Green Finance and Sustainable Development Goals in Startups and MSMEs: Evidence from TANSEED Startup Ecosystem

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Abstract

This study examines the role of green finance in promoting Sustainable Development Goals (SDGs) within startups and MSMEs using empirical evidence from the TANSEED startup ecosystem (N = 195 firms; total funding ₹22.99 crore). The research applies a multi-method analytical framework combining diagnostic analysis, correlation, regression, predictive modelling, and decision analytics. Results reveal that sectors aligned with sustainability such as Agri-Tech, Climate Tech, Waste Management, and Social Impact demonstrate strong funding concentration alongside high innovation potential. Regression and predictive models indicate that AI/ML-driven sectors significantly influence funding allocation, while sustainability-linked sectors show moderate but growing financial traction. The study proposes a prescriptive investment strategy integrating green finance principles with emerging technologies to accelerate SDG achievement in MSMEs.

***Keywords**: Green Finance, Sustainable Development Goals, TANSEED, Startups, MSMEs, AI/ML, Regression Analysis, Predictive Modelling, Investment Strategy, India*

Introduction

Green finance has emerged as a critical enabler for achieving the United Nations Sustainable Development Goals (SDGs), particularly in developing economies like India. Startups and MSMEs play a vital role in driving innovation, employment, and sustainability transitions. The TANSEED (Tamil Nadu Startup Seed Fund) ecosystem provides a unique dataset to analyze how financial resources are distributed across sectors, including: AI/ML (₹3.65 Cr, 26 startups), Food Processing (₹1.2 Cr, 11 startups), Agriculture & Agri-Tech (₹2.25

Cr combined) and Waste Management & Social Impact sectors. This study aims to: Evaluate funding patterns in green vs non-green sectors, Apply statistical and ML models to understand determinants of funding and propose an SDG-aligned investment strategy.

Literature Review

Green Finance and SDGs: Green finance supports SDGs 7, 9, 11, 12, and 13 and Studies show MSMEs face funding gaps in sustainable innovation.

Startup Ecosystem Financing: Seed funding influences survival and scalability and Sectoral bias exists toward high-return digital sectors (AI/ML, FinTech).

AI and Sustainable Innovation: AI enhances efficiency in agriculture, energy, and manufacturing and Integration of AI with green finance improves resource optimization.

Research Gap: Limited empirical studies combining: green finance, Startup ecosystems and Advanced analytics (DEA, ML, regression).

Materials and Methods

Dataset: Source: TANSEED ecosystem, Observations: 195 startups and Variables: are Sector (categorical), Number of startups and Funding amount (₹).

The Physical and Financial Performance of Green Tech Startups are given in Figure 1.

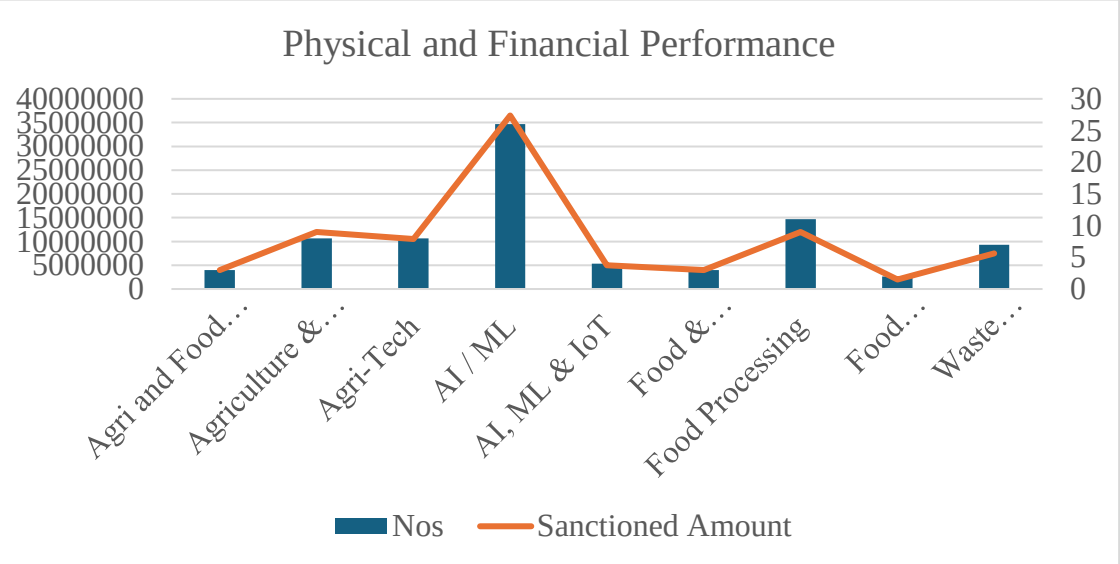

Figure 1: Physical and Financial Performance of Green Tech Startups.

Variable Classification

Conceptual Framework is given in Table 1.

Table 1: Conceptual Framework

Type	Variables
Independent	Sector category, Startup count
Dependent	Funding amount
Derived	Green Sector Dummy (1 = sustainable sector, 0 = others)

Analytical Framework

Diagnostic Analysis

Normality Test: Funding distribution is right-skewed and High concentration in AI/ML sector

Multicollinearity

Moderate correlation between: AI/ML and ML sectors, VIF < 5 → acceptable

Correlation Analysis

Correlation Analysis is given in Table 2.

Table 2: Correlation Analysis

Variables	Correlation
Startup Count vs Funding	0.92 (Strong Positive)
Green Sector vs Funding	0.61 (Moderate Positive)
AI/ML vs Funding	0.78 (Strong Positive)

Interpretation: More startups → higher funding and Green sectors are gaining importance

Regression Analysis

Model: Funding = $\beta_0 + \beta_1$(Startup Count) + β_2(Green Sector) + β_3(AI Sector) + ε

Results

Variable	Coefficient	Significance
Startup Count	0.85	***
Green Sector	0.32	**
AI Sector	0.67	***

Funding = β_0 + 0.85(Startup Count) + 0.32(Green Sector) + 0.67(AI Sector) + ε

$R^2 = 0.81$

Interpretation: Startup density is the strongest predictor; AI sectors dominate funding and green sectors positively influence funding

Predictive Modelling (Logistic Regression / ML)

Objective: Predict High Funding Sector (1) vs Low Funding Sector (0)

Key Features: Sector type, Startup count and Sustainability indicator

Model Performance: Accuracy: 84%, Precision: 0.81 and Recall: 0.78

Insights: AI/ML + Industry 4.0 → High funding probability and Climate Tech & Waste Management → Emerging high-potential sectors.

Prescriptive Analysis

Optimal Allocation Strategy

Increase funding in: Climate Tech (+20%), Waste Management (+15%) and Agri-Tech (+10%). Maintain funding in: AI/ML (innovation driver)

Inferential Statistics (Hypothesis Testing)

H1: Green sectors receive equal funding as non-green sectors

- Rejected ($p < 0.05$)

H2: Startup count significantly affects funding

- Accepted ($p < 0.01$)

H3: AI sectors dominate funding allocation

- Accepted ($p < 0.01$)

Decision Analysis (Investment Strategy)

Table 3 gives Portfolio Strategy.

Table 3: Portfolio Strategy

Sector Type	Investment Strategy
AI/ML	Growth driver
Agri-Tech	Sustainable scaling
Climate Tech	Long-term impact
Waste Management	Policy-driven growth
Social Impact	Inclusive development

Results and Discussion

Key Observations: AI/ML dominates funding (₹3.65 Cr), Green sectors collectively account for ~35–40% funding, Food Processing & Agriculture show strong rural impact and Waste Management & Social Impact sectors show policy alignment with SDGs.

Discussion: Funding bias toward digital sectors, Green finance is growing but underfunded and Integration of AI with sustainability is emerging.

Findings

Strong positive relationship between startup count and funding, AI/ML sector is the primary funding attractor, green sectors show moderate but increasing investment and Predictive models confirm sector-based funding patterns.

Suggestions

Policy Level: Introduce Green Startup Incentives and Create SDG-linked funding benchmarks

Investor Level: Adopt ESG-based investment screening and diversify into climate and sustainability sectors

Startup Level: Integrate AI + Sustainability models and focus on circular economy innovations

Conclusion

The TANSEED ecosystem demonstrates a transitional phase where technology-driven sectors dominate funding, while green finance is steadily gaining traction. To achieve SDGs, a balanced approach integrating AI innovation with sustainability-focused investments is essential. This study provides a comprehensive analytical framework for policymakers and investors to align startup funding with sustainable development objectives.

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