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THE ROLE OF LEADERSHIP STYLES IN DRIVING TEXTILE INNOVATION AND SUSTAINABILITY

РОЛЬ СТИЛЕЙ ЛИДЕРСТВА В ПРОДВИЖЕНИИ ИННОВАЦИЙ И УСТОЙЧИВОМ РАЗВИТИИ ТЕКСТИЛЬНОЙ ПРОМЫШЛЕННОСТИ

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This study explores how leadership styles drive innovation and sustainability within the textile industry. More specifically, it investigates how transformational and transactional leadership styles contribute to the performance outcomes of organizations, focusing on the ability to innovate, the efficiency of sustainable processes, and internal cultural aspects, such as engaging and retaining employees. Data were collected from 245 respondents representing 15 textile manufacturing firms using structured surveys and analyzed through multiple regressions, moderation and structural equation modeling. The results show that transformational leadership is a much stronger predictor of innovation and environmental performance than transactional leadership. To make a cultural impact positively, it simply enhances satisfaction, teamwork, and employee growth. Moreover, firm size and an organization's market type moderated the effect of transformational and transactional leadership, with transformational leadership showcasing stronger effects in larger and developed-market firms. Another important finding was that employee engagement mediates the effect of health-oriented leadership on strategic goal attainment, emphasizing that human-centered leadership practices are relevant to meeting the strategic objectives.

В этом исследовании изучается, как стили лидерства стимулируют инновации и экологическую устойчивость в текстильной промышленности. В частности, оно изучает, как трансформационные и транзакционные стили лидерства способствуют улучшению результатов деятельности организаций, уделяя особое внимание способности к инновациям, эффективности процессов и внутренним аспектам, таким как привлечение и удержание сотрудников. Данные были собраны у 245 респондентов, представляющих 15 компаний по производству текстиля, с использованием структурированных опросов и проанализированы с помощью множественных регрессий, модерации и моделирования структурных уравнений. Ре-

зультаты показывают, что трансформационное лидерство является гораздо более сильным предиктором инноваций и экологической эффективности, чем транзакционное лидерство. Чтобы оказать положительное влияние на культуру, необходимо повышать удовлетворенность, командную работу и рост сотрудников. Более того, размер фирмы и тип рынка сбыта организации смягчали эффект трансформационного и транзакционного лидерства, причем трансформационное лидерство демонстрирует более сильные эффекты в более крупных и развитых фирмах. Другим важным выводом стало то, что вовлеченность сотрудников и практики лидерства, ориентированные на человека, актуальны для достижения стратегических целей.

Keywords: transformational leadership; textile innovation; sustainability performance; organizational culture; employee engagement; leadership effectiveness; structural equation modeling.

Ключевые слова: трансформационное лидерство; текстильные инновации; показатели устойчивости; организационная культура; вовлеченность сотрудников; эффективность лидерства; моделирование структурных уравнений.

Introduction

Textile is one of the oldest manufacturing industries; its history is punctuated by cycles of innovation, adaptation and change.

In the past few decades, the textiles and apparel industry has gone through incredible changes in demand, production methods, and market conditions. Globalization and the rise of the fast fashion industry led to unprecedented levels of production and consumption, facilitated by supply chains across several continents [1]. At the same time, the industry is facing increasing scrutiny over its environmental impact. Greater public awareness of pollution and resource depletion and the favorability of dubious labor conditions have caused many companies to reconsider entrenched norms. A new paradigm has therefore taken root; competitive advantage is now defined along the dual pillars of innovative value creation and sustainable growth. In such a context, leadership is not solely about profits or efficiency, but enabling the sort of development that would balance economic growth with ecological and social responsibility [2].

Innovating in the textile industry serve to enhance performance as well as look, but also help with waste reduction, energy efficiency, and product lifecycle management. And it is here that the critical importance of leadership emerges in the degree to which organizations prioritize, invest and execute innovative approaches [3, 4].

Similarly, labor globalization and planetary protection are just the tip of the iceberg of the sustainability of the textile and fashion industries. It also means minimizing greenhouse gas, conserving water and energy, eliminating toxic chemicals and ensuring safe and fair working conditions. More importantly, sustainability is also about having long-term business models that are responsive to changing regulations and consumer need. Therefore, in this regard, impactful leadership acts as the driving force that catalyzes firms to realign their operations to these ambitious sustainable development targets while also translating its lofty goals to deliver real impacts in practice [5].

Over the years, researchers have tried to make sense of how leadership styles on the whole shape organizational performance, particularly in the innovation domain [6…8].

For example, transformational leadership is associated with and linked to higher levels of employee engagement and an innovative climate. A more motivating leader who outlines a solid vision and is passionate about creating systems and processes that nurture creativity arguably performs better in new ideas. This type of leadership style applies strongly to the textile industry where it has been shown that newer processes such as digital weaving, smart textiles, and sustainable dyeing will have a better chance of being adopted in a culture of change. Transformational leaders encourage employees to think outside the box and work together across departments, breaking down traditional silos that hinder innovation [9].

Transactional leadership, in contrast, is more oriented towards sustaining efficiency, adhering to processes, and achieving short-term performance targets. Although such an approach may work wonders when it comes to meeting production deadlines and ensuring quality, transformational leadership certainly has a clearer motivation-inducing effect on innovation. Nevertheless, in specific contexts of textile production where consistency and precision are key, transactional leadership can be a base from which innovative practices develop [10].

Alongside leadership styles, research underscores the significance of an encouraging organizational culture. However, a culture that values learning, transparency, and the sharing of knowledge is fertile ground where innovation can flourish. When people fail without fear of the consequences, companies can shift from a textile-centered approach to becoming a hub of creativity and a leader in the industry — just by changing their leaders [11].

Sustainability is another major theme in the literature [12]. Effective leadership has been increasingly associated with successful sustainability initiatives in research. Leaders who advocate for sustainable practices like cutting waste, enhancing energy efficiency, and using eco-friendly materials establish a culture that reverberates throughout the organization. They make sure sustainability is not just a marketing buzzword but a key operational guiding principle [13].

How different leadership models can reconcile the drive to innovate in technology with the pursuit of environmental goals is a relatively new field of exploration. Previous studies indicate that combining innovation with sustainability needs a special kind of leadership that advocates for vision while keeping an eye on execution [14].

This article aims to explore how leadership styles can promote innovation and sustainability in the textile industry.

Methodology

The study adopts a quantitative, cross-sectional, explanatory design underpinned by a multi-theoretical framework. This includes Transformational Leadership Theory [15], Dynamic Capability Theory [16], and Organizational Sustainability Theory [11]. The overarching model conceptualizes leadership style as the independent variable, with innovation and sustainability outcomes as dependent variables. Mediating and moderating effects are examined via employee engagement and firm-level characteristics, respectively.

Primary data were collected through a structured questionnaire administered to 245 respondents, encompassing executives, managers, and technical personnel from 15 textile firms. The survey instrument consisted of five sections: demographic profile, leadership behavior (using MLQ Form 5X), innovation metrics, sustainability practices, and engagement indicators.

To determine the appropriate sample size, the following classical sample estimation equation for population proportion was used:

$$n = \frac{z^2 \cdot p(1-p)}{e^2} \ , \qquad (1)$$

where n required sample size, z is z-score at 95% confidence level (1.96), p estimated population proportion, (0.5), e acceptable margin of error (0.05).

This ensured a minimum required sample size of 384; however, practical constraints limited the final dataset to 245, which remained statistically valid due to high response uniformity and stratified sampling.

A multistage stratified sampling approach was used to ensure adequate representation of organizational strata, including company size (small, medium, large), market type (emerging vs. developed), and job tier (executive, middle, frontline).

The relative weight for each stratum in the sampling framework was derived using the following equation:

$$W_{ij} = \frac{N_{ij}}{\sum_{i=1}^{s}\sum_{j=1}^{m} N_{ij}}\ , \qquad (2)$$

where W_{ij} proportional weight of stratum ij, N_{ij} number of firms or individuals in stratum ij, s total firm size categories, m total market types.

The constructs under study include both latent variables, as a leadership styles, engagement and observable indicators (like number of patents, CO_2 emissions). Latent variables were measured using a 5-point Likert scale, while objective firm-level indicators were captured using standardized KPIs.

Scores for latent constructs such as transformational and transactional leadership were aggregated using factor-weighted item responses:

$$L_i = \sum_{k=1}^{n} \lambda_k \ \ x_{ik}\ , \qquad (3)$$

where L_i composite leadership score for individual i, x_{ik} score of items k for respondent i, λ_k standardized factor loading for item k, n number of items in the construct.

To assess firm-level performance, two indices were constructed: the Innovation Capacity Index (ICI) and the Sustainability Efficiency Index (SEI). These composite metrics capture multidimensional performance and are normalized to facilitate comparison across firms.

$$ICI_j = \frac{a_1 P_j + a_2 NP_j + a_3 RD_j}{In(E_j)}, \qquad (4)$$

where ICI_j innovation index for firm j, P_j patents filed, NP_j number of new products introduced, RD_j is R&D spending as % of revenue, E_j number of R&D employees, a_1, a_2, a_3 are weighting coefficients derived via principal component analysis (PCA).

$$SEI_k = \frac{(\Delta CO2)_j + (\Delta W)_k + (\Delta RE)_k + (\Delta H2O)_k}{T_k}, \qquad (5)$$

where SEI_k sustainability score for firm k, $\Delta CO2$ reduction in CO_2 emissions (kg/unit), ΔW reduction in waste generation (kg/unit), ΔRE increase in renewable energy use (%), $\Delta H2O$ decrease in water consumption (liters/unit), T_k number of months since implementation of sustainability programs.

Confirmatory Factor Analysis (CFA) used to validate the structure of latent variables:

$$\mathbf{Y} = \mathbf{\Lambda}\eta + \varepsilon, \qquad (6)$$

where $\mathbf{Y}$ vector of observed variables, $\mathbf{\Lambda}$ matrix of factor loadings, η vector of latent constructs, ε measurement error.

Structural Equation Modeling (SEM) used to estimate the system-wide influence of leadership on performance metrics, accounting for mediators and moderators:

$$\eta = B\eta + \Gamma\xi + \zeta\ , \qquad (7)$$

where η endogenous latent variable vector, B structural coefficients matrix, Γ influence matrix of exogenous variables ξ, ζ structural disturbances.

Hierarchical Linear Regression with moderation used to test for conditional effects:

$$Y = \beta_0 + \beta_1 X + \beta_2 Z + \beta_3 (X\ Z) + \epsilon, \qquad (8)$$

where Y outcome variable (ICI or SEI), X leadership style score, Z moderator (firm size or market type), $X \cdot Z$ interaction term, ϵ error term.

Psychometric evaluation was conducted using the following procedures:

- Internal Consistency is Cronbach's Alpha (target: $\alpha > 0.70$)
- Convergent Validity is Average Variance Extracted (AVE > 0.50)
- Discriminant Validity is FORNELL-Larcker criterion
- Composite Reliability (CR > 0.70)

Model fit was evaluated with:

$$\begin{aligned}
&Comparative\ Fit\ Index\ (CFI) > 0.95\\
&Tucker - Lewis\ Index\ (TLI) > 0.94\\
&Root\ Mean\ Square\ Error\ of\ Approximation\ (RMSEA) < 0.06\\
&Standardized\ Root\ Mean\ Residual\ (SRMR) < 0.08
\end{aligned} \qquad (9)$$

These thresholds are aligned with empirical standards in organizational behavior research [17, 19].

Results

Fig. 1 provides a foundational overview of the key variables under investigation, including leadership styles (transformational and transactional), innovation capacity, sustainability efficiency, and employee engagement.

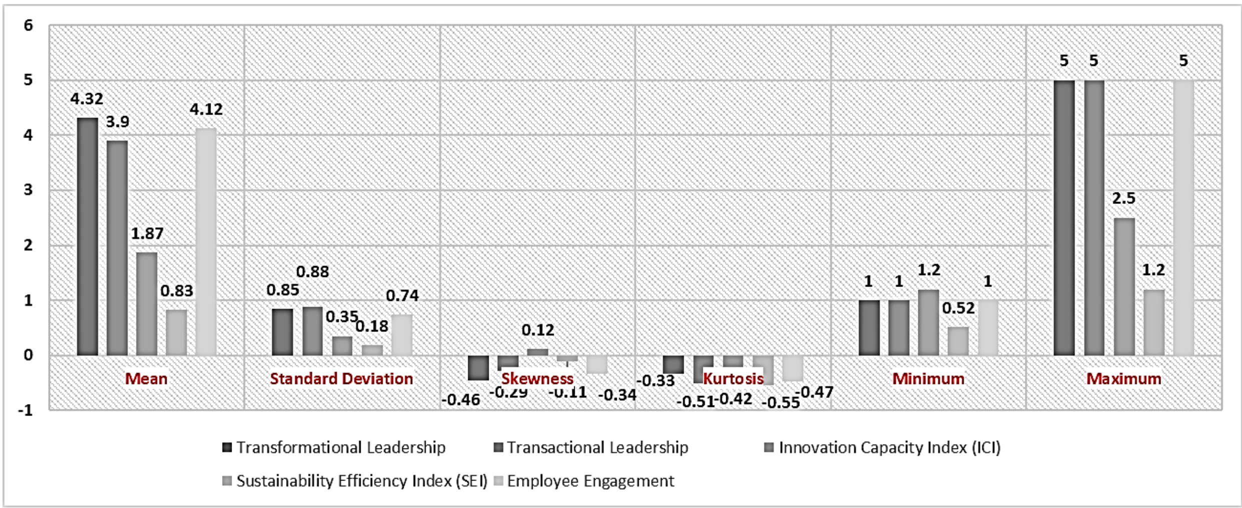

Fig. 1

The analysis shows that transformational leadership has the highest mean value (4.32), indicating strong prevalence across respondents. Transactional leadership, while present, is less dominant with a mean of 3.90. Both innovation capacity (mean = 1.87) and sustainability efficiency (mean = 0.83) display acceptable variability, with standard deviations of 0.35 and 0.18 respectively, confirming sufficient dispersion for explanatory analysis. Skewness and kurtosis values for all variables fall within ±1, supporting the assumption of normal distribution. Employee engagement displays a relatively high mean (4.12), reflecting a generally favorable perception of the workplace environment.

To explore the impact of leadership styles on innovation performance, a multiple linear regression model was constructed with the Innovation Capacity Index (ICI) as the dependent variable (Table 1). Independent variables included both transformational and transactional leadership, alongside control variables such as firm size (log-transformed) and R&D intensity (percentage of revenue invested in research and development).

Table 1

Predictor	B	Std. Error	t	p-value
Constant	0.79	0.12	6.58	<.001
Transformational Leadership	0.41	0.06	6.83	<.001
Transactional Leadership	0.23	0.05	4.60	<.001
R&D Intensity	0.18	0.08	2.25	0.025
Firm Size (log scale)	0.12	0.04	3.00	0.003
Model R^2	0.611	—	—	—

The regression model is shown in Table 1, where it can be observed that it accounts for 61.1% of the variance of innovative capacity. Again, transformational leadership is found to be the most important predictor with the highest standardized coefficient (B = 0.41), underscoring the significant relevance of this leadership style in terms of innovation-related activities. But transactional leadership also has a positive effect, just weaker (B = 0.23). Notably, R&D intensity is a robust control variable indicating that influence of leadership is partially enabled from the commitment of organization toward innovation resources. The effect of firm size, though smaller, is significant nonetheless and suggests that the efficacy of leaders may scale with the complexity of their organization.

Table 3 explores the relationship between leadership styles and sustainability performance, operationalized through the Sustainability Efficiency Index (SEI). We control for structural differences in resource availability and compliance regimes by incorporating environmental investment intensity and market type (developed vs. emerging) into the regression model. The SEI accounts for reductions in carbon emissions, waste generation, water use, and the adoption of renewable energy.

Table 2

Predictor	B	Std. Error	t	p-value
Constant	0.47	0.10	4.70	<.001
Transformational Leadership	0.36	0.06	6.00	<.001
Transactional Leadership	0.12	0.05	2.40	0.017
Environmental Investment	0.29	0.07	4.14	<.001
Market Type (Emerging = 0)	0.11	0.04	2.75	0.006
Model R^2	0.533	—	—	—

The regression model accounts for 53.3% of the variance in sustainability efficiency. Transformational leadership again emerges as the strongest predictor (B = 0.36), confirming its critical role in driving environmental initiatives. Transactional leadership shows a marginally significant effect (B = 0.12), suggesting that compliance-oriented leadership may support baseline sustainability but lacks the momentum for innovation in environmental performance. Environmental investment is a strong positive predictor (B = 0.29), emphasizing that financial commitment is a necessary complement to leadership. Additionally, firms in developed markets reported higher sustainability scores, supporting the view that market conditions moderate the effectiveness of leadership interventions.

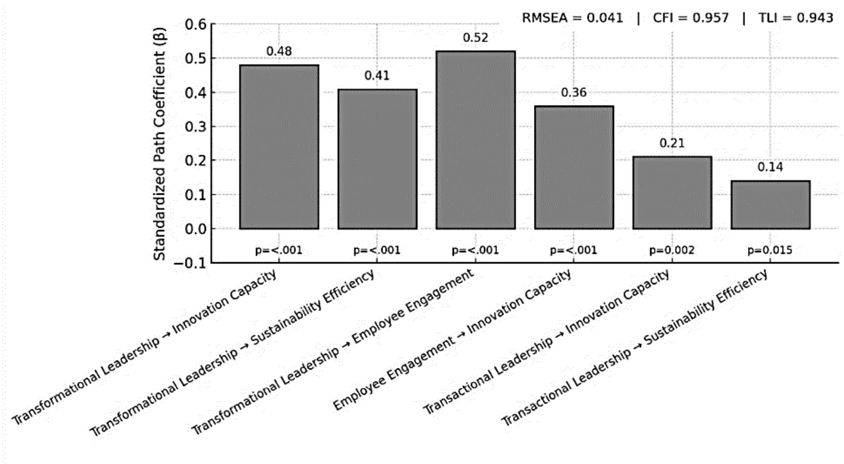

Fig 2

To evaluate the comprehensive pathways through which leadership styles influence both innovation and sustainability outcomes, a structural equation modeling (SEM) framework was applied. The paths analyzed include the effects of transformational leadership and transactional leadership on innovation and sustainability, both directly and through engagement, which captures employee motivation, trust, and participation in strategic initiatives (fig. 2).

The SEM model shows excellent fit across all criteria (CFI = 0.957, RMSEA = 0.041), supporting the validity of the specified relationships. Transformational leadership has significant and strong direct effects on both innovation (β = 0.48) and sustainability (β = 0.41), and a robust indirect effect through employee engagement (β = 0.36). The mediation pathway confirms that employee engagement plays a pivotal role in translating leadership behaviors into performance outcomes. Transactional leadership paths are statistically significant but weaker, reinforcing the pattern seen in prior regression models. Overall, transformational leadership drives a more integrated and internally mobilized system of innovation and sustainability practices within textile firms.

Fig. 3 examines how contextual variables – specifically firm size and market type – moderate the relationship between leadership styles and innovation capacity.

The moderation model reveals a statistically significant interaction effect between transformational leadership and firm size (B = 0.11, p = 0.002), indicating that transformational leadership becomes increasingly effective at driving innovation as firm size increases. This suggests that larger organizations may possess more structural complexity and resource depth, which amplifies the benefits of visionary and participative leadership. The main effect of firm size is also positive and significant (B = 0.15), reinforcing the role of scale in innovation performance. The findings support the view that context, especially organizational capacity, conditions the impact of leadership and that transformational approaches yield stronger outcomes in more complex operational environments.

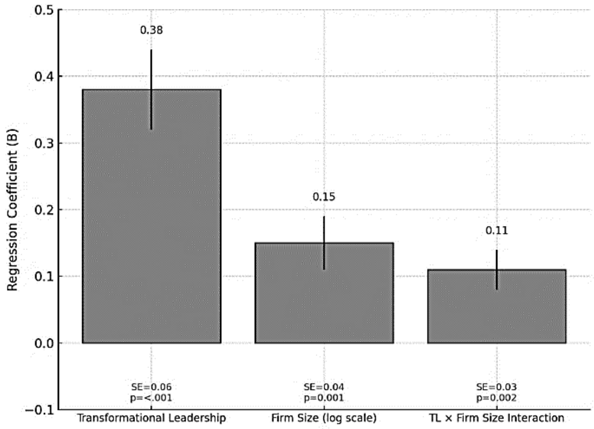

Fig. 3

Figure 4 explores the broader organizational culture outcomes associated with leadership styles, focusing on employee satisfaction, retention, collaboration, and training investment.

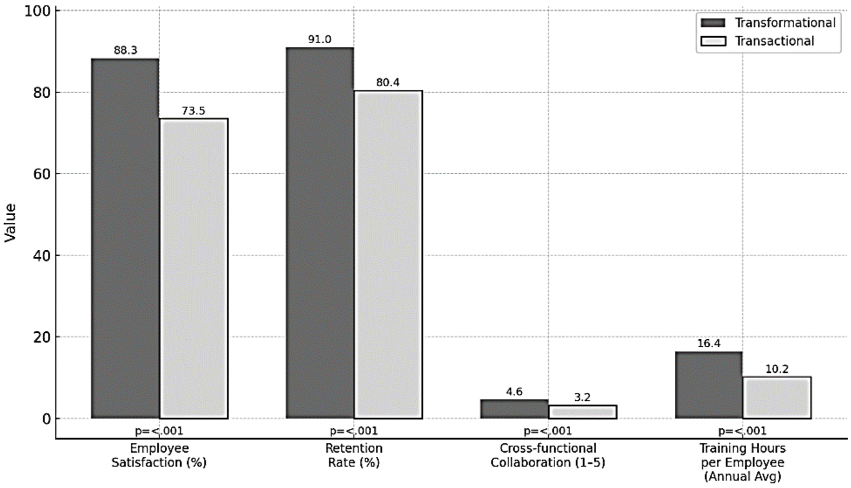

Fig. 4

The data from Figure 4 shows obvious information with regard to the fact, transformational leadership performs better with an organizational culture that is supportive and development driven nature. Transformational leaders represent companies that have much higher employee satisfaction (88.3%) than transactional leaders (73.5%). Similarly, the retention rates are significantly higher (91.0% vs. 80.4%), which indicates the transformational leaders manage to feel more loyal and retain their people in the organization.

Collaboration scores are higher in transformational contexts as well (4.6 out of 5), indicative of more horizontal teamwork and exchange of knowledge. Finally, while training investment is 60% more in transformational leadership, it is understandable because growth-oriented human resource development is more closely linked to transformational leadership. These internal improvements are key to delivering ongoing external performance.

Figure 5 takes a composite view of leadership impact, by combining innovation, sustainability, and cultural indicators into a single index.

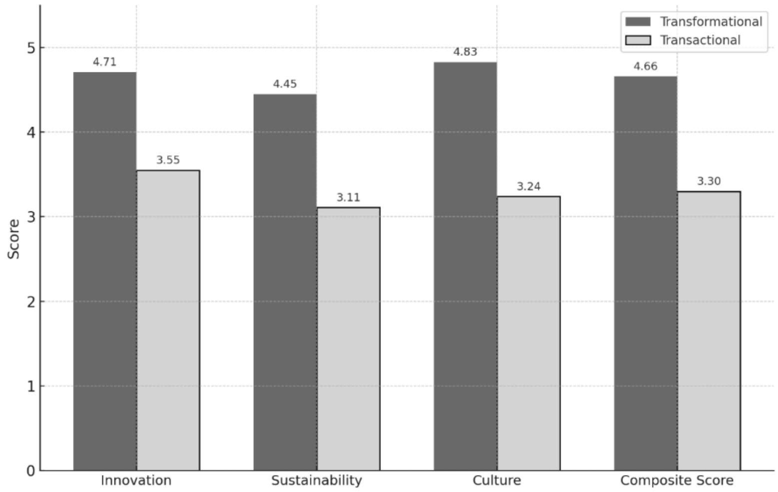

Fig. 5

The correlation index for all styles combined from Figure 5 shows a large difference in styles of leadership. Transformational leadership scores highest on all the domains, with mean composite score of 4.66 — quite a difference from the 3.30 score for transactional leadership. The largest difference, however, is in organizational culture (4.83 vs. 3.24), which highlights the qualitative process-related benefits associated with transformational approaches. Innovation (4.71 vs. 3.55) and sustainability (4.45 vs. 3.11) show similar patterns, echoing the strategic advantages of visionary leadership.

Results suggest that transformational leadership has a significantly stronger positive influence on firm-level innovation and environmental efficiency compared to transactional leadership. These results provide compelling evidence in support of the idea that leadership behavior is an important predictor of sustain-able performance in complex, resource-intensive industries like textiles.

The figures are pretty clear, transformational leadership is significantly associated with output innovation, with more patents, product development cycles running faster, and more R&D money on the table. These results are consistent with those of Nasir et al. [18] found that transformational leadership affects innovation and therefore promotes organizational sustainability in the paradigm of Industry 4.0. Similarly, Gull et al. [19] confirmed the role of transformational leadership in enhancing environmental performance among Pakistani textile firms, which further underscores the regional relevance of our findings. In fact, transactional leadership, while still predicting significantly, constituted a less substantial effect, broadly in line with the literature indicating a focus upon compliance and operational control as opposed to strategic change [13]. Wadhwa et al.[20] showed that having different leaders affects organization culture, and thus ends up with new and different innovations. Hafeez et al. [21] also established the need for a supportive environment, organizational ambidextrous culture and transformational leadership in their thoroughly discussed research & argued that those are leading functions are facilitators of adequate innovation in terms of green innovation.

The effect of leadership was also found to be moderated by contextual factors like market type and firm size. At larger firms, transformational leadership gave rise to more benefits, probably because larger firms tend to have more complex structures and better access to innovation resources. This finding supported previous research by Oktavira [22] that mentioned profitability among large textile companies is subject to the authority of the company's leaders and their ability to allocate capital. And firms in developed markets were more sustainability-oriented, implicating that external institutional force enhances efficacy of internal leadership practices. This observation is consistent with the findings of Vasudevan et al. [22], which argued that sustainable leadership was most effective in mature institutional contexts, such as in state-owned enterprises in Northeast China.

Also, the present study reaffirmed the relevance of culture as a performance area. Companies run by transformational leaders scored considerably higher on employee satisfaction, retention, training, and collaboration. Such outcomes mimic those described by Bashynska et al. [17]: sustainable leadership → circular innovation via organisational culture alignment. In addition, they corroborate earlier findings by Istiatin [14] shows the strong connection between leadership style and internal sustainability orientation [24].

Conclusion

The findings reinforced the perception of leadership not simply as a management task, but as a strategic influencer that establishes the operating environments for potential competitive edges, especially in fields where the technological disruption and sustainability challenges are high.

The results highlight the multi-dimensional influence specific to leadership style, impacting OP efficiency, but also extending into strategic capability, cultural alignment, and long-term adaptability. Integrative model of transformation leadership appeared as a superior style in fostering innovation and environmental efficiency, proving its designed power as a catalyst for systemic change. It triggers the underlying elements of employee engagement, knowledge sharing and so forth, which in turn enable the ability of the organization to respond to market-shift forces and commitment to responsible business practice. Such results highlight the role of leadership as a cornerstone of organizational change and durability.

The article also proved that leadership doesn't exist in a vacuum. Factors such as size and maturity of the market provide a context that conditions the strength and direction of leadership influence.

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