

# Green Financing and Sustainable Entrepreneurship: A Comparative Analysis of Developed and Developing Economies through Key Sustainability Indicators

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## ABSTRACT:

As economies worldwide confront the urgent need to transition toward low-carbon and socially inclusive development models, the interaction between green finance, sustainable entrepreneurship, and innovation ecosystems has become central to both academic debate and policy agendas. This article investigates how these dimensions jointly shape national trajectories across 30 developed and developing countries by combining key sustainability indicators, including the Green Growth Index, Global Green Finance Index, Global Innovation Index, ESG scores, and the number of unicorns. Using Principal Component Analysis (PCA), the study identifies two main latent dimensions integrated sustainability and technological dynamism and reveals a typology of sustainability-driven, tech-driven, and lagging economies. Countries such as Switzerland and Sweden demonstrate a strong convergence between ESG performance, green growth, and innovation capacity, whereas others, including the United States, India, and Kenya, exhibit more fragmented patterns. The findings highlight the critical mediating role of institutional quality in translating green financial flows and innovative potential into sustainable entrepreneurial outcomes. For policymakers, the results offer a comparative diagnostic tool to prioritise interventions in green finance infrastructure, ESG regulation, and ecosystem support, and to design more inclusive regional cooperation frameworks. The study also points to avenues for future research, including the integration of blue economy indicators and subnational data, as well as the use of causal modelling approaches, to further inform evidence-based strategies for sustainable and resilient development.

*Keywords: finance; sustainable entrepreneurship; ESG; innovation; green and blue economy; Principal Component Analysis (PCA)*

## 1. Introduction

The global quest for sustainability has reached a critical inflection point. Rising greenhouse gas emissions, accelerating biodiversity loss, and recurrent climate-related shocks are increasingly undermining both ecological resilience and socio-economic stability. In this context, governments, investors, and firms are under growing pressure to rethink how economic growth is financed, organised, and governed. At the centre of this reconfiguration lies the evolving nexus between green finance and sustainable entrepreneurship, supported by innovation ecosystems that can convert climate ambition into concrete, scalable solutions.

Green finance has emerged as a key mechanism for reallocating capital towards low-carbon and socially responsible activities. Through instruments such as green bonds, ESG-aligned investment funds, and blended finance facilities, financial systems can

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support technologies and business models that reduce environmental harm while creating new sources of economic value. At the same time, sustainable entrepreneurs act as pivotal agents of change by developing ventures that internalise environmental and social objectives within their core value propositions. Yet access to these opportunities remains highly uneven. Advanced economies typically combine mature financial markets, robust ESG regulations, and innovation infrastructures that favour sustainability-oriented ventures, whereas many developing countries face persistent barriers including high capital costs, fragmented regulatory frameworks, and limited institutional support for green start-ups.

A growing body of research suggests that these asymmetries cannot be explained by financial and technological factors alone. Institutional quality encompassing governance effectiveness, regulatory enforcement, and prevailing cultural norms plays a mediating role in determining whether green financial flows and innovative capabilities translate into sustainable entrepreneurial outcomes. In countries with coherent governance systems and credible ESG frameworks, green finance and innovation are more likely to reinforce each other; in weaker institutional contexts, however, similar mechanisms often fail to generate broad-based transformation. Understanding how these structural conditions interact with finance and entrepreneurship is therefore essential for assessing the feasibility of replicating high-performing models, such as those of Nordic economies, in other regions without eroding policy autonomy.

Against this backdrop, this article examines how disparities in sustainable development manifest across 30 developed and developing countries by integrating green performance, innovation capacity, and entrepreneurial dynamics into a unified analytical framework. Building on composite indicators the Green Growth Index (GGI), Global Green Finance Index (GGFI), Global Innovation Index (GII), ESG scores, and the number of unicorns the study applies Principal Component Analysis (PCA) to reduce dimensionality and reveal latent structures in national sustainability and innovation profiles. The empirical results identify two principal components, interpreted as integrated sustainability and tech/start-up ecosystem strength, and allow for a clustering of countries into sustainability-driven, tech-driven, and lagging groups.

The contribution of this study is threefold. First, it offers a holistic, cross-country comparison that simultaneously incorporates green finance, innovation, ESG performance, and entrepreneurial activity, thereby responding to the fragmentation observed in prior literature. Second, by explicitly linking these dimensions to institutional quality, it provides a conceptual bridge between macro-level governance debates and the micro-level dynamics of sustainable entrepreneurship. Third, the PCA-based typology yields a practical diagnostic tool for decision-makers, helping them to benchmark national performance, identify structural gaps, and design more targeted policy mixes. In particular, the analysis informs strategies to strengthen green finance infrastructures, support sustainable entrepreneurial ecosystems, and foster regional cooperation mechanisms including, in future research, the integration of blue economy indicators and subnational data to advance an inclusive and resilient green transition.

## 2. Theoretical Background

### 2.1 Conceptual foundations: sustainable entrepreneurship and green finance

Early scholarship on sustainable entrepreneurship redefined the entrepreneur's role by positioning businesses as agents for environmental and social value creation. Hockerts and Wüstenhagen (2010) contrasted “emerging Davids” with incumbent “Goliaths,” arguing that new entrants may disrupt established industries through business models built around sustainability; this theme was expanded by Muñoz and Cohen (2018), who identified sustainable entrepreneurship as an opportunity - driven process that aligns ecological transition with the triple bottom line. Subsequent contributions developed archetypes for sustainable business models, showing that firms can integrate economic, social, and environmental value propositions into their core strategy, and emphasised that well-designed environmental policies can spur innovation, offset compliance costs and enhance resource productivity. These insights form the backdrop to debates on how finance can catalyse sustainability transitions.

Empirical research on green and sustainable finance suggests that investors and policymakers have begun treating environmental, social and governance (ESG) considerations as value drivers rather than constraints. Friede, Busch and Bassen's meta-analysis of more than 2,200 studies demonstrated that roughly 90 % of empirical findings report a non-negative relationship between ESG performance and corporate financial performance. In capital markets, dedicated instruments such as corporate green bonds have attracted growing attention; Flammer (2021) showed that green bond issuance triggers positive stock-market reactions and is associated with subsequent improvements in environmental performance. These findings imply that financial markets can reward credible sustainability commitments and channel resources toward low-carbon projects. However, the distributional impact of green finance remains uneven across countries and sectors, hinting at deeper structural drivers.

### 2.2 Measuring entrepreneurship and sustainability across countries

Comparative analyses of entrepreneurship underscore the importance of integrating individual and institutional dimensions. The Global Entrepreneurship and Development Index (GEDI) combines data on attitudes, abilities and aspirations with institutional variables, producing a composite measure of entrepreneurial ecosystems across countries (Acs et al., 2017). This “embedded” approach highlights that entrepreneurial activity is shaped not only by individual attributes but also by regulatory quality, access to finance and cultural norms (Acs et al., 2017; North, 1990). Other cross-country indices relevant to sustainability include the Global Green Finance Index (GGFI), Global Innovation Index (GII) and Green Growth Index (GGI); together these indicators capture financial depth, innovation capacity and environmental performance and underpin the dataset used in this study (see Methodology).

Beyond static indices, panel analyses link entrepreneurship to macroeconomic outcomes and stress the mediating role of institutions. Aparicio, Urbano and Audretsch (2016) used panel data for 43 countries (2004–2012) and found that informal institutions

such as trust and cultural values have a stronger effect on opportunity entrepreneurship than formal regulatory structures. Their results show that control of corruption, confidence in one's skills and access to credit enhance the positive impact of opportunity entrepreneurship on economic growth, particularly in Latin America. In a comprehensive review of research on institutions and entrepreneurship, Urbano, Aparicio and Audretsch (2019) concluded that institutional factors influence economic growth indirectly through their effects on entrepreneurial activity, calling for more research into which institutional dimensions support entrepreneurship and growth. Such evidence suggests that high-quality institutions are critical for translating entrepreneurship into sustainable development. Recent studies extend this insight to resilience contexts: Boudreaux, Jha and Escaleras (2023) investigated how natural disasters affect start-up activity and discovered that disasters deter entrepreneurship in countries with low governance quality but stimulate it where governance is strong. These findings underscore that institutional quality mediates the relationship between exogenous shocks and entrepreneurial dynamics. Similarly, Audretsch et al. (2024) analysed 1,789 ecosystem actors in 17 Eastern and Southern European cities and showed that entrepreneurs' sustainability orientation enhances ecosystem growth only when institutional quality is high. Together, these studies indicate that institutional context is a prerequisite for converting financial incentives and entrepreneurial orientation into tangible outcomes.

### **2.3 Drivers of green entrepreneurship and innovation**

Literature on green entrepreneurial orientation (GEO) explores how firms adopt ecological values and translate them into environmental performance. Ameer and Khan's systematic review synthesised drivers of GEO and found that micro-, meso- and macro-level factors stimulate the adoption of green entrepreneurial practices; organisational characteristics mediate the relationship between green orientation and environmental performance, while socio-demographic and contextual variables moderate the link

. At the individual level, studies on green entrepreneurship intention in emerging economies reveal that values and education matter: Amankwah and Sesen (2021) showed that green entrepreneurial intention among Ghanaian students translates into green behaviour, moderated by higher-education support and commitment to green consumption; Yasir et al. (2023) found that environmental values shape attitudes and perceived behavioural control among Pakistani students, though subjective norms exert limited influence.

Complementary research examines the competencies required for sustainable entrepreneurship. Diepolder, Weitzel and Huwer (2021) identified the absence of consensus on competency frameworks in higher education, highlighting the need for curricula that develop systems thinking, stakeholder engagement and interdisciplinary collaboration. Rosário and Raimundo's (2023) review of 59 studies on sustainable entrepreneurship education similarly noted that most frameworks focus on higher education and the authors note that, compared to higher education, secondary education has received less systematic attention. Lechuga-Jimenez et al. (2024) emphasised

transversal skills communication, teamwork and critical thinking as prerequisites for social and “blue” entrepreneurship, advocating integration of these competencies into curricula.

At the macro level, research into environmental innovation and entrepreneurship emphasises the role of technological progress and policy. Barbieri’s (2016) citation-path analysis of environmental innovation literature identified four main themes: determinants (such as regulation, firm size and R&D), economic effects, environmental impacts and policy instruments. Bo et al. (2024) provided empirical evidence from China, demonstrating that green technological progress fosters green entrepreneurship in the short and long run; their nonlinear model shows that positive shocks to environmental technology promote entrepreneurship while negative shocks have little impact. Financial development and stringent environmental policy reinforce long-run green entrepreneurship

The link between regulation and innovation has long been debated. Porter and van der Linde (1995) challenged the traditional view that environmental regulation merely imposes costs; they argued that properly designed standards can trigger innovation offsets process and product innovations that increase resource productivity and competitiveness. Subsequent studies, such as Fatica and Panzica (2021), support this hypothesis by showing that green bond issuers reduce their carbon intensity, especially when projects are externally verified and align with the Paris Agreement.

A relevant model of regional cooperation supporting sustainable innovation and green entrepreneurship is the EIT Regional Innovation Scheme (EIT-RIS), established by the European Institute of Innovation and Technology (EIT). This mechanism connects highly innovative regions with “modest” and “moderate innovator” regions, thereby facilitating knowledge transfer, integrating local SMEs into broader innovation networks, and providing access to targeted programmes that support sustainable entrepreneurship. Evidence from European evaluations shows that EIT-RIS strengthens regional innovation capacities, develops green entrepreneurial ecosystems, and reduces intra-European disparities in sustainability performance, making it an operational multi-level cooperation model aligned with the European Union’s green transition objectives.

## **2.4 Financing sustainable entrepreneurship**

Access to finance remains a central constraint for sustainability-oriented ventures. OECD analyses note that small and medium-sized enterprises (SMEs) struggle to access green finance due to high transaction costs, information asymmetries and underdeveloped markets. Emerging work on ESG-based valuation and financing mechanisms suggests that investors increasingly assess sustainable ventures using tailored metrics; Mansouri and Momtaz (2022) discuss methods for valuing sustainability-oriented startups, highlighting the need for reliable ESG measurement frameworks. Picard (2024) similarly argues that financial innovation and an ecosystem of specialised investors such as impact investors and mission-driven venture funds are critical for scaling inclusive and sustainable startups.

Empirical evidence links venture capital, innovation and sustainable growth. Pradhan et al. (2020) used a vector error-correction model for 25 European countries and

found that diffusion of information and communication technology (ICT), innovation, and venture capital investment significantly drive economic growth in the long run. These results underscore the importance of financial infrastructure for sustaining innovation-led growth and innovative firms, including green technology. Complementary studies on financing mechanisms, including blended finance and public–private partnerships, emphasise that coordinated policy and private-sector participation are needed to mobilise capital at scale.

Qualitative research in developing contexts underscores additional barriers. Arslan et al. (2023) interviewed entrepreneurs, policymakers and educators in Oman and identified high transition costs, limited access to appropriate financial and digital tools, lack of tailored training and bureaucratic hurdles as major obstacles to sustainable entrepreneurship. Sivashanker (2022) surveyed 750 entrepreneurs in Sri Lanka and found that environmental concern, pollution awareness and resource sustainability drive green entrepreneurial activity, but that financial and cultural barriers persist. Labbé, Ola and Lefebvre (2024) examined business angel–entrepreneur relationships in cleantech startups and highlighted information asymmetry and uncertainty about economic value as challenges for financing.

## 2.5 Gaps in the literature and rationale for the study

Although existing scholarship offers rich insights into sustainable entrepreneurship and green finance, several gaps remain. First, research is often fragmented along disciplinary or sectoral lines: studies focus either on firm-level orientation (e.g., GEO), institutional determinants of entrepreneurship, or the effects of specific financial instruments. Few analyses integrate multiple dimensions finance, innovation, ESG performance and entrepreneurship across a diverse set of countries. Second, cross-country analyses typically emphasise high-income regions, leaving emerging and developing economies underexplored. Third, while case studies and panel regressions identify individual relationships, they seldom provide a holistic picture of how these variables co-evolve and cluster at the national level.

To address these gaps, the present study constructs a comparative dataset of 30 developed and developing countries and integrates five indicators GGI, GGFI, GII, ESG scores and the number of unicorns into a Principal Component Analysis (PCA) framework. By standardising and analysing these heterogeneously scaled variables, PCA reduces dimensionality and reveals latent components representing sustainable and innovative development and tech-driven entrepreneurship. This approach differs from prior literature by capturing structural disparities between countries in a multidimensional space, allowing for the identification of clusters (e.g., sustainability-driven, tech-driven, lagging economies). Incorporating institutional quality measures (e.g., the World Bank's Worldwide Governance Indicators) links our empirical analysis to theoretical debates on how governance mediates the relationship between green finance, innovation and entrepreneurship.

## 2.6 Linkage to methodology and discussion

The literature underscores the necessity of considering institutional quality when analysing the interplay between green finance and sustainable entrepreneurship. Evidence that informal institutions and governance mediate the effects of

entrepreneurship on growth, that sustainability orientation influences ecosystems only under high institutional quality (Audretsch et al., 2024), and that governance moderates the impact of natural disasters on start-up activity, all support the inclusion of governance indicators in our empirical framework. At the same time, because governance is not directly included in the PCA variables, these insights support the consideration of governance quality alongside our PCA results. Furthermore, insights on how venture capital, ICT and innovation jointly drive growth inform our choice to include innovation and financing metrics. Findings that green bond issuers improve environmental performance and that ESG investments yield positive financial returns, combined with research on the non-linear effects of environmental technology on green entrepreneurship, justify our focus on countries' financial and innovation ecosystems.

By synthesising these streams, our literature review demonstrates that sustainable entrepreneurship emerges at the intersection of finance, innovation and institutional quality. It highlights the need for holistic, cross-country analyses capable of revealing latent structures and informing policy. The PCA-based methodology adopted in this article responds to this need, offering a novel way to visualise and interpret the comparative positioning of countries and to derive targeted policy recommendations.

### **3. Methodology and Empirical Analysis**

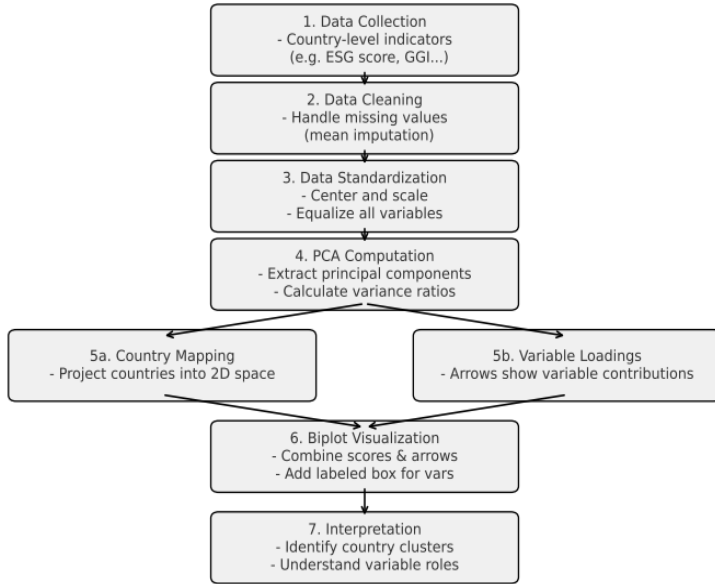
#### **3.1. Methodological Approach**

To explore the comparative positioning of countries in terms of green finance, sustainable entrepreneurship, and innovation capacity, this study applies Principal Component Analysis (PCA) a dimensionality reduction technique that simplifies complex datasets while retaining the most important information. A panel dataset was constructed for 30 countries, including both developed and developing economies, integrating five key indicators:

- Green Growth Index (GGI)
- Global Green Finance Index (GGFI 14 Rank)
- Global Innovation Index (GII Rank)
- ESG Scores
- Number of Unicorns

Since these variables are expressed in heterogeneous units (ranks, scores, and counts), all data were standardized using z-score normalization. This ensures comparability across metrics. Missing values were imputed using column-wise means to preserve the country-level representation without data loss.

PCA was then conducted on the standardized dataset to extract the primary dimensions (components) that explain the variance in sustainability performance and innovation structures. Each country was plotted in a new 2-dimensional space based on the principal components. Additionally, variable loadings were computed to assess how each indicator contributes to the latent dimensions and to identify clusters of similar country profiles.



**Figure 1.** Methodological Workflow

### 3.2 Key Findings and Interpretation

The first two principal components (PCs) together explain 83.32% of the total variance:

**Table 1.** Explained Variance Ratio

PC	Explained Variance	Percentage
PC1	0.6262	62.62%
PC2	0.2070	20.70%

PC1 captures the primary underlying dimension (Sustainable and Innovative Development), while PC2 captures a secondary dimension (Startup Ecosystem Strength). This high explanatory power confirms that the selected indicators adequately reflect the multidimensional nature of national sustainability and innovation performance. Following that, the loadings show how each original variable contributes to the principal components:

**Table 2.** PCA Components (Loadings)

Variable	PC1	PC2
Green Growth Index	0.809095	-0.190355

GGFI 14 Rank	-0.920349	-0.094188
Global Innovation Index Rank	-0.914026	-0.084620
ESG score	0.934779	-0.177321
Unicorns	0.156866	0.992821

Starting by interpreting PC1, the ESG score (+0.935) and Green Growth Index (+0.809) indicate that countries scoring high on sustainability and green growth contribute positively to PC1. While GGFI 14 Rank (-0.920) and Global Innovation Index Rank (-0.914) suggest that lower (better) ranks in these indices correlate with higher PC1 scores. Thus, PC1 represents "Sustainable & Innovative Development"—higher values indicate strong ESG performance, green growth, and top innovation rankings. Concerning the PC2, Unicorns (+0.993) is the only major contributor, meaning PC2 captures startup/unicorn density. Then, PC2 represents "Tech/Startup Ecosystem Strength", higher values indicate more unicorns (e.g., the U.S. is an extreme outlier). Continuing the analysis by exploring the country clustering:

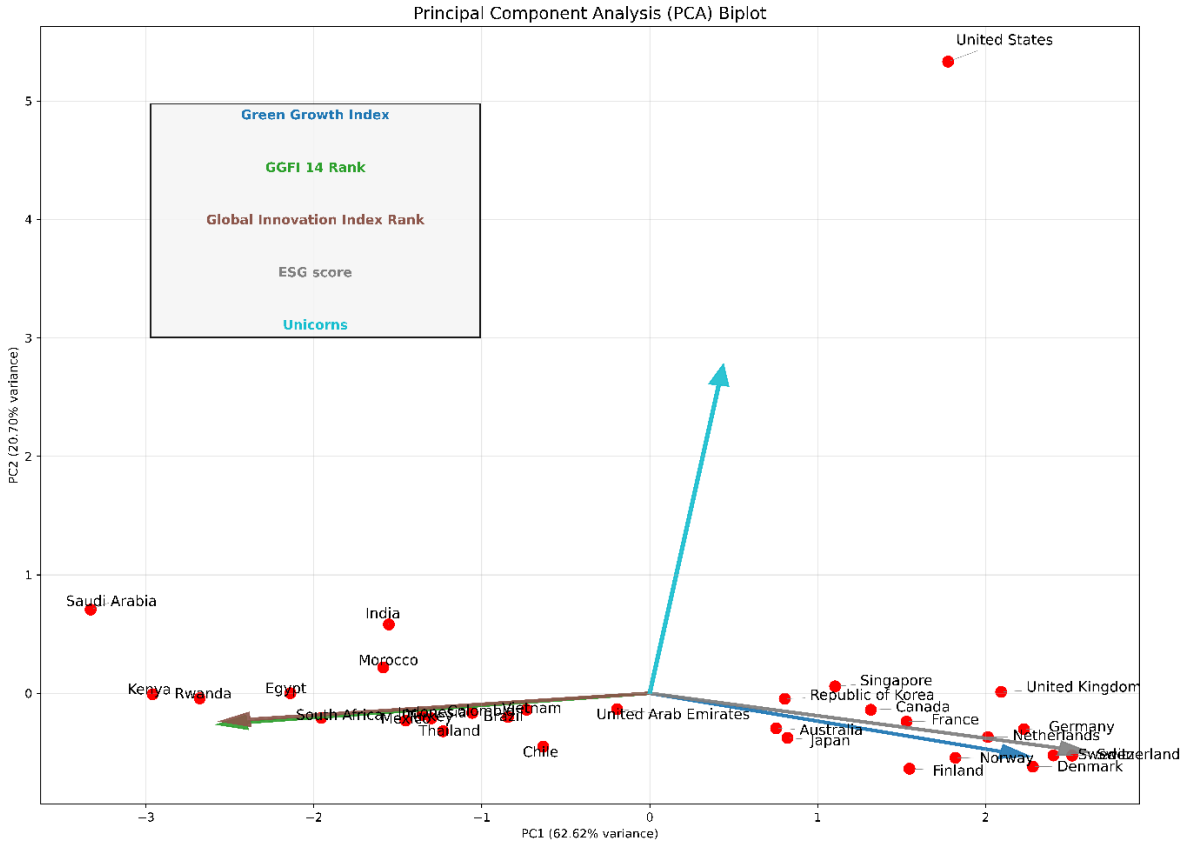
**Table 3.** Transformed Coordinates of Countries

Country	PC1	PC2
Sweden	2.404062	-0.524930
Denmark	2.281827	-0.618912
Norway	1.820386	-0.544958
Netherlands	2.013379	-0.369899
Germany	2.228287	-0.303022
France	1.528947	-0.239110
United Kingdom	2.092526	0.011958
Finland	1.546402	-0.636497
Canada	1.316241	-0.139505
United States	1.776827	5.332451
Japan	0.820649	-0.376256
Singapore	1.103701	0.058403
Australia	0.752311	-0.295597

Republic of Korea	0.803824	-0.046284
Switzerland	2.515211	-0.525868
Morocco	-1.586515	0.218754
South Africa	-1.956675	-0.207709
Kenya	-2.960270	-0.008234
Rwanda	-2.679660	-0.042255
Brazil	-0.844279	-0.200552
Mexico	-1.453927	-0.230112
Chile	-0.634104	-0.450082
India	-1.553253	0.580930
Indonesia	-1.352763	-0.181365
Vietnam	-0.733068	-0.138016
Turkey	-1.299617	-0.211594
Saudi Arabia	-3.329439	0.706642
United Arab Emirates	-0.193600	-0.133211
Egypt	-2.139639	0.000558
Thailand	-1.230741	-0.320467
Colombia	-1.057031	-0.165261

Countries can be grouped according to their performance on principal component scores reflecting sustainability, innovation, and startup activity. Top performers on the first principal component (PC1), which reflects strength in sustainability, innovation, and green growth, include Switzerland (2.52), Sweden (2.40), Denmark (2.28), Germany (2.23), and the Netherlands (2.01). These countries lead in both environmental and innovation indicators. Mid-tier countries such as the UK (2.09), France (1.53), Canada (1.32), and Singapore (1.10) show solid performance but lag slightly behind the leaders in ESG and innovation metrics. The United States is an outlier, with PC1 = 1.78 and PC2 = 5.33; it demonstrates exceptional strength in unicorns and startup activity (high PC2), but only moderate performance in sustainability (PC1). Emerging economies, including India (-1.55, PC2 = +0.58) and Saudi Arabia (-3.33, PC2 = +0.71), show moderate startup development but weaker sustainability and innovation scores. Lastly, countries like Kenya (-2.96), Rwanda (-2.68), and Egypt (-2.14) struggle across both dimensions, reflecting

challenges in both ESG and innovation capacity. The visualization helps us quickly spot which countries are similar, which variables are driving the differences, and how innovation, environmental, and financial factors interact across the global landscape:



**Figure 2.** PCA Biplot of Countries by Sustainability and Innovation Dimension

The analysis highlights several key takeaways across country groups. Sustainability-driven economies, particularly in Europe, such as Switzerland, Sweden, and Denmark, lead the way with strong performance in both ESG and innovation, reflected in high PC1 scores. In contrast, tech-driven economies like the United States stand out as major outliers with extremely high levels of unicorn and startup activity (high PC2), yet do not lead in sustainability performance. Developing economies, including countries in Africa (such as Kenya, Rwanda, and Egypt) and Latin America (Brazil and Mexico), tend to lag on both sustainability and innovation dimensions, showing low scores on both PC1 and PC2. However, there are potential actionable insights for countries like India and Saudi Arabia, which exhibit some strength in technology and startup activity but could benefit from a greater emphasis on improving ESG performance to create a more balanced and sustainable growth trajectory.

#### 4. Policy Implications and Recommendations

Based on the country clustering and principal component structure, several policy recommendations can be drawn. Tech-driven economies such as the United States, India, and Saudi Arabia can leverage their strong innovation bases by strengthening regulatory frameworks, enhancing ESG transparency, and expanding the availability of green financing, thereby fostering more balanced and sustainable entrepreneurial ecosystems. Emerging markets in Africa and Latin America, including Kenya, Rwanda, and Brazil, should prioritize the development of green finance infrastructure through green banks, public–private financing facilities, and sustainability-focused startup incubators to bridge gaps in ESG adoption and innovation. Mid-tier countries such as France, Canada, and Singapore can advance balanced growth by implementing horizontal policies, green taxonomies, circular economy strategies, and ESG disclosure obligations to scale sustainable entrepreneurship. Additionally, coastal developing nations with strong blue economy potential such as Morocco, Egypt, and Indonesia should integrate ocean innovation and biodiversity finance into broader green entrepreneurship policy mixes.

Overall, the empirical findings confirm that green finance, innovation capacity, and ESG integration are interrelated and collectively shape national trajectories in sustainable entrepreneurship. Countries that align these dimensions tend to occupy leading positions in global sustainability rankings, while those lagging behind require tailored policies and ecosystem support. Looking ahead, future research would benefit from incorporating blue economy indicators including ocean-based industries, marine ecosystem services, and biodiversity finance into comparative frameworks. Doing so would broaden the analytical scope and provide deeper insights into how green and blue economic models jointly enhance inclusive and resilient growth across coastal and island nations. This extended perspective would further strengthen the typology's relevance for targeted interventions, international benchmarking, and transition acceleration.

#### 5. Conclusion

This study examined how green finance, sustainable entrepreneurship, and innovation ecosystems jointly shape national progress toward a low-carbon and socially inclusive economy. By applying Principal Component Analysis (PCA) to a sample of 30 developed and developing countries, the analysis revealed clear structural asymmetries: while advanced economies such as Switzerland and Sweden exhibit a strong alignment between ESG performance, innovation capacity, and entrepreneurial dynamism, many emerging economies continue to face institutional constraints that limit the transformative impact of green finance. These disparities highlight that sustainable entrepreneurship is not solely driven by technological capability or capital availability, but also by the broader institutional ecosystem in which financial and entrepreneurial actors operate.

Two principal dimensions were identified through PCA: one reflecting integrated sustainability capturing ESG performance, green growth, and regulatory quality and another reflecting technological dynamism, proxied by unicorn density and innovation strength. Countries that perform well on both axes demonstrate coherent governance frameworks, predictable regulatory environments, and a cultural commitment to

sustainability. Conversely, fragmented patterns in countries such as the United States, India, or Kenya point to the need for tailored policy mixes, stronger ESG disclosure frameworks, and improved access to sustainable finance mechanisms.

The findings underscore the importance of institutional quality as a mediating factor that shapes the effectiveness of green financial flows. Governance effectiveness, regulatory enforcement, and societal attitudes toward sustainability condition the translation of financial incentives into meaningful entrepreneurial outcomes. Understanding these institutional features is therefore critical for countries seeking to replicate the convergence achieved by Nordic economies without compromising their own developmental trajectories.

Policy implications extend beyond national boundaries. Opportunities for regional collaboration including North–South knowledge transfer, blended finance partnerships, and integration into regional innovation platforms such as the EIT Regional Innovation Scheme (EIT-RIS) could help emerging economies overcome barriers related to capital access, skills development, and technology adoption. Strengthening these cooperative frameworks would support more inclusive and resilient sustainability ecosystems across regions.

This research also acknowledges the limitations inherent in relying on aggregated national indicators, which may obscure subnational heterogeneity in entrepreneurial activity, regional ESG performance, and localized innovation clusters. Future work would benefit from incorporating regional and city-level datasets, enabling a more granular understanding of sustainability dynamics and allowing policymakers to design interventions that target specific territorial needs.

Looking forward, expanding the analytical scope to include blue economy indicators such as ocean-based industries, marine biotechnology, sustainable fisheries, and biodiversity finance would provide a more comprehensive assessment of sustainability pathways, particularly for coastal and island nations. Integrating green and blue economic dimensions would enrich comparative analyses and illuminate how these models jointly contribute to inclusive growth and climate resilience.

Finally, future research could adopt more advanced empirical approaches, including Equation Modelling (SEM) and panel regression techniques, to move beyond associative patterns and test causal relationships among institutional quality, green finance, innovation capacity, and sustainable entrepreneurial outcomes. Expanding the sample to more than 150 countries would further enhance the robustness of the findings, allowing for a more systematic evaluation of how differing governance models influence convergence, and whether emerging economies can emulate the institutional success of high-performing nations while preserving their policy autonomy.

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