Innovation and Imitation: Migrating the World of Intellectual Capital

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1. Innovation is the lifeblood of all forms of capitalism
2. Putting oil based economies to one side, nation states that are rich developed and applied new technology and organizational arrangements to customer needs while providing a supporting business infrastructure
3. The era of the manufacturing economy will soon come to an end in China too. Consumers are (or will become) saturated with material goods and will begin buying services
4. Wealth generation for industrial companies involves building developing, using, and protecting intangible assets
5. The paper orchestration of these assets is as important as their ownership
What are Intangible Assets?

- Intellectual property
- Scientific, technological, industrial and business know-how
- Reputations
- Relationships

How do they get allocated?

- Good public policy
- Strong dynamic capabilities
Development of knowledge assets and their orchestration now central to firm-level competitive advantage and national comparative advantage

**The Firm**: Competitive advantage today is built and defended not in product markets, but “upstream” – in markets for know-how and other intangibles

(Dynamic Capabilities perspective)

**The Nation**: “The increase in the stock of useful knowledge and the extension of its application are the essence of modern economic growth”

(Kuznets, 1966)

- Requires the right institutional structure and ____ arrangements
- Requires a system which allows innovators to profit handsomely
Consequences of (Semi) Globalization

- Firms everywhere can outsource to anywhere (almost)
- All firms can access the same inputs and intermediate products
- Race by MNE’s to locate in low wage countries
- Profit margins are their at best absent points of difference (i.e. non-tradable assets of one kind or another)
- To avoid the “zero rent trap” firms need to:
  - Superior product offerings which requires VRIN resources

Such differentiation more after than not involves leveraging intangible assets
Resources

- Ordinary Resources are commodities
- VRIN Resources are:
  
  \[ \text{V} \text{aluable} \]
  \[ \text{R} \text{are} \]
  \[ \text{I} \text{nimitable} \]
  \[ \text{N} \text{on-Substitutable} \]

These constitute “strategic resources”
Main Classes Of Intangibles

1. Technological know-how
2. Intellectual property
3. Business process know-how
4. Customer relationships advantage
5. Reputations
6. Ordinary Capabilities

None of these assets are on balance sheets; they often lie “upstream” from the product market.

How do they get built allocated/developed adroitly?

- Good public policies
- Strong dynamic capabilities
Why Have Knowledge Assets and Dynamic Capabilities Become so much More Valuable?

- VRIN resources and especially intangibles with foundation for product and process improvement
- Intangibles are hard to build and difficult to manage and impossible to buy
- Inherently not as easy to access as some other assets
- Hold certain “strategic value” (price ≠ value in use); illiquid markets (non-traded assets)
- Legal barriers to imitation
  - Strong in some industries in some countries, eg, pharmaceuticals, electronics
  - Undermined in others, e.g. digital music and movies

Dynamic Capabilities
Asset orchestration skills require entrepreneurial managers that are a rare breed
The Markets For Intangible Assets Do Not Function Like Commodity Markets

- The market for know-how has characteristics that complicate exchange
  - Property rights poorly defined
  - Utility unclear
  - Few buyers and sellers
  - High transaction costs

- These complications create imperfections which impair imitation, but potentially support quasi rent generation (“strategic value”)
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Know-how IP</th>
<th>Physical Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Recognition of trading opportunities</td>
<td>Inherently difficult</td>
<td>Posting frequent</td>
</tr>
<tr>
<td>2. Disclosure or attributes</td>
<td>Relatively difficult</td>
<td>Relatively easy</td>
</tr>
<tr>
<td>3. Property rights</td>
<td>Limited (trade secrets, copyrights, etc.)</td>
<td>Broad</td>
</tr>
<tr>
<td>4. Item of sale</td>
<td>License</td>
<td>Measurable units</td>
</tr>
<tr>
<td>5. Variety</td>
<td>Heterogeneous</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>6. Unit of consumption</td>
<td>Often unclear</td>
<td>Value, weight</td>
</tr>
<tr>
<td>Inherent tradability</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>
The Changing World...

- Intangible and or intellectual assets (IA) dominate portion of overall market valuation
- Balance sheet silent about native IA. Accounting standards inadequately handle IA valuation. Current reporting practices do not support transparency of resource allocation...
- IA serve as aggregators of value from investments in innovation and knowledge
- Competitive advantage, growth and wealth creation accrues to those firms who proactively manage these assets
Valuations Shift to Intangibles

Tangible Assets
Intangible Assets

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Chiquita- Perishables Bananas become a Commodity Business

**Product Challenge**

- In the 1990’s, Chiquita’s once highly profitable banana business turned into a price-competitive, commoditizing market
- Rising competition (Dole & Del Monte) and big retailers (Wal-Mart) eroded margins
- Trade practices restricted markets

**Innovation**

- Began search for production innovation by looking at Chiquita’s overall growth opportunities
- Created an “innovation roadmap” of opportunities:
  - Extending product shelf-life
  - Increasing efficiencies of production and packing
  - Introducing new banana varieties
The Basis Of (Firm Level) Competitive Advantage In The Age Of Advanced Information Technology, Ubiquitous Markets, And Deep Marketplace Uncertainty

- Decreased cost (and increased speed) of information flow
- Expansion of (intermediate product) markets
- Easier access to many complementary assets
- Erosion of old bases for differentiation
- Tacit knowledge and intangibles become the bottlenecks
- Dynamic Capabilities reflect the firms capacity to develop, deploy and orchestrate value creation and capture

Resources

Dynamic Capabilities

Profits
Old and New Conceptual Frameworks and Anchoring Concepts for Business Analysis and Performance

**Conventional**
- Tangible Assets
- Industry Analysis
- (Vertical) Integration
- Managerial Integration
- One Product, One Patent
- Transaction and Aging Costs
- Equilibrium
- Resources Matter
- Regional Geography
- Irrelevant

**Next Generation**
- Intangible Assets
- Ecosystem-Level Analysis
- Modulation
- Entrepreneurial Modulation
- One Product, Hundreds of Patents
- Transaction and Aging Costs
- Equilibrium
- Resources Matter
- Regional Geography Matters

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What am I saying that is Different from Conventional Wisdom?

1. The textbooks are out of date and have been for some time
2. “Innovation is about much more than new products. It is about reinventing business processes and building entirely new markets that meet untapped customer needs.” (Samuel j. Palmisano, CEO of IBM, Business Week, 4/24/2006, p. 64)
3. Next generation competition has already arrived
4. Intangible assets and intellectual property increasingly ___ to competitive advantage
5. Implementing best practices not sufficient to achieve global competitive advantage
6. Dynamic capabilities are key to competitive advantage at the level of the firm
7. The ecosystem, not the industry, is what undergirds competitive advantage
Intellectual Property (IP) Continuum of Protection

Patents
Copyrights
Trademarks
Trade Names

17-20 years
70-100 years
Indefinite

Life of Property Protection

High Functionality
No Functionality

Functionality

...a Framework for IP Life Cycle Management
In part II, I will focus on just two elements of the framework:

1. The role of intellectual property in the global innovation system: present and future
2. The role of districts/clusters in regional development
Factors at Work

1. Appropriability Regime
2. Complementary Assets
3. Timing

The main focus for the rest of my talk is the appropriability regime, and in particular the role of I.P.
Three Challenges for a Private Firm is to Increase their Share of the Pie

Sales

- Suppliers
- Profits
- Customers

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The Profiting from Innovation Framework: How Firms Capture Value from Innovation

1. Social returns to innovation are typically much greater than private returns
   Maurfield: Private Social
   Pilkerton Glass: XYY

2. The Baumol exception must be noted:
   • Productive and destructive (rent seeking; organized crime)
   • This negative result occurs when society has a wrong set of rules (i.e. structure of payoffs)
“Did it not frequently happen during the course of Chinese history that the scholar-officials, although hostile to all inventions, nevertheless gathered in the fruits of other people’s ingenuity? I need mention only three examples of inventions that met this fate: paper, invented by a eunuch; printing used by the Buddhists as a medium for religious propaganda; and the bill of exchange, an expedient of private businessmen.”

Baumol, William J., Entrepreneurship: Productive, Unproductive, and Destructive, JPE 1990, p. 903
# Appropriability Regimes for Knowledge Assets

<table>
<thead>
<tr>
<th>Intellectual Property Rights</th>
<th>Inherent Replicability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose</td>
<td>Weak</td>
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<tr>
<td>Tight</td>
<td>Moderate</td>
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<tr>
<td>Easy</td>
<td>Hard</td>
</tr>
<tr>
<td>Moderate</td>
<td>Strong</td>
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</table>
Importance of Complementary/Co-Specialized Assets

- Innovations generally need to be paired with complementary (and/or co-specialized) assets in order to generate value
- Complementary assets can take many forms
  - Entrepreneurial capabilities
  - Skilled/knowledgeable workforce
  - Tangible assets (plant, etc.)
  - Distribution capabilities
  - Suitable business model
    - Marketing and promotional efforts
Key Features of Patent System

- Patents are “probabilistic”
  - There is only some positive probability that a given patent will be found valid and infringed by a given product
  - Three distinct probabilities
    - Raw probability of finding of validity and infringement
    - Probability that a patent will be found valid/infringed when it should not be: “False positive” (Type I) errors
    - Probability that a patent will be found invalid/not infringed when it should be: “False negative” (Type II) errors
    - Parties can disagree about all of three of these probabilities
    - Empirical data from US/Europe shows that about 50% of litigated patents are found valid/infringed

- Patents are not self-enforcing
  - Unlike suppliers of tangible inputs, who can withhold their goods unless they are paid, patent holders have to rely on (costly, time-consuming, risky) litigation to protect their rights
  - Lemley: many implementers simply ignore patents unless/until forced to pay attention
  - Conversely, firms can be falsely accused of infringing others’ patents, be forced to defend themselves against patent litigation

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Patent Quality Issues

- Not so much a concern about patent over/under-breadth per se, as about a “mismatch” between the scope of the invention and the scope of the patent grant.
- 45-degree line diagram
Improving Patent Quality

- In the patent examination process
  - Improving quality is costly
    - Lemley: “Rational Ignorance” at Patent Office
      - does not make economic sense to improve quality unless it matters
      - most patents are never practiced/litigated
      - Varies with type of patent, technology field

- In the patent enforcement process: parties
  - Winnowing out spurious litigation/defenses

- In the courts
  - Claim construction and enforcement
Most patent coverage is directed to a specific solution to a customer need.

Innovators should seek patent coverage that focuses on benefits to customers, not know the problem is solved.

Patents that cover only one solution to a broad customer need will allow competitive to solve the same customer need with a non-intriguing substitute.

Patent coverage that secures benefits over features will provide a greater barrier to imitation.

A strategic patent is thus one that is market making.
The value of an invention to the innovator can also be enhanced by patenting improvements... e.g. DuPont has secured over 50% with the patented inventions that directly build on this discovery
Value Transference:

The premeditated use of multiple IP regimes across the product life cycle to achieve sustainable differentiation
A Plethora of Books about IC & IP Management...

CREATE OR PERISH
The Case for Inventions and Patents

MANAGING INTELLECTUAL CAPITAL

REMBRANDTS IN THE ATTIC

Einstein in the Boardroom
Moving Beyond Intellectual Capital to I-Stuff

FROM IDEAS TO ASSETS

CREATING NEW WEALTH FROM IP ASSETS

COMPREHENSIVE INTELLECTUAL CAPITAL MANAGEMENT

The Art & Science of TECHNOLOGY TRANSFER

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“I have a general principle that I follow. I don’t go into any area that I can’t get a patent on... [otherwise], you quickly find yourself manufacturing commodities.”

Business Model

718 Registered trademarks in 98 countries; 81 in the U.S.

“Trademarks are one of Dolby’s most valuable assets.”
Dolby.com, 2003
Monsanto Context 1995:

- Ninety year old chemical company with historic experience in herbicides, food ingredients and agricultural markets
- Herbicides important by only way to meet anticipated demand from population growth is through improved crop yield
- Monsanto leadership senses opportunity in recombinant DNA technology as applied to improved yield (performance) of major crops
- They are not a crop seed company but rather a herbicide company. See is an adjacent market...
- They do have the technology to participate in the agribiotechnology revolution... Mary Clinton Smith and other leading plant geneticists from academia
- How does Monsanto transform itself to become the leader in an adjacent seed market and benefit from the inevitable demand growth in emerging economies
Monsanto Case Observations:

- Monsanto has transformed itself from the ninety year old chemicals firm to the modern day innovator at the heart of agribusiness
- Original opportunity and initially seized by Shapiro was more or less on point
- Executing transformation took much more time than expected due to both market and non-market factors...
- While Shapiro sensed and initially seized, it took others to execute the transformation
Explicating Dynamic Capabilities: The Nature and Micro-foundations of Sustainable Enterprise Performance
Types of Patents in China

- Invention patents (20 year life)
- Utility models (10 year life, streamlined application approval process)
  - Infrequently used by foreign inventors
- Design patents (10 year life, streamlined application approval process)
China has overtaken the U.S. as the country issuing the most patents
  – Caveat: many are utility model patents, which have no analogue in other countries
  – Concern is not with patent quantity *per se*, but patent quality; some concerns have been expressed about quality of patents from China

Chinese firms have also increased their level of overseas patenting, though still lag behind many other countries
  – GRAPH showing patenting in:
    • US
    • Europe
    • Japan
    • China
In theory, Chinese courts can award several types of patent infringement damages:

- Patent holder’s actual losses due to infringement
- Defendants’ gains from infringement
- Reasonable royalty
- Statutory damages
  - Capped at RMB 1 million (US$160,000)
- However, in practice limitations on discovery often mean that courts award statutory damages because patent holders cannot prove entitlement to more
Proposed Revisions to Damages

- Allowing awards of punitive damages (up to treble damages for deliberate patent infringement)
- Allowing Patent Bureaux to award damages
- Changing the allowable statutory damages
- (Possible) awarding damages for infringing products made in China but exported
Patently catching up

Number of foreign-oriented patent families*, ’000

- United States
- Japan
- Germany
- South Korea
- China

*Groups of patents to protect one invention, filed in at least one country other than the applicant’s home country

Source: WIPO
USTC claims that:

- Copyright infringement is the most damaging form of IPR infringement ($23.7 billion)
- Trademark infringement is the most common form of IPR infringement
- IPR enforcement varies significantly at local levels

IPR infringement negatively impacts both domestic and Chinese firm’s MNE’s

Online infringement in China is a significant concern for foreign IP intensive firms
U.S. Firms Experiencing IPR Infringement in China: Type of Chinese IPR Infringement Experienced Worldwide

Source: USITC staff calculations of weighted responses to the USITC questionnaire
- Special problems of trademark infringements from “super fakes” counterfeit (copy exact) products from spinoff of contract manufacturers supplying foreign firms, e.g. footwear, blue jeans

- Online sale makes identifying counterfeits harder (at least as compared to street vendors)

- Piracy sale makes identifying counterfeits harder (at least as compared to street vendors)

- Counterfeit mobile markets often conflicted with legitimate low cost handsets made by “white label” manufacturers in China
Consequences:

1. Chinese firms distracted from innovation by ease of counterfeiting/imitating
2. High tech MNEs get fed up and relocate away from China... China may not be aware of the investment that isn’t made for fear of misappropriation
Many Chinese businesses built on cheap labor and ordinary capabilities to produce commodity (i.e. undifferentiated) products

Some businesses have reached practice and sell technology based goods... but so do other firms in China and elsewhere

“Nike will produce more trainers (sneakers) in Vietnam this year than in China, it is the leading source for 15 years”

Economist, Feb. 19, 2009
“With rare exceptions, notably Lenovo, which purchased IBM’s laptop business and Haier, the maker of cheap refrigerators... Chinese names have failed to make much of a dent”

Economist, Feb. 18, 2009

The main reason for this, according to the Economist, is “the country’s weak intellectual property protection. Why invest in design or innovation when the results can be knocked off by competitors”

Economist, Feb. 18, 2009
What Should be Private and What Should be Public

- Both private and public aspects of technology play an essential role in its advance
- Technical advance inevitably proceeds through improvements (variety) driven by competitors
- New findings and understandings do not adhere to their finders/creators for long but are, at least to some extent, shared amongst contemporaries
- Hence, technology advances through a social, cultural, and evolutionary process
- When a technology goes public, there are often many efforts to improve it
- As Richard Nelson notes, the “public” aspects of technology exist in part because firms leak and share knowledge... not just because of holes in I.P. shields
• Why Care?
2003: 80% of the value of Fortune 500 companies is in the intangible.

Today:
P&G: 67%  Apple: 95+%  
Google: 97+%
So what in your IP portfolio can enhance your brand?

- Patents for WiFi, earphone ports, CPU, Camera, etc.
- Trade Secret for Supplier lists, supply chain
- Patents for hardware, Mfg methods, function
- Copyright for photo, Icon designs, software
- Trademarks for iPad and Apple logos
- Design Patent for overall look
“Intellectual property protections are like islands in a sea of free competition... If one is not able to place the fruits of one’s investment, ingenuity, or creativity no one or more of the islands then on in the sea”

“The copyright island, which is low and sandy, has a gradual sloping beach called the merge idea and expression. Thus, opinion may differ on how far out one has to wade before the boundary is crossed; that is, when the water is up to your neck, are you still on the island?”

“The patent island is a volcanic island with sheer cliffs rising to a commanding view of the surroundings. But the patent island also has a sandy beach, tucked away in a corner. It is called the doctrine-of-equivalents beach”

"Fuzzy boundaries"
- Unclear how claims will be interpreted in practice
- "inadvertent" infringement can occur
- Unclear boundaries "fouls up" workings of the Coase Theorem
- Disputes over value are not uncommon
- IP "discounted" in the marketplace as a consequence
Value and Stages of Patent Life

- Invention
- Patent Applied For
- Patent Granted
- Patent Valid/Infringed
- After Patent Expiration
Other Elements of Appropriability Regimes

- Other IP (trade secrets, copyright)
- Complementary assets
- Lead time to market (first mover)
- Learning curve cost advantage
Constitution of an organizational path: A modified and expanded model

I. Preformation phase
II. Path formation
III. Path dependence

(Managerial discretion)

Scope/range of variety

Critical juncture
Lock-in

t
Importance of Bulk Licensing

- Bulk/package licensing and/or cross-licensing are important (and justified) when innovation is systemic
  - Too costly to license patents one at a time
    - Cannot test all patents against all products
    - Not practical to condition royalties on a product-by-product, patent-by-patent basis
  - Achieves design freedom and freedom to operate
“Patent Thickets”

- Patent thickets may or may not map to “technology thickets”
  - Numerous patent grants may reflect numerous technological breakthroughs
  - Whether patent thickets are desirable or undesirable depends on whether or not they are undergirded by technology thickets
Complements vs. Substitutes

- Many “patent thickets” involve complex mixture of substitutes and complements
  - Especially in the context of bulk licensing
- Cross-licensing of complementary patents is unambiguously good
- Cross-licensing of substitutes sometimes requires further analysis
Patent Breadth Issue

Too Broad

Too Narrow

(Managerial discretion)

Scope of Invention
## Characteristics of Legal Forms of Protection in the USA

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Copyright</th>
<th>Trade Secret</th>
<th>Patent</th>
<th>Trademark</th>
<th>Mask Works*</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Uniformity</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Protected property</td>
<td>Expression of ideas</td>
<td>Secret information</td>
<td>Invention</td>
<td>Goodwill</td>
<td>Semiconductors</td>
</tr>
<tr>
<td>Scope of protection</td>
<td>Exclusive right to reproduce, prepare derivate works, publicly distribute, display and perform</td>
<td>Right to make, use and sell secret and to protect against improper use or disclosure</td>
<td>Right to exclude others from making, using, selling</td>
<td>Proscribes against misrepresentation of source</td>
<td></td>
</tr>
<tr>
<td>Effective date of protection</td>
<td>Creation of Work</td>
<td>From date of conception or receipt of secret information</td>
<td>Patent application date</td>
<td>Use and/or filing date of US application issuing as principal registration on or after 11/16/89</td>
<td>First commercial exploitation</td>
</tr>
<tr>
<td>Cost of obtaining protection</td>
<td>Low</td>
<td>Low</td>
<td>Moderate</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Term of protection</td>
<td>Life of author plus 50 or 70 years</td>
<td>Life of author plus 50 or 70 years</td>
<td>20 years</td>
<td>20 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Cost of maintaining protection</td>
<td>Nil</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Nil</td>
</tr>
<tr>
<td>Cost of enforcing rights against violators</td>
<td>Moderate</td>
<td>High</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

*Semiconductor industry only*
Enhanced Intellectual Property Protection Around a Core Technology

- **NEW FEATURES PROTECTABLE?**
  - **N**
  - **Y**

- **MFG. PROCESS PROTECTABLE?**
  - **N**
  - **Y**

- **ESTABLISH TRADE SECRET PROTECTION SYSTEM**

- **APPEARANCE PROTECTABLE?**
  - **N**
  - **Y**

- **DESIGN PATENT APPLICATION**

- **PAT. APPLIC.**
  - **N**
  - **Y**
Some big IP damage amounts

- Samsung vs Apple (patent damages) $1+b
- Polaroid vs Kodak (patent damages) $800+m
- Rambus vs Hyundai (patent damages) $300+m
- Lexar vs Toshiba (trade secret misappropriation) $100+m
• **Lost profits**
  – For patent owners to receive damages based on lost profits, the patent owner must prove (Panduit factors):
    • Demand exists for the infringed product
    • Acceptable non infringers substitutes were not available
    • The patent owner had the capability to exploit the demand

• **“Reasonable” royalties**
  – The amount the parties would have negotiated at or about the time of first infringement, knowing that the patent was valued and infringed
Lost profits involves estimating incremental profits

- Lost profits = Lost sales minus Variable cost

- Variable costs: Those cost directly related to sales volume (ex: manufacturing & selling costs)

- Overhead cost are generally (but not always) fixed costs
## Incremental (lost profits) calculation

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional unit sales in the “but for” world</td>
<td>1,000</td>
</tr>
<tr>
<td>Price per unit</td>
<td>$500</td>
</tr>
<tr>
<td><strong>Incremental revenue</strong></td>
<td><strong>$500,000</strong></td>
</tr>
<tr>
<td>Incremental costs</td>
<td></td>
</tr>
<tr>
<td>Manufacturing at $100 /unit</td>
<td>$100,000</td>
</tr>
<tr>
<td>Research &amp; Development</td>
<td>0</td>
</tr>
<tr>
<td>Marketing and Selling at $50 /unit</td>
<td>$50,000</td>
</tr>
<tr>
<td><strong>Total incremental costs</strong></td>
<td><strong>$150,000</strong></td>
</tr>
<tr>
<td><strong>Total incremental (lost) profits</strong></td>
<td><strong>$350,000</strong></td>
</tr>
</tbody>
</table>
“Reasonable” Royalties (Georgia-Pacific vs US Plywood)

- **Factor 15**

The amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement; that is, the amount which a prudent licensee—who desire, as a business proposition, to obtain a license to manufacture and sell a particular article embodying the patented invention—would have been willing to pay as a royalty and yet be able to make a reasonable profit and which amount would have been acceptable by a prudent patentee who was willing to grant a license.
Average adjudicated royalty rates

Before 1970
1970-1974
1975-1979
1980-1984
1985-1989
1990-1993
Mean and medium adjudicated royalty rates in the US (1982-mid 2005)
Profiting from innovation

- IP is a key element
- Business strategy must also support and take into account available IP protection
- Good market entry strategies will balance IP considerations with other factors
## Market Entry Strategies: Failures & Successes

<table>
<thead>
<tr>
<th></th>
<th>Innovator</th>
<th>Follower-Imitator (within the decade)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Win</strong></td>
<td>Pilkington (float glass)</td>
<td>S.W. Airlines (discount airlines)</td>
</tr>
<tr>
<td></td>
<td>Du Pont (Teflon)</td>
<td>Sony (transistor radio)</td>
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<tr>
<td></td>
<td>W.L. Gore (Goretex)</td>
<td>Dell (personal computer)</td>
</tr>
<tr>
<td></td>
<td>Apple (iPod)</td>
<td>Matsushita (VHS video recorder)</td>
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<tr>
<td></td>
<td>Silicon Graphics (computer graphics)</td>
<td>Boeing/Airbus (civilian jet airliner)</td>
</tr>
<tr>
<td><strong>Loose</strong></td>
<td>Laker Airlines (discount airline)</td>
<td>DEC (personal computer)</td>
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<td>EMI Scanner (medical imaging)</td>
<td>Intel (digital watch)</td>
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<td></td>
<td>Xerox (personal computer)</td>
<td>Peoples Express (discount airlines)</td>
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<td>AMPEX (first video recorder)</td>
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<td></td>
<td>Sony (Betamax video recorder)</td>
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<tr>
<td></td>
<td>De Havilland (Civilian jet airliner)</td>
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</tr>
<tr>
<td></td>
<td>Lexar (Flash memory controllers)</td>
<td></td>
</tr>
</tbody>
</table>
Appropriability Regime: Key Dimensions

- Legal instruments
  - Patents
  - Copyrights
  - Trade secrets
  - Trademarks

- Inherent immittability of industrial knowledge
  - Codified ("non articulable")
  - Tacit ("articulable")
  - Autonomous
  - Systemic
Components of Industrial Knowledge

- **tacit**
- **codified**
  - Intellectual property
### Appropriability Regimes for Knowledge Assets

<table>
<thead>
<tr>
<th>Intellectual property rights</th>
<th>Inherent replicability</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose</td>
<td>Easy</td>
<td>Weak appropriability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate appropriability</td>
</tr>
<tr>
<td>Tight</td>
<td>Hard</td>
<td>Moderate appropriability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Strong appropriability</td>
</tr>
</tbody>
</table>
Innovation over the product/industry life cycle

- Competition amongst competing designs; general purpose equipment used in production
- Strong price competition; specialized equipment used in production
- Time

Diagram showing:
- Process innovation curve
- Product innovation curve

Rate of Innovation
Representative Complementary Assets Needed to Commercialize Innovation

Colored area represents the less imitable portion of the value chain. Outer segments represent complementary assets; inner circle segments represent know-how.
Strategies for deploying knowledge assets: weak appropriability case

Strategies for deploying knowledge assets: strong appropriability scenario

**Contract and integration strategies and outcomes for innovators: Specialized asset case**

<table>
<thead>
<tr>
<th>Strong Legal/Tech. Appropriability</th>
<th>Weak Legal/Tech. Appropriability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovators and imitators...</td>
<td><strong>Innovator Excellently Positioned vs Imitators...</strong></td>
</tr>
<tr>
<td>advantageously positioned (vis a vis independent owners of complementary assets)</td>
<td>Innovator will win</td>
</tr>
<tr>
<td>Innovator will win</td>
<td>Innovator should win</td>
</tr>
<tr>
<td>Innovator should win</td>
<td>Innvator should win</td>
</tr>
<tr>
<td>Contract if can do so in competitive terms; integrate if necessary</td>
<td>Contract (to limit exposure)</td>
</tr>
<tr>
<td>Innovator should win; may have to share profit with asset holders</td>
<td>Innovator will probably lose to imitators and/or asset holders</td>
</tr>
<tr>
<td>Integrate</td>
<td></td>
</tr>
</tbody>
</table>
Calibrating the Strength of Patent Protection

- **Length**: How much time left to run?
- **Breadth**: Range of products covered?
- **Validity**: Likelihood of being upheld if challenged
- **Exclusionary power**: Can the owner refuse to license without raising antitrust or other issues
- **Available remedies**: If patent infringed
Value and Stages of Patent Life

Value Stages of Patent Life

Invention
Patent Applied for
Patent Granted
Patent Found...
After Patent...

Value

Copyright Teece 2014
Other Elements of Appropriability Regimes

- Other IP (trade secrets, copyright)
- Complimentary Assets
- Lead time to market (first mover)
- Learning curve cost advantage
Complementary IP and the Fallacy of “One Patent, One Product” Thinking

- All innovators “stand on the shoulders” of others
- Important distinctions between:
  - Complex v. discrete technology
  - Discrete/autonomous may have just one patentable element
Importance of Bulk Licensing and Cross-Licensing

- Bulk/package licensing and/or cross-licensing are important (and justified) when innovation is systemic too costly to license patents one at a time.
- Cannot test all patents against all products.
- Not practical to condition royalties on a product-by-product basis.
- Patent-by-patent basis achieves design freedom and freedom to operate.
"Patent Thickets"

- Patent thickets may or may not map to “technology thickets”
  - Numerous patent grants may reflect numerous technological breakthroughs
  - Whether patent thickets are desirable or undesirable depends on whether or not they are undergirded by technology thickets
Once the duration of patents and copyrights is taken into account, the carry over should be encouraged.

Intangible property, not just intellectual property, to embrace the airways (electromagnetic spectrum) and the internet.

While there are significant differences between tangible and intangible property, there are “tight logical and functional resemblances” (R. Epstein).

State action was needed to access networks created by nature e.r. rivers, coast, hills.
## Similarities and differences

<table>
<thead>
<tr>
<th>Intangible</th>
<th>Tangible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scope very fuzzy boundaries of patents</td>
<td>Crisp boundaries for patents</td>
</tr>
<tr>
<td>Mildly fuzzy boundaries for copyright</td>
<td>Perpetual rights</td>
</tr>
<tr>
<td>Disposition of misused trade secrets (transfer of knowhow is irrevocable)</td>
<td>Eviction available remedy as a</td>
</tr>
</tbody>
</table>
## Inherent Tradability of Different Assets

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Know-how / IP</th>
<th>Physical commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition of trading</td>
<td>Inherently difficult</td>
<td>Inherently easy</td>
</tr>
<tr>
<td>opportunities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disclosure of attributes</td>
<td>Relatively difficult</td>
<td>Relatively easy</td>
</tr>
<tr>
<td>Property rights</td>
<td>Limited (patents, trade secrets,</td>
<td>Broad</td>
</tr>
<tr>
<td></td>
<td>copyright, etc.)</td>
<td></td>
</tr>
<tr>
<td>Property boundaries</td>
<td>Often fuzzy</td>
<td>Generally sharp</td>
</tr>
<tr>
<td>Item of sale</td>
<td>License</td>
<td>Measurable units</td>
</tr>
<tr>
<td>Variety</td>
<td>Heterogeneous</td>
<td>Homogeneous</td>
</tr>
<tr>
<td>Unit of consumption</td>
<td>Often unclear</td>
<td>Weight, volume, etc.</td>
</tr>
<tr>
<td><strong>Inherent tradeability</strong></td>
<td><strong>Low</strong></td>
<td><strong>High</strong></td>
</tr>
</tbody>
</table>
The first patent

The United States.

To all to whom these Presents shall come.

Whereas, Samuel Hopkins of the city of Philadelphia and State of Pennsylvania hath discovered an Improvement, not known before, which Discovery in the making of Pearl ash and Pearl-ash by means Apparatus and Processes, that is to say, in the making of Pearl-ash, 1st. by burning the raw ashes in a Furnace, 2nd. by depositing and boiling them when so burnt in water, 3rd. by drawing off and setting the dry and 4th. by boiling the dry into bats, which then are burnt Pearl-ash, and also in the making of Pearl ash by placing the Pearl ash made as before said, which Operation of burning the raw ashes in a Furnace, together with their Dehydration and boiling in water, is new, leaves little Ashimmon, and produces a much greater quantity of salt: These are therefore in pursuance of the Act, entitled, “An Act to promote the Discovery of useful Arts,” granted to the said Samuel Hopkins, his Heirs, Administrators and Assigns, for the Term of fourteen Years, the sole and exclusive Right and Liberty of making and vending to others the said Discovery of burning the raw ashes previous to their being depurated and boiled in water, according to the true Intent and Meaning of the Act aforesaid. In Testimony whereof, I have caused these Letters to be made Patent, and the Seal of the United States to be hereunto affixed.

Given under my Hand at the City of New-York this thirty first Day of July in the Year of our Lord one thousand seven hundred Ninety.

City of New York July 31, 1790.

I do hereby certify, that the foregoing Letters Patent were delivered, in pursuance of the Act, entitled “An Act to promote the Discovery of useful Arts,” that I have examined the same, and find them conformable to the said Act.

Sam: Randolph, Attorney General for the United States.
Ambivalence about patents

Some economists are ambivalent about patents because of the so-called monopoly feature or patents, but:

1. A patent, while sometimes providing control of elements of a technology, very rarely confers monopoly over a market.
2. Absent control over a market, there is no market power (i.e., meaningful monopoly power).
3. Complementary assets and technologies are almost always needed to launch innovative products – this increases the difficulty of extracting excess profits.
4. Patents favor systematic innovation-based competition.
Inadequate IP system slows innovation in China

“Another result of China’s inadequate system of property rights and legal enforcement is the disincentive it creates for investing in R&D and pursuing cooperative inter-organizational, network-based strategies.”

“Free riding, possibly under a weak intellectual property rights regime, clearly reduces the incentive...to invest in R&D...the patent system and intellectual property rights protection in general has an important effect on primary actors’ motivation to innovate, and the government must continue to refine it....”

Source: X. Liu and S. White, Research Policy, 2001
Inadequate IP system slows innovation in China

“Intellectual property...just one component of any ‘natural system of innovation’.” (R.R. Nelson

Developing a western style natural system of innovation may not be viable or even desirable...only China will know.

But since innovation is globally dispersed, no one nation can monopolize it. China must figure out how to engage vigorously with other national systems, and vice versa.

The growing emphasis on intangibles will require a more positive approach to intellectual property, otherwise China will remain trapped as a follower/imitator, and deny itself the chance of being the pioneer.