

Executive Summary

Globalisation increasingly affects how companies in OECD countries operate, compete and innovate, both at home and abroad. Global competition drastically shortens product life cycles, while the growing integration of different technologies makes innovation riskier and more costly. Companies more and more internationalise knowledge-intensive corporate functions, including R&D, and simultaneously open up their innovation process to collaborate with external partners (suppliers, customers, universities, etc.). This clearly has important implications for policy making, given the contribution of (business) innovation to economic growth.

In order to match the growing demand for innovation from customers, suppliers, etc., with the worldwide supply of science and technology, (large) companies increasingly adopt so-called “ecosystems of innovation” across countries. They link into these global innovation networks with people, institutions (universities, government agencies, etc.) and other companies in their own or different countries to solve problems, source knowledge and generate ideas. These global innovation networks include own R&D facilities abroad as well as collaborative arrangements with external partners and suppliers, in which firms depend in various ways on the expertise of the different partners.

While open innovation is not totally new, the organisation of innovative activities (technological as well as non-technological) across firm boundaries is clearly on the increase, with more balance between internal and external sources of innovation. Other terms have also been used to describe this trend, and all stress to some extent the openness of innovation activities: open source, open standard, open research, user-driven innovation, etc. The fact that the term “open” is usually thought of as cost-free creates confusion; however, in contrast to open source, for example, open innovation typically implies the payment of licence fees as well as other financial arrangements. In this context, therefore, open does not mean free.

New evidence on global innovation networks based on case studies as well as on large-scale data sets shows that:

- The main reason for locating research and/or development facilities abroad is the proximity of large and growing markets. Other important factors are

the availability of engineers and researchers, and the company's proximity to other activities (production, sales).

- Suppliers and customers are the most sought-after innovation partners. While universities and public research institutes are generally considered an important source of knowledge for companies' innovation activities, especially in more upstream research and exploration activities, they represent only a small share of innovation collaborations.
- Larger firms innovate more openly than small firms. Innovation survey data indicate that large companies are four times more likely than small and medium-sized enterprises (SMEs) to collaborate on innovation.
- Geographical proximity matters in global innovation networks. Companies seem to prefer innovation partners that are geographically close. As the only information available concerns the number of collaborations, however, the fact that companies may enter collaborations with more distant partners only if they are strongly motivated by market demand or excellence seeking may be masked.
- Differences among industries are significant. Collaboration on innovation is important in manufacturing as well as in services, notwithstanding some differences among countries. Industries such as chemicals, pharmaceuticals and information and communication technology (ICT) typically show high levels of open innovation.

The degree of openness in innovation models differs, depending on factors such as the importance of the technology, the strategy of the firm, the characteristics of the industry, etc. Companies traditionally seek to retain their core capabilities and determine what to outsource or with whom to collaborate. Their core competencies (in technology and markets) are developed internally to the greatest extent possible, but open innovation may be a faster, less risky alternative to internal development in order to diversify (in terms of technology and/or markets).

In industries characterised by rather short technology life cycles, *e.g.* the ICT, electronics and telecommunications industry, companies have sought external partners in order to keep up with new developments in and around their industry. In industries characterised by rather long technology life cycles and strong protection of intellectual property rights (IPR) (*e.g.* pharmaceutical, chemical and materials industries), companies mainly look outside the firm to keep up with research. In industries in which patents are important but can be more easily circumvented (*e.g.* the transport equipment industry and the fast-moving consumer goods industry), companies set up collaborations to keep pace with new developments. They seek technologies or products that have proven their market potential, which they can improve, scale up and commercialise.

The largest benefit of open innovation is a much larger base of ideas and technologies. Companies source external knowledge in various ways: partnerships with external parties (alliances, joint ventures, joint development, etc.); or acquisition or sale of knowledge (contract R&D, purchasing, licensing). In addition to these common modes, open innovation is increasingly realised through corporate venturing (equity investments in university spin-offs or in venture capital investment funds).

Open innovation is not only about sourcing external knowledge (“outside-in”) as companies look for ways to generate additional revenue from in-house innovations (“inside-out”) especially when the technology has future potential but is not part of the firm’s core strategy. Companies also increasingly use venturing to find external partners for commercialising innovations that are not used internally (divestment, spin-out, spin-off).

Theft of intellectual property (IP) is seen as the most important risk to global innovation networks. Unique knowledge may be revealed to external partners that may later become competitors. Working closely with external partners can create uncertainty about the appropriation of the benefits of technology collaboration. When collaborating with larger companies, SMEs especially may face larger risks because they typically have fewer resources and limited expertise in IPR issues. The effective management of IP is crucial for identifying useful external knowledge and particularly for capturing the value of a firm's own intellectual property rights (IPR).

Successful open innovation also depends on the open character of the business model. As knowledge has become companies’ key resource, open innovation needs to be embedded in an overall business strategy that explicitly acknowledges the potential use of external ideas, knowledge and technology in value creation. Owing to the integration of different technologies, industry borders are shifting or even disappearing, necessitating new business models and organisational structures, including the effective management of human capital (open culture, diversity, etc.).

Global innovation networks significantly influence national and regional innovation systems. The ecosystems or networks of innovation of multinational enterprises (MNEs) create cross-border nodes between regional/national systems of innovation. MNEs also link S&T actors in different countries, and their ecosystems often span clusters and industrial districts in specific industries across countries. In this context, geographical proximity permits localised learning.

Science, technology and innovation policies can no longer be designed solely in a national context. As a country’s attractiveness as a location for R&D and innovation activity becomes a priority, framework conditions that affect

the location of production as well as costs (production, labour, tax) become critical. Appropriate structural policies, such as labour market and competition policies, as well as the public infrastructure for innovation and a highly skilled workforce, are essential.

In addition, global innovation networks have some more specific policy implications:

- Universities and public research organisations increasingly play a significant role in the open innovation strategies of firms both as a source of basic knowledge and as potential partners. Support for basic research must therefore continue. Given the scarcity of public resources and competition to attract R&D-related foreign direct investment (FDI), countries must balance their research efforts and investments in specific fields with the need to be open and develop sufficient absorptive capacity in a range of fields.
- World-class clusters and networks remain important but integration across fields and borders may require different interfaces and competencies. The potential for innovation depends on how well knowledge flows and how well the system is connected: policies to foster or enable the development of world-class clusters and networks.
- Sharing intellectual property may require different kinds of management tools in firms and public research organisations. Companies participating in national R&D programmes may need to share IP with foreign subsidiaries/partners or seek to commercialise it in foreign markets, but may be constrained by national regulations.
- Investing in people and fostering cross-functionality and mobility and a “culture of innovation” is crucial, as open innovation implies that people must be able to work in networks and across borders, sectors and at the interface of converging technologies. It also requires openness to a geographically mobile workforce.
- Open innovation stresses the broad characteristics of innovation. Much public support for innovation still focuses on R&D and technological innovation and less on non-technological innovation or other forms of user-driven innovation. While open innovation involves service firms, much public support for innovation still targets manufacturing firms. Policy attention focuses more on the supply side of innovation and less on building market demand for innovation (*e.g.* through public procurement).
- National R&D programmes need to be more open while ensuring benefits via reciprocity and cost-sharing agreements. Also arising from open innovation is the question of capturing national benefits from cross-border

spillovers of the ecosystems of innovative firms. Potential national benefits must be communicated and demonstrated to public stakeholders.

- Building a strong knowledge base is necessary to develop next-generation innovation policies and best practices. A strong knowledge base will be necessary to identify policy implications and develop next-generation innovation policies and best practices. OECD work over the coming years will seek to address these issues.