

## Markets for technology

Markets for technology play a critical role in innovative businesses as they allow innovative firms to get access to technologies that are key for in-house innovation but that would be too time consuming, too costly or even impossible to develop internally. Markets for technology may also create markets and generate revenues for companies that develop new technologies, but who lack the capacity or desire to produce and commercialize them. Data, although scarce, also suggest that these markets may be important for innovative companies. Studies indicate a growing trend in transactions in markets for technology over the past decade. The development of markets for technology critically depends on the quality of national IP systems. It is closely related to technological collaborations among firms and with universities and public research institutes. Several policies could contribute to the development of markets for technology to support innovative businesses, including: raising firms' awareness about the strategic opportunities offered by markets for technology, improving information in markets for technology, establishing standards and transparent methods for valuing patents, ensuring that the IP system does not discriminate against small firms, encouraging the commercialisation of IP, and, more generally, ensuring the existence of appropriate conditions to support competitive and well-structured markets for technology (e.g. through IP policy, competition policy, taxation policy, and R&D policies).

### What are markets for technology?

Markets for technology refer to “transactions for the use, diffusion and creation of knowledge and technology” (Arora et al., 2001, p. 423). They are places where the technology seller (supply side) meets the technology buyer (demand side). Markets for technology can be characterised along several dimensions, including:

- their **purpose**, which may be to circulate existing technologies (e.g IP marketplace), or to produce or co-produce new technologies (e.g. based on bilateral contracts).
- the **type of technology transactions**. Technology transactions can **take different forms**, from pure licensing or sale of well-defined intellectual property, to complicated collaborative agreements that may include the development of the technology or its realization “from scratch” (Arora and Gambardella, 2010).
- the **actors involved**, which can be businesses, individuals, universities, government bodies and market intermediaries (e.g. technology brokers).

### How do markets for technology affect innovative businesses?

Markets for technology may support innovative businesses by:

- Allowing innovative ventures to **adapt rapidly and at lower cost to the accelerated pace of innovation by getting access to technologies that already exist**, and which would be more time consuming, more costly and more difficult to reproduce internally than if they were purchased from the company that developed them.
- **Creating markets for firms that have developed innovations but cannot produce or commercialize them effectively**. Markets for technology provide a way to make money by selling their technology to companies that already have existing complementary assets (brand, distribution, production capacity). **Generating additional revenue from in-house**

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**innovations, especially when the technology has future potential for products or services** that are not part of the firm's core strategy. By making inventions available to a **broader range of potential manufacturers**, markets for technology allow their use on a larger scale, and their embodiment in larger quantities and varieties of products, beyond the uses or applications foreseen by the sole proprietor.

- **Fostering innovation by facilitating the combination of existing technologies.** Inventions are born out of a combination of existing ideas, data and insights (Weitzman, 1998), which are initially separate and need to be put together for new ideas to emerge. Markets for technologies allow the exploitation of complementarities across innovative entities, hence boosting the collective efficiency of the involved innovators. For instance, new drug treatments are increasingly the result of joint work by biotech companies specialising in the identification and analysis of genetic pathways, and of pharmaceutical companies specialising in the effects of drugs on human health.
- **Encouraging firms to engage in innovative activities by enabling them to share risk and realize synergies with other companies.** At the same time, markets for technologies, such as IP marketplaces, can lead to opportunistic rent-seeking behaviour, with potential perverse effects on innovative businesses. For instance, the strategy of patent trolls (i.e. holding patents hidden in order to provoke hold-up situations and infringement, from which they expect revenues) may constitute a substantial obstacle to innovative firms.

### **What are specific aspects of markets for technology when it comes to innovative entrepreneurship?**

Markets for technology might be of highest value to smaller innovative companies since they have fewer internal capabilities to develop technologies in-house and therefore need to rely more on external linkages. Besides, they may lack the ability to develop and commercialize products that stem from their technology. In this context, markets for technology provide a way for companies to make money by selling their technology to other firms that already have existing complementary assets (brand, distribution, production capacity). Markets for technology may therefore encourage the development of independent entrepreneurs specializing in the production of technology by allowing technologies to be implemented by actors other than the inventors and enabling companies to focus on what they do best.

### **Evidence on the importance of markets for technology to the success of innovative entrepreneurs**

Small and new ventures are often at a disadvantage in access to technology markets vis-à-vis larger firms. In IP marketplaces, for instance, informational or negotiation costs are mainly fixed (for each transaction) and decline with the experience and size of the party. In addition, the ability to enforce contracts and IP are also subject to economies of scale.

Yet young firms are present in the market for technologies, as their patenting activities may suggest. During 2007-09, firms less than five years old that filed at least one patent application represented about 25% of all patenting firms and generated 10% of patent applications. The share of young patenting firms varies considerably across countries, led by Ireland (42%) and followed by the Nordic economies. SMEs are found to increasingly pursue Intellectual Property Rights (IPR) to gain access to knowledge markets, although IP choices are still not frequently embedded in a coherent long-term strategy. A United Kingdom ICT survey suggests that the large majority (67%) of SMEs that exchange patents do so because they hope to obtain direct income from market transactions (OECD, 2011). SMEs also use IPR as a way to increase collaboration with other firms. To this end, one trend observed in studies conducted in Australia and the United Kingdom is the growing use by SMEs of open source technologies, with firms increasingly constructing business models that allow a part of their technology to be adopted, built on and improved by the open source community (OECD, 2011).

However, the adoption of open source is still relatively limited in sectors surveyed in the United States (biomedical and ICT) and in Nordic creative industries.

## Figure 1. Young patenting firms per billion USD PPPs GDP

### What is the evidence on markets for technology and innovative businesses?

There is no statistical method that enables the development of a reliable and comprehensive measure of markets for technology. This lack of empirical data is mainly due to the private nature of technology transactions. Indeed, **most transactions are proprietary and confidential**. However, evidence exists on specific aspects of markets for technology.

Studies on **licensing** usually indicate that 10-15% of patents are ultimately licensed. The share of patenting companies that license their technologies to non-affiliated companies was estimated by Zúñiga and Guellec (2009) at 20% in Europe and 27% in Japan, based on a survey conducted in 2007, while Gambardella et al. (2007) found that 13.4% of European patents resulted in licensing, based on a survey covering approximately 7,000 applications.

Available information on **international licensing** also suggests an **upward trend in transactions** in markets for technology. Cross-country licence and royalty payments, and receipts for all types of IP, including among affiliates, increased in the OECD area by an average annual rate of 10.6% between 2000 and 2010 (Figure 2), well above the growth of OECD gross domestic product (GDP) over the same period. However, it is important to note that these figures do not capture payments internal to countries and include intra-company international payments. The latter represent more than 80% of receipts in the cases of the United States, France and Germany (OECD, 2010). Overall, Arora and Gambardella (2010) estimate the size of the global market for technology at USD 100 billion.

Another indicator of markets for technology is the amount of extra-mural business R&D, which is R&D funded by a company but implemented in another organization, including all R&D contracted out. In the United States, extra-mural business R&D showed a significant increase between 2001 and 2007, from about 4.5-5% of total company-funded and -performed R&D expenditures to almost 8% (National Science Foundation, 2009). These are still a relatively low numbers. However, the increase is significant.

## Figure 2. Exports, royalties and license fees

### What other topics relate to markets for technology and innovative businesses?

**Intellectual property rights and innovation in firms** (see [Intellectual property rights and innovation in firms](#) [1]) and **intellectual property rights for innovative entrepreneurship** (see [Intellectual property rights for innovative entrepreneurship](#) [2]). Intellectual property rights and patents are essential to promoting markets for technology. Although it may be possible to trade unprotected technologies, patents greatly facilitate the realization of market deals, especially when knowledge is codified and hence easily imitable. It allows for both the disclosure and protection of technology.

**Interface with universities and public research institutes** (see [Interface with universities and public research institutes](#) [3]). Universities and public research centres are important technology suppliers in markets for technology (Mowery et al., 2004). In the United States, for instance, the Bayh-Dole Act, by incentivizing universities to patent and license the technology they invent, has

strongly contributed to the development of markets for technology. In a sense, Technology Transfer Offices are IP brokers, whose role is to favour the transfer of technology from universities to industry.

**Technological co-operation between firms** (see [Technological co-operation between firms](#) [4]). Markets for technology, defined as transactions for the use, diffusion and creation of technology, include various types of interactions and co-operation between firms, from licensing of well-defined intellectual property to collaborative agreements that may aim at developing new technologies. Co-operation between firms in markets for technology can also take the form of cross-licensing and patent pools. Cross-licensing refers to agreements where two or more parties grant a license to each other for the exploitation of subject matter claimed in one or more of the patents each owns. Patent pools are bundles of patents held by separate holders, who come together to give each other, as well as other firms, access to the bundle. These forms of agreement are particularly important in complex technology sectors, where technologies have multiple components and thus often several patents, because they grant companies the right to sell their products (secure freedom to operate) (Grindley and Teece, 1997).

**What other topics relate to markets for technology and innovative entrepreneurship in particular?**

**Trajectories of new innovative ventures** (see [Trajectories of new innovative new ventures](#) [5]). Markets for technology can have substantial effects on the trajectories of innovative new ventures, as they determine the extent to which innovative businesses can trade on market, generate revenue from in-house inventions and collaborate with other companies, which may encourage growth and future trade sales (defined as outright, phased or partial sales of the company to a strategic investor).

**Business support infrastructure** (see [Business support infrastructure](#) [6]). Business support services, education and training programmes can improve innovative entrepreneurs' expertise in the IP field, help them adopt a more strategic use of internally developed technologies and increase their participation in markets for technology.

**What policies relate to markets for technology and innovative businesses?**

Public policy can influence markets for technology by:

- **Raising firms' awareness about the strategic opportunities offered by markets for technology** and intellectual property rights. Innovative firms often have only a partial perception of the benefits and costs implied by access to IP instruments. Information and training programmes could contribute to increased awareness about the "pro-active" use of IPR, as an asset around which innovative business strategies can be developed, as a tool for opening up new markets or segmenting existing ones, and as a key to accessing technology markets, gaining revenues or combining with complementary assets to generate new value. Such use of IPR can also be a positive signal of the value of a business to competitors, customers, potential partners or investors.
- **Supporting trading mechanisms that facilitate the match between supply and demand for technologies.** Examples include: licensing markets, university technology transfer offices, clearinghouses and patent auction houses.
- **Improving information in markets for technology.** This may include making licensing deals public in order to enable the identification of patent owners, advertising IP-protected inventions available for licensing by using online databases, as well as increasing patent quality and lowering the number of patents. Indeed, the proliferation of low quality patents and the fact that patent owners may remain secret create a favourable environment for troll activity, a serious threat to markets for technology.

- **Establishing standards and transparent methods for valuing patents.** The valuation of IP is a very difficult operation, especially for small entities. The lack of references hampers the existence of reliable prices, which in turn might deter the entry of potential participants.
- **Encouraging the commercialisation of IP through bigger rewards.** This can be particularly relevant in the case of universities and public research institutions. Two important steps are appropriate incentives for researchers and effective Technology Transfer Offices (TTOs) that offer services to facilitate the search for suitable private sector partners.
- **Ensuring the existence of appropriate conditions to support competitive and well-structured markets for technology.** In particular, policy makers should ensure that markets for technology allow fair and efficient access to technologies, and that the related distribution of revenues generated by the trade of technologies is fair and balanced. Several policy areas may be particularly relevant in this context, such as **IP policy** affecting the use and circulation of IP rights, **competition policy** ensuring that market mechanisms are not distorted by collusive or monopolistic behaviour, policies relating to the valuation of IP (e.g. by promoting standards), **taxation policy** affecting the flows of technologies across international boundaries, and **R&D policies** stimulating the creation and circulation of knowledge and new technologies.

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