

Financing Innovation: looking back at History

Invention and Inventors . The history of innovation was marked by Joseph Schumpeter (1883-1950)¹, for whom the key to growth in the 19th century lay in the radical inventions made possible by entrepreneurial investment in cutting-edge technology. Inventions were seen as agents of the transformation of economies with a focus on innovation; technical progress tended to orient industrial history towards the success stories of innovative companies.

Joel Mokyr² highlighted the importance of micro-inventions - incremental inventions - which had made possible the very efficiency of great inventions. This continuity between micro-inventions and breakthrough inventions question and call for the need to continuously fuel research with adequate funding in order to enable the emergence of major inventions. James Watt's patents at the end of the 18th century were a major breakthrough in steam technology which is said to have played a prominent role in the industrialisation of the world. Steam became a totem image of the onset of a new age and help to built a very simple narrative around innovation, ignoring the ups-and-downs of research and the need to explore many avenues before achieving great transformative innovations. This ongoing process and the need to fund it is core to understand the transformative power of Science trough the 20th century.

In the 19th century, the English context at the time was capitalistic with institutions adapted to business. Patents started to protect inventions and inventors since 1698, and were operated by companies in a competitive atmosphere. Engineers and scientists were closely linked. Through patent investors started to understand how science could become a major field of investment, starting a process of virtuous interaction between business men, inventors and scientists. The patents granted for pharmaceutical products since the middle of the 19th century³ is a privilege granted to pharmaceutical companies in exchange for investment in research and development of medicines that improve people's health, save lives and meet unmet medical needs. They were designed to guarantee a profit for the pharmaceutical companies as long as they develop innovations for the benefit of health. Therefore, patents, on top of protecting invention and innovation, can be seen as a proof of the social contract between Pharma companies and the society at large. However, the 20th century started to change this dynamic by putting the Market and the needs for financial return as the sole and primary reason for investment.

The evolution, from the early stage of invention and technical innovation to the current time of booming innovation in most scientific fields, is calling for a re-thinking of the funding mechanisms of scientific innovation. In the field of drug discovery questions are raised regarding patent, financial return of private companies developing drugs, budget impact for the society and current price level of new innovations. All these questions are intricately connected in a complex web.

The Current Pharma Business Model . In 2015, the public was outraged by the 50 fold increase of an old drug after its acquisition by a pharmaceutical start-up. This was the last nail in the coffin of Pharma reputation and triggered immediate and violent reaction by all stakeholders. Few years later, this drug (*i.e.* Daraprim) still costs significantly more than it did before the initial price increase. However, the issue here is not the exact level of price one should expect but rather whether the company explains the steps it was taking to come to this drastic increase in price *e.g.* increasing profitability to invest in new clinical development for example. Both shareholders and stakeholders should have a genuine interest in controlling such behaviour: disparities in access due to unacceptable pricing mechanisms, are ultimately making the Pharma business unsustainable for the greater society. A clear definition of what corporations should and should not be doing

¹Histoire des techniques, Liliane Hilaire-Pérez *et al.*

²Mokyr, J. "A Culture of Growth: The Origins of the Modern Economy". press.princeton.edu. Retrieved 9 March 2017

³Gabriel Galvez-Behar. Posséder la science, la propriété scientifique au temps du capitalisme industriel. collection "en temps et lieux". éditions RHESS.ISBN 978-2-7132-2853-7

is a key ethical element of corporate behaviour when it comes to price drugs. As mentioned earlier, historically the purpose of the patent system is to promote innovation by granting exclusive rights and a fair return to the "inventor" and not favouring a culture of "taking advantage" but rather encouraging innovation.

In the 1990s and early 2000s, the Pharma Business Model was characterised by large, diversified pool of companies with a large R&D footprint in multiple Therapeutic Areas and primary care driving growth. This model heavily relied on a classical marketing and sales approach, not very different from any consumer business, with a very minimal impact of the emerging world on company's revenues. This dramatically changed between 2000 to 2010 with declining R&D productivity, rising costs, increased payor influence and shorter exclusivity period; As a consequence, average expected returns decreased. The Blockbuster mentality *i.e.* searching for the largest opportunity possible in whatever Therapeutic Area it may occur, is long gone. The search for new inventions and the need to fill new patents is still a driving force of the Pharma industry; however, the need to focus and making a clear competitive advantage is becoming a crucial dimension. This largely explained the current transition to a lean, focused model with a research footprint in cutting innovation, increase revenue from specialty care / rare diseases and a decisive importance of non-US non-EU markets. The demand for new therapies using new approaches such as immunology, gene therapy, RNA therapeutics, stem cells. . . will remain a major trend for the long-term industry dynamics. Increasingly affordability is a significant global challenge as well as providing fair and universal access. This is even more the situation in non-US non-EU countries where health systems remain largely funded by the patients and their family (out-of-pocket). The need for new pricing models such as coverage assistance, tiered pricing, performance-based models, among others, are key elements of the new Pharma Business models. In addition to these new pricing approaches, the valuation of companies by investors and their ethical expectations will play a key role: in the Health sector should a company be only profitable or profitable and driven by innovation as well as by the social contract to improve health for all ? Shouldn't innovation be the key element of any financial analysis ? As a consequence, the importance of first in class drugs in the pipeline should drive company rating. This implies that Pharma companies will focus on specialty medicines and biologics, as well as exiting non-innovative portfolio and expanding in non-US non-EU countries. This shift towards highly specialised products and the race for breakthrough innovation is a clear call for financial innovation in the Pharma.