
From Closed Innovation to Collaborative Ecosystems: The Future of Startups in the Age of Open Innovation (International experiences in Fintech & Biotech)

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Abstract:

This study investigates the importance of open innovation in promoting the growth and development of startups within collaborative innovation ecosystems, with a specific focus on overcoming resource scarcity challenges. Adopting a descriptive-analytical approach, the research examines leading international experiences in the Fintech and Biotechnology sectors. The findings indicate that integration into collaborative ecosystems and the adoption of coopetition mechanisms are structural necessities for reducing Research and Development costs and accelerating time to market. The study concludes that the success of startups depends on the ability to balance external knowledge sharing with the protection of core competitive advantages. Furthermore, it recommends the development of regulatory frameworks that incentivize data openness and innovation flows among diverse economic actors.

Keywords: Open Innovation, Startups, Coopetition, Resource Scarcity, Fintech & Biotech.

Jel Classification Codes : O31, O32, L26, G21.

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1. Introduction :

The introduction to the article should contain a preface to the topic, and then introduce the research problem and make the appropriate assumptions, in addition to determining the research objectives and methodology of the study.

In today's knowledge-driven economy, startups face intense competition and rapidly changing market demands. Traditional closed innovation models often limit their ability to access external ideas and resources. Open innovation, by integrating both internal and external knowledge, has emerged as a strategic approach that can enhance startup growth, accelerate technological development, and improve their competitiveness in collaborative environments.

General Research Question:

What is the importance of open innovation in promoting the growth and development of startups within collaborative innovation ecosystems?

Case Study-Specific Question:

How have international experiences in the Fintech and Biotechnology sectors demonstrated the effectiveness of Open Innovation, particularly through its mechanism of Co-opetition in overcoming resource scarcity challenges?

Study Objectives:

- To analyze the transition from closed to open innovation models within the context of technology-intensive startups.
- To investigate the role of collaborative ecosystems in providing startups with access to critical financial and scientific infrastructures.
- To identify the key success factors of Fintech and Biotech startups that have successfully implemented Open Innovation strategies.
- To extract practical lessons from international experiences that can be adapted to foster a more resilient startup environment.

Study Importance:

This study highlights the importance of open innovation for startups facing limited resources and challenges. By drawing on international experiences, it provides practical lessons and strategies to support startup growth and development. It also contributes to understanding how collaborative innovation ecosystems can enhance startup performance.

Methodology:

This study adopts a qualitative, descriptive-analytical approach, relying primarily on secondary data from academic literature, industry reports, and documented case studies. The research employs a case-study method focusing on international experiences in Fintech and Biotechnology.

2. Literature review:

2.1. The Start-up

A start-up is conventionally defined, according to the English dictionary, as a small project that has just begun. The term *start-up* consists of two parts: "start," which refers to a project in its initial phase, and "up," which implies rapid growth, progress, or establishment in reality. (Bousouikh, M., 2020, p. 405)

It is also defined as a temporary organization designed to evolve into a larger enterprise. In its early stages, a start-up seeks a proper alignment between its products and market needs. During the maturity phase, it aims to establish a viable and scalable business model, ultimately transforming into a well-established organization operating with high levels of confidence. (Makhansha, A., 2021)

Characteristics of Start-ups

Start-ups are characterized by the following features: (Horma, M., & Khamira, A., 2021, p. 11):

Newly Established: A start-up is a recently founded organization, not an established player in the market; it is inherently in its initial development phase.

- **Small-sized:** Start-ups are typically small in terms of physical space, workforce, capital, production lines, and market reach.
- **Aiming for Rapid Growth:** These organizations face a choice between rapid expansion to secure a market position or exiting quickly in case of failure.
- **Creative and Innovative:** Start-ups are distinguished by their creative products and services, which enable swift growth and significant revenue increases within a short market presence. They frequently employ modern technologies to implement their innovations in practice.
- **Low Capital Requirements:** Start-ups generally require minimal investment relative to their inputs. Often, they do not depend on extensive physical space or equipment, relying instead on virtual spaces and digital marketing for their products and services.

2.2 Innovation and Open Innovation

Introduction to Innovation

Defining innovation precisely is challenging, as it varies across disciplines such as economics and psychology. Schumpeter (1934) defines innovation as the "driving force of improvement," (Atalay .M, Sarvan.F.2013, p227) encompassing (Sassi.H. 2007, p50):

- New products.
- New production or marketing methods.
- Entry into new markets.
- Use of new raw materials.
- Organizational restructuring.

Innovation can also be seen as the application of new ideas in products, processes, or activities that create added value. Its purpose is to improve operations, reduce costs, enhance market offerings, and generate value for both the organization and its customers. (Greenhalgh,C,& Rogers,M, 2010, p4)

Importance of Innovation:

Innovation is essential for organizational sustainability and competitiveness. It enables firms to adapt rapidly to change, explore new products and markets, and enhance profits and market share. Factors driving its importance today include increased competition, larger organizations, higher consumer expectations, resource scarcity, and demand for new ideas (Manaa, 2011, p. 7)

2. Open Innovation:

The Concept of Open Innovation

Before defining open innovation, it is essential to clarify the concept of closed innovation, as illustrated in the figure below:

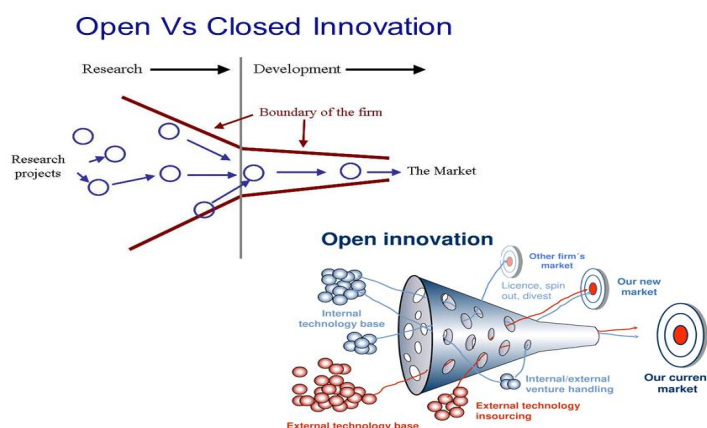


Figure 1: Closed vs. Open Innovation Model (Chesbrough) Source: Julien, Penin, et al. (2013). Open Innovation: Definition, Practices, and Perspectives. CCI Paris-Île-de-France, Strasbourg, France, p.15

Open innovation, introduced by Chesbrough (2003), contrasts with the traditional closed innovation model, which relied on internal R&D secrecy.

Closed innovation had limitations: no single firm could control the full value chain to transform inventions into marketable innovations. Open innovation emphasizes combining internal and external knowledge to accelerate innovation and expand market opportunities. (Chabouh, H, Boudjelbne. 2016, p02)

Principles and Forms:

Open innovation relies on several principles: leveraging external knowledge, allowing external research to add value, and using intellectual property strategically. It has two main forms (Gassmann & Enkel, 2004):

- Inbound: Integrating external knowledge through partnerships with universities, customers, suppliers, or competitors.
- Outbound: Sharing internal ideas and technologies externally via licensing, technology transfer, or spin-offs.

Benefits and Challenges:

Open innovation offers significant advantages: access to diverse knowledge sources, sustained innovation, shared risk, increased patents, enhanced strategic awareness, and a culture of creativity. However, it also presents challenges such as potential loss of intellectual property, resistance to change, cultural differences, and complex organizational processes. (Mekri, 2016, pp. 201-202).

2.3 The Structural Interplay between Open Innovation and Sustainable Growth in Startups

The transition toward an Open Innovation model is predicated on the necessity of transcending traditional organizational boundaries, particularly in environments characterized by a scarcity of resources (technical, financial, and human capital). By integrating into Collaborative Ecosystems, startups can leverage external knowledge flows and share the inherent risks of R&D with diverse economic actors. These ecosystems provide startups with access to strategic assets and advanced infrastructures that exceed their internal resource capabilities, effectively transforming resource constraints into operational efficiencies. Consequently, this integration serves as a fundamental driver for startup growth, accelerating innovation cycles, reducing time-to-market, and enhancing the ability to achieve strategic scaling based on the collective competitive advantages of the ecosystem.

3. International Experiences of Open Innovation under Resource Constraints:

3.1 Open Innovation and Coopetition in the Biotechnology Sector

The biotechnology sector represents one of the most prominent international examples of open innovation and coopetition due to its high research costs, long development cycles, and high levels of uncertainty. Startups operating in this sector often face severe resource constraints, particularly during the

early stages of basic research and drug discovery, which makes independent innovation financially unsustainable (Powell, Koput & Smith-Doerr, 1996, pp. 116–145; Chesbrough, 2003, pp. 21–43).

To overcome these limitations, biotech startups increasingly engage in collaborative innovation networks where pre-competitive research outputs are openly shared among multiple actors. A well-documented international experience is the Structural Genomics Consortium (SGC), a public–private partnership that brings together universities, research institutes, pharmaceutical companies, and biotech startups in the United States and Europe. Within this model, early-stage research results, biological data, and research tools are shared without patent restrictions, significantly reducing innovation costs and risks (Powell et al., 1996, pp. 116–145).

Once the foundational scientific knowledge is developed through collaboration, firms shift toward competition in later stages such as applied research, product development, clinical trials, and commercialization. This model illustrates how coopetition enables startups with limited resources to access critical knowledge while preserving competitive advantages in downstream activities (Chesbrough, 2003, pp. 21–43; Brandenburger & Nalebuff, 1996, pp. 3–35).

3.2 Open Innovation in the Fintech Sector: The European Experience:

The Fintech sector provides another important international example of open innovation, particularly within highly regulated financial environments. In the European Union, the implementation of the Payment Services Directive (PSD2) marked a major transition from closed innovation models toward open and collaborative ecosystems. This directive obliges banks to grant licensed third-party providers access to customer data through standardized application programming interfaces (APIs), with customer consent (Nicoletti, 2017, pp. 45–78).

Under this framework, Fintech startups collaborate with traditional banks, technology firms, and regulatory authorities to develop innovative digital financial services. By sharing data infrastructure and technological standards, startups significantly reduce development costs, lower entry barriers, and accelerate innovation processes, despite limited internal resources (Gassmann, Enkel & Chesbrough, 2010, pp. 213–221).

Competition subsequently emerges in areas such as service design, user experience, pricing models, and market strategies rather than in the development of core infrastructure. This European experience demonstrates how open innovation and coopetition can coexist, enabling startups to innovate efficiently while maintaining competitive differentiation.

4. Results and discussion

Based on the descriptive-analytical review of international experiences in the Fintech and Biotechnology sectors, several key results emerge.

First, the findings confirm that open innovation significantly reduces the structural constraints faced by startups. In both sectors analyzed, startups were unable to independently finance high Research and Development

(R&D) costs or build full innovation infrastructures. However, integration into collaborative ecosystems enabled them to access shared knowledge, technological platforms, and regulatory frameworks. This supports the main research hypothesis that open innovation plays a critical role in promoting startup growth within innovation ecosystems.

Second, the study demonstrates that coopetition represents a strategic mechanism rather than a paradox. In the Biotechnology sector, startups cooperate during the pre-competitive research phase, sharing risks and scientific outputs, while shifting toward competition in commercialization stages. Similarly, in the European Fintech experience, regulatory openness (such as API-based banking systems) allowed infrastructure sharing, while competition focused on service differentiation and customer experience. These findings validate the sub-hypothesis that coopetition enables startups to overcome resource scarcity while preserving competitive advantages.

Third, the results highlight that regulatory and institutional frameworks are decisive variables. Open innovation flourishes when supported by structured governance mechanisms that organize knowledge flows and protect intellectual property rights. Without regulatory coordination, openness may increase risks related to knowledge leakage or strategic dependency.

From a theoretical perspective, the study confirms that the transition from closed to open innovation is not merely an operational shift but a structural transformation in how startups generate and capture value. From a managerial perspective, startups must develop alliance management capabilities and strategic boundary management to balance openness and protection.

Overall, the results demonstrate that open innovation constitutes a structural necessity for startups operating in knowledge-intensive and high-uncertainty environments, particularly in Fintech and Biotechnology sectors.

5. Conclusion:

This study aimed to explore the strategic role of open innovation in supporting and sustaining the growth of startups while addressing the challenge of resource scarcity. The research analyzed the transition from closed models to active participation in collaborative ecosystems. By examining international experiences in the Fintech and Biotechnology sectors, the study demonstrated how the mechanism of coopetition enables startups to overcome internal constraints and enhance their competitive positioning.

Study Results:

Based on the analytical review of international case studies, the research reached two primary conclusions:

- the international experience, particularly in the European Fintech sector, proves that open innovation is a structural necessity rather than a technical choice. Regulatory frameworks such as PSD2 have allowed startups to utilize the large-scale infrastructure of established banks, significantly lowering market entry barriers and reducing development costs despite limited capital.
- the effectiveness of open innovation in the Biotechnology sector lies in the strategic separation of research phases. Startups cooperate during the pre-competitive research stage to share high costs and risks, while maintaining intense competition in the commercial and service stages. This balance of coopetition ensures a faster time to market while preserving the startup's innovative identity.

Study Recommendations:

Based on these findings, the study offers the following recommendations:

- startups should develop specialized alliance management strategies, moving from a culture of absolute secrecy toward strategic knowledge sharing.
- policymakers are encouraged to design regulatory environments that mandate organized openness of data and infrastructure to allow startups to grow within integrative ecosystems.
- there should be increased investment in collaborative innovation hubs that bring together universities, large corporations, and startups to facilitate knowledge flow and reduce resource waste through collective research and development.

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