Types and Patterns of Innovation

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Economics of innovation

Technology trajectory

The path a technology takes through its lifetime.
This path may refer to its rate of performance improvement, its rate of diffusion, or other change of interest.

➢many factors can influence these technology trajectories, some patterns have been consistently identified in technology trajectories across many industry contexts and over many periods.

➢Understanding these patterns of technological innovation provides a useful foundation that we will build upon on formulating technology strategy.

Differences among industrial sectors

A number of studies have shown marked, similar and persistent differences amongst industrial sectors and directions of technological change.

They can be summarized as follows:

- Size of innovating firms
- Type of product made
- Objectives of innovation
- Sources of innovation
- Place of own innovation

TYPES OF INNOVATION

Four of the dimensions most commonly used to categorize innovations are:

- Product Innovation versus Process Innovation

- Radical Innovation versus Incremental Innovation

- Competence-Enhancing Innovation versus Competence-Destroying Innovation

- Architectural Innovation versus Component Innovation

Types of innovations

10 types of innovation: move beyond products to win

1. Business model DELL
how the enterprise makes money

2. Networking
enterprise's structure/
value chain
WAL★MART

3. Enabling process
assembled capabilities
SIEBEL

4. Core process
proprietary processes that add value
GE Capital
Aviation Services

5. Product performance Intel® Pentium® 4
basic features, performance and functionality

6. Product system
extended system that surrounds an offering
Microsoft Office

7. Service
how you service your customers
FedEx

Finance	Process	Offering	Delivery
Business model	Networking	Enabling process	Core process	Product performance	Product system	Service	Channel	Brand	Customer experience

8. Channel
how you connect your offerings
to your customers
NIKETOWN

9. Brand
how you express your offering's
benefit to customers
Virgin
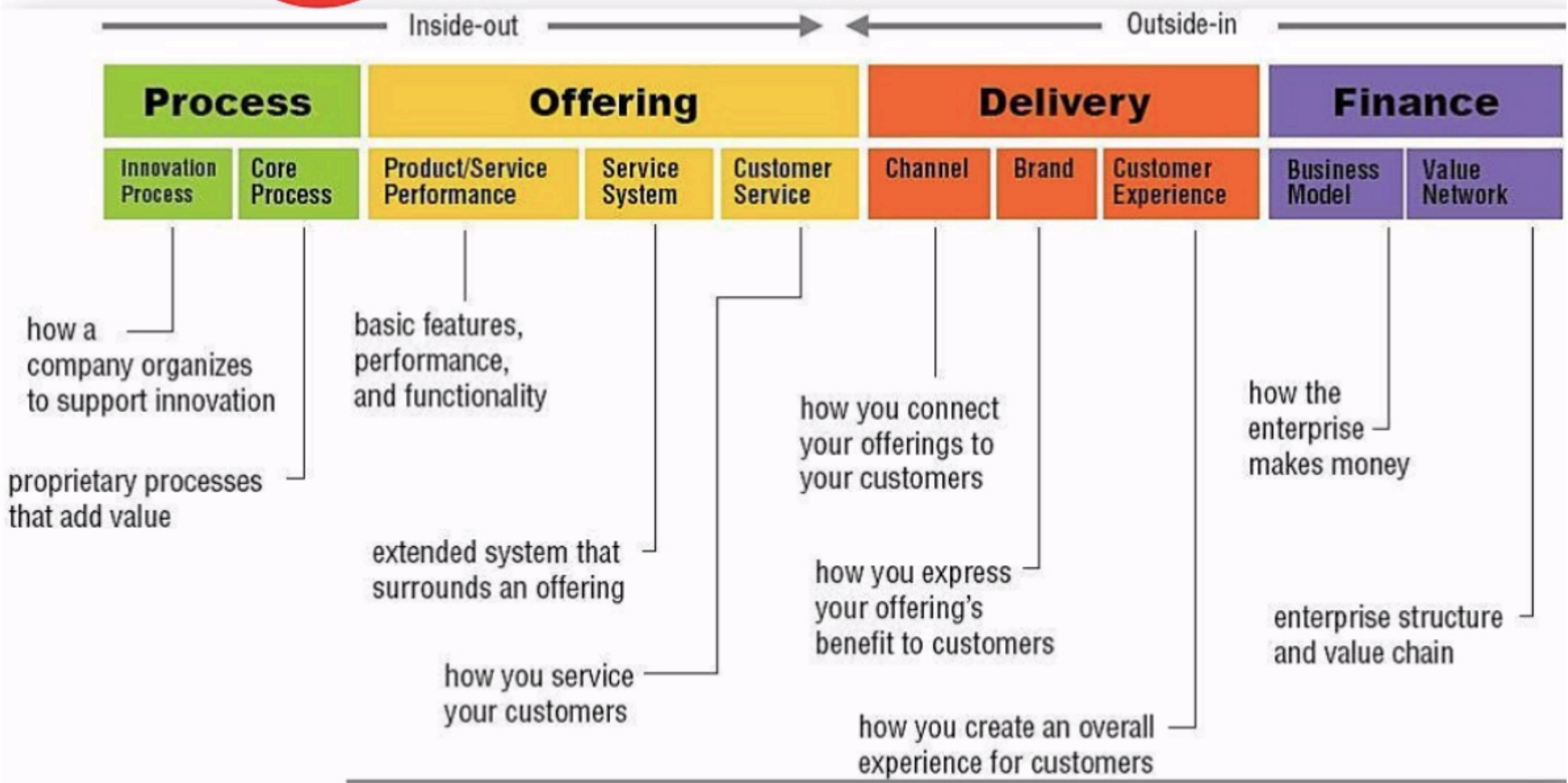
10. Customer experience
how you create an overall
experience for customers
LEXUS
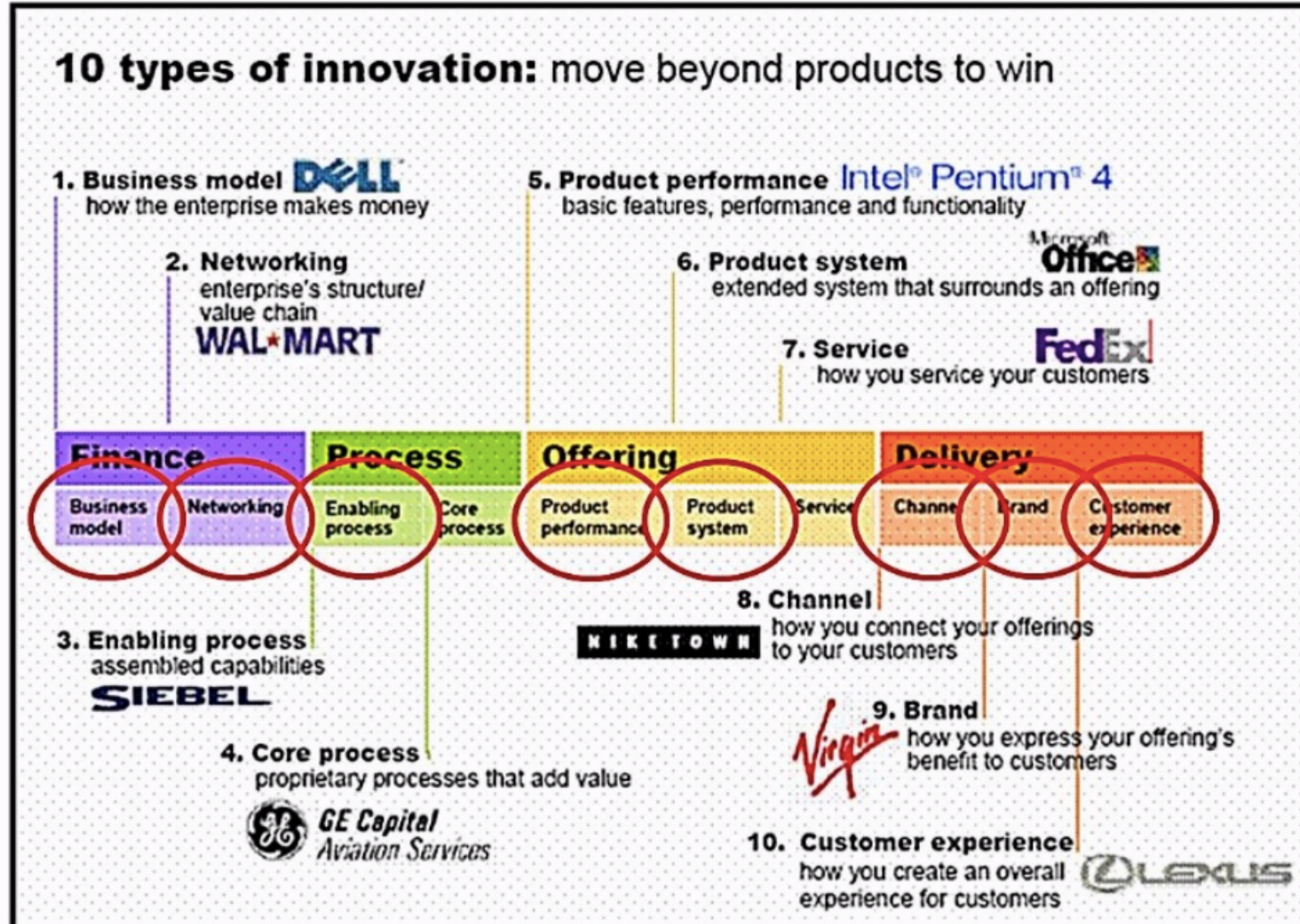
Product Innovation versus Process Innovation

- Product innovations are embodied in the outputs of an organization—its goods or services, even if those products are services.

- Process innovations are innovations in the way an organization conducts its business, such as in the techniques of producing or marketing goods or services.

    - New product innovations and process innovations often occur in tandem. First, new processes may enable the production of new products.
    - New products may enable the development of new processes.
    - A product innovation for one firm may simultaneously be a process innovation for another.

Radical Innovation versus Incremental Innovation

Radical innovation An innovation that is very new and different from prior solutions. is an innovation that has a significant impact on a market and on the economic activity of firms in that market.

Incremental innovation An innovation that makes a relatively minor change from (or adjustment to) existing practices.

How important are radical and incremental innovations?

- **Incremental innovation most prevalent.** Incremental innovation is the dominant form of innovation. Radical innovation is generally a complex process, rather than a discrete event, and generally implies a difficult, lengthy and risky process.

- **Innovation differs by sector.** The nature of innovation and the rate of technological change greatly differ from sector to sector. Some sectors are characterised by rapid change and radical innovations, others by smaller, incremental changes. In high-technology sectors, R&D plays a central role in innovation activities, while other sectors rely to a greater degree on the adoption of existing knowledge and technology.

Competence-Enhancing Innovation versus Competence-Destroying Innovation

- A competence-enhancing innovation builds on existing knowledge and skills whereas a competence-destroying innovation renders existing knowledge and skills obsolete.

- Innovation is competence enhancing or competence destroying depends on whose perspective is being taken. An innovation can be competence enhancing to one firm, while competence destroying for another.

- Schumpeter wrote about the *Creative Destruction*, which he described as a *'process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one.'* To a certain extent, the blockchain technology can be compared to this concept within capital markets. If it is adopted by incumbents, the middle and back offices functions as we know them today could become obsolete.

Activity: Competence destroying and competence enhancing innovation

Look at the example of the music industry. Review the case in terms of the following questions:

● To what extent are the changes involved competence-enhancing (i.e. building on what a player in the industry already knows so they can strengthen their position) or competence destroying (i.e. something completely new which requires learning some new tricks) innovations?

● And for whom? (Think about the different players in the industry - who are the likely winners and losers).

● What strategies might a firm use to exploit the opportunities? (Again think about the different players in the industry and how they might defend their positions or open up new opportunities).

You might like to use the following framework to capture your answers; this example looks at the music industry.

Activity: Competence destroying and competence enhancing innovation

	An established company	A newcomer wanting to offer entertainment on the Web	A music publishing company (responsible for copyrights on sheet music, etc.)	Other examples....
Is the change competence enhancing? Why?				
Is it				

competence destroying? Why?				
What might you do about this to secure and improve your position?				

Architectural Innovation versus Component Innovation

- **component (or modular) innovation**
  An innovation to one or more components
  that does not significantly affect the overall configuration of the
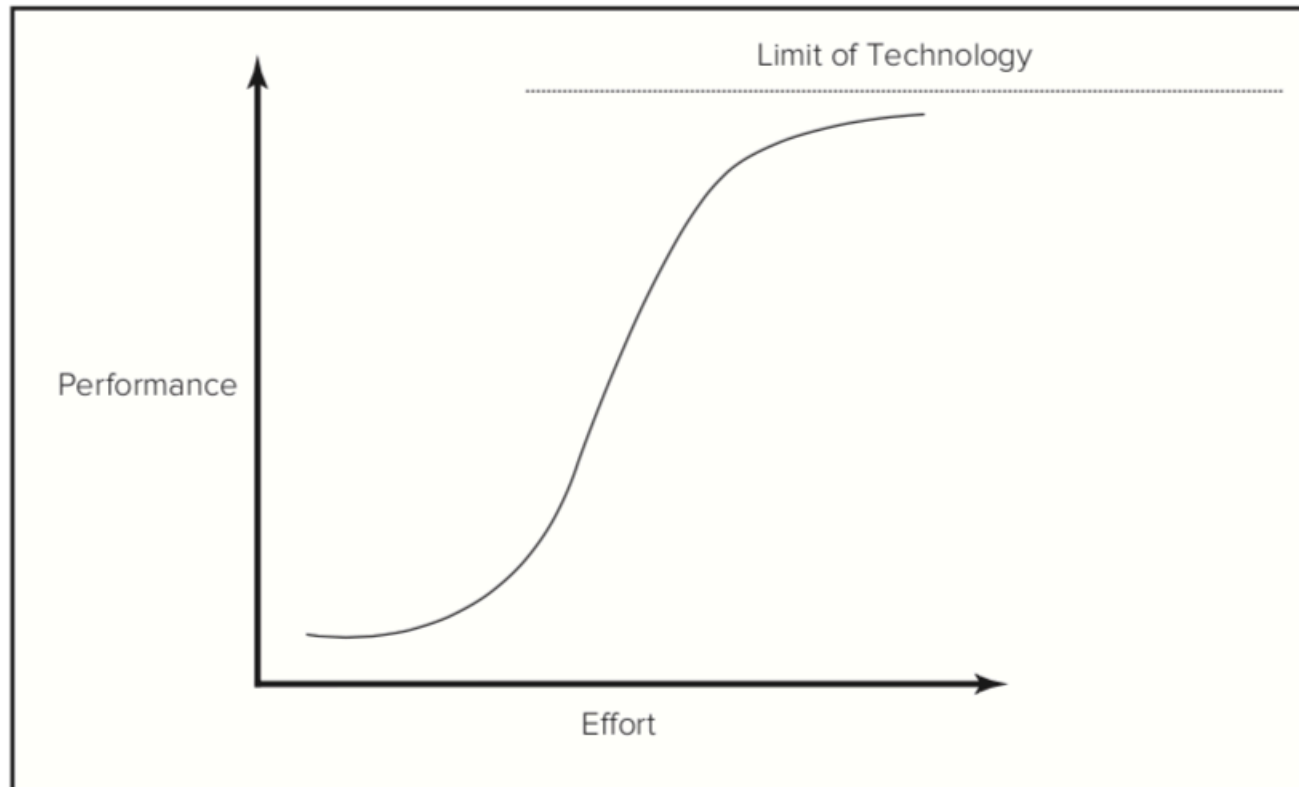 system.

- **architectural innovation**
  An innovation that changes the overall design of a system or the way
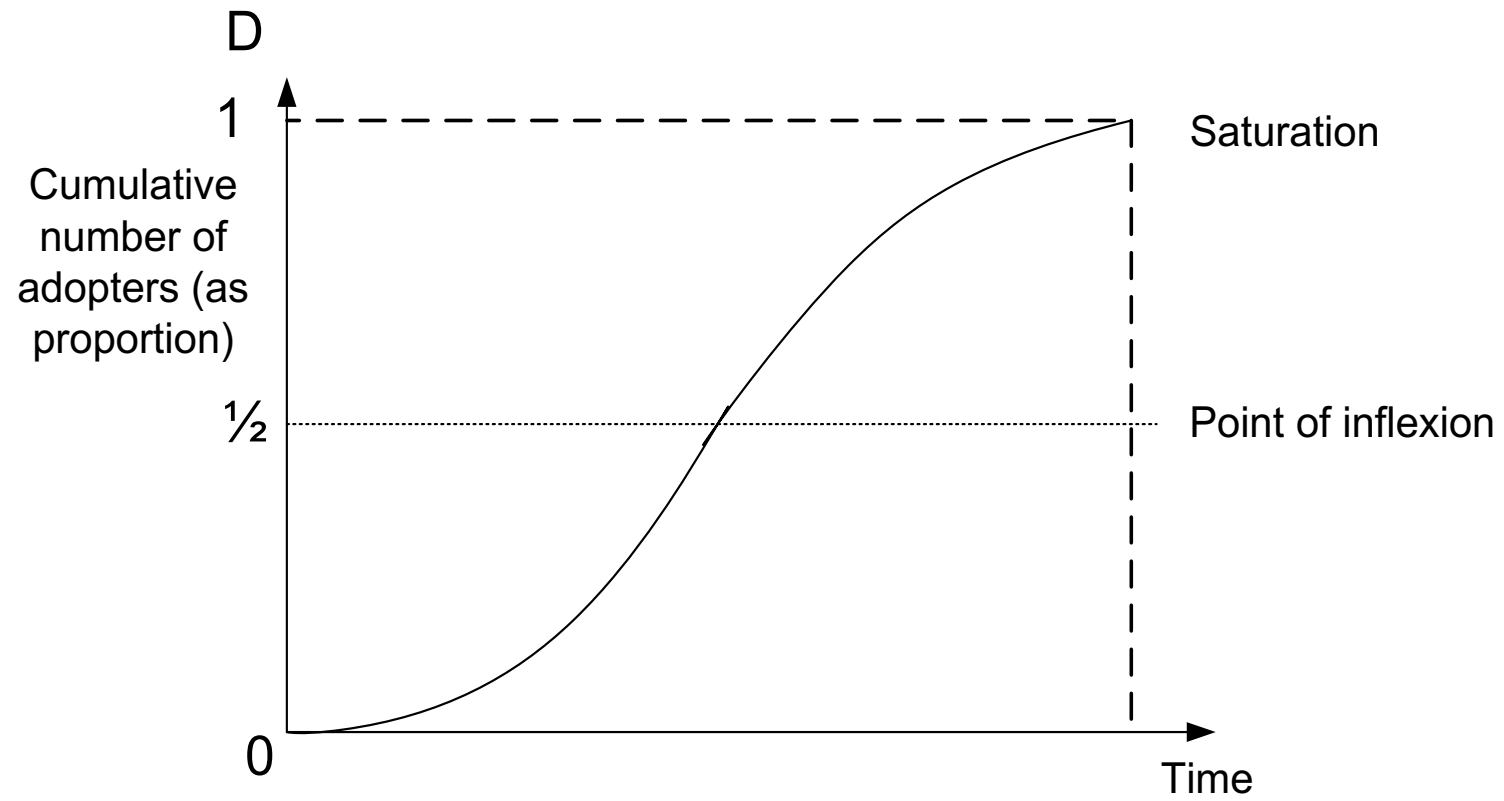 its components interact with each other.

TECHNOLOGY S-CURVES

S-Curves in Technological Improvement

technologies exhibit an s-curve in their performance improvement over their life-times.
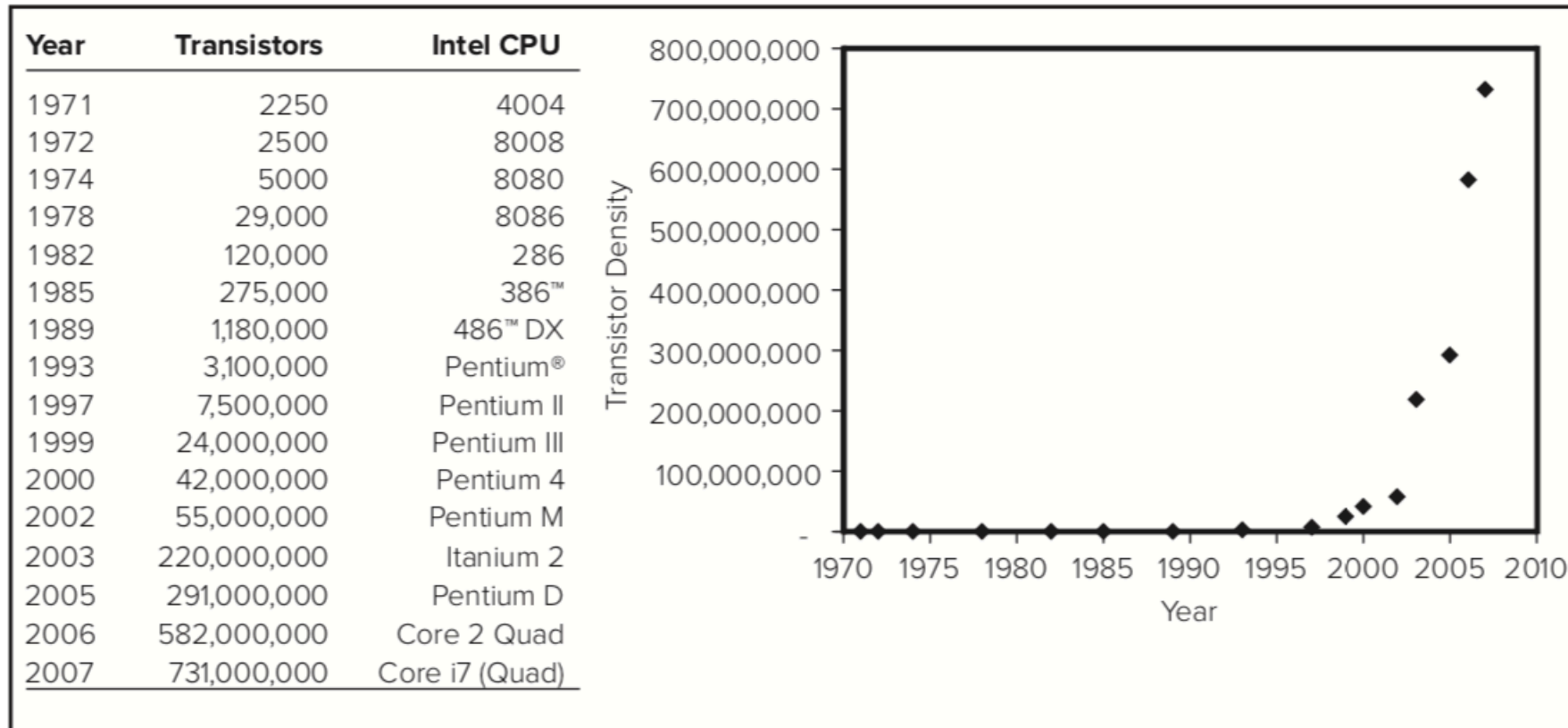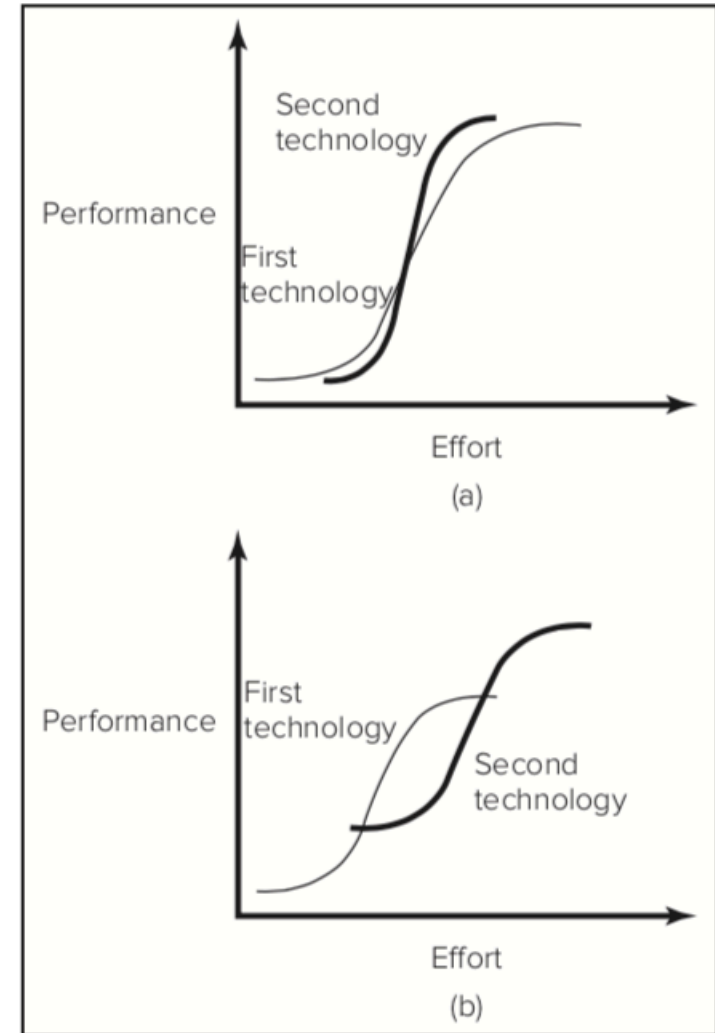
TECHNOLOGY S-CURVES

Improvements in Intel's Microprocessor Transistor Density over time

Improvements in Intel's Microprocessor Transistor Density over Time

Year	Transistors	Intel CPU
1971	2250	4004
1972	2500	8008
1974	5000	8080
1978	29,000	8086
1982	120,000	286
1985	275,000	386™
1989	1,180,000	486™ DX
1993	3,100,000	Pentium®
1997	7,500,000	Pentium II
1999	24,000,000	Pentium III
2000	42,000,000	Pentium 4
2002	55,000,000	Pentium M
2003	220,000,000	Itanium 2
2005	291,000,000	Pentium D
2006	582,000,000	Core 2 Quad
2007	731,000,000	Core i7 (Quad)

Discontinuous technology

A technology that fulfills a similar market need by building on an entirely new knowledge base.

S-Curves in Technology Diffusion

S-curves in **technology diffusion** are obtained by plotting the cumulative number of adopters of the technology against time. This yields an s-shape curve because adoption is initially slow when an unfamiliar technology is introduced to the market; it accelerates as the technology becomes better understood and utilized by the mass market, and eventually the market is saturated so the rate of new adoptions declines.

S-Curves as a Prescriptive Tool

The s-curve model can be used by managers as a tool for predicting when a technology will reach its limits and as a prescriptive guide for whether and when the firm should move to a new, more radical technology.

Firms can use data on the investment and performance of their own technologies, or data on the overall industry investment in a technology and the average performance achieved by multiple producers.

Managers could then use these curves to assess whether a technology appears to be approaching its limits or to identify new technologies that might be emerging on s-curves that will intersect the firm's technology s-curve.

TECHNOLOGY CYCLES

The s-curve model suggests that technological change is cyclical:

Each new s-curve ushers in an initial period of turbulence, followed by rapid improvement, then diminishing returns, and ultimately is displaced by a new technological discontinuity.

The emergence of a new technological discontinuity can overturn the existing competitive structure of an industry, creating new leaders and new losers.

Schumpeter called this process *creative destruction*, and argued that it was the key driver of progress in a capitalist society

Stages of the technology cycle

Stages of the technology cycle proposed by Utterback and Abernathy:

- *fluid phase:* In the first phase there was considerable uncertainty about both the technology and its market. Products or services based on the technology might be crude, unreliable, or expensive, but might suit the needs of some market niches.

- *specific phase* The dominant design establishes a stable architecture for the technology and enables firms to focus their efforts on process innovations that make production of the design more effective and efficient or on incremental innovations to improve components within the architecture.

Technology diffusion S-curve with adapter categories
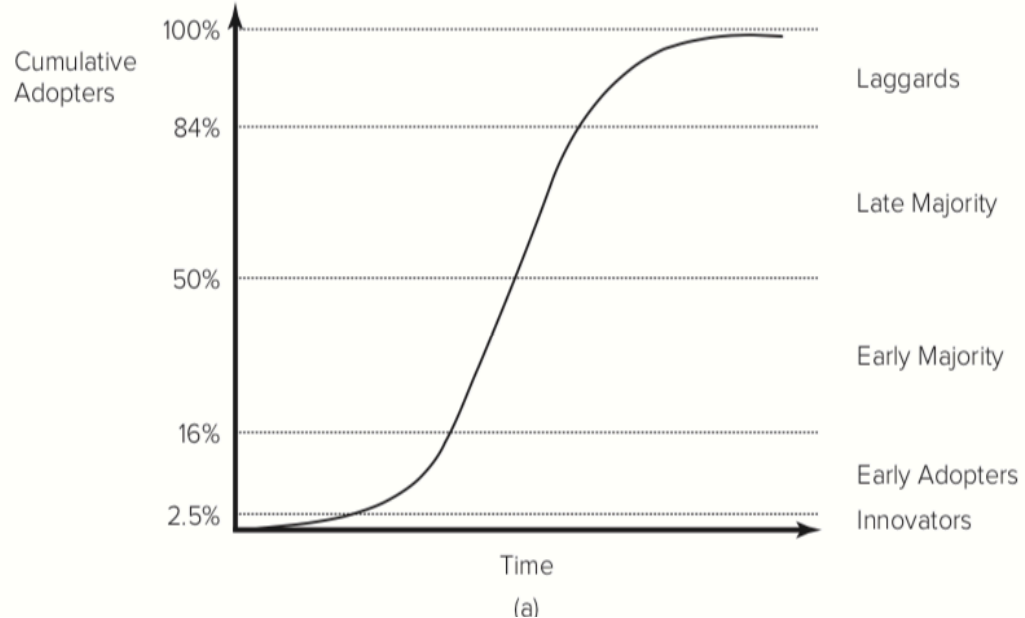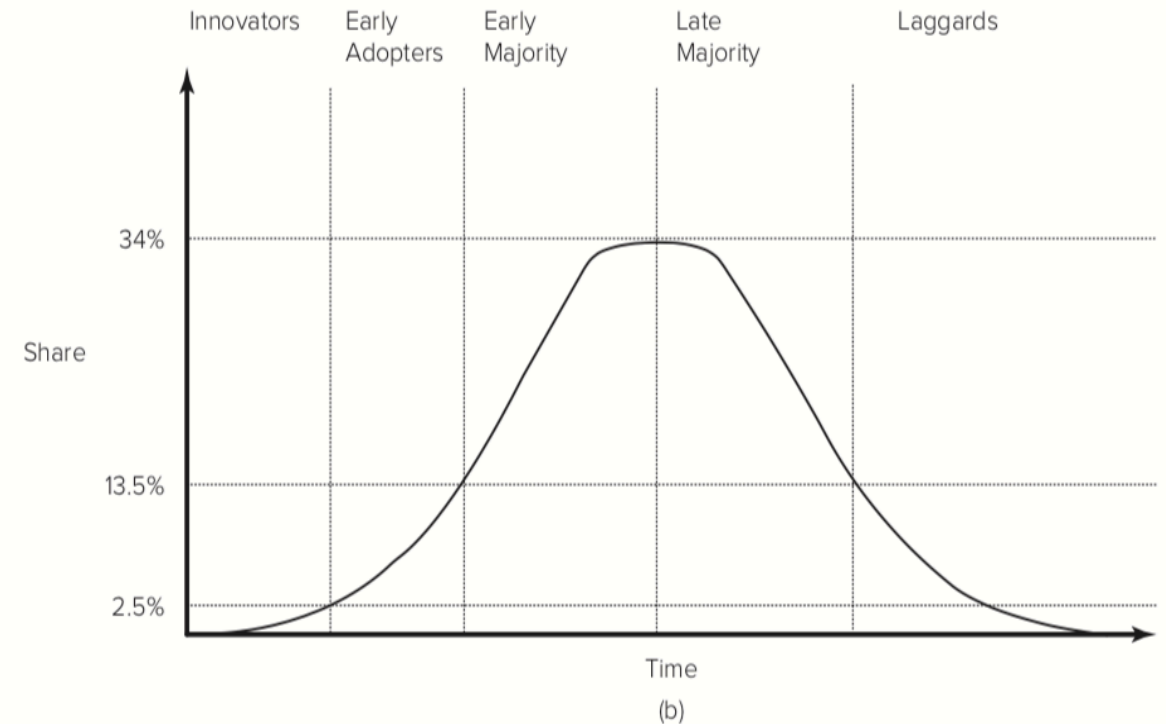
How Markets Adopt Technology

How markets move and your position changes with it

Customer Goal:	Competitive Advantage	Solve Problem	Adopt Obvious	Extend Paradigm
Customer Need:	Potential of Technology	Complete Solution	Safe Choice	Better Value
Vendor Goal:	Validate Technology	Segment Share	Market Share	Profitability
Strategy:	Demo the Technology	Show ROI	Gorilla Power!	Segment Focus
Skills:	Technology Proficiency	Customer Intimacy	Closing Deals	Relationship Mgmt.

"The Chasm Companion" Paul Wiefels

"Crossing the Chasm" by Geoffrey Moore

The tecnology cycle