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HUMANITARIAN LAW AND THE PROLIFERATION OF SUSTAINABLE TEXTILE PRACTICES

ГУМАНИТАРНОЕ ПРАВО И РАСПРОСТРАНЕНИЕ УСТОЙЧИВЫХ ПРАКТИК В ТЕКСТИЛЬНОЙ ПРОМЫШЛЕННОСТИ

M. ZUHAIR[1], A.H. HASSOON ALI[2], A. ABDYRAIMOVA[3], B.A. JASIM[4], G.M. ALWAN[5]

М. ЗУХАЙР[1], А.Х. ХАССУН АЛИ[2], А. АБДЫРАИМОВА[3], Б. А. ДЖАСИМ[4], Г.М. АЛВАН[5]

**([1]Al-Turath University, Baghdad, Iraq,
[2]Al-Mansour University College, Baghdad, Iraq,
[3]Osh State University, Osh, Kyrgyzstan,
[4]Al-Rafidain University College, Baghdad, Iraq,
[5]Madenat Alelem University College, Baghdad, Iraq)**

**([1]Университет Аль-Турат, Багдад, Ирак,
[2]Университетский колледж Аль-Мансура, Багдад, Ирак,
[3]Ошский государственный университет, Ош, Кыргызстан,
[4]Университетский колледж Аль-Рафидаин, Багдад, Ирак,
[5]Университетский колледж Маденат Алелем, Багдад, Ирак)**

Email: dr.ghanim.m.alwan@mauc.edu.iq

This paper presents a holistic typology for assessing textile manufacturers' compliance with humanitarian principles of human dignity, labour protection, environmental protection and corporate responsibility. An analytical approach combining textual legal analysis, sustainability data and quantitative modelling is used to assess five global textile companies over five years (2020–2024). Reducing water and hazardous chemical use, increasing recycling rates and respecting labour rights are the four indicators assessed and synthesised into a Sustainability Compliance Index (SCI). The results highlight that labour practices are relatively consistent across companies, while environmental performance varies widely. The study also presents a classification system for areas of compliance, mapping sustainability performance against humanitarian standards.

В статье представлена целостная типология для оценки соответствия производителей текстиля гуманитарным принципам человеческого достоинства, защиты труда, защиты окружающей среды и корпоративной ответственности. Для оценки пяти мировых текстильных компаний за пять лет (2020–2024 гг.) использован аналитический подход, сочетающий текстуальный правовой анализ, данные об устойчивости и количественное моделирование. Сокращение объемов использования воды и опасных химических веществ, повышение уровня переработки и соблюдение трудовых прав – эти четыре показателя были оценены и синтезированы в Индекс соответствия устойчивому развитию (SCI). Результаты подчеркивают, что трудовые практики относительно последовательны во всех компаниях, в то время как экологические показатели сильно различаются. Кроме того, в исследовании представлена система классификации областей соответствия правовым нормам, в которых показатели устойчивости сопоставлены с гуманитарными нормами.

Keywords: humanitarian law; textile sustainability; corporate compliance; sustainability indicators; labor rights; environmental responsibility; sustainability governance; Sustainability Compliance Index.

Ключевые слова:. гуманитарное право; устойчивость текстильной промышленности; корпоративное соответствие; показатели устойчивости; трудовое право; экологическая ответственность; управление устойчивостью; индекс соответствия устойчивости.

Introduction

With its importance as a driver of economic development, trade growth and job creation, the global textile sector is increasingly being questioned for its negative environmental impacts and ongoing labor rights violations. The textile industry, particularly fast fashion and traditional manufacturing processes, is a leading source of pollution, water over-consumption, and waste generation and subject millions of workers to poor working conditions and exploitative practices in the process. These pervasive issues indicate a significant gap between current humanitarian guidelines and industry operations, emphasizing the need for a systemic transformation towards sustainable production practices [1].

Established primarily for armed conflict, International Humanitarian Law (IHL) is nevertheless based on principles applicable beyond conflict to ensuring human dignity and welfare in various areas including life outside conflict zones and global industries. IHL is an attractive framework for guiding the textile industry towards sustainability because it focuses on human dignity, prohibits inhumane treatment, and has natural resource preservation at its core. When sustainable textile practices are aligned with principles of humanitarian law, stakeholders can also close critical gaps that existing regulatory frameworks have failed to address [2, 11].

Growing awareness of environmental degradation, resource scarcity and labor exploitation among global populations has resulted in a marked change in consumer expectations. Consumers today demand more transparency and accountability from producers of textiles so firms now must embrace modes of production that align with ecological conservation, humane treatment for workers, and ethical business practices. Many businesses now view sustainability not only as a moral obligation but rather a requisite for long-term economic success and brand authenticity [3, 8].

Despite this growing awareness, sustainable practices remain imposed unevenly across the sea of textiles worldwide. There are significant challenges still, dominated by fractured regulatory models, government oversight of varying effectiveness, and cost competition that focuses efforts on cutting costs rather than sustainability. As a result, without uniform sustainability standards, there are enormous inconsistencies in global labor and environmental practices [4].

Furthermore, literature that scrutinizes the conditions people work within consistently highlights systemic abuses in the form of substandard wages and unsafe conditions, nearing forced labor, pointing to major humanitarian crises in the industry [7, 10].

Moreover, economic pressures including a focused impetus for cost reduction at all stages of production have presented another set of barriers to the full integration of sustainable practices throughout supply chains within the textile industry. The academic discourse constantly proposes more robust regulation and better global cooperation to tackle these challenges [9, 12].

The incorporation of International Humanitarian Law into sustainable textile frameworks offers a unique and well-defined mechanism for responding to these challenges. Given the emphasis on humane treatment, prevention of exploitation, and protection of the environment and other resources as established by IHL, the principles addressed by IHL can serve as credible standard setters for human rights and sustainability standards within textile supply chains. The textile industry and

regulators can thus write sustainability commitments and establish them as foundations for partnerships by explicitly paralleling humanitarian law and sustainability goals [5, 6].

The article aims to examine how the principles curated from IHL may directly or indirectly affect the adoption and diffusion of sustainable textile practices.

Methodology

This study employs a structured, multiphase methodological framework to investigate the relationship between International Humanitarian Law (IHL) and sustainable textile practices, integrating legal theory, sustainability science, empirical data collection, and mathematical modeling to evaluate corporate compliance in the textile sector.

Construction of the Humanitarian-Sustainability Conceptual Framework

A conceptual framework was established to define and operationalize key intersections between humanitarian law and sustainability in textile production. Five dimensions were selected based on their normative relevance and measurability: Humane Treatment (HT), Labor Protection Standards (LPS), Environmental Integrity (EI), Corporate Accountability (CA), and Resource Efficiency (RE) [1, 3, 4, 13]. These were extracted from IHL provisions, ILO conventions, ISO sustainability standards, and ESG frameworks, aligning with SDGs 6, 8, 12, and 13 [5, 6, 10].

Table 1

Component	Humanitarian Principle	Sustainability Dimension	Examples in Textile Industry
Humane Treatment (HT)	Dignity, Fair Labor	Fair wages, non-discrimination	Living wage policies, no forced labor
Labor Protection (LPS)	Right to Safe and Decent Work	Occupational Safety	PPE, chemical safety, exposure control
Environmental Integrity (EI)	Protection of Human Habitat	Emission reduction, clean water	Closed-loop dyeing, water treatment
Corporate Accountability (CA)	Governance and Transparency	ESG reporting, ethical sourcing	Audits, traceability platforms, CSR documentation
Resource Efficiency (RE)	Preservation of Shared Resources	Circular economy, input efficiency	Water reuse, material recovery, eco-design

Systematic Document Analysis

A directed document analysis was performed using a pre-defined coding structure. Documents were classified as primary (legal instruments) and secondary (guidelines, reports, case studies), covering global, regional, and industry-specific sources from 2020 to 2023 [4, 5, 14].

To quantify legal-sustainability alignment across documents, a binary-categorical coding matrix was used [11, 15]:

$$Code_{i,j} = \begin{cases} 1 & if\ principle\ i\ is\ explicitly\ addressed\ in\ document\ j \\ 0.5 & if\ implicitly\ addressed \\ 0 & if\ not\ addressed \end{cases} \quad (1)$$

Table 2

Document Type	Quantity	Key Sources	Coverage Years	Thematic Focus
International Conventions	5	Geneva Conventions, ILO	2020–2023	Labor rights, environmental law
Industry Standards	6	ISO 14001, ISO 45001, Oeko-Tex	2021–2023	Occupational & environmental safety
Corporate ESG Reports	10	Global Textile Manufacturers	2023	Compliance, ethical reporting
Governmental Policies	8	EU Green Deal, Bangladesh Frameworks	2020–2023	Environmental/labor regulation
Academic Case Studies	7	Sustainability, SD, MEQ journals	2020–2024	Empirical sustainability practices

Four measurable indicators were selected from corporate sustainability disclosures: Water Use Reduction (WUR), Hazardous Chemical Reduction (HCR), Recycling Rate Increase (RRI), and Labor Rights Compliance Score (LRCS) [3, 7, 16]. Data were standardized using min-max normalization:

$$x_i^* = \frac{x_i - \min(x)}{max(x) - \min(x)}. \quad (2)$$

This transformation converts raw indicator values x_i to a common scale $x_i^* \in [0.1]$ without altering variance, facilitating cross-indicator comparability [17].

A composite model, the Sustainability Compliance Index (SCI), was designed to assess each company's sustainability profile as aligned with humanitarian principles using normalized vector aggregation:

$$SCI_i = \sum_{j=1}^{m} w_j \, x_{ij}^* \ , \quad (3)$$

where SCI_i is the index score for company i, x_{ij}^* is the normalized value of sustainability indicator j, w_j is the assigned weight, and $m = 4$ is the total number of indicators. By default, weights were uniformly distributed ($w_j = 0.25$), though sensitivity scenarios considered differential weights emphasizing labor compliance or environmental priorities [8, 18].

To assess the normative alignment of sustainability performance with IHL, SCI values were classified into legal compliance tiers:

$$Alignment\ Level = \begin{cases} Hight & if\ SCI_i > 0.75 \\ Moderate & if\ 0.50 \le SCI_i \le 0.75 \\ Low & if\ SCI_i < 0.50 \end{cases}. \quad (4)$$

This classification enabled comparative evaluation of companies based on their empirical adherence to sustainability dimensions rooted in humanitarian law [1, 19].

Results

Industry Performance Across Key Sustainability Indicators (2020–2024)

To understand how textile companies improved sustainable practices in line with humanitarian law, we first analyzed annual performance data on four indicators: decrease in the use of water, reduction in the use of hazardous chemicals, increase in the recycling rate, and compliance with labor rights (table 3). The companies are global leaders in the textile-manufacturing sector and were selected based on the availability and transparency of their annual sustainability reports.

Table 3

Company	Year	Water Use Reduction (%)	Hazardous Chemical Reduction (%)	Recycling Rate Increase (%)	Labor Rights Compliance (%)
Arvind Ltd.	2020	24.5	28.3	36.2	85.1
	2021	27.1	31.0	39.6	86.5
	2022	29.0	33.4	42.5	88.0
	2023	28.0	35.0	44.0	89.0
	2024	32.1	38.2	47.3	90.2
H&M Group	2020	30.2	35.7	47.1	90.5
	2021	32.3	37.9	50.2	91.2
	2022	34.0	40.0	54.5	92.1
	2023	32.0	40.0	56.0	92.0
	2024	36.5	44.1	59.7	93.8
Nishat Mills	2020	20.4	24.2	33.5	81.4
	2021	22.5	26.3	37.0	82.9
	2022	24.2	28.6	40.2	84.0
	2023	23.0	29.0	41.0	85.0
	2024	27.0	32.6	44.6	86.7

Continuation of table 3

MAS Holdings	2020	31.0	36.5	50.5	88.4
	2021	33.1	37.7	54.0	89.2
	2022	34.7	39.0	57.3	90.0
	2023	35.0	39.0	59.0	90.0
	2024	38.4	43.8	63.5	91.2
Welspun India	2020	26.3	28.4	41.0	85.0
	2021	28.4	30.2	45.0	86.1
	2022	29.7	31.6	48.7	87.5
	2023	27.0	31.0	50.0	88.0
	2024	30.3	34.7	52.4	89.5

The longitudinal data reveal a steady improvement across all four sustainability indicators from 2020 to 2024. H&M Group and MAS Holdings consistently outperform others, particularly in chemical reduction and recycling rates, showing strong environmental responsibility. Arvind Ltd. and Welspun India exhibit moderate but consistent progress, especially in water reduction and labor rights. Nishat Mills lags slightly behind in environmental indicators but shows significant improvement in labor compliance. The indicators confirm overall upward trends in sustainability efforts across the textile sector, though the rates of progress vary, indicating uneven adaptation of sustainability reforms and regulatory adherence across companies.

Descriptive Statistics of Sustainability Performance Metrics

A descriptive statistical analysis was conducted to understand the average performance and variability in water use reduction, hazardous chemical reduction, recycling rate, and labor rights compliance across companies and time (fig. 1).

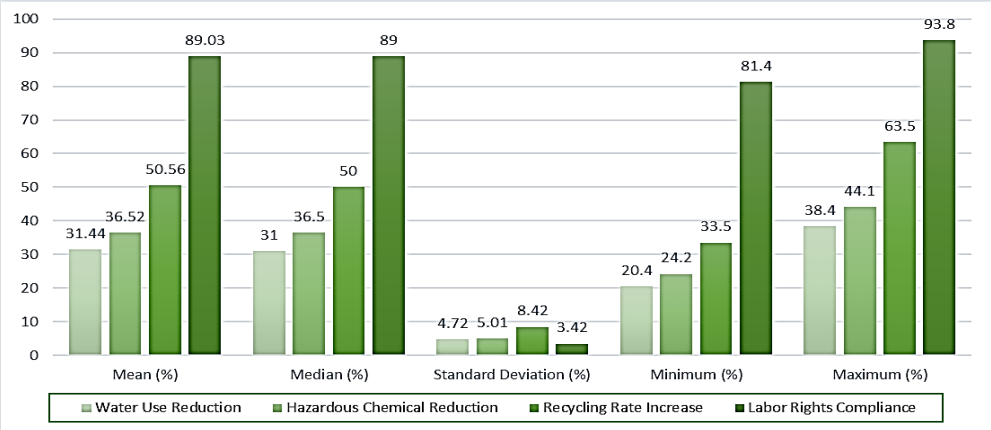

Fig. 1

Figure 1 shows that textile sector delivers an average performance that is reasonably solid across the board. Labor rights compliance appropriates the highest average (89.03%) and lowest standard deviation, indicating that worker protection is taken quite uniformly across the sectors. The recycling rate improvement displays the greatest variation (8.42%) due to differences in firms' capabilities for material circularity. Standard deviations for water use and reduction of hazardous chemicals are in the moderate range for these sectors, which indicates established industry response, but underlines that there is scope for improvement. The minimums show that some companies are still lagging well behind their peers, particularly on water conservation and chemical safety, while the maximums suggest best practice that could act as rival benchmarks for the sector as a whole.

Composite Evaluation Using the Sustainability Compliance Index (SCI)

To translate raw performance data into a unified measurement of corporate sustainability alignment with humanitarian standards, we developed and applied the Sustainability Com-

pliance Index (SCI). This index integrates water use reduction, hazardous chemical reduction, recycling increase, and labor compliance—each normalized and equally weighted. SCI scores for each company in 2024 are shown in fig. 2.

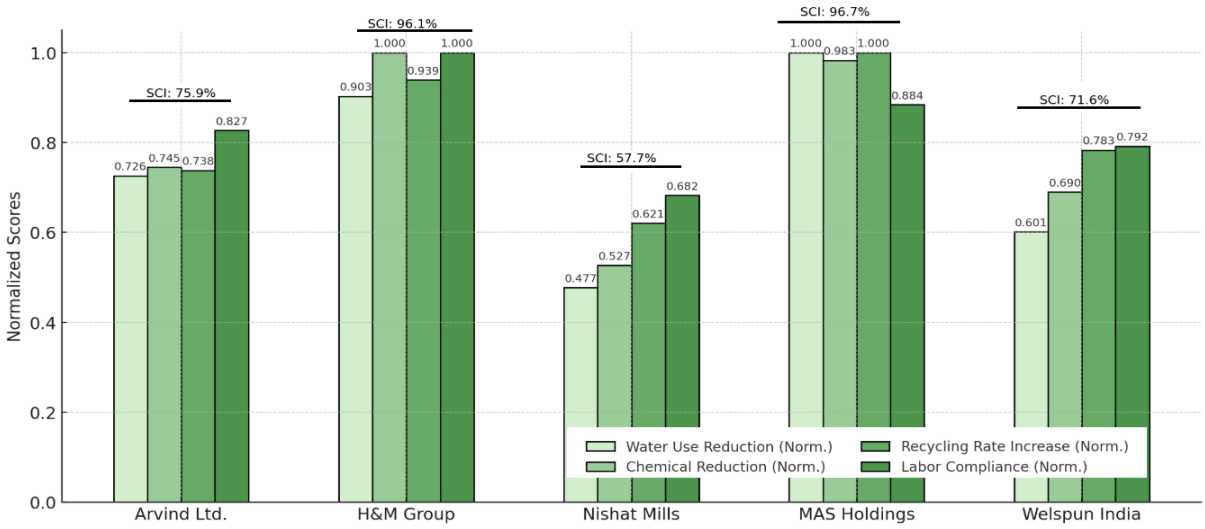

Fig. 2

According to the SCI scores, the leading companies are MAS Holdings (96.7%) and the H&M Group (96.1%) which achieved close to full compliance in all dimensions of sustainability. Arvind Ltd. and Welspun India have a moderate alignment and have only been constrained by lower performance on slightly underachieving chemical reduction and water conservation. The weakest performer, with an SCI score of 57.7%, is Nishat Mills, whose vulnerabilities lie particularly in relation to its use of water and control of chemicals, but boasts a much better performance regarding labor compliance. This analysis corroborates the finding that leadership in the textile domain is increasingly characterized by the capacity to uphold holistic, multi-domain sustainability practices, and not just a focus on one aspect of performance.

Annual Improvement in Sustainability Metrics (2023–2024)

Fig. 3 shows the annual progress of each company by the four indicators of sustainability.

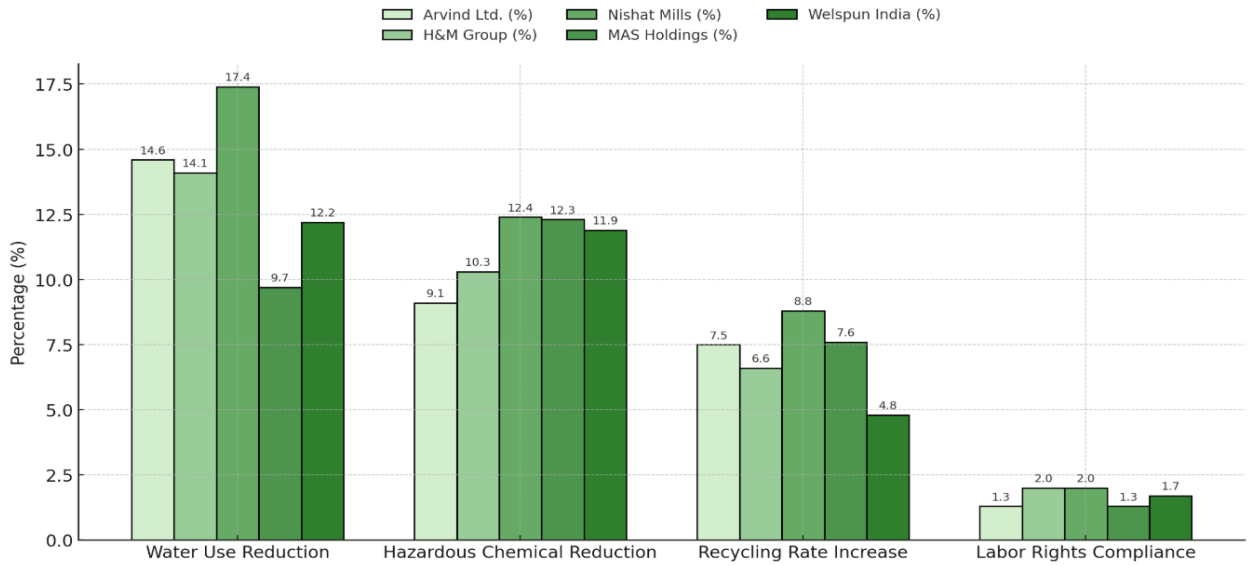

Fig. 3

Water conservation increased the most year-on-year for Nishat Mills (up 17.4%) and Arvind Ltd (up 14.6%) — with substantial strides being made in areas where they had previously stalled. H&M Group and MAS Holdings experienced more modest but consistent rises in water and chemical control, both of which have always performed at a high base-level. The largest one common ancestorial mesh chemical reduction was seen at Nishat Mills, where a 12.4% chemical reduction was introduced through the process, and MAS Holdings with a 12.3% chemical reduction, showing their determination to launder out as many harmful chemicals as possible before the resulting fabrics were introduced to the supply chain. This indicated an already-improving sector, so labor compliance improvements were negligible. This shows that companies with medium performance are currently making the most progress in aligning themselves with humanitarian expectations.

Indicator Variability and Industry-Wide Consistency Evaluation (2024)

In order to understand how consistently, sustainability is implemented across the textile industry, we calculated a Variability Index (VI) (table 4). This index reveals where there is uniformity and where there is diversity in industry performance on sustainability indicators. Under this transformation the smaller is the VI, the stronger is standardization and embodies good sector governance or adoption of best practices. On the other hand, high VI indicates a lack of equity in the adoption of policies or variability in technological and economic capacity.

Table 4

Sustainability Indicator	Mean (%)	Standard Deviation (%)	Variability Index (%)	Consistency Level
Water Use Reduction	32.9	4.95	15.05	Moderate
Hazardous Chemical Reduction	38.7	5.63	14.55	Moderate
Recycling Rate Increase	53.5	8.11	15.15	Moderate
Labor Rights Compliance	90.3	2.89	3.20	High

The textile industry shows strong homogeneity in labor compliance with a very small variability index of 3.20%. This implies that humanitarian labor standards have become standardized across the sector — perhaps a product of international labor conventions and external audits. Moderate variation (growth ~ 15%) of water metrics, chemical reduction, and recycling all give an indication of differentiated sustainability capabilities and varying investments (e.g., in sustainability in tech). This inequity is most noticeable when it comes to recycling efforts where strategies for material recovery are based on the structure and capital resources of a particular supply chain. The findings show that while labor rights have reached high levels of compliance, environmental practices are still not harmonized across the industry.

Classification of Humanitarian Alignment by Sustainability Domain

To cast a legal-analytical view of performance, each company was classified according to the degree of alignment with IHL-based sustainability expectations. Performance on each indicator was categorized as high, moderate, or low, using thresholds (table 5).

Table 5

Company	Labor Compliance	Recycling Practices	Water Use Reduction	Chemical Reduction	Overall Alignment
Arvind Ltd.	High	Moderate	Moderate	Moderate	Moderate
H&M Group	High	High	High	High	High
Nishat Mills	Moderate	Moderate	Low	Low	Moderate
MAS Holdings	High	High	High	High	High
Welspun India	Moderate	Moderate	Moderate	Moderate	Moderate

At all four domains, MAS Holdings and H&M Group align at the highest level, with comprehensive systems established to avoid harm to labor and the environment, while ensuring full transparency through their reporting. Implemented at a steady but incomplete scale for water and chemical reduction steps, Arvind Ltd. and Welspun India also achieve moderate scores. While standards on labor protections are improving, Nishat Mills continues to face challenges in environmental domains. The classifications demonstrate the need for targeted interventions, both regulatory and technological, which will help lagging firms must catch up without collateral damaging those already moving towards a compliance with the principles of humanitarian law. The facts call for a dual-tier approach to policy: one that patently rewards leaders and compels improvement among those further behind.

Discussion

The study resulted in both a quantifiable and growing parallel between the sustainable practices adopted by the textile industry as well as the pillars of International Humanitarian Law (IHL), namely in the areas of labor rights, environmental stewardship, and corporate accountability.

Labor rights compliance turned out to be the most consistent and matured dimension in the companies, as all companies scored relatively high and there was low variability. This confirms the trend of institutionalized labor standards through vertical and horizontal diffusion in supply chains, as identified by Holzberg [20]. Global textile leaders, under pressure from international buyers and regulatory bodies, have integrated fair labor conditions and occupational safety into their corporate compliance systems. This harmonization is also supported by the widespread adoption of ILO conventions, audit certifications, and legally binding agreements within global value chains.

Environmental indicators, however, revealed more variability. While leading firms such as MAS Holdings and H&M Group demonstrated strong performance in reducing water use, chemicals, and increasing recycling rates, others such as Nishat Mills and Welspun India showed moderate to low environmental alignment. This variation reflects what Žarković et al. [16] described as a dual-speed environmental transition, where large multinational firms drive innovation while smaller or regionally constrained firms lag behind. The disparities also underscore the findings of Khan and Syeda [23], who emphasized that hazardous chemical substitution and green process design still pose operational and cost-related challenges for many manufacturers.

A comparative analysis with prior sustainability assessments reveals important advances. Islam et al. [21] provided an early synthesis of sustainability metrics in the textile industry but lacked integration with legal frameworks. In contrast, our results explicitly link sustainability indicators with humanitarian legal principles, offering a framework through which compliance can be evaluated not only for performance but for moral and legal legitimacy. Furthermore, our SCI model extends the lean–green compliance indicators proposed by Abreu et al. [17] by adding a legal dimension rooted in international law, moving from mere environmental efficiency toward rights-based sustainability.

From a methodological perspective, the integration of legal-text analysis, normalized performance metrics, and composite indices reflects an evolution from previous sectoral reviews. Nawazish et al. [14], in their systematic review of humanitarian supply chains, called for more interdisciplinary models capable of capturing legal obligations, operational realities, and sustainability trends simultaneously. This study addresses that gap by creating a replicable model for measuring humanitarian compliance using environmental, social, and governance (ESG) data—a trend also explored in Liu et al. [18] highlighted the potential of ESG indices to serve as proxies for ethical compliance in complex industries.

Although there are contributions, some limitations should be recognized. First, even as the SCI represents multidimensional performance, it is based on publicly disclosed data and this may not represent the full ground-level realities or practices in unmonitored facilities. As mentioned by Atta and Sharifi [13], a misalignment between legal frameworks and enforcement mechanisms can skew sustaina-

bility claims and result in symbolic compliance. Second, five was as far as we could cut, but it doesn't represent the SMEs or regionals, who as noted by Kumar et al. [22] can face more pressing environmental and labor challenges.. Additionally, though equal weights were assigned to the indicators for comparability, future work may also consider weighted methods based on stakeholders or multi-criteria decision-making techniques, such as those reported by Özdağoğlu et al. [15], to incorporate the perceived significance of diverse sustainability sectors.

A further limitation is the cross-sectional nature of SCI computation in that it reflects performance only at a point in time as opposed to long-term trends or lagging effects of investments. Prenovitz et al. [23] there was show of how recycling performance and environmental sounded too market motivation with lagging influence. A longitudinal or panel-data approach could be useful in making future sustainability compliance models more robust.

This is quite significant in terms of what this research means. First, the SCI framework can help to inform policymakers as a benchmark for identifying underperforming firms or regulatory areas in need of intervention. Second, firms can leverage the model in-house to assess their own sustainability performance using a humanitarian framework that enhances alignment with both legal (deposit/contribution) and ethical (maximal deposit/maximal contribution) norms. Advocacy groups and certification bodies could also leverage the alignment classification as a communication tool to promote public perception changes and investor behavior.

Conclusion

The research has provided new insights through generation of an integrated conceptual platform, which is supported by both empirical analysis and mathematical modelling, as to how legal expectations can be operationalized in corporate sustainability performance.

The results confirm that labor rights protection has become relatively consistent among major textile producers, while environmental sustainability indicators still show convergence. This shows that labor standards, which have been codified over decades via international pacts and global supply chain pressure, are now institutionally stronger than environmental ones, which require local enforcement and some level of technological capacity. The gaps uncovered in chemical use reduction, water preservation and recycling practices demonstrate that environmental integration in sustainability strategies is not applied evenly.

The article provided a tangible tool for assessing ethical compatibility in corporations by developing a Sustainability Compliance Index and anchoring performance levels within the framework of the law. This perspective fills a pertinent gap between demands for corporate accountability, which stretch beyond superficial sustainability reporting, and the need to use the rules of law, an operation through rights, as a lens to measure corporate behavior. The methodology presented combines legal-quantitative approaches and fills an important gap between normative approaches and empirical sustainability knowledge, yielding a swift and meaningful tool for analyzing compliance and strategic planning.

By anchoring sustainability in the textile sector to humanitarian law, the study offers a new way of understanding and assessing the industry's sustainability. This framing provides a forceful contrast to the dominant narrative of corporate responsibility of being a voluntary pro-social activity, to one of legal and ethical obligation, thereby cementing the argument that corporate sustainability is not simply a strategic priority but a moral imperative of global justice.

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