- Use it in public-private policy dialogue.

Goal: Direct support where risk is highest.

6. Treat CBAM as a Trade Issue, Not Just Environmental

- Embed CBAM compliance into export and industrial policy.
- Create early-warning systems using CRI and export data.
- Engage EU buyers and financial institutions in co-financing compliance.

Goal: Protect market access and competitiveness.

CORE MESSAGE

Without stable energy rules, strong MRV systems, and targeted finance, technical awareness will not translate into competitiveness. Policy coherence is now more important than policy intent.



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CONCLUSION

This research shows that Pakistan's textile sector is aware of CBAM requirements and many large firms have begun preparing. However, domestic policy instability, especially in energy pricing and renewable incentives, is slowing real investment. The evidence demonstrates that non-compliance risks, such as buyer exit, contract loss, and reputational damage, already outweigh the cost of gradual compliance for most exporters. CBAM is therefore not only an environmental issue but a trade and competitiveness issue. To protect EU market access, Pakistan must align energy, climate, finance, and export policy into one clear and predictable transition strategy. The challenge is no longer awareness; it is coherent implementation.