Pharmaceuticals Policy and Law 18 (2016) 45–53
DOI 10.3233/PPL-160431
IOS Press

Patent protection as a key driver for pharmaceutical innovation

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A robust, time-limited system of patent protection is proven to facilitate development of, and access to, innovative pharmaceutical products and processes. In particular, a well-functioning patent protection system is a prerequisite for attracting finance for costly pharmaceutical research, given its high failure rates, by ensuring that successful innovation is rewarded. This article offers a short scientific introduction to current research and development (R&D) in the biopharmaceutical industry before going on to consider the economic role of patent protection, in enabling research through access to capital markets and in accelerating access to new, innovative medicines. In this regard, the article discusses the beneficial economic effects of well-functioning patent systems in regions with restricted access to investors and capital markets. It concludes by underlining the importance of a robust and finely-tuned patent system in contributing to scientific progress and development of new life-saving drugs.

Keywords: Pharmaceutical patients, innovation, research and development

1. The role of intellectual property rights in knowledge-based economies

As the world's economies become more knowledge-based, protection of intellectual property rights (IPRs) becomes more important. IPRs are exclusive rights fostering innovation, entrepreneurship, and investment in knowledge-based assets, which ultimately contribute to economic growth by creating the prospect of a return on investment [1] and by facilitating knowledge diffusion.

Patents protect new, technology-based products and processes from being appropriated by third parties, which would dilute the ability of inventors to recoup their investments and to profit from their inventions [2]. The patent system is an incentive system; an exclusive right with economic value is granted for a limited time in exchange for disclosure of the technology that advances the scientific prior art to the benefit of society. It operates at different levels, providing an incentive to invent, disclose, and optimize exploitation efficiency as well as to innovate and diffuse, while providing a tool for governance of markets and firms in a globalized knowledge market economy [3]. Knowledge diffusion [4] is enhanced by the disclosure requirement in the patent application process, which facilitates new collaborations, partnership and licensing arrangements. In this regard, empirical evidence suggests that patent

disclosure increases licensing opportunities [5] and that licensees themselves make significant investments in research and development (R&D) [6].

Disclosure not only reveals the existence of the technology, but also enables a person sufficiently skilled in the art to use the information to make further advances [7]. In essence, the IP system is an exchange between society and inventor in which the grant of exclusive rights potentially sacrifices short-term efficiency gains in order to foster "dynamic long-term efficiency in the form of greater innovation and creativity" [8].

2. The importance of patents for the pharmaceutical industry – empirical evidence

The growing economic importance of patents over the last decades has underscored the role of IP in contributing not only to innovation, but also to competition and trade. In particular, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), which is governed by the World Trade Organization (WTO), sets minimum standards for national IP laws, including patent laws. These standards, incorporated into national patent laws according to each country's requirements, are aimed at facilitating trade among the WTO's member states.

Two caveats apply to the present discussion. First, the role of patents as a key driver for innovation, though significant for the pharmaceutical industry, cannot be generalized across all sectors. The number of patents granted worldwide has roughly tripled from 400,000 in 1995 to 1.2 million in 2012 [9], but not all industries have been equally innovative or relied on patent protection to secure investment. For pharmaceuticals, however, there is strong empirical evidence that patents have led to the socially desired result of higher R&D spending on developing new life-saving medicines and therapies [10]. Not only have investments increased, but drug approvals also continue to run at high levels; for example, the US Food and Drug Administration (FDA) approved 182 novel medicines between 2011 and early 2016 [11]. Today's drug discovery and innovative R&D activities take place in an environment of growing complexity, alongside the need for greater resources and incentives for investments in a scientific field with a high failure rate.

Second, patent quality meant not to encompass each and every granted patent, but only those timely granted, providing for legal certainty in the innovation ecosystem. The majority of legal [12] and economic scholars assume such quality if the patent (1) withstands a legal challenge without being invalidated, and (2) "fulfil[s] the key objectives of the patent system, i.e. to reward and incentivise innovation while enabling diffusion and further technological developments" [13], granted without any significant lag [14].

Recent WIPO data show patent filings worldwide increasing by 7–10 percent a year, with China now filing more applications than the US and Japan combined [15]. The rising patent filing trend has been observed for decades, and there is empirical

evidence for a significant impact on the medical innovation ecosystem too, especially for the pharmaceutical industry [16]. Most of the value of today's medicines does not stem from their physical material, but from the continued efforts in research, testing, and innovation required to develop them [17]. So it is not surprising that pharmaceutical and biotechnological patents have the highest indices in studies that aim at measuring both the economic and technological value of patents [18] and their originality [19].

3. Understanding pharmaceutical research and manufacturing

Whether patent protection for pharmaceutical products and processes hinders access to innovative medicines is a long-standing and often highly politicized issue between stakeholders, though mainly in a legal and policy context. As stated above, patents promote innovation by providing an incentive to invest in R&D, while they function to structure, define and build innovation partnerships at the same time. Developing new medicines requires high investments in R&D that are essentially speculations on profitable scientific progress to the benefit of mankind. However, the failure rate is high. Unless a few patent-protected commercially-successful drugs are able to recoup investments and generate a profit, finance will dry up and the industry will fail to deliver new drugs.

Before discussing the economic and policy side of pharmaceutical patents, it would be worth having a closer look at the scientific side to see where industry and scientific progress currently stand. It may also be opportune from a pure policy perspective to raise awareness of the scientific complexity of today's R&D and manufacturing. Biologic drugs are complex molecules; they are used as very specific therapeutics that are essential to the health and well-being of patients around the world for diseases which in most cases could not otherwise be treated.

4. Understanding the market

4.1. Knowledge-based capital as a prerequisite for gaining access to financing

As both discovery and manufacturing have become more complex and expensive, financing risky R&D has become more difficult, especially since the financial crisis in 2008. Investment appears economically favourable if time-limited patent protection offers the prospect of recouping the investment and generating a profit.

According to a recent OECD study [20], young, innovative companies contribute 17 percent to the job market and a disproportionate 45 percent to job creation. An important success factor is access to financial market instruments; new capital is often relatively difficult to obtain in the absence of a loan history and a traditional

collateral. For young pharmaceutical companies operating in an R&D- and resource-intensive environment, patents can be considered an asset and a positive managerial and technological signal to lenders and investors to provide financing [21]. Even where there is access to financing, asymmetric information, which describes cases in which the investor or lender is not completely able to receive all information for an informed decision, moral hazards, and other specific features of innovation can have the "combined effect of driving interest rates for financing innovation higher than for other types of financing" [22]. These rates can be significantly lowered for companies with a patent portfolio. Innovative companies with IP assets are able to finance projects more easily by obtaining venture capital [23], which is usually accompanied by the introduction of senior management to the company. Investors see exclusive rights, such as patents as potential drivers of profitability and competitive advantage, even though the patented product may still in its early stages of development and need to be further developed and tested for its safety and efficacy.

Furthermore, where there is a functioning secondary market for patents, they can serve as collateral in debt financing and can be sold separately. Policymakers in several countries are currently supporting their IP secondary market, mainly through greater transparency of IP ownership [24] and the creation of new IP market infrastructures [25]. Knowledge-based capital in the form of patents is linked to higher productivity and growth, mainly because the initial costs are not re-incurred when knowledge is used again and because knowledge generates considerable spill-over effects for other sectors [26].

Although it has been questioned whether the patent system can spur innovation and progress in countries with less relevant markets for the pharmaceutical industry [27], patents are assumed to help in gaining access to financing as a prerequisite for local R&D activities that address local needs. However, the value of knowledge-based capital depends on its use, ease of access, level of transaction costs, and extent of protection [28]. In countries without effective IP enforcement, a granted patent alone might not lead to the desired financing, growth, and higher productivity.

4.2. Patents and access to medicines

As patents are exclusive rights, they do – by nature and design – result in higher prices for a limited amount of time than if the innovation could be directly copied and sold. However, policy discussions on whether patents hinder access to medicines often take place in a context in which, without those patents, the medicines in question would not have been discovered in the first place. At least for essential medicines there seems also to be little evidence that patent protection hinders access to such medicines or treatments; only 8 percent of medicines on the Essential Medicines List of the World Health Organization are patent-protected [29].

Overall, access to medicines is determined by a variety of factors in combination rather than by patent protection alone. Access often depends on the price of a drug, which is in turn influenced by the regulatory system, distribution costs, importer and

supply chain margins, and investment in physicians' and patients' outreach and education [30]; policy factors include taxation, procurement policies, and the use of TRIPS flexibilities. While the availability of these flexibilities has in general facilitated cooperation and can be useful in limited contexts, like health emergencies, their disproportionate use in some cases has resulted in higher prices and delayed availability of new medicines, both ultimately worsening access. Data show that countries with developed IP systems gain access to new medicines earlier than others [31].

However, this finding appears to apply mainly to high-income countries with attractive markets. Significant empirical evidence for the impact of patents on access in developing countries is missing. Currently available studies are mostly inconclusive and the results are not completely understood given the high level of heterogeneity between different countries [32]. For example, one study [33] found that patent regimes accelerate the entry of new treatments for HIV/AIDS in developing countries, but only in those with relatively equally distributed incomes. However, there is also evidence that innovative companies invest in medical education that increases the availability of new treatments to patients in developing countries [34].

Price premiums for patent-protected medicines in developing countries following implementation of the TRIPS Agreement are relatively small; implementation has mostly resulted in higher sales, and better and faster availability of medicines [35]. Contrary to the expectations of some stakeholders, India's implementation of the TRIPS Agreement has not led to high price premiums that could be considered a barrier to access. Although a model study beforehand had predicted a sharp rise [36], the price increase for patented drugs following the Indian reform was 3–5.3 percent overall, 6–12 percent comparing patented drugs and drugs where the application was still pending, and only about 20 percent for patented, newly developed drugs [37]. In comparison, patented medicines in the US market cost on average three times as much as the subsequently marketed generic drug [38]. In addition, one study even suggests that it was India's obligation to comply with TRIPS that transformed several companies' business models from imitation-based to innovation-based [39].

And finally, it should be mentioned that innovative medicines are the basis for the development and later launch of lower-priced generic medicines. By fostering innovation, patents indirectly contribute to making new generic medicines available. Moreover, generic companies in emerging economies are themselves starting to invest in R&D in order to further develop off-patent medicines adapted to local needs. Therefore, it can be concluded that patent protection does not necessarily hinder access to generic drugs, but is an enabler for the existence of generic drugs and furthermore encourages innovation by the generic industry itself.[1]

[1] One example of such appears to be the Indian generic company Cipla, which refused to provide patent data for the Beall/Attaran study.

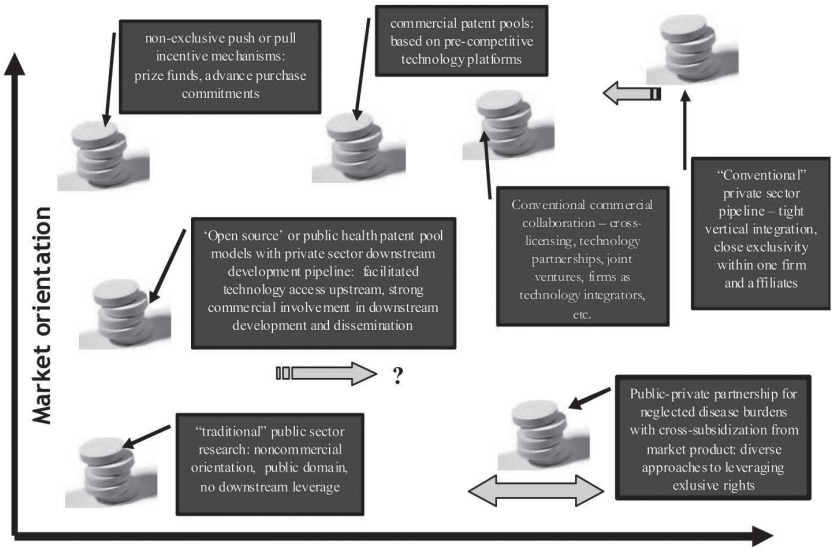

Fig. 1. Source: Taubman, A Typology of Intellectual Property Management for Public Health Innovation and Access: Design Considerations for Policymakers, Open Aids J, 4, 2010: 4–24.

4.3. New strategies and models

Most pharmaceutical research is not publicly funded, nor could it all be publicly funded as a public fund could never fund amounts that the capital market can. However, high costs and risks for private investment in pharmaceutical R&D have led research to focus mainly on therapeutic areas with a relevant market for innovative medicines and therapies. This has led to the neglect of some areas by private sector R&D efforts. The World Health Organization, the industry, national authorities, NGOs and other stakeholders have recognized these market failures, especially with regard to neglected tropical diseases (NTDs), and have established several successful collaborations to address this issue, with encouraging outcomes.[2] Nevertheless, some stakeholders advocate a radical change of the current R&D model.

While some proposed measures have their theoretical and/or practical merits, and can complement the current privately funded R&D model, they cannot replace it. From a pragmatic point of view, charitable R&D initiatives, state-directed R&D, and/or public-private partnerships could not sufficiently finance the development of needed innovative medicines in an efficient and sustainable way as through the current capital-market based R&D model (Fig. 1).

No alternative R&D models could replace the private pharmaceutical R&D model with its functioning patent system, without severely affecting the development of

[2]Compare http://www.ifpma.org/subtopics/neglected-tropical-diseases/.

new life-saving medicines. The often discussed "de-linkage" of the price for a medicine and R&D costs remains academic as none of the suggested models could provide the continued supply of resources for research as the financial markets do. Especially with regard to NTDs, where market incentives are not available, the further fostering of collaboration between WHO, industry, national authorities and other stakeholders – complementing rather than replacing private-sector funded research – can be expected to continue to produce encouraging results in the future. New models should therefore be seen as complementary, as add-ons to current collaborations, rather than as radical changes to the current innovation ecosystem.

5. Conclusion and outlook

This article aims to raise understanding of pharmaceutical R&D, its economic aspects from a capital-market perspective, and the role of patents as a key enabler for pharmaceutical R&D and innovation to the benefit of patients. Today's most effective and cost-intensive medicines are protein therapeutics which can only be developed with enormous investment in resources. The growing complexity of both drug discovery and manufacture for such medicines will demand a corresponding increase in the resources needed. This underlines the importance of patents as an incentive and source of growth and innovation. The technological and economic framework in which pharmaceutical R&D takes place requires a finely-tuned patent system that encourages continued scientific progress to combat current and future diseases.

While the analysis of large data sets has shown that the individual value of pharmaceutical patents was slightly declining since 2004 [40] and may continue to decline, patents remain of crucial importance to the pharmaceutical industry to attract investment, and by this, have the means to fail, learn and succeed in the future.

While positive effects of patents on innovation and access to innovative medicines have been observed in countries with developed markets and high GDP, studies in low-income countries are mainly inconclusive and differ considerably between low/middle-income and high-income countries. Although there is no one-size-fits-all approach with regard to IP policy, a well-functioning patent system in accordance with TRIPS as well as a juridical system for enforcement would seem to favour all countries. Given that neither positive nor negative effects for low-income countries have been observed [32], several countries are currently building capacities and adapting their IP laws to stimulate local innovation to join the global trend towards knowledge-based societies. The currently available studies mostly analysed low- and middle-income countries in the process of establishing their IP systems and not their effect after implementation on fostering innovation. It can nevertheless be assumed that implementation of such IP systems will help to address more local health-related issues in the future. The author encourages further empirical studies in this regard to increase the overall understanding of the impact of IP systems on low- and middle-income countries to help formulate more concrete policy recommendations to support creation of an innovation friendly environment.

Acknowledgement

I would like to thank Dr. Axel Braun, Head International Developments at F. Hoffmann – La Roche for providing helpful comments and taking the time to review the article.

References

[1] OECD, New Sources of Growth: Knowledge-based Capital, p. 416: "There is a need, furthermore, to ensure that the importance of intangible assets is given sufficient recognition to secure the levels of investment required for their continued growth and economic contribution.".
[2] *Id*, p. 8.
[3] Ove Granstrand, presentation "Patents and Innovation for Growth in a Converging World Economy", WIPO Seminar Series on "The Economics of Intellectual Property", 5 September 2011.
[4] OECD, New Sources of Growth: Knowledge-based Capital, p. 31.
[5] Hegde/Luo, Imperfect Information, Patent Publication, and the Market for Ideas, p. 26.
[6] Arora/Athreye, Patent Incentives: Returns to Patenting and the Inducement for Research and Development, p. 7f.
[7] Graham et al., High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey, 24 Berkeley Tech. L.J. 1255 (2009), p. 1326f.
[8] OECD, New Sources of Growth: Knowledge-based Capital, p. 416f.
[9] WIPO, World Intellectual Property Indicators 2013, p. 48, Figure A.1.2.1.
[10] OECD, New Sources of Growth: Knowledge-based Capital, p. 431 with further references, though cross-sectorial research with highly aggregated data, such as Westmore, 2013, p. 21, is sometimes used to argue for the opposite.
[11] Center for Drug Evaluation and Research, New Drugs at FDA: CDER's New Molecular Entities and New Therapeutic Biological Products.
[12] Bessen/Meurer, Patent Failure: How Judges, Bureaucrats, and Lawyers Put Innovators at Risk, p. 254f.; Devlin, The Misunderstood Function of Disclosure in Patent Law, p. 443f.
[13] OECD, New Sources of Growth: Knowledge-based Capital, p. 88 with reference to Guellec/van Pottelsberghe de la Potterie, The Economics of the European Patent System: IP Policy for Innovation and Competition.
[14] Harhoff/Wagner, The Duration of Patent Examination at the European Patent Office; Motsoeneng, South Africa tackles drug approval delays, Reuters article from 29 May 2012.
[15] WIPO, World Intellectual Property Indicators 2015, p. 23, 37.
[16] Levin et al., p. 824; OECD, New Sources of Growth: Knowledge-based Capital, p. 431.
[17] OECD, New Sources of Growth: Knowledge-based Capital, p. 13.
[18] *Id.*, p. 91, calculations based on PATSTAT (EPO, April 2012), October 2012, indexed by industry.
[19] OECD, New Sources of Growth: Knowledge-based Capital, p. 111f. with reference to Hall, et al., The NBER Patent Citation Data File: Lessons, Insights and Methodological Tools, defined as resulting from a large number of diverse knowledge sources.
[20] OECD Science, Technology, and Industry Scoreboard 2013, p. 198.
[21] OECD, New Sources of Growth: Knowledge-based Capital, p. 9.
[22] OECD, New Sources of Growth: Knowledge-based Capital, p. 57f.
[23] Hall/Harhoff, Recent Research on the Economics of Patents, p. 4; Hoenen, et al., Do Patents Increase Venture Capital Investments between Rounds of Financing?, p. 22f.
[24] Harhoff, The Role of Patents and Licenses in Securing External Finance for Innovation, p. 13f.; Brassell/King, Banking on IP? The role of intellectual property and intangible assets in facilitating business finance; Terroir, Rebalancing the Patent Economy, p. 71.
[25] OECD, New Sources of Growth: Knowledge-based Capital, p. 58.
[26] *Id.*, p. 12.

[27] WHO, WIPO, WTO, Promoting Access to Medical Technologies and Innovation, p. 105.
[28] OECD, New Sources of Growth: Knowledge-based Capital, p. 12.
[29] WIPO document WIPO/GC/IP/GE/16/1, p. 25; 5 % of the 2015 Model List; however, a rising trend due to the fact that the WHO start to consider more innovative treatments essential; Beall/Attaran, Global Challenges Report: Patent-based analysis of the World Health Organization's 2013 Model List of Essential Medicines, 5% earlier.
[30] Aitken et al., Understanding the pharmaceutical value chain, p. 21f.
[31] Cockburn/Lanjouw/Schankerman, Global diffusion of new drugs: The role of patent policy, price controls and institutions, p. 16f.; Lanjouw, Patents, Price Controls and Access to New Drugs: How policy affects global market entry, 41f.
[32] Maskus, Intellectual Property Rights and Social Development: Issues and Evidence, WIPO/IPDA/GE/16/T4.
[33] Borrell, Patents and the faster introduction of new drugs in developing countries. Applied Economics Letters, 12(2), 379f.
[34] Kyle, Margaret, Intellectual Property Rights, Price, and Access to Innovation: Evidence from the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), WIPO/IP/ECON/GE/3/13/INF.1.
[35] Kyle/Qian, Intellectual Property Rights and Access to Innovation: Evidence from TRIPS, p. 2f.
[36] Chaudhuri et al., Estimating the Effects of Global Patent Protection in Pharmaceuticals: A Case Study of Quinolones in India, p. 35f.
[37] Duggan et al., The Market Impacts of Pharmaceutical Product Patents in Developing Countries: Evidence from India, p. 103f.
[38] Alazarki, The 10 Biggest-Selling Drugs That Are About to Lose Their Patent, Daily Finance, 27 February 2011.
[39] F. Angeli, With the help of a foreign ally: biopharmaceutical innovation in India after TRIPS, I: Health Policy and Planning 2014; 29: 280–291, p. 283.
[40] OECD, New Sources of Growth: Knowledge-based Capital, ENQUIRIES INTO INTELLECTUAL PROPERTY'S ECONOMIC IMPACT, Chapter 1, p. 33, calculations based on PATSTAT (EPO, April 2012), October 2012.