Lecture 19: Innovation

Primary reference:
Besanko et al, Economics of Strategy, Ch. 15
We have considered the problem of creating and sustaining competitive advantage.

Let’s return to Airborne Express. In that case, what was the most striking (and long-lived) example of creating competitive advantage?

While Airborne’s ability to hang around when facing two large competitors is impressive, the answer is...

Federal Express! Fred Smith thought the idea of “overnight delivery anywhere” up, brought time, energy and capital to bear on it, and changed the market forever.

Is this the most striking example from everything we have done in class?
Dynamic Competitive Advantage and “Creative Destruction”

- Joseph Schumpeter (1943) argued that innovation causes market evolution to have several recognizable characteristics.
- There are periods of quiet when established firms earn positive profits.
- These periods end with disruptions, or “shocks,” that alter sources of advantage.
- Entrepreneurs who exploit these shocks gain the competitive advantage in the next quiet period.
- This process is called creative destruction.
What really counts is competition between new products, technologies and organizations.

Consider the long history of antitrust cases in the US. The government sued IBM for monopolizing the computer industry in 1969. The case dragged on for 13 years, during which time entrepreneurs such as Steve Jobs and Bill Gates made major innovations to hardware and software that rendered IBM’s dominant position unthreatening.

Microsoft’s innovations in the 1970s, 80s and 90s brought antitrust scrutiny to it in the late 1990s. Are we really very worried about Microsoft today?

No, now we’re worried about...Google!
Schumpeter’s basic point is simple. New innovations lead to first-order improvements in consumer welfare, and therefore first-order profit opportunities.

By contrast, gaining market power in a market at a given moment in time is likely to be of second-order importance (for profit and welfare) if the market is characterized by improvements in products, technology and organization.

That is, good management may require cannibalizing existing profitable products now so that you may remain competitive in the future.
Disruptive Technologies

- Quartz watches, cellular communications, computer flash memory...all delivered higher benefits $V$ at lower cost $C$ than what they replaced.

- There are many technologies that disrupt without providing higher benefits, though. PCs deliver lower benefits than mainframe computers, ink-jet printers deliver lower benefits than laser printers, etc.

- In these cases, the cost savings are big enough that the new technology dominates without delivering higher benefits. All that matters is that $V - C$ rise...by a lot.
A Simple Model of Innovation

- Even when an innovation alters only costs and benefits, there are still degrees of disruption.
- Let demand for a product be given by $P = 100 - Q$ and let the pre-innovation marginal cost be $\overline{c}$.
- Consider an innovation that lowers the marginal cost of production to $c$.
- To keep things simple, assume that the innovation is protected by a patent that prevents all imitation with certainty, so that it leads to monopoly.
- Two Starting Points:
  - Monopoly
  - Perfect Competition
Initially, a monopolist prices and profits as usual.
After innovation, the monopolist earns higher profits.

Note, however, that the new profit “replaces” the old profit. This weakens incentives to innovate.
Perfect Competition Incentives to Innovate

- Now consider the case where the market is initially characterized by perfect competition.
- There are two cases to consider.
- A **drastic** innovation is such that, post-innovation, the innovating firm’s monopoly price is below the old marginal cost (which is the marginal cost for other firms).
- A **non-drastic** innovation is such that, post-innovation, the innovating firm’s monopoly price is above the old marginal cost.
Perfect Competition Incentives to Innovate: A Drastic Innovation

Let the new marginal cost be 0. No one can compete, even against a monopoly price.
Perfect Competition Incentives to Innovate: A Non-Drastic Innovation

Let the new marginal cost be \( c \). Now, the monopoly price is above \( \bar{c} \). If the innovator chooses this price, it will be undercut by other firms producing at cost \( \bar{c} \).

Instead, it pursues a type of limit-price approach, choosing a price that is (a penny less than) \( \bar{c} \), and earns a positive profit.
Perfect Competition Incentives to Innovate: Comparison vs. Monopoly

- A perfectly competitive firm initially earns zero profit, so by innovating it does not replace any profits.
- Its incentives to innovate are strictly higher than for a monopolist.
- This is trivial to see for a drastic innovation, but is a bit more complicated for a non-drastic innovation.
- The reason for this phenomenon is called the replacement effect.
The story above is a bit too simplistic in that the monopolist is comparing the profit under innovation to a profit under no innovation. What if not innovating meant losing your initial profit?

More specifically, let the monopoly profit as a function of marginal cost be \( \Pi^M(c) \) and consider the possibility that an entrant may innovate.

Suppose that if the monopolist innovates, it earns payoff \( \Pi^M(c) \). If the entrant innovates, the (former) monopolist earns duopoly payoff \( \Pi^D(\bar{c}, c) \) and the (innovating) entrant earns \( \Pi^D(c, \bar{c}) \). Note that the duopoly profit could be positive for both firms (e.g. Cournot).
Monopoly Threatened by Entry

- The payoff to innovating for the entrant is $\Pi^D(c, \bar{c})$, while the payoff to innovating for the monopolist is $\Pi^M(c) - \Pi^D(\bar{c}, c)$.
- Thus, the payoff to innovating for the monopolist is higher if $\Pi^M(c) - \Pi^D(\bar{c}, c) > \Pi^D(c, \bar{c})$, that is, if

  $$\Pi^M(c) > \Pi^D(\bar{c}, c) + \Pi^D(c, \bar{c}).$$

- If the total profit under duopoly is smaller than under monopoly, then the monopolist has higher incentives to innovate than a prospective entrant.
- This is called the **efficiency effect**.
Patent Races

Now suppose an incumbent monopolist and a prospective entrant each choose a level of R&D effort.

Suppose the timing and incidence of innovation are random, but that innovation is more likely, and happens sooner, the more R&D is spent.

Then, either the replacement effect or efficiency effect may dominate. More drastic innovations favor entrants (no efficiency effect).

Lessons:

- Incumbents: Do not get complacent.
- Entrants: Do not get discouraged...your incentives to innovate may be stronger than a complacent incumbent.
- Be careful in incorporating sunk costs into strategic thinking.
The models above present a simplistic picture about the payoffs to innovating. First, it must be recognized that the main output of innovation is ideas—ways to improve existing products and processes, new products and processes, etc.

Fundamentally, ideas are non-rival—one person’s use of an idea does not diminish its value to another user—and non-excludable—once an idea is in the public domain, it cannot be fenced off.

Imitation is typically cheaper than innovation (Mansfield, Schwartz and Wagner 1981), about 67 % on average in terms of both money and time.

This creates a natural second-mover advantage situation, where innovators may face entry that destroys their ability to earn back innovation costs.
The US Constitution stipulates in Article I, Section 8, that to stimulate progress in science and useful arts, inventors and artists are to be given exclusive rights to their inventions and works.

This provision has led to multiple ways to protect innovations:

- Patents
- Trade Secrets
- Trademarks
- Copyright

Collectively, these means of protecting intangible assets such as ideas are called intellectual property.
Trademarks and Copyrights

- Trademarks give firms the exclusive rights to use the symbols and names that distinguish and “brand” their products. The economic rationale for trademarks is that they improve firms’ incentives to make quality products. Without them, it would be easier for knock-off firms to fool customers with cheap imitations.

- Trademarks must be registered with the US Patent and Trademark Office to secure protection throughout the US. They last forever as long as the owner uses and defends them.

- Copyrights protect authors and artists similarly but need not be registered. In the US, copyright protection lasts for the life of the author plus 70 years, or a total of 120 years if the author is a corporation. Computer software code is an example of a business product that is copyrightable.

- In nearly all cases, the penalty for violation of trademark or copyright is civil damages and/or injunctions.
Trade Secrets

- A trade secret is a formula, design, process, practice, instrument or set of information not generally known or easily obtainable.
- The formulas for Coca-Cola, Kentucky Fried Chicken and WD-40 are famous examples.
- If the secret confers some economic benefit to the owner and the owner takes sufficient precautions to protect it, then it is protected as intellectual property.
- If protected, it may last forever. It need not be registered.
- Trade secrets fall under the jurisdiction of state law, though 46 states have unified their trade secret law by ratifying the Uniform Trade Secrets Act.
Patents

- A trade secret loses its protection the moment it is revealed. In contrast, to get a patent the owner must reveal her invention.

- Patents are granted by the US Patent and Trademark Office for inventions that are **novel**, **useful** and **non-obvious**.
  - Novel: the invention must be new. If two inventors file for the same invention in the US, the first to invent is awarded the patent (first to file in nearly all other countries).
  - Useful: the invention must have some useful purpose. This historically is almost trivial to satisfy.
  - Non-obvious: an individual “skilled in the relevant art” would not find the invention obvious.

- Patents expire 20 years after the date of the application.

- A typical patent issues 2-3 years after application and costs upwards of $10,000 in legal and other fees.
Patents and Exclusion

A patent gives its owner the right to exclude others from using the patented invention. It is a *negative* right. Owning a patent on an invention does *not* mean that you can use the invention for its main purpose. Someone else may have a conflicting patent that excludes you. Hence, cases arise where conflicting patents effectively prevent all people from using a particular product.

In most industries, patents do not enable an owner to *prevent* use up front. Rather, they enable the owner to sue for damages or for injunctions. Often, suits come after use or *infringement* occurs.

The big exception is the pharmaceutical industry. The Food and Drug Administration (FDA) bases its decisions on whether to allow generic entrants on whether the pioneer manufacturer has patents covering the drug.
If you believe your patent has been infringed, then to recover damages, you must file an infringement suit in Federal District Court (patents are federal grants).

Most cases (95% or so) are settled out of court. Those that proceed to trial include two basic inquiries:

- Is the patent valid? That is, does it satisfy novelty, utility and non-obviousness? Here, the patentee enjoys a fairly strong “presumption of validity”—this may be overcome only with “clear and convincing evidence” to the contrary.
- Is the patent infringed? That is, does the alleged infringer’s product or process fall within the language of the patents’ claims, or of equivalents to the patents’ claims.

If the patent is found “valid and infringed,” the patentee wins and is entitled to damages and/or an injunction.
Money damages come in the form of either “lost profits” or “reasonable royalties.”

“Lost profits” reflect the difference between a (hypothetical) monopoly payoff and a realized duopoly payoff. If there are other competitors (“acceptable non-infringing substitutes”), courts typically do not award lost profit damages.

“Reasonable royalties” follow a 15-part test based on the 1970 Georgia-Pacific case. In essence, the court asks what two parties bargaining in good faith prior to infringement would hypothetically agree to in fixed and per unit royalty components. Often, courts ask what prevailing industry standard rates are and award something close to that.
Injunctions: The eBay Case

- Traditionally, when a patent was found valid and infringed, the court always awarded a permanent injunction against the infringer. In eBay Inc v. MercExchange (2006), the Supreme Court ended this practice.
- U.S. Patent 5,845,265 covers eBay’s ”Buy it Now” function and was owned by MercExchange, a non-practicing entity (NPE).
- “Buy it Now” represented more than 30% of eBay’s business.
- In 2000, eBay tried to buy MercExchange’s patent portfolio relating to online auctions.
- When this did not work, MercExchange sued eBay. They won a 2003 Virginia jury trial and sought an injunction to prevent eBay from continuing to use “Buy it Now.” The District Court refused.
- The United States Court of Appeals for the Federal Circuit (CAFC) reversed, stating the general rule permanent injunctions issue against infringers absent exceptional circumstances.
Injunctions: The eBay Case

- The Supreme Court ruled that injunctions should not always issue. Rather, whether an injunction issues follows the standard four-factor inquiry:
  - (1) that it has suffered an irreparable injury;
  - (2) that remedies available at law are inadequate to compensate for that injury;
  - (3) that considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted;
  - (4) that the public interest would not be disserved by a permanent injunction.

- Though the eBay ruling is not explicit about this, one consequence of the ruling has been that non-practicing entities (NPEs) are not typically able to get injunctions anymore.

- This is a big deal.
Non-practicing Entities

- Many patent owners do not “practice,” or use, their patents. Entire organizations exist which merely maintain a portfolio of patents for the purpose of securing licensing deals and/or suing for damages.

- A prominent example is Intellectual Ventures (IV), founded by Nathan Myrhvold. IV buys patents and prosecutes licensing deals and lawsuits.

- NPEs are very controversial. Detractors call them “patent trolls,” conjuring the image of the troll requiring tribute to cross his bridge. Supporters argue that they provide an efficient way for small inventors to capture returns on their inventions.
Non-practicing Entities

- NPEs file a sizable fraction of lawsuits. The most famous NPE was Jerome Lemelson, who acquired over 500 patents and filed lawsuits on a wide range of products, against Mattel for “Hot Wheels,” against Illinois Tool Works for a robot tool spraying device, and against many others.

- Entrepreneurs need to be aware that NPEs are out there. It is very difficult to accurately search to determine whether patents exist that cover your product.

- Good intellectual property strategy recognizes that there are both offensive and defensive reasons to patent.

- If you are sued for infringement, the possession of related patents may allow you to countersue and obtain a better bargaining position.

- Lawsuits are expensive...settle if possible!