Innovation and Technical Change

IP and the patent system in practice
Prof. Bronwyn H. Hall
UC Berkeley

Quiz Tuesday Oct. 5
☐ Length: 45 minutes
☐ Format: questions drawn from study questions
☐ Bring one blue book
☐ Questions?

Outline (Sept 28 and 30)
☐ What is intellectual property?
☐ Overview of IP protection mechanisms
☐ How does the patent system work in practice?
  ■ How do firms protect their IP?
  ■ The strategic use of patents and the increase in patenting
☐ Current policy problems
  ■ Growth in patenting worldwide
  ■ Subject matter expansion
  ■ Research tools
  ■ IP and development
How do firms protect IP?

- Two surveys of industrial R&D
  - Yale survey (Levin, Kleverick, Nelson, and Winter 1983)
- Asked industrial R&D managers about
  - sources of knowledge (domestic, intl, methods)
  - contribution of universities and competitors
  - appropriability conditions
  - nature and role of patents
- Separate questions for product and process innovations

Methods for Appropriating the Returns to Innovation

- Patents
- (Trade) Secrecy
- Lead time (being first to introduce new product)
- Complementary sales and service
- Complementary manufacturing facilities
- Know-how and product complexity

Effectiveness of Appropriability Mechanisms for Product Innovations

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Fall 2004 (C) B. H. Hall Econ 124/PP 190-5/290-5
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Share of firms ranking the means 1st, 2nd, etc.

Where are patents effective?

- **Product:**
  - 1983: drugs, plastics, chemicals; steel, pumping equipment, auto parts, measuring devices, medical instruments
  - 1994: medical instruments, drugs, special purpose machinery, auto parts

- **Process:**
  - 1983: drugs, oil, chemicals, plastics, steel, pumping equipment – no less effective than other means
  - 1994: none really; drugs, oil, medical instruments highest

A useful taxonomy

- "discrete" product industries
  - food, textiles, chemicals including oil and plastics, pharmaceuticals, metals, and metal products
  - patents used to exclude, and for some licensing; also to prevent litigation

- "complex" product technologies
  - machinery, computers, electrical equipment, electronic components, instruments, and transportation equipment
  - patents used in negotiations (cross licensing and others), to prevent litigation

- Cohen et al define two variables:
  - Player1 – patents used for blocking and for negotiations
  - Player2 – patents used for blocking and negotiations, but not to secure licensing revenue
Hall and Ziedonis (RJE 2001)

- Large increase in US patenting since early 1980s
  - Kortum and Lerner (1998) hypotheses:
    - "friendly court" hypothesis – pro-patent era (CAFC 1982)
    - "regulatory capture" hypothesis
    - "fertile technology" hypothesis
    - "managerial improvements" hypothesis
  - But patents still not considered important for securing returns to innovation for firms in many industries
  - Why did patenting increase even in these industries?

Patent Propensity: Semiconductors vs. All US Manufacturing, 1979-93
Recent changes in the U.S. patent system

- 1980 patentability of artificially engineered genetic organisms
  - Diamond v Chakrabarty
- 1980 increased university patenting
  - Bayh-Dole Act
- 1981 patentability of software
  - Diamond v Diehr
- 1982 creation of CAFC/court
  - Patent validity more likely to be upheld
- 1985/6 TI sues several Japanese semiconductor firms
- 1986 Kodak-Polaroid decision on instant cameras
  - $1B judgment; injunction that shut down Kodak business
- 1994 TRIPS agreement leads to change in term/but not "first to file" or elimination of grace period
- 1998 patentability of business methods
  - State Street and ATT vs Excel

Summary of our interview results - Capital-intensive manufacturers

- Strong demonstration effect of TI and Kodak-Polaroid cases
  - "Ramping up"; "harvesting latent inventions"
  - "If in doubt, patent"
- Safeguard assets; avoid halt in production
  - Semiconductor manufacturing plant costs $1B
  - Expensive to shut down, even for a week
- Improve bargaining position with other patent owners
  - Gain access to technology on more favorable terms
  - Secure royalty income
- Changes in the management of patent process
  - Patent advocacy committees
  - Increased bonuses and targets

Summary of our interview results - Design firms

- Secure rights in niche product markets
  - Traditional exclusion role for patents
- Critical role of patents in attracting venture capital
  - When financing a firm that only has an idea, VC needs assurance that the idea is "owned"
- But... growth in patenting entirely due to manufacturing firms
The patent explosion

- U.S. utility patent grants between 1965 and 2003
  - Application lags => only complete through 1997
- Sharp break in trend in 1983/84
  - Applications and grants were roughly flat, then begin to grow at about 5-6% per year
  - Real R&D increases only 2.4% per year over same period
- Growth slows in 2001

![USPTO Utility Patents](image)

![Growth of patent grants and applications](image)
Sources of the change - regions

- Break it down by regions
  - United States
  - Greater Europe
  - Asia (mostly Japan, Taiwan, and Korea)
  - Other countries: developed (Canada, Israel, etc.) and developing (very few)

- Results
  - Structural break in 1983/1984 due to inventors resident in the U.S.
  - Structural break for Asian inventors was earlier (1981)

Sources of the change - technologies

- Break it down by technology classes
  - No break in chemicals and pharmaceuticals
  - Significant (and in 1984) in other technologies
    - increased 8.4% per annum in electrical, computers, and communication equipment
    - increased 5.5% per annum in mechanical and other technologies
  - Growth accounted for by US firms in electrical, computers, comm. eq., and instruments industries

Conclusions

- Patents are not the most important means for securing returns to innovation, except for products in a few sectors
- One product or innovation $\leq$ one patent can be a misleading model of the innovation process
- Patents are used in a number of ways not foreseen by the original design of the system
### Some current policy issues (1)

- Increase in patenting rates and consequent increase in patent office workloads worldwide, traced to
  - Subject matter expansion (business methods/genome)
  - Required inventive step decreasing
  - Increased strategic use (⇒ harvesting existing innovations)
- Research tools and university patenting
  - Negative effects on open scientific research?

### Some current policy issues (2)

- IP protection in developing countries
  - Should it be enforced the same way as in developed countries?
  - Indigenous technology; IP for traditional plant forms.
- Subject matter expansion
  - Business method patents
    - Should they be allowed?
    - Do they pass the non-obviousness test?
    - Are they too broad?
  - Gene-sequence and life-form patenting
    - In what form should these be allowed?
- Cumulative and overlapping innovation
  - the patent thicket and increasing transactions costs to innovation

### Research Tools

- Examples:
  - Cohen-Boyer patent for method of inserting genes into bacteria
  - Genentech - use of bacteria to express human proteins
  - Computer text editors & spreadsheets
- Used for a non-revenue producing activity
  - Should a license be required simply for research
  - If not, how do we provide incentives to create them?
- Madey v. Duke controversy
Are business methods and software patentable?

- Yes, in the US, Australia, Japan, and Korea
- In Europe including UK, and Canada
  - no business methods patentable
  - software patentable only if it has a "technical effect"
  - European debate now 2 years old, no decision
- Are algorithms patentable?
  - no, but applications of algorithms are
  - How can we tell the difference?
- Until recently, patent examiners not experienced in this area, so low quality patents may have issued
- 2001 – a number of changes made to patent regs with respect to business methods patents
  - Second pair of eyes
  - Prior use defense against infringement

Extra slides (not in lecture)

Systems Innovation

- Examples:
  - Cellphones, in general (chipsets, phone parts, materials, battery technology, etc.)
  - Semiconductor chips (both cumulative and involve a large number of IP pieces owned by different parties)
  - Computer systems
Using IP to Facilitate Systems Innovation

- Helps to negotiate cross-licensing agreements using well-defined technology “packages”
- Enables the establishment of standards with “reasonable” licensing fees
- Grants property rights to small innovative entrants

History of U.S. patent reform efforts

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