

## Article Review

# The Role of Green Entrepreneurship in Achievement of Sustainable Development Goals

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## Abstract

*Green entrepreneurship new and growing companies that create environmental value alongside economic and social value is moving from the margin of policy and research to the mainstream of strategies to sustainable development. This review synthesizes recent theoretical and empirical contributions to the role of green entrepreneurship (GE) in the contribution to the 2030 Agenda's Sustainable Development Goals (SDGs), with focus on mechanisms, effects, and enabling conditions. We discuss definitional accuracy with respect to sustainable and environmental entrepreneurship; map GE pathways to specific SDGs; amalgamate evidence on effects (including mixed findings); examine the functions of ecosystems, funds, regulation, human assets, and culture; and suggest measurement techniques and testing requirements. While robust evidence links GE with progress in SDGs that include clean energy (SDG 7), responsible consumption and production (SDG 12), industry and innovation (SDG 9), decent work and growth (SDG 8), and climate action (SDG 13), environmental impacts depend on context and policy design in terms of direction and strength. The review is succeeded by a pragmatic scorecard and agenda for researchers and policymakers to accelerate GE's role in the SDGs.*

**Keywords:** Green Entrepreneurship, Sustainable Development Goals (SDGs), Strategies.

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## Introduction

Entrepreneurship is now being seen as a way of addressing intertwined environmental and social challenges. In the past ten years, governments and international organizations have deliberately aligned policies for entrepreneurship with the Sustainable Development Goals (SDGs), which focus on innovation, inclusive development, and green sustainability. Green entrepreneurship, defined broadly as business that minimizes environmental degradation or creates environmental advantages through its products, services, or processes, is at the core of the SDGs. Environmental science and SDGs are crucial issues that deserve careful attention in various areas of our lives [1-3]. Recent bibliometric studies and reviews describe a sudden

growth of research that links entrepreneurship with the Sustainable Development Goals (SDGs). In particular, "sustainable/green entrepreneurship" was a high-priority research field that covers the 5Ps of the 2030 Agenda: People, Planet, Prosperity, Peace, and Partnerships. Such research suggests that entrepreneurial innovation has the potential to convert sustainability challenges into opportunities by leveraging large-scale applications of finance, technology, and human resources [4].

This paper provides an overview of how GE supports some SDGs, the mechanisms involved, the policy instruments that encourage GE, and impact indicators for tracking impact. We also outline tensions and trade-offs (e.g., rebound effect, risk of greenwashing, distributional effects) and areas where the evidence is presently incomplete. Green entrepreneurship (GE) generally describes firms whose core objective is to offer environmental benefits, e.g., resource-efficient technologies, circular business models, clean energy services, or biodiversity solutions. While it is related, GE is a more technical term than sustainable entrepreneurship, whose goal is to create value across all environmental, social, and economic dimensions (the triple bottom line), though environmental benefits are not its primary objective. The term environmental entrepreneurship is widely utilized in place of GE, but certain research views it as a phenomenon involving anything that is a new enterprise significantly reducing environmental degradation. Global policy makers also highlight that GE is "deployment by new start-ups of green products, services and processes. that reduce or prevent environmental damage or are more resource-efficient than conventional alternatives." This policy-oriented frame is significant because it ties venture activity to demand-side levers (e.g., green public procurement) and ecosystem facilitators (e.g., accelerators, finance) [4-6].

## Materials and Methods

This overview captures key areas like Behavioral Flexibility and Adaptation; Learning and Sociality in Innovation, Niche Exploitation and Resource Optimization; Resilience through Innovation Ecosystems and Behavioral Coping; Technological Innovation Motivated by Wildlife Behavior, and Behavioral Strategizing as a Complex Systems Approach. To better comprehend these interconnected issues, these subjects must be critically analyzed. A thorough systematic search was executed in major academic databases utilizing exclusive keywords that pertain to rural livelihoods, climate resilience, and food security. Include relevant gray literature from key agencies and peer-reviewed literature. The collected sources were categorized systematically through themes and reviewed extensively. The search was extended to prestigious databases such as Scopus, JSTOR, Web of Science, and Google Scholar, employing pre-agreed keywords such as Entrepreneurship Ventures and Animal Farming.

## Results and Discussion

### How Green Entrepreneurship Helps to Support Some SDGs

#### *Mechanisms and Pathways*

Green ventures influence SDGs through some overlapping mechanisms: [4, 7-10].

1. Innovation and diffusion of cleaner technology (e.g., renewable energies, efficiency, circular materials), advancing SDG 7, 9, 12, and 13. Asian manufacturing experience from empirical work shows that environmental innovation increases companies' capacity for sustainability goals.
2. New market development transforming consumption and production behaviors (SDG 12) by product-service systems, repair/refill models, and sharing platforms.
3. Skills and jobs in environmentally friendly industries (SDG 8), including entrepreneurship training to build capacity for sustainability transitions.
4. Spillovers from ecosystems—supplier development, local clusters, and knowledge spillovers that enhance the environmental performance of incumbents and related industries (SDG 9, 11)

5. Behavioral change—role-model and network influences that green everyday behavior and increase green self-efficacy of future founders (SDG 4, 12, 13).

The below table 1 provides example links between venture activity and SDG goals. Table 1 identifies the several ways in which green entrepreneurship (GE) aids achievement of selected Sustainable Development Goals (SDGs). It explains how green enterprises foster systemic transformation through encouraging clean energy, sustainable industry, good consumption, and climate action. All the pathways are linked with standard types of ventures, i.e., decentralized renewable systems, circular fashion, or e-mobility platforms, and the associated consequences include emission reduction, enhanced eco-efficiency, and enhanced urban resilience. The table highlights that GE has cross-cutting effects on not just environmental dimensions but also employment, inclusivity, and empowerment, hence supporting the interdependencies of the SDG framework.

**Table 1. Green Entrepreneurship Pathways to SDG Targets (illustrative)**

SDG	GE pathway	Typical venture types	Example outcomes
7 Affordable & Clean Energy	Decentralized renewables, demand response, clean cooking	Solar micro-grids, heat pumps, energy management SaaS	Increased renewable share; reduced energy poverty; avoided emissions. (ScienceDirect)
9 Industry, Innovation & Infrastructure	Clean tech R&D, circular process innovation, green industrial services	Waste heat recovery, biobased materials, pollution control	Higher R&D intensity; eco-efficiency; greener supply chains. (Ris Utwente)
11 Sustainable Cities	Mobility-as-a-service, building retrofits, urban nature tech	E-mobility platforms, retrofit startups, nature-based solutions	Lower urban emissions; improved air quality and resilience. (SpringerLink)
12 Responsible Consumption & Production	Product-service systems, reuse/refill, repair marketplaces	Circular fashion, refill packaging, repair platforms	Reduced waste intensity; extended product lifetimes. (SpringerLink)
13 Climate Action	Mitigation/adaptation tech, MRV tools	Direct air capture suppliers, climate analytics	Emissions reductions; climate risk management. (ScienceDirect)
Cross-cutting (1, 4, 5, 8)	Inclusive green jobs, training, women-led green ventures	Green skills programs, GESI initiatives	Quality employment, empowerment, equitable participation. (growingscience.com)

### What the Evidence Says: Impacts and Nuances

#### *Macroeconomic and environmental impacts*

Empirical evidence from a variety of nations (Journal of Cleaner Production) indicates that a higher proportion of green entrepreneurial activity (GEA) is indeed linked to economic as much as social development. However, the environmental performance does appear to be less calculable and exhibits considerable variations contextually. This indicates that environmental benefits of green entrepreneurship (GE) are uncertain and depend significantly on policy and market dynamics. Additional econometric analysis on the emerging Asian economies finds that eco-innovation and environmental entrepreneurship can immensely lower CO<sub>2</sub> emissions if supported by augmenting renewable electricity and environmental innovation policy. The

findings highlight the crucial role of appropriately targeted sectors of industry and complementarity policies. At the national level, institutional and policy frameworks affect green entrepreneurship and SDGs' nexus. For example, an institutional economics-based study in Saudi Arabia proves that GE effectiveness in achieving sustainable development to a large extent depends on the quality of formal institutions, policies for entrepreneurship, and regulatory assistance [11-13].

### Individual- and venture-level drivers

Psychological factors and human capital determine green entrepreneurs' development. The studies on green entrepreneurial self-efficacy (ESE) reveal that the perception of people's capability to solve environmental issues significantly affects their intention to start green ventures and to engage in related opportunities. Pakistani studies also mention environmental values and perceived behavioral control as necessary, with social pressures exerting a lesser influence, which necessitates greater education and experiential learning.

Not all studies find direct environmental benefits. Certain sectoral studies suggest that green product activity may not result in measurable gains to sustainability unless it is embedded in mainstream operations or made possible by policy institutions. This emphasizes the risk of "bolt-on greening" rather than system transformation [6], [10], [14].

### Enablers, Barriers, and the Role of Policy

OECD green entrepreneurship support analysis in the major economies reiterates two supportive columns: direct intervention in favor of green entrepreneurs and indirect market-altering measures that boost demand. The report highlights that most of these tools remain in infancy and emphasizes the need for interdependent governance between governments and ministries. Similarly, the UN system prioritizes policy tools on technology and innovation and green growth toolkits for inclusive purposes to align entrepreneurship with the Sustainable Development Goals (SDGs).

**Table 2. Policy Instruments That Enable Green Entrepreneurship and SDG Progress**

Instrument	How it helps GE	SDG links
Green public procurement	Creates early markets for clean solutions; lowers demand risk	9, 11, 12, 13 (OECD)
Dedicated green finance (grants, blended capital)	De-risks R&D and first-of-a-kind deployments	7, 9, 13 (OECD)
Standards & regulations (efficiency, eco-design)	Raise baseline, reward innovators	7, 9, 12 (OECD)
Entrepreneurship education & mobility schemes	Build green skills, ESE, and networks	4, 8, 9, 12 (SDGs, Europe PMC)
Inclusive green-growth toolkit (EFR, PES, green accounting)	Align prices/incentives with environmental value	8, 12, 13, 15 (SDGs)
Mission-oriented innovation programs	Coordinate actors around SDG missions	9, 13, 17 (SDGs)

Table 2 presents the institutional settlements and policy instruments that enable the growth and scaling of green entrepreneurship. These instruments green public procurement through to targeted financing facilities, as well as eco-design standards and inclusive growth toolkits enable de-risking of innovation, market-enabling markets, and entrepreneurial capital. By cross-referring each policy tool with one of the SDGs, the table reveals the pivotal function of governance structures in securing correspondence between entrepreneurial activity and broader sustainability objectives. The table further illustrates that in the absence of

accompanying facilitatory regulatory and financial frameworks, the transformative power of GE is circumscribed.

GE thrives in partnership ecosystems involving university, incubator, investor, corporate, and public agency collaborations. Bibliometric and review studies emphasize stakeholder value creation and intelligent, sustainable cities as catalytic contexts that enable entrepreneurial innovation to turn into SDG-compliant outputs [1]. Gender equality and social inclusion (GESI) reinforce GE by broadening the pool of founders and enhancing problem articulation for diverse societies; empirical evidence indicates that inclusive institutions are associated with more robust GE-SDG connections. Locally, green business models in coastal and other societies are substantively influenced by skills, motivation, and attitudes [16-17].

### Common obstacles and how to overcome them

Common challenges are market failures (unpriced externalities), gaps in financing for capital investment or "first-of-a-kind" projects, policy fragmentation, skills shortages, and measurement challenges. The table summarizes the barriers with solutions. Table 3 outlines the major barriers to green entrepreneurship as market distortions in the form of unpriced externalities, financing needs, scattered policy, and insufficient skills and impact measures. For each of these barriers, corresponding solutions are proposed, for instance, environmental fiscal innovations, blended finance mechanisms, joined-up governance systems, and SDG-linked performance indicators. The comparative analysis demonstrates that the barriers are systemic but are amenable to intervention. The table hence places barriers not as irremovable hindrances but as sites of institutional invention and choreographed policy action.

**Table 3. Barriers to Green Entrepreneurship and Practical Remedies**

Barrier	Why it matters	Practical remedy
Unpriced externalities (carbon, pollution)	Distorts competition against clean solutions	Environmental fiscal reform; carbon pricing; green procurement commitments.
Early-market risk & valley of death	Clean tech ventures face long commercialization cycles	Blended finance, guarantees, catalytic grants, public buyers of first resort.
Policy fragmentation & short time-horizons	Lowers investor and founder confidence	Integrated governance, long-term transition plans, mission-oriented programs.
Skills and ESE gaps	Constrains opportunity identification & scaling	Green entrepreneurship education, mobility schemes, experiential learning.
Inclusion gaps	Missed local insights; inequitable outcomes	GESI-aware program design, targeted support for underrepresented founders.
Impact measurement	Hard to prove SDG contributions and attract capital	SDG-aligned KPIs, transparent MRV, lifecycle assessments.

### Measuring What Matters: A Practical Scorecard for GE & SDGs

Sustainable Development Goals (SDGs) and climatic issues should be a part of our daily life and guide our decision-making [18], [19]. Investors and policymakers increasingly require decision-useful impact metrics that are auditable, specific, and comparable. From industry-SDG mapping efforts and entrepreneurship literature, the following scorecard can be adapted by funds, accelerators, and ventures.

Table 4 is a structured framework of key performance indicators (KPIs) to be used in measuring the contribution of the green ventures toward the SDGs. The scorecard involves six dimensions—climate mitigation, resource circularity, pollution and biodiversity, decent work,



inclusion, and governance. All the dimensions are measured in terms of quantifiable indicators, such as avoided CO<sub>2</sub> emissions, percentage of recycled input, green jobs created, and authenticity of claims of impact. Having both environmental and social measures is a reflection of the multi-dimensional aspect of sustainability and that there has to be a requirement of having strong monitoring, reporting, and verification (MRV) mechanisms. This approach offers policymakers, investors, and practitioners valuable instruments to analyze, benchmark, and improve the sustainability performance of entrepreneurial initiatives.

**Table 4. SDG-Aligned KPIs for Green Ventures (illustrative)**

Dimension	Example KPI	SDG(s)
Climate mitigation	tCO <sub>2</sub> e avoided per unit of revenue; % energy from renewables	7, 13
Resource circularity	Material circularity indicator; % recycled/biobased inputs	12, 9
Pollution & biodiversity	Reductions in NO <sub>x</sub> /PM/PO <sub>4</sub> loads; hectares restored/avoided impacts	6, 14, 15
Decent work	Green jobs created; % living-wage jobs; training hours per FTE	8, 4
Inclusion & access	% women/underrepresented founders and employees; affordability index for low-income users	5, 10
Governance & transparency	Third-party assurance of impact claims; lifecycle assessment coverage	12, 16

### Sector Windows: Where GE Can Move the Needle Quick

Entrepreneurial businesses propel diffusion of decentralized energy (solar mini grids, pay as you go technology) and demand-side efficiency (heat pumps, smart controls). Data from industrial environments show that environment innovation increases capacity for delivery of SDGs and supports mitigation and competitiveness. Policy complements quality standards, concessional finance, and grid-integration regulations amplify benefits [7].

Circular businesses (reuse, repair, remanufacturing, refill) tackle upstream design and downstream recovery, decreasing waste intensity and virgin-material dependence. Ex-post analyses and bibliometric reviews credit these models with quantifiable reductions in resources and emissions footprints where complemented with eco-design and producer responsibility regimes. Green mobility, building, and nature solutions investing can drive city-level decarbonization and resilience, particularly where municipal procurement and regulation are leading SDG outcomes [4]. Process innovation, low-carbon fuel, and measurement/verification start-ups unlock emissions reduction in hard-to-abate industries. Quantitative mapping of industry-SDG interactions provides a basis for targeting such innovations to maximize co-benefits and minimize trade-offs [9].

### Entrepreneurship Education, Self-Efficacy, and Talent Pipelines

Green entrepreneurial self-efficacy (ESE)-enhancing education programs utilizing project-based learning, climate and clean-technology classes, and founder mentoring consistently predict intention to start ventures as well as actual venture launches. Survey evidence from Pakistan indicates environmental values and perceived behavioral control are important drivers of sustainable entrepreneurial intentions. Also, combining experiential learning experiences with connections to alumni entrepreneurs enhances the likelihood of realizing such intentions into tangible businesses. Such findings warrant high investments in higher education and vocational training initiatives linked to local sustainability targets [6], [10].

### Governance, Inclusion, and Place-Based Development

Institutional quality and stable policy mixes mediate outcomes: where credible and stable regulation prevails, green entrepreneurs can access capital and forge supply-chain partnerships;

where policies are incoherent or temporary, green innovation is pilot-bound. OECD action focuses on multi-level governance and public-private partnership, and UNCTAD on inclusive entrepreneurship to deliver employment and social value alongside environmental value facilitating SDG interlinkages across the 5Ps. Inclusive design matters: GESI-sensitive entrepreneurship policy improves women's and marginalized groups' participation, strengthens problem formulation, and distributes benefits more equitably outcomes which are unequivocally tied to SDGs 5 and 10. Local evidence also shows that motivation and skills can alter business models at the grassroots level when given an ecosystem platform [5], [8], [9], [17].

### **Risks and Trade-offs**

Greenwashing and impact dilution occur when unsound measurement and assurance cause environmental claims to outpace real impact, eroding trust and misallocating capital, so third-party certification are essential. Rebound happens when efficiency gains feed through into higher total consumption, so policy needs to link gains in efficiency with absolute limits or prices. Distributive pressures arise from cleaner alternatives having higher costs in the short term, and inclusive finance and subsidies must be applied to prevent exacerbating inequities (SDG 10). Furthermore, fragmented ecosystems arise as a result of fragmented programs that discourage scaling, thus coordinated governance and mission-based strategies counter such risks [1], [4], [9].

### **A Practitioners' Checklist for Policymakers, Funders, and Accelerators**

Additionality and scale design. Focus on opportunities whose green impact is core to their business model and scalable with policy-driven markets (procurement, standards). Mix finance to drive commercialization. Use guarantees, concessional tranches, and patient capital to navigate the "valley of death," particularly in industries of high capital intensity. Build human capital and ESE. Incorporate green entrepreneurship modules in business and STEM learning; facilitate fellowships and mobility schemes among academia, startups, and the industry.

Institutionalize inclusive design. Track GESI indicators in programs, target underrepresented founders, and community co-design for context-sensitive solutions. Measure what matters. Employ SDG-aligned KPIs (Table 4), lifecycle-based accounting, and open reporting to secure impact-aware investors and public buyers [4], [5], [10].

### **Gaps in Research and Future Work**

1. Heterogeneity and causality. More quasi-experimental and longitudinal studies are needed to identify causal GE effects on environmental measures (e.g., emissions, biodiversity) across various contexts and sectors. Current cross-country studies show positive economic/social correlations with variable environmental impacts, highlighting the need for detailed designs.
2. Demand-side policy effectiveness. Firm assessments of green purchasing and standard-setting on startup production, survival, and spillover remain scarce. Cross-country analyses can inform best thresholds and design.
3. Inclusion and just transitions. Quantitative analysis of GE's effect on distributional impacts (quality of employment, access) by groups and regions is scarce; integrating GESI approaches and mixed-methods research can do so.
4. Impact on accounting standards for startups. Formed, low-cost MRV systems that respond to venture growth would improve comparability and reduce greenwashing risk.
5. Ecosystem spillovers. More research is needed on how green startups prompt incumbents' decarbonization and how policies for clusters can maximize diffusion into supply chains and cities.

Farzpourmachiani A. [19], in "Attrition Entrepreneurship Theory," recognizes that there may be challenges for some businesses. Green entrepreneurship is not a magic bullet, but it can be a powerful mechanism to drive the Sustainable Development Goals (SDGs) when part of

integrated policy packages and facilitative systems. There is wide-ranging evidence of robust, positive impacts on SDGs around clean energy, industry and innovation, decent work, responsible consumption and production, and climate action—particularly when institutions enable such entrepreneurship, markets pay environmental value back, and education instills green confidence and competencies. Mixed environmental outcomes highlight that what and how entrepreneurs make a difference depends on factors such as design specifications, sectoral concentration, and enabling policies: they decide whether green entrepreneurship makes a real difference to individuals and the world. Intentional impact measurement, inclusive program planning, and intentional governance are essential to bringing green enterprises to fruition in fulfilling the 2030 Agenda from intentions to action.

This study places emphasis on the strategic value of green entrepreneurship in advancing the 2030 Agenda for Sustainable Development. The findings presented in (Tables 1–4), cumulatively evidence that GE is an innovation driver and a system facilitator of sustainability transitions. Evidence indicates that GE facilitates technological advancement, resource efficiency, and inclusive employment while simultaneously promoting environmental sustainability and climate resilience. The gains here depend, however, mainly on facilitation institutional institutions, policy packages, and inclusive ecosystem architecture.

## **Conclusion**

The findings further reveal that the breakdown of systemic barriers and the incorporation of robust impact measurement systems are prerequisites for scaling the GE contribution to the SDGs. In particular, the introduction of gender equity, social inclusion, and open governance increases the legitimacy and effectiveness of green ventures. Green entrepreneurship must thus not be regarded as a marginal phenomenon but rather as an integral component of sustainable development strategies. Through the combination of entrepreneurial innovation with policies that enable, inclusive institutions, and robust accountability systems, GE is able to translate hopes for sustainability into actual advancement, thereby solidifying its role as a critical impetus towards the SDGs.

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