



INNOVATION AND INTELLECTUAL PROPERTY

Investments in new technologies, experimentation and learning lead to innovations that improve product and service offerings. Intellectual property protections of innovations are intended to foster innovation and thereby increase dynamic efficiency, i.e., increases in consumer surplus over time.¹

It is hard to rank the innovations by their importance over the course of human history. How do shifts such as monks copying texts one at a time to the printing press, and horse and buggies being replaced by automobiles, compare to recent innovations such as eBooks, portable music, and vast computing power to store data and solve complex problems?

But three observations seem right. One, the pace of technological innovations has accelerated in recent decades, in large part because of digital technologies and advances in genomics. Two, many recent innovations have relaxed time and location constraints on how individuals can access products and services. Three, because innovations are disrupting so many industries at the same time, dramatic changes in many aspects of business and society now challenge our collective abilities to keep up. Referring to the terms associated with Joseph Schumpeter, the scale and scope of the *creation* and *destruction* we are experiencing are unprecedented.²

How do high-tech firms innovate? While few modern-day economists focus on innovation at the firm level, we do know that often large financial investments in innovation are necessary. But so too are other requirements: Innovations must be matched to evolving customer needs; and firms must be able to supply innovative products and services on a timely basis to major customers. Given the mix of requirements, we observe that firms are demonstrably different in their ability to get to, and stay on, the *leading edge*.³

The point that innovative firms may lose their position on the leading edge indicates that the competitive advantages from incumbency, including learning and economies of scale, may be of limited value. A good example comes from modem chips in smartphones. Apple chose Infineon in 2007 to supply these chips for the first iPhone, and chose Intel to supply modem chips for iPhones in 2014. Neither supplier, however, was able to keep up the innovative pace and thereby maintain its incumbent position with Apple. This led Apple to switch to Qualcomm and later Broadcom.⁴

We also know that the process of innovation in many high-tech industries is a mix of product cycles, shifts to new generations of products, sometimes facilitated by new industry standards,

¹ Dynamic efficiency focuses on how consumers alter their purchases over time. Consumer gains are measured by their Willingness-To-Pay. Such analysis does not account for the full effects of innovations on business and society.

² Schumpeter, Joseph A., *Capitalism, Socialism and Democracy*. London: Routledge (1942).

³ Relevant academics include (a) Joseph Schumpeter, known for the term “creative destruction”, and (b) John Sutton, who modeled how firm level factors, including innovation, influence industry structure.

⁴ I offered testimony in the *Qualcomm Antitrust Litigation*. These facts are in the public record.



and big discrete changes. The technological origins of Liquid Crystal Displays (LCDs) date back to the 1960s.⁵ Subsequent innovations made LCDs sharper, brighter, thinner, and available in all kinds of dimensions. Since 2000, quality adjusted prices fell by over 90 percent and sales volumes took off:⁶ LCDs are now the now ubiquitous – in monitors, televisions, laptops, phones, copy machines and printers, vehicles, and, very important for morning routines, easy-to-use coffee machines. LCDs, however, may go the way of Cathode Ray Tubes, which were used before LCDs, because Organic Light-Emitting Diode (OLED) screens offer advantages over LCDs.⁷

Intellectual property (IP) rights come in different forms:

- Patents cover novel inventions in designs, compositions, and processes.
- Copyrights cover a broad range of works by authors, including music, video, and brands.⁸
- Legal protections may also extend to proprietary business information, including product development, platform algorithms, and customer strategies.⁹

When they are granted and when they can be enforced,¹⁰ these types of IP exclude others from using another's innovations without permission. Innovators may, as a result, be able to exercise monopoly power.

Whether or not their innovations are protected by IP laws, innovative firms face the challenge of how to monetize their value. One way is the sale of goods and services that embody the innovation. Another is the transfer of such knowledge. Knowledge transfers are, however, tricky. Sellers do not want to reveal the innovation to potential buyers. At the same time buyers do not want to pay for ideas whose value is uncertain. This problem of information asymmetries¹¹

⁵ <https://www.techwalla.com/articles/the-history-of-flat-screen-tvs>

⁶ The downward price paths reflect product-cycle effects whereby new models come in at lower prices and then sales volumes increase.

⁷ <http://www.acnodes.com/blog/what-are-the-differences-between-oled-and-led/>

⁸ Professor Schiller's books, the VW logo, and the Star Wars brand are examples.

⁹ In some circumstances, contractual restrictions on employee movement may legitimately protect a firm's proprietary business information, but this is a controversial area for high-tech companies, cf. www.cand.uscourts.gov/judges/koh-lucy-h-lhk/in-re-high-tech-employee-antitrust-litigation.

¹⁰ What is and what is not protected by IP laws is beyond the scope of this brief, but country differences are substantial.

¹¹ For example, see Joseph E. Stiglitz, "The Contributions of the Economics of Information to Twentieth Century Economics", *Quarterly J. of Economics*, Vol. 115, Issue 4, November 2000, pp. 1441-1478. For insights on contract design, see N.T. Gallini and B.D. Write, "Technology transfer under asymmetric Information", *Rand J. of Economics* (1990); Robert M. Townsend, "optimal contracts and competitive markets with costly state verification", *J of Economic Theory*, (1979).



is exacerbated by another challenge: once the innovation is sold to one buyer, it can be transferred to others, often at low marginal cost.

Firms and markets have dealt with these problems for thousands of years. With the development of modern legal systems, a common means is to design long-term contracts that include (a) various exclusivity provisions, and (b) mechanisms to measure the value of the innovation. Payments to content developers of music and video, for example, may be based on contracts that measure listeners and viewers. Contracts may also prevent switching to other suppliers who are “fast followers.” Lastly, some contracts specify that the marginal price falls after some level of use.

When the transfer of innovation is especially difficult and when it is difficult to exclude unauthorized users, vertical integration may be the result. Apple, for example, contracts with manufacturers to build their products and contracts with suppliers for many of the components, but Apple produces some of the most important inputs itself and has chosen to keep its operating system (iOS) proprietary.

Readings:

1. “[What is Intellectual Property?](#)” and “[The Concept of Intellectual Property](#)” booklets from the World Intellectual Property Organization (2019)
2. “[A History of Intellectual Property in 50 Objects](#)” (2019)





Back in the 1990s, this elegant device answered missed calls on land lines and recorded phone messages. Not too many consumers regret its demise.