Open Innovation as a driver of Creative Construction

1. Introduction

Innovation has long been recognized as a vital driver of economic growth, industrial transformation, and societal development (Dosi, 1984; Freeman & Soete, 1997; Grossman & Helpman, 1994). Traditionally, innovation has been linked to Schumpeter's (1934) concept of creative destruction, where new technologies disrupt established industries. However, recent scholarship emphasizes creative construction—where innovation fosters collaboration between startups and incumbents, benefiting both and contributing to ecosystem growth (Agarwal et al., 2007, 2010; Agarwal & Audretsch, 2020).

This article explores open innovation as a key enabler of creative construction within entrepreneurial ecosystems. Open innovation, introduced by Chesbrough (2003), integrates external ideas, knowledge, and resources with a firm's internal R&D. This model supports technological advancement and competitiveness (West & Bogers, 2014). Extending Agarwal et al.'s (2007, 2010) work on incumbent-spinoff interactions, we argue that open innovation broadens these across ecosystems, facilitating collaboration among startups, incumbents, and other actors, creating systemic innovation dynamics.

In entrepreneurial ecosystems, knowledge exchanges drive startup creation and innovation diffusion (Audretsch & Belitski, 2017). Open innovation accelerates firm-level innovation and nurtures ecosystem-wide growth (Weiblen & Chesbrough, 2015). It also enhances firms' absorptive capacities, improving their ability to leverage external knowledge (Lichtenthaler & Lichtenthaler, 2009).

At the ecosystem level, open innovation generates positive externalities similar to R&D investments (Arrow, 1962; Griliches, 1979; Roper et al., 2013). It supports shared infrastructures like networks and collaboration platforms, enhancing knowledge flows. Public policies that support open innovation through subsidies, infrastructure, and public-private partnerships amplify these benefits (Nelson, 1959; Arrow, 1962).

Ecosystems with open innovation infrastructure reduce collaboration costs and increase efficiency, offering a competitive advantage in driving creative construction (Agarwal et al., 2007, 2010; Avnimelech & Amit, 2024). Policymakers play a critical role in promoting such infrastructure to ensure sustained innovation and growth (Chesbrough & Bogers, 2014; West & Bogers, 2014).

This framework provides a foundation for empirical research with significant policy implications, emphasizing the public benefits of investing in open innovation infrastructure to support thriving ecosystems.

2. Conceptual Development: Open Innovation as a Driver of Creative Construction

This section explores how open innovation fosters knowledge spillovers, enhances absorptive capacity, and drives creative construction within entrepreneurial ecosystems, along with the implications for government policy.

2.1 Knowledge Spillovers, Absorptive Capacity, and Government Policy

Knowledge spillovers, the unintended diffusion of knowledge between firms, play a crucial role in innovation within ecosystems. These occur through channels like employee mobility, collaborations, and networks (Audretsch & Feldman, 2004; Jaffe, 1986). Firms that can access and leverage these spillovers build on existing R&D and generate new innovations, benefiting the ecosystem (Acs et al., 1994).

The societal benefits of spillovers often exceed the private returns, justifying government intervention (Nelson, 1959; Arrow, 1962). Public investments in R&D systems can foster broader societal innovation. Firms also need strong absorptive capacity—the ability to recognize and apply external knowledge (Cohen & Levinthal, 1990). Open innovation facilitates both external collaborations and the absorption of external knowledge, improving firms' innovation capacity.

Traditional government policies focus on individual firm activities, but open innovation offers a systemic approach that enhances collaboration across the ecosystem. By promoting cooperation, open innovation ensures broader diffusion of knowledge, benefiting the entire ecosystem.

2.2 Open Innovation Enhancing Knowledge Spillovers and Absorptive Capacity

Knowledge spillovers can occur naturally but are often sporadic and inefficient. Open innovation structures these spillovers, enabling more systematic exchanges through joint ventures, collaborations, and licensing agreements. This helps firms benefit from external knowledge more effectively.

By collaborating on R&D and product development, firms exchange intellectual property and ideas, enhancing the likelihood that external knowledge will be absorbed and applied. Open innovation also boosts absorptive capacity in two ways: it improves the firm's ability to leverage external knowledge and enhances its capacity to manage collaborations. Firms investing in both R&D and open innovation are better positioned to innovate effectively, gaining a competitive edge.

Thus, open innovation drives both knowledge spillovers and absorptive capacity, fostering firm-level innovation and contributing to the broader ecosystem's creative construction.

2.3 Open Innovation Spillovers and Ecosystem-Wide Infrastructure

While previous sections focused on firm-level dynamics, it is essential to examine open innovation as a systemic infrastructure shaping the entire entrepreneurial ecosystem. Open innovation fosters a collaborative framework for knowledge sharing, trust-building, and innovation among startups, incumbents, research institutions, government agencies, and global partners.

This infrastructure includes supporting institutions, collaborative networks, and trust-based relationships that enhance knowledge circulation within and beyond the ecosystem. The collective open innovation efforts of firms and other actors improve the absorptive capacity of the entire ecosystem.

A well-developed open innovation ecosystem fosters both vertical and horizontal knowledge spillovers. Vertical spillovers occur within industries, while horizontal spillovers enable cross-sector collaboration. Coworking spaces, accelerators, and innovation hubs serve as touchpoints where stakeholders collaborate, share insights, and form partnerships, enhancing the ecosystem’s overall innovation capacity.

2.4 Open Innovation and Creative Construction

We propose that open innovation shifts the dynamic from Schumpeter’s creative destruction to creative construction. In this framework, startups and incumbents collaborate to generate mutually beneficial innovations. Unlike creative destruction, which displaces incumbents, creative construction fosters cooperation, with both types of firms contributing to technological advancement and market transformation (Agarwal et al., 2007, 2010).

Creative construction is a positive-sum game, with startups providing disruptive insights and incumbents offering resources and legitimacy. This synergy is most evident in ecosystems with strong open innovation infrastructure, where efficient knowledge flows accelerate innovation.

While creative construction emphasizes synergy, ecosystems are still subject to disruptive technologies. However, through collaboration, incumbents can integrate these

innovations, driving market transformation and ensuring ecosystem resilience and competitiveness.

3. Mathematical representation of the Conceptual Role of Open Innovation

Building on the conceptual framework presented above, this section develops a formal model to capture the dynamics discussed. Our aim is not to analytically solve the model but to provide a formal mathematical representation of the conceptual ideas to make them more explicit.

3.1. Basic Model - Key Assumptions

Firm-Specific Investments:

Each firm i invests in Research & Development (denoted as, RD_i), and in open innovation (denoted as, OI_i). R&D investment directly enhance firm i's internal knowledge base and generates positive externalities in the form of knowledge spillovers that benefit other firms within the ecosystem. Open innovation investment also generates positive externalities that contribute to the broader ecosystem's open innovation infrastructure (denoted as, I_OI_i), which increases the efficiency of knowledge spillovers across the ecosystem.

Absorptive Capacity:

The absorptive capacity of firm i, denoted as AC_i, determines how effectively the firm can absorb knowledge from external sources, including spillovers from other firms. AC_i increases with both RD_i. and OI_i.

Knowledge Spillovers:

Knowledge spillovers available to firm i, denoted as KS_i, depends on both the R&D investments of other firms and the open innovation infrastructure I_OI_i. The actual spillover absorption by firm i, denoted as SA_i, depends on AC_i and and on KS_i.

3.2.Basic Mathematical Model

Each firm i in the model decides its investment in two parameters: its R&D investment (RD_i) and its open innovation investment (OI_i). Both RD_i and OI_i exhibit diminishing returns, with their elasticities of output, denoted by α and β respectively, being less than 1 (but greater than zero). This reflects the decreasing marginal returns as investments increase.

Firm i's RD_i generates spillovers into the ecosystem, quantified by $\lambda_1 RD_i^{\alpha}$ (where λ_1 is the R&D spillover efficiency parameter), while OI_i create spillover represented by $\lambda_2 OI_i^{\beta}$ (where λ_2 is the open innovation spillover efficiency parameter).

4.2.1. Absorptive Capacity AC_i:

Firm i's absorptive capacity increases with its R&D investment RD_i and open innovation investment OI_i, expressed as:

$$(i) \qquad AC_i = \delta_1 RD_i^{\alpha} + \delta_2 OI_i^{\beta}$$

Where δ_1 and δ_2 represents the contributions of R&D and open innovation to absorptive capacity.

4.2.2. Open Innovation Infrastructure I_OIi:

The open innovation infrastructure observed by firm i, denoted I_OI_i, is the weighted sum of the open innovation efforts of all other firms in the ecosystem, expressed as:

$$(ii) \qquad I\_OI_i = \lambda_2 \sum_{j \neq i} OI_j^{\beta}$$

4.2.3. Knowledge Spillovers KS_i:

The knowledge spillovers that firm i can absorbs from the ecosystem depend on the accumulated spillovers from other firms' R&D investments and the open innovation infrastructure, donated I_OI_i, expressed as:

$$(iii) \qquad KS_i = I\_OI_i \lambda_1 \sum_{j \neq i} RD_j^{\propto}$$

$$(iv) \qquad KS_i = \lambda_2 \sum_{j \neq i} OI_j^{\beta} \lambda_1 \sum_{j \neq i} RD_j^{\propto}$$

4.2.4. Knowledge Absorption KA_i:

The knowledge absorption that firm i can achieve from the ecosystem is a function of its absorptive capacity AC_i and the knowledge spillovers KS_i that firm i absorbs from the ecosystem, represented as:

$$(v) \qquad KA_i = AC_i KS_i$$

$$(vi) \qquad KA_i = (\delta_1 RD_i^{\alpha} + \delta_2 OI_i^{\beta}) \lambda_2 \sum_{j \neq i} OI_j^{\beta} \lambda_1 \sum_{j \neq i} RD_j^{\propto}$$

4.2.5. Firm Innovation Output Function:

The innovation output of firm i, denoted Y_i, depends on its R&D investment RD_i, and the RD it absorbs from the other firms in the ecosystem KA_i, represented as:

$$(vii) \qquad Y_i = A_i(RD_i^{\alpha} + KA_i)$$

$$(viii) \qquad Y_i = A_i(RD_i^{\alpha} + (\delta_1 RD_i^{\alpha} + \delta_2 OI_i^{\beta}) \lambda_2 \sum_{j \neq i} OI_j^{\beta} \lambda_1 \sum_{j \neq i} RD_j^{\propto})$$

Where A_i represents firm i's specific productivity of R&D investment.

4.2.6. Firm Profit Function π_i:

Firms maximize profit, defined as output Y_i minus the costs of R&D and open innovation investments:

$$\text{(ix)} \qquad \pi_i = pY_i - c_{RD}RD_i - c_{OI}OI_i$$

$$\text{(x)} \qquad \pi_i = pA_i(RD_i^{\alpha} + (\delta_1 RD_i^{\alpha} + \delta_2 OI_i^{\beta})\lambda_2 \sum_{j \neq i} OI_j^{\beta}\, \lambda_1 \sum_{j \neq i} RD_j^{\propto}) - c_{RD}RD_i - c_{OI}OI_i$$

Where p is the price of innovation output, and c_{RD} and c_{OI} are the costs of R&D and OI investments, respectively.

4. Government Policy in the Context of R&D and Open Innovation Externalities

The conceptual development above highlights the importance of public policy in fostering open innovation and supporting creative construction. Through targeted investments in innovation infrastructure and collaborative networks, governments can enhance firms' absorptive capacity, facilitate knowledge spillovers, and create conditions for sustained ecosystem-wide innovation. Policymakers play a pivotal role in driving innovation, ensuring ecosystems have the resources, frameworks, and incentives needed to thrive.

5. Conclusion and Discussion

Innovation has long been a key driver of economic growth, traditionally linked to Schumpeter's concept of creative destruction, where disruptive entrants replace incumbents. However, Agarwal et al. (2007, 2010) introduced creative construction, which emphasizes collaboration between startups and incumbents. Our study extends this perspective by exploring how open innovation facilitates and enhances this cooperative dynamic.

By integrating open innovation with absorptive capacity (Cohen & Levinthal, 1990) and creative construction (Agarwal et al., 2007, 2010; Agarwal & Audretsch, 2020), we show that when firms across an ecosystem engage in open innovation, they reach a critical mass that transforms innovation patterns. Open innovation acts as a catalyst for knowledge sharing and co-creation, enhancing creative construction. While previous frameworks primarily focused on startups founded by former employees of incumbents, we argue that

open innovation enables knowledge flow across diverse actors, both regionally and globally. This strengthens knowledge spillovers and improves the overall efficiency of entrepreneurial ecosystems.

Open innovation fosters a win-win dynamic. Incumbents gain fresh ideas, while startups access resources, legitimacy, and networks. Additionally, open innovation generates positive externalities, enhancing R&D productivity through shared infrastructure, institutions, and best practices. As open innovation strengthens, knowledge flows become more efficient, amplifying firms' innovation capacity and ecosystem competitiveness.

Entrepreneurial ecosystems with robust open innovation infrastructures benefit from enhanced absorptive capacity, promoting efficient knowledge exchange and fostering sustained innovation. By participating in open innovation initiatives, startups and incumbents alike can leverage the collective intelligence of the ecosystem, strengthening their competitive positioning.

Our framework positions open innovation as a key driver of creative construction, benefiting both individual firms and broader ecosystems. We encourage industry stakeholders, policymakers, and researchers to recognize its role in fostering sustained growth. Conceptually, our study highlights open innovation’s significance within entrepreneurial ecosystems, as illustrated in a recent case study (Avnimelech & Amit, 2024). Normatively, we advocate for policies that reinforce open innovation practices.

Governments should frame innovation initiatives explicitly as open innovation support programs to strengthen their theoretical foundation and expand their scope. Addressing market and system failures in open innovation infrastructure may require new policy interventions. Supportive measures, such as innovation hubs, funding for incubators, and incentives for collaboration, can foster a thriving open innovation ecosystem.

Future research should further explore the impact of open innovation through both quantitative and qualitative studies to refine theoretical frameworks and deepen our understanding of its role in entrepreneurial ecosystems.