

How can Open Innovation and Industry Ecosystem Work Together to Achieve Sustainable Value Creation and Society Development?

Yongjiang Shi

Email: ys@eng.cam.ac.uk

Institute for Manufacturing, Department of Engineering, University of Cambridge
17 Charles Babbage Road, Cambridge CB3 0FS, The United Kingdom

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This paper seeks to understand and clarify the relationships between open innovation and industrial ecosystem based on comprehensive literature reviews on the concepts and their interactive relationships. It eventually aims to enrich the understandings about main mechanisms and management processes of the industrial ecosystems, taking open innovation as one of the key enabling approaches in the ecosystem. The paper takes its title as the research question – “**how can open innovation make an innovation ecosystem work?**” It mainly emphasizes on the theoretical reviews, discussions and synthesis, including five sections and ending with a conceptual framework development for the future research work.

Since introduced in 2003, open innovation is adopted to increase embrace of external cooperation in a complex world (Chesbrough, 2003). It is now regarded an established paradigm in the innovation management (Patrucco et al., 2021). Meanwhile, various types of ecosystems including both innovation and the broader concept business ecosystems have been mushroomed in the last two decades across strategy and innovation disciplines to deal with dynamic environments, providing important strategic guidance to companies. It seems that open innovation and the ecosystems share similar characteristics of collaboration, openness, change and complementor interaction, yet the exact linkage between the two bodies of knowledge is unclear.

Literature review on open innovation will cover motivations, evolutionary process and practical tools. Open innovation is defined as “*the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation, respectively. [This paradigm] assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as they look to advance their technology*” (Chesbrough, 2006 p.1). The incentives and motivations of open innovation are identified as reducing R&D cost and risk, stimulating growth, accelerating the process of commercialisation, shared learning, and accessing complementary capabilities and knowledge (Huizingh, 2011; Chesbrough and Crowther, 2006). Outside-in, inside-out and coupled open innovation activities are widely acknowledged as

improving product novelty through sourcing ideas externally, and improving customer satisfaction through user engagement and co-creation (Chesbrough and Brunswicker, 2014).

While most open innovation strategies are led focal large firms or SMEs collectively, innovation system and ecosystem concern the scale of innovation at national and regional levels, or with multiple players involvement. Apart from examining macro-economic and industry sector related factors, studies of innovation system also address the dynamic relationship between innovative actors, such as university, industry, government and society. This can be interpreted as non-static non-linear models such as the Triple Helix (Etzkowitz, 2003) and Quadruple Helix (Carayannis and Campbell, 2009).

Meanwhile, the concept of ecosystem can be traced back to the early studies of business ecosystem, where business evolution follows the stages of birth, expansion, leadership and self-renewal if not death, just like natural lifecycle (Moore, 1993). Ecosystem is an economic community supported by a foundation of interacting organisations and individuals, where participants coevolve their capabilities and roles and tend to align themselves with the directions set by one or more central companies (Moore, 1993). Under the structure-based view, ecosystem witnesses knowledge creation, development, transfer, and exchange among economic agents and non-economic parties such as technology, institutions, sociological interactions, and culture (Mercan and Goktas, 2011). The focal firm approaches the alignment of partners and secures its roles, while providing a governance structure to deal with non-generic complementarities (Adner, 2017). These features demonstrate similarities with innovation system, yet the co-evolution-based view suggests that ecosystem is a much more complex adaptive system which reacts to external disruption and absorb opportunities (Hou and Shi, 2021). Thus, the literature review session will highlight the debates on the concepts between system and ecosystems.

To combine the structure and co-evolution-based view of ecosystem, a holistic model is needed (Hou and Shi, 2021). Known as the Tornado model, ecosystem can start with a resource pool based on social networks, then transformed from fragmented resource towards an integrated industrial system, and eventually through the iteration process it is re-embedded back to the resource pool (Shi et al., 2021). Inspired by this model, an initial theory framework of industrial ecosystem has been generated to reflect several synthesized characteristics of business value-creation process, innovation for adaptation, and industrialization for efficiency and scale-up productivity.

Drawn from the above literature review, further analysis will link open innovation to the industrial ecosystem framework. It will address the key positions of open innovation in the framework from three perspectives: 1) strategic positions (in the resource pool and innovation system formation process, as well as in the innovation system and its re-embedding process) ; 2) deep penetration and embeddedness within the ecosystem and its sub-systems and mechanisms (everywhere), and

3) practical implications of the Framework: an integration of existing processes and tools in the framework of innovation ecosystem.

To enrich and validate the theory framework, we propose an action research approach with case studies for the future research. With expected findings of an improved and verified framework and process model, our study can contribute to the theories of innovation and ecosystem. In addition, it has important practical implication. With better awareness of the ecosystem, companies can explore a wider resource pool beyond existing partners and suppliers, and using open innovation mechanism to adapt, integrate and configure their process and capabilities, as to respond to the unpredictable external environment. Research limitations and implications will be identified in the conclusion session.

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