Innovation, Components, and Complements

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Overview

- What can we learn from history?
  - Technology revolutions
    - Nature of innovation
    - Business problems
    - Policy problems
Stylized facts about innovation

- Importance of *simultaneous innovation*
- Critical role of
  - Components
  - Complements
  - Standards
- These forces are still active today
Simultaneous innovation

- Historical
  - Howe/Singer …
  - Edison/Swan …
  - Bell/Gray …

- Recent
  - Digital computer
  - Personal computer
  - Dot coms
Why simultaneous innovation?

- Demand side
  - Recognized problem and/or need
  - Problem seems solvable

- Supply side
  - Standardized components
  - Parallel experimentation
  - “Combinatorial innovation”
  - Development of complements (before, after, during initial innovation)
Examples

- **Historical**
  - Standardized parts in the 1800s
  - Edison Menlo Park laboratory
  - Wright Brothers in early 1900s

- **Recent**
  - Integrated circuit
  - Web components
    - TCP/IP, HTML, HTTP, CGI, forms, menus, etc.
    - Particularly rapid innovation due to…
Components and complements

- **Components**
  - Standardized interface, ubiquitous, cheap
  - Often developed for some other purpose
  - Part of a more complex system
  - Examples: screws, chips, TCP/IP, etc.

- **Complements**
  - Value to user depends on entire system: DVD player+disks, autos+gasoline, hardware+software
  - Often components assembled by manufacturer, complements assembled by user (but many exceptions)
Complements

- Supply side: cheaper to produce one product if also produce other
  - Economies of scale: decreasing unit costs
  - Economies of scope: shared facility (software)

- Demand side: value of one product is enhanced by other
  - Scope: hamburger+catsup, VCR+tapes
  - Scale: fax machine+fax machine

- Book to read (in addition to *InfoRules*): Brandenburger and Nalebuff: *Co-opetition*
Consumption complements

- Complementary products: value to user depends on whole system
  - Radio/TV + content
  - DVD player + disks
  - CPU + hard drives

- Fundamental questions
  - How is coordination accomplished?
    - Chicken and egg problem with new system
    - Technology evolution with existing system
  - Who does “system integration”? 
  - How to divide value up among complementors?
Examples from Silicon Valley

- Question about coordination
  - 3Com: “must align with others”
  - Adobe: works with printers, integrators, VARs, CPU manufacturers
  - Juniper: other network manufacturers, other layers
  - Seagate: “drives are always part of a larger system”
- Moore’s Law as coordination device to avoid bottlenecks for technology treadmill?
Working with complementors

- Two sorts of problems
  - Coordination
    - All parties have same objectives, major problem is in organization and management
  - Incentives
    - Different objectives lead to working at cross-purposes
  - Normal case is a mixture of two problems
Pure coordination problems

- A natural leader emerges
  - E.g., a system integrator, or someone who controls a standard or bottleneck
  - Extremely powerful position
    - IBM System 360
    - Microsoft/Intel “gift from IBM”

- One side absorbs other (merge or acquire)
  - But can be hard to succeed due to differences in competencies
    - Sony/Columbia example
    - AOL-Time Warner
Coordination technology

- Coordination is easier now because of technology
  - Fax, email, attachments, intranet, etc. Pixar database.
- Impact on boundaries of firm?
  - Lower communication cost means...
    - Easier to coordinate across firms
    - But also easier to coordinate within a firm (Alfred Chandler)
- High-powered incentives across separate firms
  - Everybody likes competition among suppliers more than internal monopolies
  - But what if the external supplier is a monopolist?
  - Market structure (determined by economies of scale) dominate communications costs as determinant of outsourcing
  - E.g. IBM sale of Global Networks to AT&T vs Windows OS
Incentive problems

- Two problems (among many)
  - Price/quality choices
  - Holdup

- Other problems for some other time
  - Channel conflict
  - Information sharing
Example: pricing

- Two components to system, e.g., hardware/software
- Cut price of hardware, increases sales of software and vice versa
- Not necessarily taken into account in price-setting calculation by single firm
- Result: system price is too high, *both* companies benefit from both reducing price
  - Consumers benefit too
  - Coordinating prices of complements is a win all the way around!
Pricing complements (detail)

- Value to user depends on all components
  - Left shoe + right shoe, hardware + software + service, DVD player + disks
- So demand depends on sum of prices
- Revenue to firm 1 = \( p_1 D(p_1 + p_2) \)
  - Cutting your price *may* raise revenue
  - Both cutting prices raises revenue for each
  - Other firm cutting its price raises your revenue the most! How to do this? See next slide…
- Big win to coordinating “quality” as well
  - Quality of system may depend on \( \min(q_1, q_2) \), as in a network
Solution: ways to cut complement’s price

- Integrate: set price yourself
- Collaborate: e.g., revenue sharing
- Negotiate: I’ll cut mine if you cut yours
- Nurture: work with them to lower costs
- Commoditize: make their industry more competitive
Cut complement’s price: integrate and negotiate

- **Integrate**
  - One firm sells both hardware and software (e.g., ethernet cards and drivers)
  - May be important for quality reasons (IBM, Sun)
  - Problems
    - Complexity management challenge
    - Core competency

- **Negotiate**
  - DVD Forum: negotiated to push prices down.
    Licensing core patents.
  - Note: Antitrust implications. But coordination of prices is a win for both consumers and producers.
Cut complementor’s price: collaborate

- Revenue sharing
  - Blockbuster “guaranteed in stock”
  - Purchase v rev share contract
  - Role of IT in providing transaction monitoring

- Outcome
  - Distributor, video store, consumers all better off

- IBM example of partnerships with applications software companies
Aside on “computer mediated contracts”

- Revenue sharing etc. may become much more widely used due to cheap monitoring devices (RFID, cash registers, etc)
  - Supermarket rev share with vendors
  - Rental car speed detection
  - Truck EVM systems
  - Wal-Mart RFID

- Contract provisions depend on monitoring costs: cheaper monitoring usually means better contracts [“Can’t manage what you can’t monitor.”] Can’t contract on it either.
Another example: Real-time marketing

- “Half of my advertising budget is wasted, I just don’t know which half…”
- Google “pay per click” pricing
  - Real time feedback from marketing campaigns
- Ad campaign monitoring with Web activity
- Tivo/Replay ad feedback
- Marketing will become much more high-tech and quantitative in future…
  - Quants move from Wall Street to Madison Avenue
Cut complement’s price: nurture

- Improve quality of complements
  - Microsoft Windows Hardware Quality Labs
  - Cisco Certified Internetwork Expert
  - Auto industry working with suppliers/complementors

- Push costs of complementors down
  - Help them to standardize
  - Communicate efficiently with them
  - Supply chain management, etc.
Cut complement’s price: commoditize

Hardware maker wants cheap software, software maker wants cheap hardware

How to achieve?
- Push for standards in complementor’s industry
- Encourage competition
  - Enter yourself to jump start industry
  - Take minority investments to maintain involvement
- Recent example: Intel and WiFi [commodity biz]

Examples
- Early history of radio, RCA, AT&T
- Wintel: “extraordinarily productive, necessarily tense”
Problem: hold-up

- One complementor may try to hold up the other (put them in a position where they have no choice and extort more value)
  - Unilaterally raise price of critical component
  - Assert intellectual property rights on key component
  - “Lowball the bid and make it up on change orders”
Solutions to hold up

- Contracts
  - But there are negotiation/verification costs
- Commitment device
  - Posting a bond
- Dispute resolution procedures
  - Binding arbitration
- Second sourcing
  - Creates competition
- Repeated interaction
- Reputation
The End

...and thanks for your attention