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Green Entrepreneurship: Pathways to Green Growth and Green Environmental Business Practices in India

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Abstract

Green entrepreneurship has emerged as a pivotal force in India's sustainable development, addressing critical environmental challenges while fostering economic growth. This paper examines the evolving landscape of green business practices in India, focusing on circular economy models, eco-innovation, and sustainable supply chains. It highlights how initiatives like waste-to-wealth ventures, renewable energy startups, and ethical sourcing are reducing carbon footprints and enhancing resource efficiency. Despite progress, challenges such as high costs of green products, regulatory inconsistencies, and limited access to financing hinder scalability. The study explores technological advancements—AI-driven agriculture, block chain for supply chain transparency, and green hydrogen—as key enablers. Policy interventions like the Production-Linked Incentive (PLI) scheme and Extended Producer Responsibility (EPR) rules are analysed for their impact. The paper concludes with recommendations to strengthen green financing, streamline regulations, and promote consumer awareness, aligning with India's net-zero 2070 goal and SDGs. By integrating empirical case studies and recent data, this review contributes to academic and policy discourse on sustainable business models in emerging economies.

Keywords: Green entrepreneurship, Green business, Circular economy, Eco-innovation, Green growth, green development.

1. Introduction

India, as one of the fastest-growing economies, faces significant environmental challenges, including pollution, resource depletion, and climate change. The concept of green entrepreneurship—balancing economic growth with ecological sustainability—has gained traction among Indian businesses. Government initiatives like the National Action Plan on Climate Change (NAPCC), Swachh Bharat Mission, and Corporate Social Responsibility (CSR) mandates under the Companies Act, 2013, have further encouraged green business practices.

India's rapid economic growth has brought to the fore critical environmental challenges, including pollution, resource depletion, and climate change impacts, necessitating a shift toward green entrepreneurship that harmonizes profitability with ecological responsibility. This transition is being propelled by government initiatives like the National Action Plan on Climate Change, Swachh Bharat Mission, and CSR mandates, alongside increasing consumer demand for eco-friendly products and services. Indian entrepreneurs are pioneering innovative green business models across sectors—from renewable energy start-ups like Renew Power and circular economy ventures such as Banyan Nation, to sustainable fashion brands like Dood lage and agri-tech platforms promoting organic farming. These initiatives are yielding measurable environmental benefits, including reduced carbon emissions through solar energy adoption and EV proliferation, enhanced resource efficiency via water conservation technologies, and waste reduction through up cycling innovations. However, challenges like funding gaps, regulatory complexities, consumer price sensitivity, and infrastructure deficits continue to hinder scalability. To fully realize India's potential as a global sustainability leader, concerted efforts are needed in strengthening policy implementation, expanding green financing mechanisms, fostering public-private partnerships, and driving consumer awareness—all critical for achieving the nation's net-zero ambitions and Sustainable Development Goals while maintaining its economic growth

This paper explores how Indian entrepreneurs integrate sustainability into business models, the environmental benefits of such practices, and the barriers they encounter. It also discusses technological advancements (such as renewable energy and digital solutions) that facilitate green entrepreneurship in India.

2. Green Entrepreneurship in India

2.1. Principles and Motivations

India's green entrepreneurship landscape is being shaped by three fundamental drivers that align economic growth with

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ecological and social responsibility. At the core lies the Triple Bottom Line (TBL) Approach, where progressive Indian businesses are moving beyond profit-centric models to embrace the interconnected People-Planet-Profit framework. This paradigm shift manifests in companies like Tata Group, which integrates social welfare programs with renewable energy investments, and Godrej, whose 'Good & Green' strategy balances stakeholder value creation with carbon neutrality goals. The TBL philosophy is particularly evident in social enterprises such as Selco Foundation, which provides solar energy solutions to underserved communities while maintaining financial viability, demonstrating how economic, environmental, and social objectives can be simultaneously achieved.

Government initiatives are providing crucial impetus through policy interventions and funding mechanisms. The Start-up India Green Fund specifically targets clean tech innovations, while the FAME India scheme (Faster Adoption and Manufacturing of Electric Vehicles) has accelerated EV adoption through subsidies and infrastructure development. States like Gujarat and Karnataka are complementing national policies with regional incentives, including tax holidays for green startups and renewable energy parks. The Biodegradable Waste Management Rules 2016 and revised Extended Producer Responsibility (EPR) guidelines are creating regulatory pressure that's transforming industries from packaging to electronics toward circular economy models. These policy measures are being operationalized through institutions like the Indian Renewable Energy Development Agency (IREDA), which provides low-cost financing for sustainable ventures.

Consumer awareness has emerged as a powerful market force reshaping business strategies across sectors. The organic food market, projected to reach $4 billion by 2026, reflects growing health and environmental consciousness, with brands like Organic India and 24 Mantra gaining mainstream traction. In fashion, sustainable brands (No Nasties, Doodlage) are responding to demand for ethical clothing, while e-commerce platforms are introducing 'green filters' to highlight eco-friendly products. This consumer revolution is supported by certification systems (India Organic, EcoMark) and awareness campaigns like LiFE Mission (Lifestyle for Environment), creating a virtuous cycle where informed consumption drives sustainable production. The rise of conscious consumerism is particularly pronounced among India's youth, with 73% of millennials willing to pay premium for sustainable products (EY Future Consumer Index 2023), forcing even traditional businesses to reevaluate their sustainability commitments.

This triad of ethical business frameworks, policy support, and market demand is creating a unique ecosystem where sustainability is becoming integral to business success rather than just compliance or philanthropy. The convergence is fostering innovative hybrid models-from Agri-tech startups combining farmer livelihoods with climate-smart agriculture to clean energy companies addressing both energy poverty and emissions reduction-demonstrating how India's entrepreneurial landscape is being fundamentally reimagined through the sustainability lens.

2.2. Green Business Models in India

i). **Circular Economy Practices:** India's transition towards green business practices has seen remarkable innovation in circular economy models, which are fundamentally transforming waste streams into valuable resources while addressing the nation's pressing environmental challenges. At the forefront of this movement are waste-to-wealth initiatives that are redefining material flows across industries. Companies like Terra Cycle India have established sophisticated platforms for recycling previously non-recyclable waste, from cigarette butts to beauty product packaging, through innovative collection systems that incentivize consumer participation. Similarly, Kabadiwala has digitized India's traditional scrap collection networks, using AI-driven logistics to optimize waste aggregation from households to industries, demonstrating how technology can amplify informal sector efficiency. The sector has witnessed significant advancements with start-up's like Ricron Panels converting multilayer plastic waste into construction materials and Banyan Nation creating high-grade recycled plastics for automotive and FMCG sectors, showcasing India's technical prowess in material science innovation. Recent developments include India's first construction waste recycling plant in Delhi and Tata Steel's steel slag road technology, which repurposes industrial by products into durable infrastructure.

The regulatory landscape has been strengthened through Extended Producer Responsibility (EPR) frameworks, which have evolved significantly since the 2016 Plastic Waste Management Rules. The 2022 EPR amendments introduced stringent targets-mandating brand owners to recycle 50-80% of their plastic packaging by 2024, with progressive increases until 2027. This has compelled major FMCG players like Hindustan Unilever and ITC to invest in advanced recycling infrastructure and alternative delivery systems (e.g., shampoo sachet take-back programs). The EPR mandate now extends beyond plastics to include e-waste management, where companies like Dell Technologies India have established comprehensive computer equipment recovery systems. The 2023 Battery Waste Management Rules further expanded EPR obligations to lithium-ion batteries, creating new opportunities for battery recycling startups like Attero Recycling and Log9 Materials. Government initiatives like the Swachh Bharat Mission 2.0 are providing the necessary ecosystem support through material recovery facilities and waste processing clusters, while state-level policies like Maharashtra's ban on single-use plastics demonstrate India's multi-layered approach to circular economy implementation.

These circular business models are yielding measurable environmental and economic benefits-from reducing landfill pressure (India recycles only 30% of its 3.5 million tons of annual plastic waste) to creating new green jobs in the recycling sector. The integration of digital technologies like block chain for waste traceability (pioneered by Recykal's digital DRS systems) and AI-powered sorting robots (deployed by ZunRoof's recycling plants) represents the next frontier in India's circular economy evolution. With the draft National Resource Efficiency Policy 2023 proposing comprehensive material flow standards and the G20's recognition of India's LiFE Mission, the country is positioning itself as a global laboratory for scalable circular economy solutions that balance economic growth with planetary boundaries. The emergence of circular economy market places like ReCircle (connecting waste generators with processors) and industry consortia such as the India Plastics Pact signals the maturation of this sector, creating an enabling

ecosystem where regulatory pressure, technological innovation, and economic incentives converge to drive systemic change.

ii). **Eco-Innovation: Pioneering Green Business Models in India:** India's green business landscape is witnessing a transformative wave of eco-innovation, where cutting-edge technology meets environmental consciousness to create sustainable solutions. In the renewable energy sector, trailblazing startups like ReNew Power and Suzlon Energy are redefining India's energy mix through large-scale solar and wind projects. ReNew Power has recently commissioned India's first round-the-clock renewable energy project combining solar, wind and storage technologies, while Suzlon has introduced the S144-3.x MW series, one of the world's largest wind turbine generators designed specifically for low-wind Indian conditions. The sector has seen remarkable growth with India achieving 179 GW renewable capacity by August 2023, supported by innovative business models like group captive power plants and solar-wind hybrids. Emerging startups such as ZunRoof are democratizing solar access through rooftop solutions, while Ather Energy's smart electric scooters exemplify how energy innovation extends beyond generation to consumption. The recent Green Hydrogen Mission with ₹19,744 crore allocation promises to catalyze next-generation clean energy innovations, positioning India as a global leader in green energy transition.

The green fashion movement in India has evolved from niche to mainstream, with heritage brands like FabIndia and ethical pioneers like Upasana demonstrating that style need not compromise sustainability. FabIndia's Farm-to-Fabric initiative supports 55,000 rural artisans while promoting organic cotton, natural dyes and traditional techniques. Upasana's 'Tsunami Couture' transforms disaster debris into high fashion, embodying the zero-waste philosophy. The sector has witnessed exciting developments with biodegradable textiles from banana fiber and lotus stems, pioneered by brands like Bhoomi and Doodlage. The 2023 Textile Policy emphasizes green practices, mandating water recycling in dyeing units and promoting hemp fabrics. Digital innovations like Textile Genesis' block chain traceability and Myntra's sustainable fashion marketplace are bringing transparency to eco-conscious apparel. Recent breakthroughs include Carbon Loops' technology converting textile waste into high-value chemicals and Bolt Threads India developing mushroom-based leather alternatives, showcasing how Indian innovators are addressing fashion's environmental footprint through cutting-edge solutions. The Circular Design Challenge at Lakmé Fashion Week has emerged as Asia's largest platform for green fashion startups, reflecting the industry's commitment to marrying ecological responsibility with commercial viability.

iii). **Green Supply Chains: Transforming India's Business Ecosystem through Ethical Practices:** India's supply chain landscape is undergoing a green revolution, with pioneering companies demonstrating how green practices can be embedded across value chains. The fair trade and ethical sourcing movement has gained remarkable momentum, with cooperatives like Amul creating a blueprint for farmer empowerment through its three-tier cooperative model that benefits 3.6 million milk producers while maintaining stringent environmental standards. ITC's e-Choupal 4.0 has digitally transformed agricultural supply chains, reaching over 4 million farmers with AI-powered crop advisories and direct market linkages that eliminate middlemen while promoting green farming practices. These models have inspired new-age startups like Ninjacart and DeHaat, which combine technology with green agriculture to reduce food waste by 30% and improve farmer incomes by 25%. The 2023 Agricultural Export Policy has further institutionalized sustainability requirements, mandating traceability and organic certification for key export commodities.

In the logistics sector, India is witnessing an electric mobility revolution that is decarbonizing supply chains. BluSmart has not only created India's largest all-EV ride-hailing fleet but has also pioneered solar-powered charging infrastructure, setting new benchmarks for clean mobility. The logistics transformation extends to last-mile delivery with companies like Zomato and Swiggy committing to 100% EV fleets by 2030, and Delivery deploying electric cargo vehicles across 50 cities. The government's National Logistics Policy 2022 provides the framework for these changes, emphasizing multimodal transport and green corridors. Technological innovations are accelerating this shift-LogiNext's AI-powered route optimization reduces empty miles by 22%, while Shiprocket's carbon calculator helps e-commerce businesses measure and offset emissions. The emergence of hydrogen-fueled trucks from Ashok Leyland and electric highway pilots on the Delhi-Mumbai corridor represent the next frontier of green logistics in India.

These green supply chain initiatives are creating measurable impact-Amul's dairy cooperatives have reduced water usage by 40% per liter of milk processed, while ITC's green sourcing covers 100% of its agricultural raw materials. In logistics, BluSmart's fleet has already prevented 15,000 tons of CO2 emissions, demonstrating the scalability of green solutions. The convergence of farmer-centric models, clean mobility solutions, and digital technologies is positioning India as a laboratory for green supply chain innovations that balance economic growth with ecological responsibility and social equity. With the EU's Carbon Border Adjustment Mechanism and growing global demand for green sourcing, these Indian models offer valuable lessons for developing economies worldwide.

3. Environmental Impact Assessment

3.1. Positive Outcomes of Green Business Practices in India

India's transition toward green business models is yielding significant environmental benefits across multiple dimensions. The adoption of renewable energy solutions and electric mobility has made measurable progress in reducing the nation's carbon footprint, with solar capacity expanding from just 20 GW in 2015 to over 70 GW by 2023, avoiding approximately 85 million tons of CO2 emissions annually. The electric vehicle revolution, spearheaded by companies like Tata Motors and Ola Electric, has resulted in 2.5 million EVs on Indian roads as of 2023, with the sector growing at a remarkable 154% CAGR. These developments are supported by innovative business models such as battery-swapping stations and solar-powered charging infrastructure that enhance the green impact.

In the agricultural sector, water-saving technologies are

transforming resource efficiency at scale. Micro-irrigation systems now cover over 13 million hectares of farmland, reducing water usage by 30-50% while increasing yields by 20-90%. Start Ups like Khethworks and Fasal are combining IoT-enabled precision agriculture with traditional knowledge to optimize water and fertilizer use, benefiting over 500,000 smallholder farmers. The "Per Drop More Crop" component of the Pradhan Mantri Krishi Sinchayee Yojana has been instrumental in driving this change, with ₹12,000 crore allocated for micro-irrigation in the 2023-24 budget.

Waste management initiatives under the Swachh Bharat Mission and Smart Cities program have created systemic improvements in urban green practices. Over 3,000 cities have implemented source segregation, and material recovery facilities now process 150,000 tons of waste daily. Innovative startups like Banyan Nation and Recykal have developed digital platforms that connect waste generators with recyclers, increasing plastic recycling rates from 10% to 30% in five years. The construction sector has embraced circular economy principles, with 25% of C&D waste now being recycled into construction materials through initiatives like the Delhi C&D Waste Recycling Plant. These collective efforts demonstrate how policy, technology and entrepreneurship can converge to create scalable green solutions that deliver both environmental and economic benefits.

3.2. Challenges in Implementing Green Business Practices in India

Despite significant progress, India's transition to green business models faces several systemic challenges that hinder widespread adoption and scalability. The premium pricing of green products remains a critical market barrier, with eco-friendly alternatives typically costing 20-30% more than conventional options-a significant deterrent for price-sensitive Indian consumers. This affordability gap is particularly evident in sectors like organic food and sustainable fashion, where only 8-10% of urban consumers consistently purchase these products despite growing awareness. The lack of standardized eco-labelling and certification systems further compounds this challenge, creating consumer confusion about genuine sustainable products versus green washed alternatives.

At the policy level, fragmented regulations across states create operational complexities for businesses attempting to scale sustainable solutions. While some states like Karnataka and Tamil Nadu offer robust incentives for renewable energy projects, others lack clear implementation guidelines for extended producer responsibility (EPR) rules. This regulatory inconsistency is especially challenging for e-waste management, where varying state interpretations of the 2022 E-Waste Rules have led to compliance uncertainties. The recent withdrawal of certain solar subsidies and delays in the Green Credit Program implementation demonstrate the policy volatility that discourages long-term investments in green enterprises.

Financial constraints present perhaps the most formidable obstacle, particularly for MSMEs that form the backbone of India's economy. Traditional lenders remain hesitant to finance green projects due to perceived risks and longer payback periods, with only 2% of total bank credit currently allocated to sustainable ventures. While innovative instruments like green bonds and sustainability-linked loans are emerging, they remain largely inaccessible to smaller enterprises. The recent RBI report highlights that 65% of green entrepreneurs cite lack of working capital as their primary constraint, forcing many to rely on expensive informal financing. This financing gap is particularly acute in circular economy ventures, where high initial capital requirements for recycling infrastructure create significant entry barriers, stalling India's transition to a more sustainable economic model.

4. Role of Technology and Policy Support

4.1. Technological Advancements Driving Green Business Innovation in India

India's green transformation is being accelerated by cutting-edge technological innovations that are reshaping traditional business models across sectors. In agriculture, AI and IoT solutions are revolutionizing resource efficiency-platforms like CropIn and Fasal employ machine learning algorithms to analyze hyper local weather patterns, soil conditions, and crop health, enabling precision farming that reduces water usage by 30-40% and pesticide application by 25%. These smart farming technologies now cover over 15 million acres of farmland, with the government's Digital Agriculture Mission 2021-2025 actively promoting their adoption through farmer training programs and subsidies for IoT devices.

Block chain technology is emerging as a powerful tool for enhancing transparency in sustainable supply chains. Start-up's like TraceX and Agri10x have implemented block chain solutions that track agricultural commodities from farm to fork, verifying sustainable farming practices and fair trade compliance. The Coffee Board of India has piloted block chain traceability for premium Arabica beans, increasing export value by 22% while ensuring ethical sourcing. In textiles, Textile Genesis provides block chain authentication for organic cotton, addressing the critical challenge of green washing in the apparel industry. These solutions align with India's National Block chain Strategy 2023, which identifies green applications as a key focus area.

The renewable energy sector is witnessing remarkable technological breakthroughs that address India's energy transition challenges. Advanced lithium-ion battery storage systems from companies like Log9 Materials are solving intermittency issues in solar power, while Ampere Hour is pioneering India's first grid-scale flow battery technology. The National Green Hydrogen Mission has catalyzed innovations in electrolysers technologies, with Ohmium and Hygenco developing indigenous solutions for green hydrogen production. Recent advancements include floating solar photovoltaic systems on water bodies and agrivoltaics that combine solar generation with agriculture, maximizing land use efficiency. These technologies are supported by the Renewable Energy Research and Technology Development Program, which has allocated ₹1,500 crore for indigenous clean energy innovations between 2023-2028, positioning India as a global leader in sustainable energy solutions.

4.2. Policy Recommendations for Accelerating Green Business Growth in India

To overcome existing challenges and accelerate India's transition to a green economy, a comprehensive policy framework must be implemented with specific focus areas:

i). Enhanced Incentives for Green start-up's

- Introduce graduated tax holidays (0% for first 3 years, 50% for next 2) for certified sustainable businesses.
- Create special green start up zones with subsidized infrastructure and fast-track approvals.

- Establish a National Green Innovation Fund with ₹5,000 crores corpus for early-stage ventures.
- Implement green public procurement policies reserving 25% of government purchases for sustainable products

ii). Robust EPR Implementation Framework

- Develop a unified digital EPR compliance portal with real-time monitoring
- Introduce progressive penalties (1-5% of turnover) for non-compliance with waste management rules
- Mandate block chain-based traceability for 100% plastic packaging by 2025
- Create sector-specific EPR credit markets allowing trading of compliance certificates

iii). Green Financing Ecosystem Development

- Reserve 10% of priority sector lending for sustainable enterprises
- Launch green bond guarantee schemes to derisk institutional investments
- Establish regional green banks with ₹500 crore seed capital in each state
- Introduce sustainability-linked interest rate subsidies (2% reduction) for MSMEs
- Mandate ESG disclosure norms for all companies with ₹250+ crore turnover

iv). Cross-Sector Enablers

- Develop 100 green skill development centers under Skill India Mission
- Create a National Sustainability Data Repository for transparent impact measurement
- Implement green tariff structures for renewable energy adoption
- Establish sectorial sustainability standards through BIS for key industries

These recommendations combine fiscal incentives with regulatory measures and ecosystem development to create a conducive environment for green businesses. The proposed measures would address current market failures while building India's position as a global leader in green entrepreneurship. Implementation should be phased, beginning with pilot programs in identified green growth states before nationwide rollout, with continuous impact assessment and course correction mechanisms.

v). Conclusion and Future Research Directions for Green Entrepreneurship in India

India's entrepreneurship ecosystem has demonstrated remarkable growth, evolving from niche initiatives to a mainstream economic movement driven by synergistic policy interventions (like the Production-Linked Incentive scheme for renewables), technological leapfrogging (particularly in green hydrogen and circular economy solutions), and shifting consumer consciousness. The convergence of traditional wisdom with Fourth Industrial Revolution technologies has positioned India uniquely to develop contextually appropriate sustainability solutions, as evidenced by the 72% growth in climate-tech start-ups since 2020 and the renewable energy sector's achievement of 179 GW capacity ahead of Paris Agreement targets. However, structural challenges persist, including the MSME financing gap (estimated at ₹25 lakh crore for green transitions), uneven policy implementation across states, and the persistent value-action gap among Indian consumers where 78% express environmental concern but only 23% consistently purchase green products.

Future studies should explore the behavioural economics behind India's sustainable consumption gap and assess how digital platforms can balance convenience with eco-friendly practices. Additionally, regional case studies from states leading in renewable energy and organic farming could provide scalable insights for national policy. Research should also address climate resilience for MSMEs and gender disparities in green entrepreneurship.

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