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Designing Entrepreneurial Ecosystems for a Greener Future through Review of Frameworks Policies and Practices with Insights from Oman

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Abstract

As environmental priorities reshape global development agendas, sustainable entrepreneurship is increasingly seen as a strategic pathway to innovation, employment, and ecological resilience. Qualitative content analysis of 53 peer-reviewed articles and institutional reports published between 2013 and 2024 is applied in the study to investigate how entrepreneurial ecosystems are structured to enable green innovation. The analysis looks for patterns across geographical settings to synthesize prominent themes related to stakeholder coordination, policy levers, institutional support, and regional adaptation. This study is guided by the following research questions: (1) What design features characterize successful sustainable entrepreneurial ecosystems across global contexts? (2) How are stakeholder coordination, policy instruments, and institutional support structured to enable green entrepreneurship? (3) How can these global insights be adapted to Oman's unique socio-economic and policy landscape under Vision 2040? Findings underscore the roles played by multi-actor governance, fiscal and regulatory levers, and academia-industry partnerships in enabling sustainability-driven entrepreneurship. For emerging economies such as Oman—where Vision 2040 demands economic diversification and environmental sustainability—ecosystem-level interventions are particularly important. The study formulates a conceptual framework capturing global lessons for local strategies in catalyzing cleantech, agri-innovation, and circular economy startups. The framework offers actionable advice to policymakers, educators, incubators, and investors in embedding sustainability in entrepreneurial ecosystems, with implications for SDG and national transformation strategy alignment.

Keywords: Sustainable Entrepreneurship, Entrepreneurial Ecosystems, Qualitative Content Analysis, Green Innovation, Policy Instruments, Institutional Support, Multi-Stakeholder Governance, Vision 2040 (Oman), Cleantech, Circular Economy, Sustainable Development Goals (SDGS)

1. Introduction

The union of entrepreneurship and environmental sustainability has radically reshaped the global development agenda, as nations adopt paradigms of development that combine economic advancement with environmental stewardship. Entrepreneurs are increasingly at the forefront of driving such a transformation, developing innovations in clean energy, sustainable agriculture, water efficiency, and circular economy approaches (Bocken et al., 2019; George et al., 2021). However, the realization of such transformative capacity is inescapably intertwined with the configuration and functioning of entrepreneurial ecosystems to promote sustainability-oriented ventures (Roundy et al., 2018). These ecosystems—institutional regulatory regimes, financing systems, research institutions,

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and collaboration networks—form the enabling infrastructure supporting sustainable innovation to emerge and disseminate.

In the situation of emerging economies such as Oman, where environmental necessities converge with national economic diversification agendas, the integration of sustainability values into entrepreneurial ecosystems is not only timely but necessary. Oman Vision 2040 articulates a national development strategy founded on innovation, environmental sustainability, and youth empowerment as drivers of a knowledge-based economy (Oman Vision 2040, 2020). Nonetheless, extant literature indicates that the majority of developing nations continue to lack integrated, ecosystem-level institutions that embed environmental and social agendas into entrepreneurial policy mechanisms (Bosma et al., 2022; Zahra, 2021).

This study bridges this gap by utilizing qualitative content analysis in the study of policy tools, institutional arrangements, and governance structures that facilitate sustainable entrepreneurial ecosystems globally. Guided by a collection of 53 peer-reviewed papers and institutional reports completed between 2013 and 2024, the study distills best practices and contextualizes them into a conceptual framework to be applied in Oman's emerging innovation ecosystem.

The significance of the study is that it supports theory building and policymaking. It offers policymakers, educators, and facilitators of innovation in Oman empirically based methods of embedding sustainability within entrepreneurship. In addition, it contributes to the literature by emphasizing the two-way dynamic interaction between international pressures for sustainability and local entrepreneurial contexts—by ultimately situating green entrepreneurship as a force for inclusive and long-lasting development.

2. Methodology

2.1 Review Framework

This study adopts qualitative content analysis (QCA) as its methodological framework to explore and interpret literature on sustainable entrepreneurship ecosystems. Unlike systematic reviews that emphasize quantification and exhaustive filtering, content analysis allows for the interpretive classification of textual data into meaningful themes. The approach supports a deeper understanding of how sustainability is conceptualized and operationalized within ecosystem design, especially in relation to policy, governance, and regional innovation systems. The method follows the principles outlined by Schreier (2012) and Hsieh and Shannon (2005), emphasizing transparency, category development, and thematic integration.

2.2 Search Strategy

Literature was gathered through a purposive search of four academic databases: Scopus, Web of Science, ProQuest, and Google Scholar. The search employed a set of relevant keywords, including “sustainable entrepreneurship,” “ecosystem design,” “green startups,” “innovation governance,” and “cleantech ecosystems.” The aim was to capture a broad range of interdisciplinary studies and institutional reports addressing sustainability in entrepreneurial and policy contexts. In addition to database queries, backward citation tracking was used to identify further sources that align with the study’s thematic focus.

2.3 Inclusion and Exclusion Criteria

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To ensure relevance and conceptual depth, the inclusion criteria were restricted to peer-reviewed articles published between 2013 and 2024, as well as grey literature produced by reputable organizations such as the United Nations Development Programme (UNDP), the Organization for Economic Co-operation and Development (OECD), the World Economic Forum (WEF), and selected regional think tanks. Included sources were required to explicitly address sustainability at the ecosystem or policy level. Excluded from the review were firm-level case studies focused on single enterprises and reports lacking methodological transparency or substantive analytical content.

2.4 Content Analysis Procedure

The analysis began with an initial pool of 178 documents, of which 53 were selected based on the established inclusion criteria. The process followed four stages: data familiarization, coding, categorization, and theme refinement. During the first stage, each document was reviewed and annotated to highlight segments relevant to the research focus. In the coding phase, inductive labels were assigned to units of meaning derived directly from the text. These codes were then grouped into broader categories, which were refined through comparison and synthesis. As a result, four key themes emerged: stakeholder structure, policy instruments, institutional support, and regional adaptation. These themes reflect the organizational, political, and contextual dimensions of sustainable entrepreneurship ecosystems, offering a coherent framework for understanding their design and functionality across diverse regions.

Table 1: Profile of Reviewed Documents

Descriptor	Details
Years of Publication	2013–2024
Document Types	39 peer-reviewed journal articles, 14 institutional/grey reports
Geographic Scope	Global (19); OECD countries (12); MENA region (11); Southeast Asia (7); Africa (4)
Methods Used	Qualitative reviews (22); Mixed methods (15); Case-based synthesis (16)
Theoretical Frameworks	Triple/Quadruple Helix; Stakeholder Theory; Circular Economy; Sustainability Transitions

3. Results and Discussion

3.1 Ecosystem Structure and Stakeholder Configuration

Green entrepreneurship ecosystems are likely to operate better under inclusive, multi-stakeholder governance structures, namely: the quadruple helix model, with public sector organizations, academe, industry, and civil society organizations. This governance system facilitates co-creation of innovation, supports systemic thinking, and ensures that sustainability agendas are scientifically informed and community responsive (Cavallini et al., 2018; Yawson, 2022). Quadruple helix governance aligns policy, research, market forces, and societal values and therefore supports more adaptive and responsive ecosystem responses to environmental challenges.

International cases provide strong evidence of the value of this model. Finland's innovation-driven circular economy clusters provide an example of how regional development organisations, universities, and SMEs can collaborate on resource-efficient approaches supported by public finance and research partnership (Lundström & Mäenpää, 2017; Lahti et al., 2022). The "Green Deal" strategy in the Netherlands has established a voluntary,

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multi-stakeholder platform for companies, civil society, and government agencies to experiment with low-carbon solutions and exchange best practices (OECD, 2022).

In contrast, Oman's green entrepreneurial ecosystem remains in its infancy. While Oman Vision 2040 captures a national commitment to sustainability, innovation, and inclusive governance, concrete action remains patchy. Central ministries—responsible for higher education, commerce, and the environment—far too often act in isolation, stifling collective action. Recent research by Al Badi et al. (2022) and Elia and Margherita (2020) identify that a deficit in cross-sectoral platforms and academia–industry engagement has held back progress on common sustainability goals. In order to circumvent this, Oman could establish a National Sustainability Council or equivalent governing body, including SMEs, research centres, civil society groups, and local authorities. This formal framework would enable policy experimentation, knowledge exchange, and inclusive agenda-setting—essentials for unlocking a resilient, innovation-led ecosystem.

3.2 Policy Instruments Supporting Green Entrepreneurship

Literature consistently identifies three interdependent categories of policy instruments as facilitators of green entrepreneurial ecosystems: fiscal instruments, market mechanisms, and regulatory innovations. Fiscal instruments include targeted subsidies, green startup grants, cleantech R&D funding, and tax rebates that decrease the expense of sustainable innovation. For instance, South Korea's "Green Growth" model qualifies as a model where public subsidies are made conditional on quantifiable environmental outcomes, thereby triggering accountability and innovation alignment (OECD, 2022). Market mechanisms, particularly public procurement policies that prefer sustainable goods and services, create demand-side pull for eco-innovation.

Sweden's Green Public Procurement model inspires the policymaking community about the ability of governments to drive market change through the promotion of sustainable production and service models (European Commission, 2021). Regulatory innovations include adaptive instruments such as emissions-based licensing, environmental impact thresholds, and sandbox regulations authorizing eco-startups to experiment under relaxed compliance regimes (ILO, 2023). Policy coherence is the common success factor throughout these policy streams. Incoherent mandates or fragmented regulations are continually referred to as hindrances to investor confidence and entrepreneurial engagement (Zahra, 2021; Carayannis et al., 2022).

While Oman has made significant institutional gains—such as the establishment of the Environment Authority and establishment of clean energy targets under Oman Vision 2040—these efforts remain compartmentalized across agencies in the absence of an overarching green entrepreneurship strategy. To bridge the gap, Oman can include environmental key performance indicators (KPIs) in its national SME development programs and insert sustainability-linked criteria in government procurement processes. These actions would not only seek demand for green products and services but also communicate consistent and credible signals to entrepreneurs and investors looking for long-term returns in the sustainability sector.

3.3 Institutional Support and Capacity-Building

Universities and public research institutes are the intellectual and functional backbone of entrepreneurial ecosystems for sustainability. Globally, institutions like Wageningen University (Netherlands) and EARTH University (Costa Rica) provide specialized agroecology, sustainable value chain, and climate entrepreneurship education—often in partnership with industry and government (UNDP, 2019).

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Rwanda's TVET system shows how green water, solar power, and waste startups can be incubated by small-scale experimentation and knowledge sharing led by the community (Mutebi & Nabaho, 2021). The examples bear witness to the importance of ecosystem density—mapping physical infrastructure (e.g., incubators) and cognitive infrastructure (mentorship and curricula).

In Oman, there are innovation support programs developed by major institutions such as Sultan Qaboos University and TRC. Incubation programs and entrepreneurship education are not sustainable. Entrepreneurship training is largely generalist, with few modules in environmental impact assessment, product life-cycle design, or ESG finance (Ratten, 2020).

To bridge this gap, Oman can initiate a national Green University Entrepreneurship initiative, integrating climate literacy, responsible innovation, and cleantech prototyping into university curricula and creating sustainability-themed incubators in university campuses.

3.4 Regional Adaptation and Context Sensitivity

One of the frequent arguments in the new literature is the imperative of contextual adaptation in the entrepreneurial ecosystem design for sustainability. Successful templates developed and experimentally validated in Scandinavian or East Asian settings cannot be automatically transplanted into nations such as the Middle East or Sub-Saharan Africa per se. As Audretsch and Belitski (2019) highlight, entrepreneurial ecosystem success is not determined by formal infrastructure and policy instruments alone but also depends on informal institutions such as networks of trust, cultural norms, and social capital. Islamic finance, a culturally embedded yet under-leveraged tool of financing sustainable enterprise, is found in the MENA region. Tools such as green sukuks—Sharia-compliant bonds that finance green initiatives—are bridging ethical investing with sustainability principles but remain on the periphery of entrepreneurship finance means (GIZ, 2021; World Bank, 2022).

Oman Vision 2040 also establishes strategic areas—such as sustainable tourism, water management, fisheries, and green logistics—where high green entrepreneurship potential exists. However, to capture the potential, there need to be tailored regulatory regimes, location-based incentives, and multi-stakeholder coordination platforms that recognize Oman's regional diversity. For example, Dhofar's rain-fed agriculture systems, Muscat's logistics, and Al Wusta's marine resources all possess unique ecological and economic circumstances that can serve as anchors for localized innovation clusters. These clusters need to integrate traditional knowledge systems, local value chains, and region-based ecological assets into the entrepreneurial support ecosystem (Al Siyabi et al., 2023).

Moreover, to create a cultural inclination towards sustainability entrepreneurship, it requires more than structural change—it requires social normalization. Public campaigns, grass-roots green startup stories, and youth-led pitching competitions can help ground sustainability as an aspirational and attainable value in Omani entrepreneurial society. Such initiatives would not only accelerate ideation and early-stage startup activity but also build societal consensus towards green innovation as a national development imperative.

Table 2: Summary of Key Ecosystem Components Across Selected Case Studies

Country	Governance Model	Policy Tools Used	Institutional Anchors	Outcomes Related to Sustainability
Finland	Quadruple Helix	Circular economy	Universities + Regional	High cleantech

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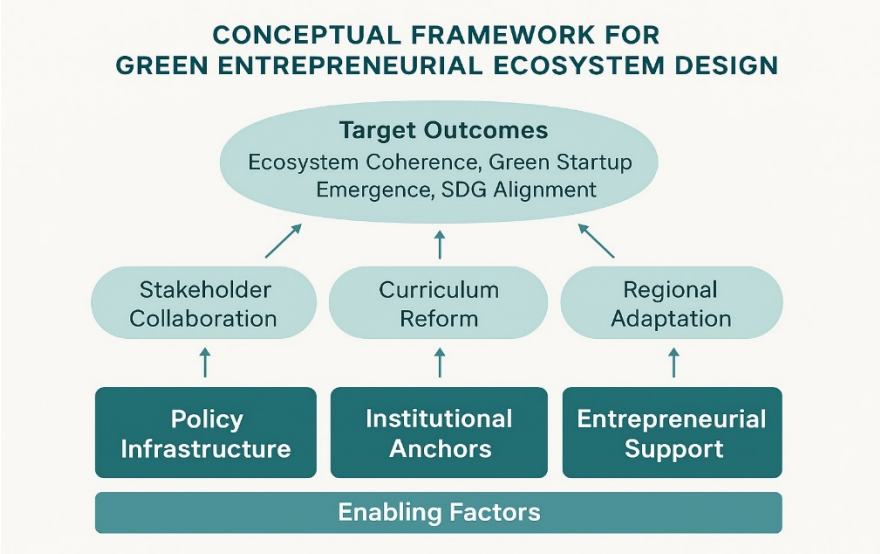
		funding, public–private clusters	Innovation Hubs	adoption, strong startup pipeline
Netherlands	Green Deal Agreements	Voluntary environmental pacts, procurement schemes	Sector-based innovation consortia	Cross-sector alignment on low-carbon goals
South Korea	National Innovation Strategy	Green R&D grants, regulatory sandboxes	Ministry–university–industry coordination	World-class clean-tech clusters
Costa Rica	Education-driven clusters	Eco-tourism incentives, sustainability curriculum	Universities with embedded startup centers	Growth in eco-enterprise exports
Rwanda	Community entrepreneurship	Localized funding, vocational green skills	Community-based incubators	Inclusive green growth in rural sectors
Oman (Current)	Fragmented coordination	SME policies (general), limited green integration	Government research funding	Untapped potential for ecosystem synergy

4. Conceptual Framework: Enabling Green Entrepreneurial Ecosystems

This paper proposes a three-pillar framework as a strategic guide to designing entrepreneurial ecosystems that embed sustainability at their core. The framework draws from global case studies and synthesizes institutional, policy, and entrepreneurial practices that have proven effective in fostering green innovation. Importantly, the framework is contextualized for Oman, aligning closely with Vision 2040's call for environmental resilience, youth-driven innovation, and cross-sectoral collaboration. Each pillar represents a foundational dimension of the ecosystem architecture:



Figuer1: Conceptual Framework for Green Entrepreneurial Ecosystem Design (Oman Context)

Why this matters for Oman: The three-pillar framework outlined in Figure 1—encompassing *Policy Infrastructure*, *Institutional Anchors*, and *Entrepreneurial Support*—positions sustainable entrepreneurship not as a siloed

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endeavor, but as a cohesive national strategy. By embedding sustainability across legislation, education systems, and innovation platforms, this approach aligns with Oman Vision 2040's goals of economic diversification and environmental stewardship. Each pillar serves as a structural lever to convert Oman's regional advantages—such as its diverse geography, youthful demographics, and policy momentum—into a competitive advantage. For example, policy infrastructure provides coherent incentives and standards; institutional anchors cultivate sustainability-oriented knowledge and governance; and entrepreneurial support mechanisms activate the capabilities of local startups and SMEs. Together, these pillars enable Oman to not only respond to global environmental challenges but also to become a leader in green innovation across the Gulf and broader MENA region.

5. Implications for Oman

Oman is at the crossroads of a pivotal turn in its national development path. With the start of Vision 2040 implementation, the country aims to transition from its Petro-driven economy to a knowledge-, innovation-, and environment-focused economy. Green entrepreneurship—facilitated by entrepreneur ecosystems consciously structured to that end—therefore becomes the economic diversification, employment generation, and ecological sustainability driver. Realizing this vision requires a series of national priorities to be articulated. Among them are the creation of green innovation clusters in Duqm, Sohar, and Salalah as centers of specialization in clean tech, aquaculture, and circular logistics, respectively. Concomitantly, curricular integration of eco-entrepreneurship into higher learning institutions, including Sultan Qaboos University and applied colleges, is required to cultivate a sustainability-focused entrepreneurial culture among the youth. Public-private partnership is also needed to mobilize green business financing, including the setting up of co-funded sustainability-themed venture capital funds in collaboration with regional investors. All of these interventions combined seek to inject sustainability into Oman's entrepreneurial ecosystem in order to harmonize national economic growth with long-term environmental stewardship.

6. Limitations

This review is based exclusively on English-language literature, which may overlook regional knowledge published in Arabic. While grey literature was included to capture practice-oriented insights, informal or community-led initiatives might still be underrepresented. Moreover, the conceptual framework has yet to be empirically validated in Oman, and future fieldwork could test its effectiveness in specific sectors such as water innovation or eco-tourism.

7. Recommendations

Building on the insights derived from the systematic review, this section outlines actionable strategies aimed at strengthening green entrepreneurial ecosystems in Oman. The recommendations are designed to translate global best practices into locally relevant interventions, supporting the implementation of the proposed conceptual framework. Each recommendation addresses a key pillar—policy, institutions, and entrepreneurial support—and collectively they provide a roadmap for operationalizing Oman Vision 2040 through sustainable innovation and inclusive economic development. Here are the detailed recommendations:

7.1 Develop an Integrated National Strategy for Green Entrepreneurship Oman's government should create a comprehensive roadmap aligning policy instruments, financing schemes, and educational initiatives to sustainability targets under Vision 2040.

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7.2 Institutionalize Sustainability in Higher Education and Innovation Centers Incorporate green curricula across universities and launch innovation labs focused on sustainability challenges in key sectors.
7.3 Establish a Sustainability Innovation Fund A blended public–private fund should support eco-entrepreneurs with seed capital, risk guarantees, and commercialization services.
7.4 Form Ecosystem Coordination Councils Launch regional councils with cross-sector representation to oversee ecosystem design, monitor metrics, and facilitate collaborative programming.
7.5 Leverage International and GCC Partnerships Engage with platforms such as UNDP and GCC innovation networks to co-develop tools, benchmarks, and impact metrics.
7.6 Promote Awareness and Culture of Green Entrepreneurship Use public campaigns, youth competitions, and storytelling to embed sustainability in national identity and entrepreneurial aspiration.

8. Conclusion

This systematic review analyzed how entrepreneurial ecosystems can be designed to provide sustainability-driven innovation, with specific interest in emerging economies such as Oman. Drawing on the synthesis of 53 scholarly and grey literature sources, the study identified four building blocks of green entrepreneurial ecosystem success: inclusive governance structures, policy instruments aimed at sustainability, institutional capacity building, and regional context sensitivity. The key findings highlight that ecosystems facilitated by quadruple helix cooperation—linking government, academia, industry, and civil society—are more responsive and resilient to sustainability transitions. Policy instruments that provide returns are fiscal incentives, green public procurement, and regulatory environments supportive of environmental experimentation. Educational institutions and incubators also play a key role in the formation of climate-ready entrepreneurs, even as curriculum and practice gaps remain in most environments, including Oman. The conceptual framework developed in this paper—policy infrastructure, institutional anchors, and entrepreneurial support—offers a practical roadmap for making Oman a green, innovation-driven economy. It is in line with Oman Vision 2040 and the UN Sustainable Development Goals. Integrated national strategies, university-driven sustainability hubs, customized finance mechanisms, and stakeholder coordination councils are proposed by the study as key building blocks. These building blocks together can reposition entrepreneurship as a core driver of sustainable development and economic diversification in Oman.

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