

# Sustainable Innovation Ecosystems

Subjects: [Economics](#) | [Others](#)

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Innovation ecosystem is a intertwined network of multi-layer relationships through which relevant knowledge and creativity flow through a framework of sustained value co-creation. The term gained popularity among academics, policymakers, managers and entrepreneurs in the last decades. These complex relations between players aim to enable technology development and innovation with an open mindset and promoting the responsible and inclusive exploitation of resources.

open innovation

innovation ecosystems

sustainability

logit models

## 1. Introduction

Rapidly obsolescent assets and constant shifts in demand in a globally competitive environment are putting pressure on both the industry and national innovation systems. Trading blocks, nations, regions, and clusters worldwide face ongoing structural changes trying to appraise global innovation trends and technological shifts. Accommodating this hectic pace demands efficient and reinforced innovative ecosystems.

The concept of innovation ecosystem gained increased popularity over the last decade, due to its particular link to open innovation. The term was firstly coined by Tansley <sup>[1]</sup>, to name one ecological element embedding the living creatures and their environment. Moore <sup>[2]</sup> revived the concept to describe a framework of players in coopetition, highlighting the geographic dimension of knowledge spillover sharing. This increased popularity put the debate on its relevance and definition. Presently, the innovation ecosystem comprises a multilayer framework in which institutions interconnect to develop and share information and knowledge required for the development of new innovation processes <sup>[3]</sup>. It evidences the co-creation and sharing of firms to provide a coherent solution to meet the challenges of the demand.

Innovation is strongly connected to problem solving, and presently, the challenges relate to complex problems demanding structural changes in individual and collective living such as sustainable development. According to the World Commission on Environment and Development (1987) <sup>[4]</sup>, this state is a dynamic process of change, allowing the present exploitation of resources, the completion of investments, and the path of technological and institutional change, combining the welfare maximization of present and future generations.

Sustainable innovations will work as catalysts for cleaner production, meeting societal challenges in both the short and long run, encompassing economic and environmental targets in local and global dimensions. Sustainable development practices provide background for any context in which humans and the environment are found. These

innovations will underpin sustainable development relying upon the networks, local communities, and corporate sustainability as think tanks developing benign solutions to societal challenges [\[5\]](#)[\[6\]](#).

The ecosystem will consist of a dynamic, interactive network embedded in an innovation mindset, an interactive set-up focused in knowledge creation and diffusion. These ecosystems might be virtual due to the digital transformation we are facing globally; however, they need some grounded hub as members need to physically meet to interact and co-create, to develop new ideas benefiting from their multidisciplinary skills and competences [\[7\]](#).

A vigorous innovation ecosystem will provide firms an innovation environment of “tropical rain forests” where they can share value with a community with shared interests; this process will include governments, the value chain, and the user community, which communicate and promote innovation in order to create valuable new products [\[8\]](#). It will be reinforced by openness and flexibility, enlarging participation to unusual partners to grasp the knowledge arising from the quintuple helix. Innovative activities are not developed inside the firm borders anymore; they are part of broader interaction with the environment, involving various players embedded within an interdependent innovation ecosystem [\[9\]](#). These frameworks present a straightforward agenda to bring together human resources boosting entrepreneurial initiatives in a bidirectional way, therefore becoming collective intelligence catalysts. The ecosystem will be revived when fed by external knowledge and contributions, which will spawn an innovative mindset [\[10\]](#)[\[11\]](#).

Traditional ecosystems tend to centralize in one entity, which benefits the most from the added value; hence, this concentration should be avoided, placing the entire community at the epicenter of the ecosystem. Establishing organized interactions will favor the continuity of the ecosystem, which should be settled on trust, sharing, and a meaningful sense of identity that will consolidate the network based on shared values, which will enhance sustainable practices [\[9\]](#)[\[10\]](#).

Sustainability does not come itself; it requires enough resources and capabilities; moreover, present environmental problems call for more environmentally benign technology. The best way to survive market volatility and survive the long run is throughout innovation management and technological innovation to enhance sustainability [\[12\]](#).

Recent theoretical developments such as Reynolds and Uygun [\[13\]](#) argue that inside modern ecosystems there will be high level of interaction between key players such as universities, the value chain, and the user community to create innovative capabilities. This is further reinforced by Song [\[14\]](#), underlining the importance of external ties with suppliers, competitors, and user community within a centralized interaction model.

## 2. Open Innovation 4.0

Open innovation is an innovation model that relies on the purposeful use of inflows and outflows of knowledge to leverage internal innovation processes reaching new paths to market, as the firms look to advance their technologies. The organization's boundaries become more flexible, permitting the combination of the internal resources with the external co-operators [\[15\]](#). This model of innovation was firstly proposed in 2003, redirecting the

flows of knowledge and the innovation strategies to boost collaboration among firms and other agents inside and outside the value chain, shifting towards a co-innovation paradigm in which the firm speeds up the innovation pace and the organization changes the business model buying and selling knowledge as needed [\[15\]](#)[\[16\]](#)[\[17\]](#).

Opening the innovation strategy plays a key role towards effective strategic sustainable management. In doing so, firms can leverage knowledge production and management promoting sustainable innovations that retro-feed organizational sustainability. Efforts will be put into knowledge management and the incoming ideas from the external stakeholders, such as research centers, universities, suppliers, and customers. If there is a breakdown of values, in which knowledge arises through partners, the network will acquire relevant skills to manage knowledge and innovation as complements [\[18\]](#).

Blurring the boundaries between the firm and its environment will enable transferring innovations to different marketplaces, with bidirectional knowledge flows circulating outside the organizational borders, highlighting the increased benefit of knowledge sharing throughout partnerships and networks. It implies leveraging external sources of knowledge such as other firms, consumer community, and the ecosystem. In doing so, organizations will combine internal and external know-how, extending the collaboration with the rest of the ecosystem, mostly the Academia and the user community, thus accelerating the innovative process [\[15\]](#)[\[16\]](#)[\[17\]](#).

Regardless of the centrality of the user community in driving socio-technical transitions, its role within sustainable innovation remains largely overlooked by policymakers. Empirical evidence proves that these agents can no longer be neglected; still, policymakers remain apprehensive about the potential of the user community in this process [\[19\]](#).

Researchers, practitioners, and policy makers quickly understood the importance of the shifting paradigm, and OI was granted important acceptance and diffusion, due to its adherence to reality. Nearly a decade later, the framework was updated arguing that success of the process depends on the knowledge flows and that they should be carefully managed inside and outside the firm boundaries with straightforward mechanisms providing already-established solutions, accordingly to the business model for all kinds of knowledge flows [\[17\]](#).

Despite some skeptical considerations [\[20\]](#), the concept was awarded the trust of the community and remained in solid position, being refined by several authors e.g., [\[21\]](#)[\[22\]](#)[\[23\]](#)[\[24\]](#). Most of the criticisms relied on the need for strong clarification about the agents needing to be involved in the process and their role in the development of the actions [\[25\]](#)[\[26\]](#); however, decentralization in governance is the major challenge put forward by this framework [\[27\]](#). Innovation is a complex and uncertain process with natural hindering factors; however, open innovation will naturally speed up the pace innovation outputs arise.

Ten years after the concept proposal, Open Innovation 2.0 was reshaped, connecting to the quadruple helix, adding the civil society to the usual players (government, university, and firms), and as a consequence, adding the structural changes driven by user-oriented innovation models; in these frameworks, the speed of the innovation process is accelerated as the different phases co-exist and are set a real world context [\[28\]](#). The second version of the framework underlines new foundations enhancing the importance of networks and collaborations, promoting

interdependencies, relying on corporate entrepreneurship, promoting R&D, and specific intellectual property management, which combined with the accelerated exchange of ideas will boost innovation success, powered by synergies and complementarities [29][30]. The establishment of trusted relations in aligned communities, networks, and stakeholders will be integrated in the surrounding communities thus creating an ecosystem. Innovation 3.0 was proposed in 2010 as conceptual approach, as “Embedded Innovation”; the framework encompasses the digital transformation. SMEs (Small and Medium Sized firms) that emerged in a digital and dynamic environment should rely on combined knowledge as it is the most important source of innovation, being essential for survival and growth [31].

This framework captures how companies survive and the way they embed with the other players, focusing on the idiosyncrasies of each. The embedding of the different organisms requires the promotion of the “innovation ecosystems” and business models for innovation to generate sustainable ecosystems. Given the dynamic nature of the innovative process, the organizational process needs to encompass the exploration/exploitation binomial to survive the demanding environment [31][32].

When fed with innovation, embeddedness is a self-sustained process in which the firms along with its stakeholders interact in a certain environment, coexisting and stressing for survival; the process will shape the environment. Mutual influences are exerted, and the innovation process is intertwined with the environment along the innovation life cycle [32].

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