Appropriability and Profiting from innovation

Terms

- **Appropriability**: Environmental factors that govern an innovator’s ability to capture profits generated by an innovation
- **Codified Vs. Tacit knowledge**: The ability to formally communicate knowledge
- **paradigmatic stage**: when the dominant design has not be formalized (technologies and arch. are fluid)
- **Dominant Design**: The standard form, technology, and architecture
- **Complementary Assets**: Non technology assets that are needed to make a product successful
What makes enables a company to keep the profits from an innovation

- Myth of the first to market
- Legal protection
- Codified/tacit knowledge
- pre/post dominant design
- Complimentary assets

Myth of first to market

- First to market that failed
  - EMI - CatScan (GE won)
  - Xerox then Apple’s user interface (Microsoft/PC won)
  - First Jet engines (DeHavaland) (Boeing/GE)
- First to market that succeeded
  - Nutrasweet
  - Teflon
  - Palm pilot
Success of innovator vs. follower

- Innovator
  - First shot at legal protection
  - Tie up complimentary assets
  - Learning curve faster (profit on early adopters)
- Follower-imitator
  - Advantage of learning from customers
  - Seeing mistakes - learning about design
  - Understanding complimentary assets

Legal protection

- Patents
  - Patents don’t give you the protection you expect
  - Design around
  - Legal challenges
- Trade secrets
  - Can’t be “reverse engineered”
  - Have to be protected
Type of knowledge

- **Codified** - easy to transmit. Algorithms, recipes, formulas, dimensioned drawings
- **Tacit** - difficult to transmit. Expertise, design processes, learning methods, Intel’s rapid ramp process

<table>
<thead>
<tr>
<th>Type</th>
<th>Patents</th>
<th>Trade secrets</th>
<th>No enforcement</th>
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<tbody>
<tr>
<td><strong>Codified</strong></td>
<td>covers the exact form but not deviations (possible design around).</td>
<td>subject to theft and reverse engineering. Not easily enforced</td>
<td>easily copied more easily controlled</td>
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<tr>
<td><strong>Tacit</strong></td>
<td>Difficult to patent (i.e., design patents)</td>
<td>Difficult to patent. Risk of explaining it too well</td>
<td>Hard to enforce trade secret</td>
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Dominant Design

- First to design may not come up with the dominant design
  - Early computer developers
  - Automotive
  - Electronic calendars
- If the design requires significant assets, by the time the dominant design appears, the first to market may have already spent their assets
- Follower has the possibility of learning
Complimentary assets

- Everything else required to bring a product to market
- Marketing, manufacturing, support, distribution channels, suppliers, learning, name,
- In pre-dominant design, complimentary assets are not as critical (i.e., EMI)
- In dominant design, costs, support, quality, and reliability (product, process, and delivery) dominate competitiveness.

Complimentary Assets

- Generic assets
  - LCD projectors
  - Benefit of low cost, low risk, typically contract based
  - Problem of appropriability
- Specialized assets
  - Unilateral dependence between innovation and asset
  - Equipment purchased for a single client
- Co-specialized assets
  - Bi-lateral dependence
  - Cannon/Kodak digital camera
Assets and dominant design

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<tr>
<th>Weak appropriability</th>
<th>pre-dominant design</th>
<th>dominant design</th>
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<td>Need to let design float, ensure that you generate the dominant design, low cost prototyping, good connection to market</td>
<td>Need to make strong connections to complimentary assets (tie up capability)</td>
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<td>Tight appropriability</td>
<td>Take the time to find the correct complimentary assets</td>
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Beta Golf - Types of profitability

- License
- OEM Supplier
- Acquisition
- Start-up
- Joint-Venture
- Level of control over revenues
- % of profits
- Complimentary assets
  - Manufacturing
  - Name
  - Distribution channel
  - Knowledge of the business
  - Marketing
- Possibility
- Financial commitment
**Information value theory**

- Information has a value associated with it
- Information content = $\sum p_i \log(p_i)$
- Content is maximized with $p_i=1/n$

**Value of information**

- Information has value
- Information reduces uncertainty about the expected loss.
- $E(C) = C_1p_1 + C_2p_2 + \ldots + C_3p_3$
- Example:
Utility of outcomes

• It is not enough to just calculate E(C) because loosing $100 may be more painful than not winning $100 (i.e., the utility of the lost $100 is higher than the utility of $100).
• The total utility is
  \[ E(U(T)) = U_1C_1P_1 + U_2C_2P_2 \]
• Risk tolerance sets the values of \( U_i \) (i.e., how much downside are you willing to put up with)

Innovation and information

• Innovation produces information (i.e., reduces uncertainties about outcomes)
• You can’t sell information on the open market without legal protection because information can be copied at no cost
• You can increase appropriability through legal protections but it is not perfect in information because some always leaks out
**Outcome tree**

- Decision to invest in R&D
  - information generated has no value
  - information has value
    - Able to protect
    - Unable to protect

**Problem with Basic research**

- Difficult to appropriate
- I.e., how do you license basic research
- How does society invest in basic research?
  - Universities
  - Government grants
  - Consortia of companies that all benefit
Methods for diversifying R&D risk

• Large R&D centers (diversify risk)
  – Each project is small investment
• Purchase R&D from other companies
  – Pay a higher price because reduced uncertainty
• Pay a lower cost (i.e., universities) for the right to have access and education