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PATHWAYS FOR HUMAN CAPITAL DEVELOPMENT IN UZBEKISTAN'S TEXTILE ENTERPRISES IN THE CONTEXT OF A GREEN ECONOMY

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Abstract: This article examines green human capital in Uzbekistan's textile enterprises using official statistics, policy documents and green HRM research. It proposes an integrated model of green and digital skills, technological adaptability, lifelong learning and ESG management, with workplace training and resource-efficiency measures. Sectoral employment was 570,000 in April 2024 and 623,000 at the end of 2025; 650,000 is a target for 2026. Economic effects remain to be verified using enterprise-level data [8-1].

Key words: green economy, human capital, textiles, green skills, digital skills, ESG, green HRM, resource efficiency.

Аннотация: В статье исследуются концептуальные подходы к развитию человеческого капитала предприятий текстильной промышленности Узбекистана в условиях перехода к зелёной экономике. На основе официальной статистики, нормативных документов и научных исследований предложена интегрированная модель развития человеческого капитала, объединяющая экологические и цифровые компетенции, технологическую адаптивность, непрерывное обучение и навыки ESG-управления. Занятость составляла 570 тыс. человек в апреле 2024 года и 623 тыс. к концу 2025 года; 650 тыс. на 2026 год - целевой показатель. Предложены производственные индикаторы оценки. Количественные эффекты требуют проверки на уровне предприятий [8-1].

Ключевые слова: зелёная экономика, человеческий капитал, текстиль, зелёные навыки, цифровые компетенции, ESG, ресурсоэффективность.

INTRODUCTION

Green transformation requires workers who are able to conserve resources, manage waste and document compliance. Thus, human capital complements cleaner technology [8; 12; 6].

Uzbekistan's textile industry generates regional employment but consumes water, energy and materials. Improvements in equipment settings, maintenance and data skills can further support modernization.

In April 2024, over 6,000 textile firms employed 570,000 people; at the end of 2025, employment reached 623,000, output reached UZS 134 trillion, and exports amounted to USD 2.5 billion. Employment of 650,000 in 2026 is a target [2; 3].

In January–October 2024, textile exports amounted to USD 2,433.4 million, including yarn (43.5%) and finished textiles (39.1%) [15]. Higher-value exports require design, quality and digital skills. Ten-month and full-year exports are not directly comparable.

The study proposes a skills-to-performance management mechanism for greener textile production (figure 1).

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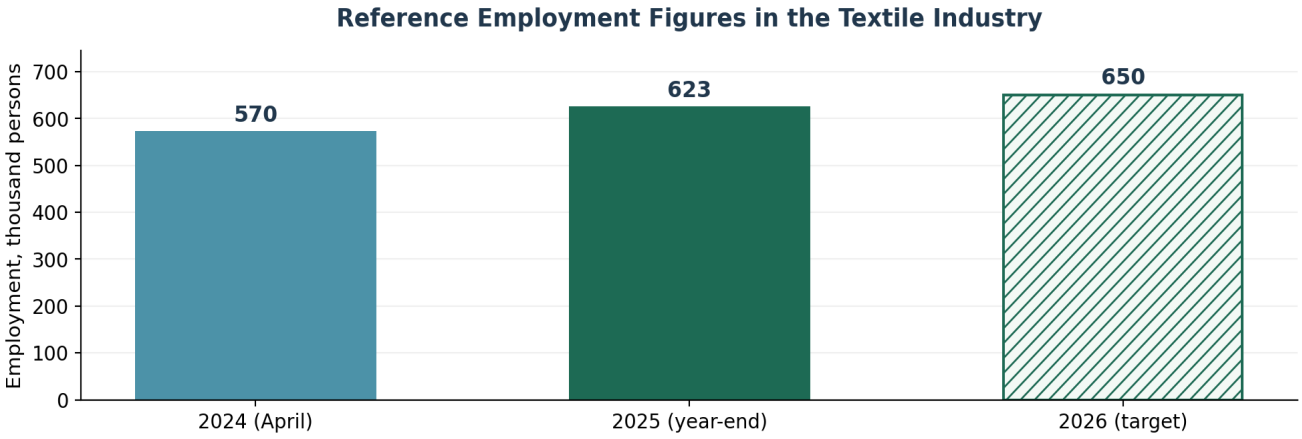


Figure 1. Textile employment: April 2024, end-2025 and 2026 target [2; 3][1].

LITERATURE REVIEW

Goyipnazarov and Kurbanbayeva [10] identify green skills gaps; the author argues that skills must match textile tasks and resource indicators. Eshmirzayev and Salimova [9] emphasize innovation, but sector-wide analysis cannot replace workplace diagnosis.

Yormatov [17] supports skills audits, dual education and digital HR; the author adds certification based on energy, water and quality outcomes. Kholbekova [14] distinguishes employment from productivity growth, yet cannot isolate green-skills effects from sector statistics.

Joshi et al. [12], Mehrajunnisa et al. [15] and Ali et al. [6] link green HRM, behaviour and sustainability. Their managerial insights matter, but cross-country transfer requires local testing.

Awais-e-Yazdan et al. [8] associate green HRM with textile innovation; Sharif and Malik [16] report mixed incentive effects. The author therefore favours practical training and independently audited outcomes.

The gap is the untested link between green competence and resource efficiency in Uzbek textiles. The proposed audit–train–apply–measure framework requires longitudinal evidence.

RESEARCH METHODOLOGY

Sources include official industry data and green-economy regulations [2-1], as well as scholarship on green HRM and skills [8-11; 9-14].

Comparative statistics, policy analysis, process mapping and conceptual modelling connect labour skills with production tasks and metrics.

Conceptual model: $\mathrm{HCD} = \beta_0 + \beta_1 \mathrm{GS} + \beta_2 \mathrm{DC} + \beta_3 \mathrm{TA} + \beta_4 \mathrm{CL} + \beta_5 \mathrm{ESG} + \varepsilon$. Here, HCD is human capital development; GS, green skills; DC, digital competence; TA, adaptability; CL, lifelong learning; ESG, environmental, social and governance competence [8-11].

This is a hypothesis, not an estimated regression. Comparable plant-level training, competence and resource data are insufficient for causal or monetary claims.

The novelty is integrating skills audits, workplace training, application, monitoring and feedback into one cycle.

In the research methodology, artificial intelligence technologies were used as auxiliary tools, accounting for approximately 10% of the research process, primarily to support the systematization of scientific information, the analysis of green and digital competencies, and the development of a conceptual framework for human capital development and resource efficiency in Uzbekistan's textile enterprises.

ANALYSIS AND RESULTS

1. Economic conditions for green transformation in the textile industry

Buyer expectations regarding quality and traceability increase the demand for skills. ERP and AI implementation was planned for 40 enterprises in 2026 but has not yet been confirmed as completed [3].

Resolution PQ-436 (2022) targets an improvement of at least 20% in industrial energy efficiency by 2030 [1]. Audits, optimized equipment and trained staff are prerequisites, not verified outcomes (table 1).

1 Author's development.

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Table 1. Official textile-industry indicators[2]

Indicator	2024	2025	2026
Employment, thousand persons	570 (April)	623 (year-end)	650 (target)
Production, UZS trillion	-	134	147 (plan)
Exports, USD billion	2.4334 (Jan.–Oct.)	2.5 (full year)	3.3 (plan)

The two employment figures differ by 53,000 (9.3%) but measure April 2024 and end-2025, not annual growth. The 2026 goal implies 27,000 more jobs if achieved.

The quotient of 2025 output and year-end employment is about UZS 215 million per person [3], not a robust productivity estimate without consistent output and workforce measures (figure 2).

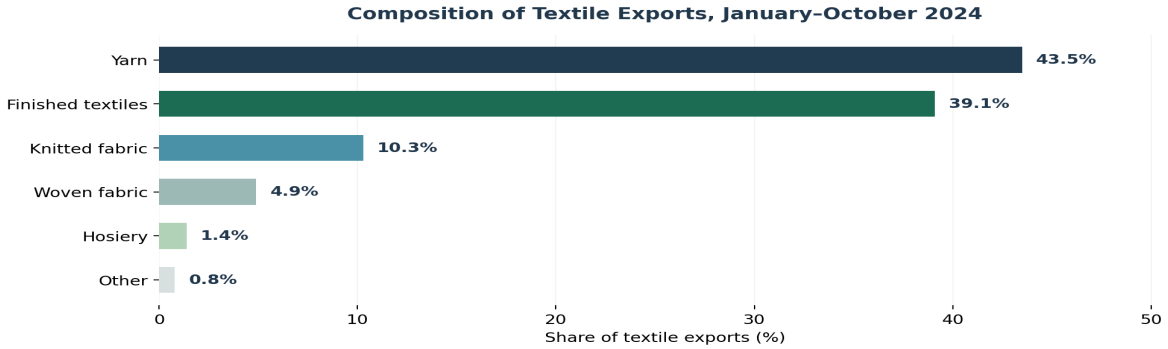


Figure 2. Textile export composition, January-October 2024 [5][3].

Value-added exports demand design, quality, fibre management and resource monitoring; green and digital skills belong in the same workplace curriculum.

2. The nature of green human capital and the competency map

Green human capital includes resource measurement, fault diagnosis and compliance, beyond formal qualifications [15; 12].

Green skills cover efficient energy, water and material use; digital skills cover sensors, ERP/MES, quality control and traceability [10; 7].

Adaptability enables equipment adjustment; lifelong learning sustains skills; ESG covers reporting, safety, labour standards and procurement [8; 16; 12; 6] (table 2).

Table 2. Priority green competencies by textile process[4]

Process / unit	Key skill	Measure
Spinning	Efficient settings; fibre loss; faults	kWh/kg; defects
Weaving / knitting	Sensors; settings; loss records	Downtime; waste/output
Dyeing / finishing	Water reuse; dosing; effluent	m³/kg; reuse
Cutting / sewing	Digital patterns; waste; quality	Material-use rate
Maintenance / energy	Energy audit; preventive care	Energy; downtime
HR / managers	Skills audit; green KPIs; training	Coverage; certificates
Export / quality / ESG	Traceability; buyer standards	Audit findings

In dyeing, batch-level water use must be assessed with fibre mix, recipes and colour quality; savings must not increase defects.

Green HRM embeds environmental goals in recruitment, training and evaluation [8; 15; 12; 6], subject to labour, privacy and safety safeguards.

2 Source: [2-5]. Reporting periods differ; annual growth cannot be inferred from ten-month exports
3 Author's development.
4 Author, based on [8-11]; targets require plant-level verification.

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3. An integrated management model for human capital development

Five competencies feed four practices: audit, modular training, workplace application and verified feedback. This builds organizational learning (figure 3).

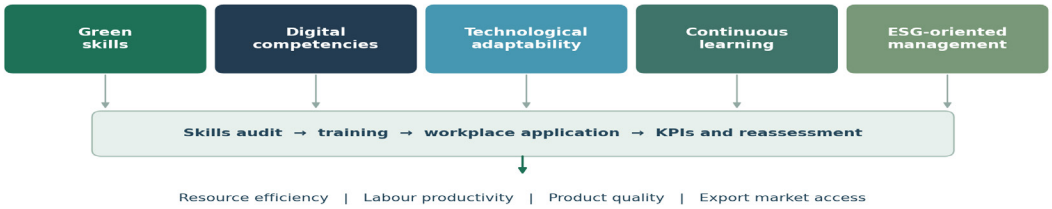


Figure 3. Integrated human-capital development model. Source: author, based on [8-11][5].

Measure skill certification and digital use alongside resource intensity, defects and downtime; joint improvement alone is not causal proof.

Operators need practical skills, control specialists need audit skills, and managers need investment and ESG skills; results require testing.

4. Indicators for assessing workforce capacity and environmental performance

Measure training inputs, verified competence and operational performance together, without neglecting product quality.

Metrics: training coverage (OQ) = completed/planned × 100%; practical validation (MQ) = certified/completed × 100%; energy intensity (ES) = energy/output; water intensity (SS) = water/output. Adjust for product mix and quality.

The optional index IYK = $\Sigma(w_j s_j)$, $\Sigma w_j = 1$ combines normalized competence scores and firm-specific weights; no verified values are claimed (table 3).

Table 3. Proposed green human-capital indicators[6]

Indicator	Computation / criterion	Interval
Training coverage	Trained/planned × 100%	Quarterly
Practical validation	Certified/trained × 100%	Quarterly
Energy intensity	Energy/standard output	Monthly
Water intensity	Water/standard output	Monthly
Waste rate	Waste/input × 100%	Monthly
Defect rate	Defects/inspected × 100%	Monthly
Downtime	Unplanned/planned hours	Monthly
ESG compliance	Findings; resolved share	Semiannual

Before-after trends also reflect fibre quality, product requirements and machinery changes. Comparative units and staggered training improve inference.

5. Enterprise implementation mechanism and institutional cooperation

A protected register should link HR training and certification with production-unit resource indicators without exposing personal data.

Management sponsors the programme, HR maps skills, technologists train, and specialists verify results; universities and suppliers can help [7; 11].

Dyeing modules should cover water by batch, recipes and quality; spinning modules should track material loss and energy. Baselines and safety matter (figure 4).

5 Author's development.

6 Author; benchmarks depend on production technology and independent verification.

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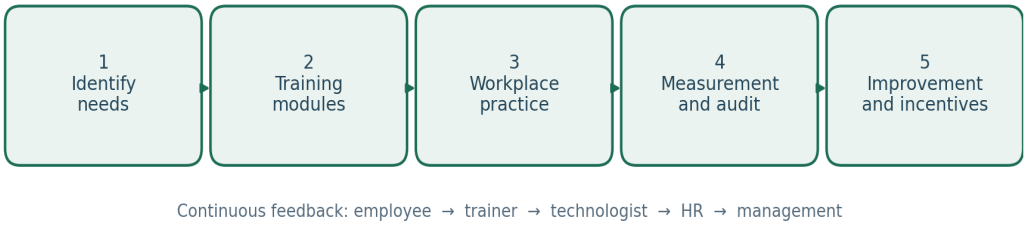


Figure 4. Enterprise green-competency development cycle[7].

Suggested sequence: 8-10 months audit; 16-12 pilot; 6-5 expand; thereafter reassess. This is not a mandatory standard.

Budget for staff time, meters, trainers and certification; verify savings before claiming returns.

6. Scientific and practical limitations

Comparable primary data on competence, training, resource use and output are missing; foreign results are not directly generalizable.

Longitudinal plant data, standardized by output type and machinery investments, are needed for testing.

CONCLUSION AND RECOMMENDATIONS

Green textile competitiveness requires both equipment and trained personnel. Export patterns highlight quality, digital and managerial skills [2-5].

The five-part model links green, digital, adaptive, learning and ESG competence with training, certification and process metrics in one management cycle. Prioritize resource-intensive units, tailor instruction by job, monitor environmental and quality outcomes, and partner with educators and suppliers. Causal and economic impacts still require longitudinal enterprise evidence.

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