The Evolution of Markets and Patterns of Technology Changes

Outline

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- Rate of technology development and transitions between technologies
- Rate of adoptions (diffusion and substitution) and adopter categories
- CT scanner -- discuss both issues

- Project?
  - What are your tech. development issues, what is your S-curve
  - Who are your lead users, what are their needs

Rate of technology maturity

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Incremental break-through: S-curve

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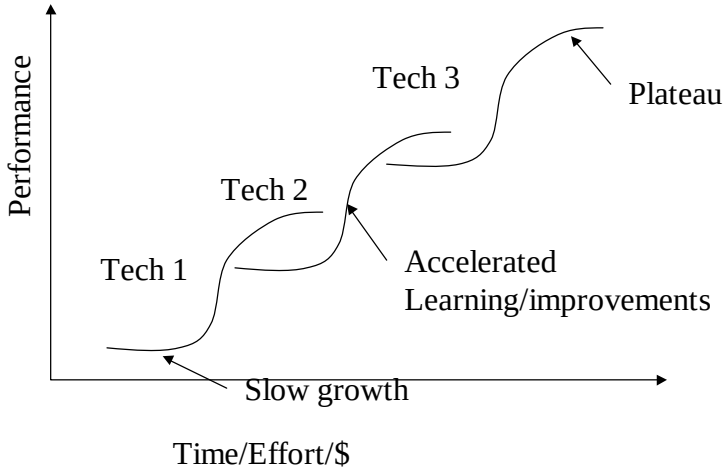

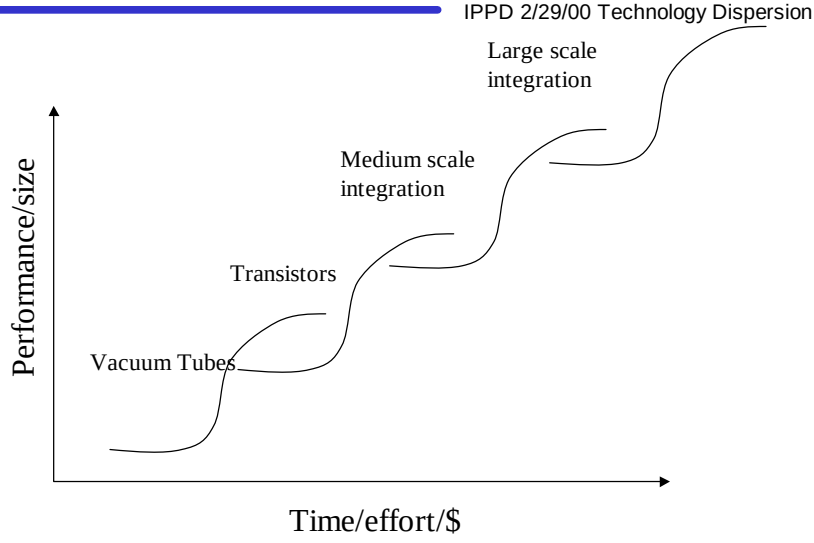

Factors in technology development

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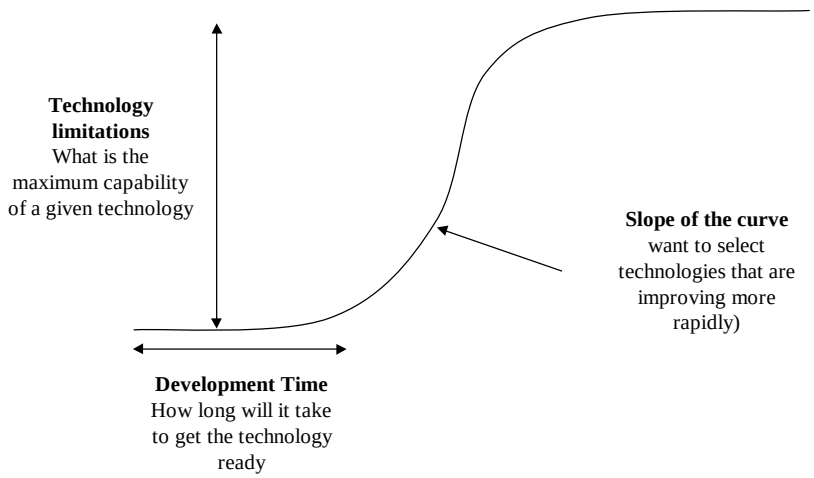

Risks in technology adoption

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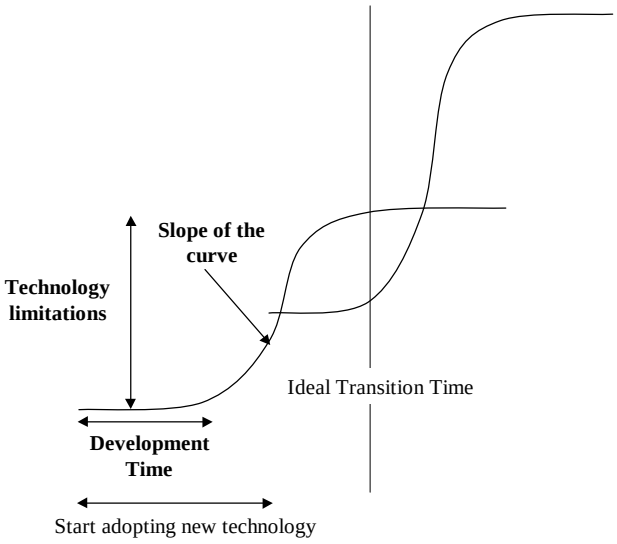

Efficiency vs. Effectiveness

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- Efficiency -
  - How fast can you get up the curve
  - Incremental improvements
- Effectiveness -
  - What is the right curve to be on
- Real options
  - Need to buy the option to develop a new technology to give you the *right* to enter a new market at a later date.

Within a single technology

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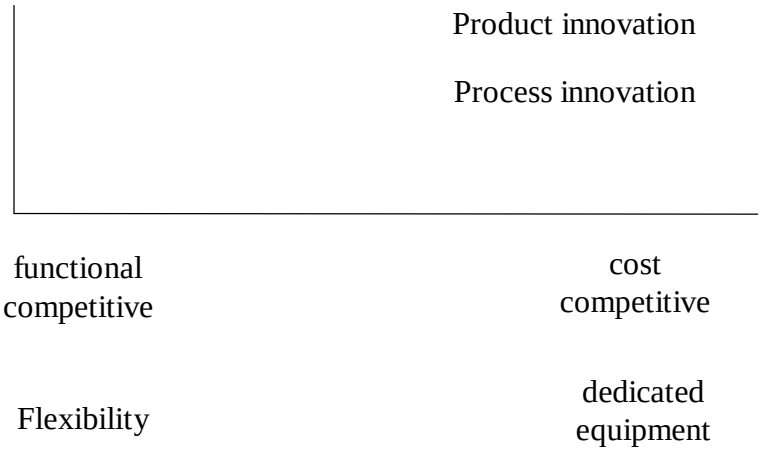

Comparison of types

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- Small innovator
  - Functional competition
  - market not defined
  - flexible
  - rapid change
  - early innovations return a larger profit (consistent with risk/return curve)
  - product focused
  - ill-defined targets
- Large established org.
  - Market defined
  - clear customer needs
  - easy comparison between companies
  - cost driven - economies of scale
  - incremental improvement
  - process focus
  - clear targets

Rate of adoption

- There is an “S-curve” for diffusion and substitution
  - Diffusion - rate at which new users are created
  - Substitution - rate at which existing users switch products

Diffusion rate

- Diffusion of technology is preceded by the diffusion of information
- Diffusion and substitution is a function of the number of people using a product (network effect)

Equations

- $dN/dt = P(t)(N_t-N)$
  - P(t) probability that a new person will change from old to new
  - (N_t-N) - number of remaining customer
- $P(t) = kN$
  - N = number of other customer (numbers of signals)
  - k = effectiveness of a message
- $dN/dt = kN(N_t-N)$

Rapid dispersion

- Need to get the value of *k* high for the early adopters. I.e., target those adopters who have the best voice and can create the most effective message.

Graph of adoption

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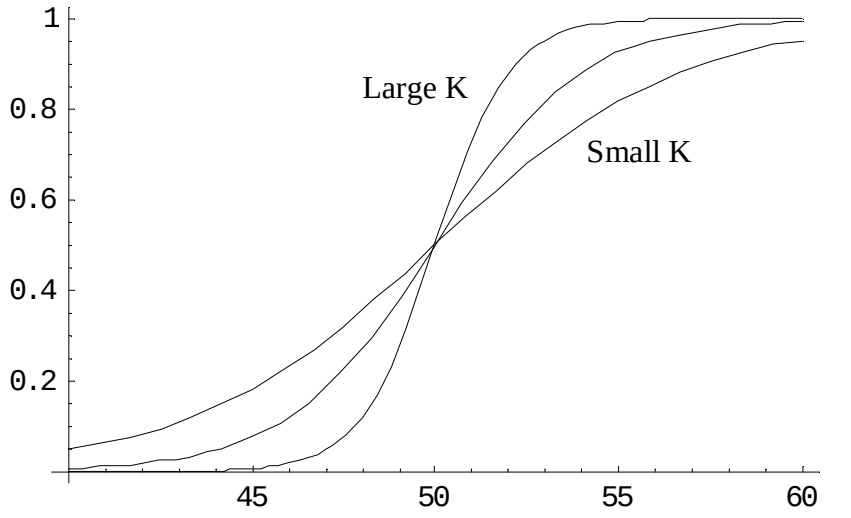

Adopter categories

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- Innovators
  - High risk, lots of capital
  - Bring the idea in
- Early adopters
  - Opinion leadership
  - Role models
- Early majority
  - Not leaders
- Late majority
  - skeptics
- Laggards
  - traditional
  - “devil-you-know”

Why was this a classic new technology?

- Classic S-curve on technology
- Don't know customer needs
- Market numbers are way off
  - first prediction 5 per year - Pfizer expected to sell 240 per year several years later
  - even later, no clear market size ranging from 120M - 1B
- Change from function to $ (govt. regulation effected this)
- Change from diffusion to substitution

What drove diffusion?

- Getting lead neurologists to use the machine
- Create it as a status symbol (every one need their own CT scan even though others had one nearby and it was underutilized)
- Create it as a technology for researchers (many journal articles on the new area)
- Have the customer want it (i.e., no one would consider having brain surgery without a CTscan first). Ethically driven to use a CT scan before surgery.
- Radiology was a money making division.
- First sales people were the technologists and a top neurologist

Profits?

- Why was the scanner initially so profitable? Is this likely to continue?
- Early profitability came from no competition. Top research hospitals have large budgets for a technology that allows what they couldn't see before.
- Low investment (relatively) because they used outside vendors -- no need to purchase capital equipment
- Later pressure came from customer demands, competition

Change in emphasis

- Early was to get the functions out
- New
  - Still getting the times down and resolution up
  - Quality issues
  - Delivery schedules
  - Reliability
  - Cost
- Complexity in the organization
  - Politics, large teams, sales force

Why was their idea appropriable?

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- Did not defend with patents
- Other medical companies had the expertise to get going quickly on the product once the technology was demonstrated (had all of the infrastructure in place)

S-curve for the CT scanner

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- Early
  - Trying to get it to work
- Mid
  - Major change in rates, technologies
  - Added features
- Late
  - Minor changes to get time down

Final wrap up question

- What strategy would you recommend EMI pursue? Why?

Next lecture - Impact of NT on PD

- **New Product Development at Cannon,**
- **EMI and the CT Scanner (A)**
- How do different companies develop new technology? What are the different strategies? What are the benefits and problems with each approach?
- What were the key technology risks in each case and how each company address them?
- What are the risks involved in new technology and what methods are used to mitigate them?
- Organizational effects on new technology introduction?

Written Assignment 1 due

- Review assignment