Understanding the Emerging Technologies Life Cycle
Notes and References

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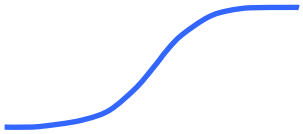
Notes



Why Are Technologies Developed? (Barker)

- Technologies are developed to solve problems
- In this context, we will define productivity in terms of how many problems a technology can solve
- If we chart the total number of problems solved by a technology over time, we will usually get an s-curve (logistics curve) (also see **Modis**)
    - This applies from the micro (e.g. a single hardware component) to the macro (a major technology platform)

How Are Technologies Made? (Arthur)

- Technologies manifest a base concept or principle that exploits some phenomenon
- Technologies are combinations of components
- Many components are pre-existing
    - There is usually a main component, which may or may not be new, and supporting components

- The first time a phenomenon is exploited (i.e. the technology uses a previously unexploited principle), we have a revolutionary technology
- New combinations of existing components result in evolutionary technologies.

Critical Question: Is there a new (unique) component that exploits some new phenomenon?

What is the Life Cycle of a Technology?

- Infancy - discovery & early development
- Childhood – learning how to use it
- Adolescence – growth may be rapid or "slow but steady", it depends on how productive it is
- Maturity – growth slows down, but continues
- Old age – eventually growth halts, replacement technologies take over
- Death – usage diminishes as the technology becomes obsolete

(Note: Not all technologies live a full life.)

Critical Question: Are there many available implementations of this technology?

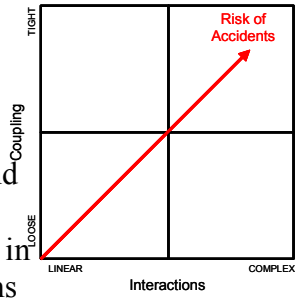
Technological Development is Realized through Innovation (Christensen)

We turn to innovation to solve new problems. There are two types of innovation:

- Continuous (think evolutionary, sustaining)
  - Improve productivity
  - Technologies rarely stand alone. Mature technologies get boosts from other technologies.
  - Continuous improvements may flow together smoothly because we can leverage prior knowledge and skills
- Discontinuous (think revolutionary, disruptive)
  - New problems arise that can't be solved with current technology.
  - To solve these new problems requires a new technology paradigm (new rules for a new platform).

Critical Question: Is this technology an incremental or a radical improvement?

Perrow Model (Perrow)



We tolerate (or even seek out) discontinuous innovation because of the "pain" and frustration caused by the unsolved problems

- In Normal Accidents, Charles Perrow describes how the risk of accidents in physical systems is increased by Tight Coupling and Complex Interactions
- "Accidents" cause pain.
- Discontinuous Innovations that loosen coupling or simplify interactions reduce pain and will ultimately be very attractive.
- This model applies to many industries, including the software industry in IT.

Critical Question: Does the technology introduce modularization where it did not exist before?

How Does the Life Cycle of a Major Platform Differ from Other Technologies? (Snyder)

- Four phases of platform development:
  - Infancy (25 years), non-productive
  - Childhood (25 years), counter-productive – dangerous?
  - Adolescence (25 years), hyper-productive
  - Maturity (x years), reliable productivity
- Platforms tend to mutate rather than die
- Change and development continue into maturity
- New platform can't become truly productive until its infrastructure is ready.

Critical Question: Is this technology a totally new thing? Is it foundational?

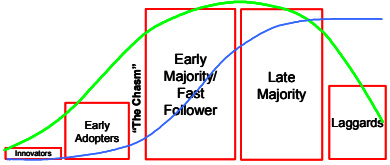
Why Make the Leap to a New Platform?

- Pros
  - If it works, we can solve these problems that have been frustrating us.
  - If it works, we might gain competitive advantage.
- Cons
  - What if this is a flash in the pan and not the next platform?
  - We know we will have reduced productivity for a time, even if this is the next platform. Should we wait?
  - The old technology still works!!

Critical Question: Are your objections to this technology logical or emotional?

How Do New, Discontinuous Technologies Come to Market?
(Rogers, Moore)

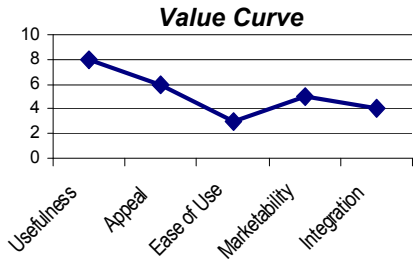
- Technology Adoption Life Cycle (TALC): When it comes to adopting new technology, people will fall into groups that pretty much follow the normal distribution curve.
- Innovators want to solve prickly problems
- Early Adopters look for competitive advantage
- Early Majority, however, need to see real value
  - if they don't, the technology won't "cross the chasm" to broader adoption
- The Late Majority are more cautious, and the Laggards wait until it's really cheap.



Critical Question: Does this appear to be a fundamentally new technology?

The Value Curve (Kim)

- When a new technology is introduced, people need a reason to buy it
  - Early Adopters and Innovators have a severe problem and/or look for possible competitive advantage
- For technology, a Value Curve is a combination of:
  - Usefulness/ Effectiveness/ Problem Solving
  - Appeal
  - Ease of Use/ Convenience
  - Perceived Marketability of application
  - Ease of Integration, fit
    - with the past and with the future
- Other factors that may vary…

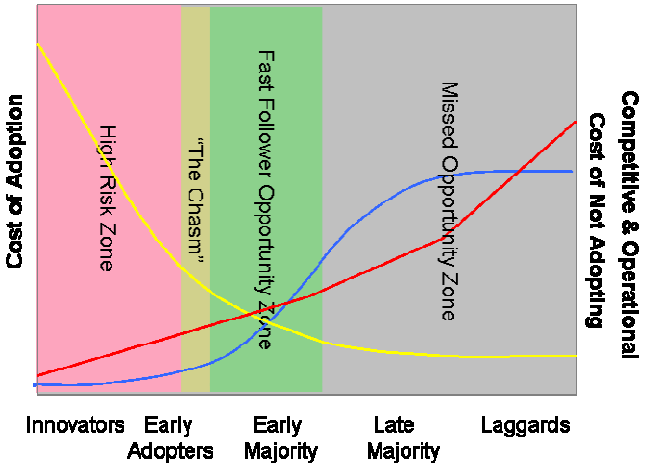


Critical Question: Do people want to use this technology? Is it cool?

Technology Adoption Risk

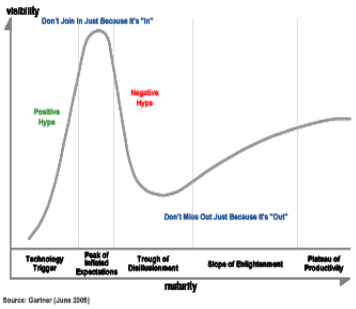
- Innovators and Early Adopters buy when the risk is high.
- Early Majority buy at lower risk because the technology has proved itself and crossed the chasm.

- Late Majority and Laggards buy too late to get much competitive advantage from the technology.
- Cost of adoption: early on, costs are high, skills cost a lot, mistakes are made. This is the high risk zone, where adoption costs are still high, and there is a risk that the technology will not "cross the chasm".
- Cost of not adopting: if you're slow, your competitors get the advantage in either lower cost or more innovative products. Eventually, you are left holding the bag using older, less productive technology.
- Productivity doesn't take off until the technology has crossed the chasm and entered the fast follower opportunity zone. The opportunity zone is where technologies can be adopted as costs are falling and productivity is rising.



Critical Question: Who is buying this technology? Do they always buy the new stuff?

But… Is It Done Yet? (Fenn)



Gartner Hype Cycle of Technology vs. Productivity S-curve

- Hype cycle is about press, not productivity.
- Productivity curve indicates how many problems the technology is solving.
- Don't confuse the two… Many bad investments due to hype…

Critical Question: Are you hearing what the technology "will do" or what it "has done"?

Key Messages

- The productive life of a technology will usually follow an s-curve
- Disruptive innovations take everyone back to zero
- Evaluate the maturity and real productivity before using a new technology

- Beware the hype
- Don't confuse a failed product with a failed technology

Expect turbulence!!

References

Arthur, W. Brian, Logic of Invention, Santa Fe Institute and PARC, c2005

Barker, Joel, Paradigms, New York: Harper Business, c1992.

Chakravorty, Bhaskar, The Slow Pace of Fast Change, Boston: Harvard Business School Pub., c2003.

Christensen, Clayton, The Innovator's Dilemma, Boston: Harvard Business School Press, c1997.

Fenn, Jackie and Alexander Linden, "Understanding Gartner's Hype Cycles, 2005", Stamford: Gartner Group, c2005.

Kim, W. C. and R. Mauborgne. Creating new market space, Boston: Harvard Business Review (January-February 1999): 83-93.

Modis, Theodore Ph.D., Predictions: 10 Years Later, Geneva: Growth Dynamics, c2002.

Moore, Geoffrey, Crossing the Chasm, New York: HarperBusiness Essentials, c2002.

Perrow, Charles, Normal Accidents, Princeton: Princeton University Press, c1999.

Rogers, Everett, Diffusion of Innovations, New York: The Free Press, c1995.

Snyder, David Pearce, Fixed Assets in Changing Times, Bethesda: The Snyder Family Enterprise, c2004.

