

TECHNOLOGY AND INNOVATION MANAGEMENT

BLG 442E
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Technical Personnel and Business Personnel

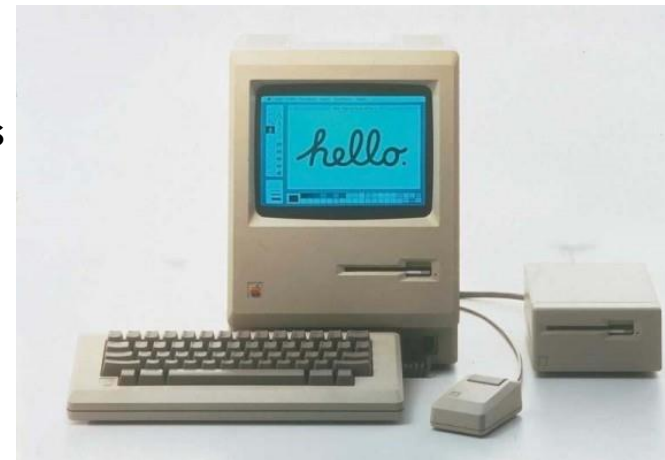
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- If technological innovation is so important, why hasn't everyone done it successfully?
- Invention is principally
 - ▣ a technical process (performing research) and
 - ▣ secondarily a business process (funding research).
- Commercialization is principally
 - ▣ a business process (investing in product development) and
 - ▣ secondarily a technical process (solving engineering problems).
- Thus, to understand the whole of innovation, one needs to understand:
 - ▣ how engineers and scientists think and
 - ▣ how marketing, production, and financial managers think.

Case Study: Altos PC System

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- ❑ In the 60's, Xerox built Palo Alto Research Center (PARC) to pioneer new computational ideas for the Xerox's strategic technical vision of a “ paperless office. ”
- ❑ Early 80's, Xerox invented a PC (Altos)— with windows, icons, mouse, object-oriented operating system, networked, and laser-printing.
- ❑ Ten years before Macintosh (Jobs stole the idea in a visit and designed it for Mac)
- ❑ Instead of Altos, Xerox focused on Star Workstation (word processor).
- ❑ Xerox lost its opportunity to capture the new emerging personal computer market. Xerox might have become the future Microsoft and Intel combined.
- ❑ Failure of a manager with a short-term, money-oriented mind.



Case Study: AT&T

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□ Lesson to be learned:

The long - term challenge of innovative high - tech companies is to keep innovative strategy going in a corporation through generations of leadership — in successive CEOs.

- Another example: AT & T established a research lab, Bell Laboratories, which made major inventions, including transistor in the 1940s.
- In the 1960s it invented the basic concepts of cellular phone systems, but did not commercialize it.
- They divided their fixed-line phone business between one long-distance phone company (AT&T) and several regional local-phone services. The regional phone services thrived, but long-distance AT&T shrank.
- Eventually, AT&T went bankrupt.
- But two of the local phone services looked ahead and established cellular phone services as Verizon and Cingular. Then Cingular bought out the bankrupt AT&T
- Can you give any other examples?

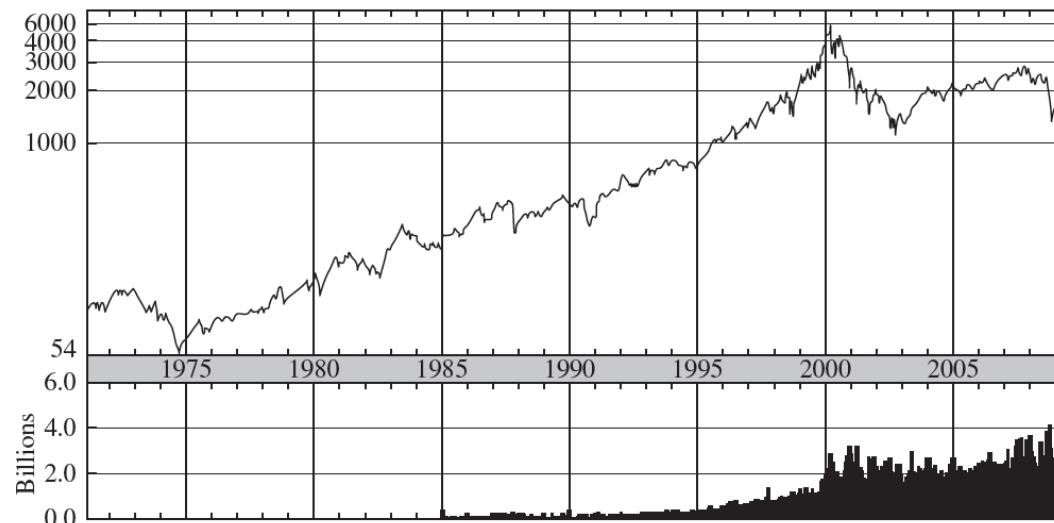
Economic Impact of Innovation

Case Study: US Dot.com Stock Bubble of the 1990s

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- In the 1990s, the rapid growth of the Internet was exciting.
- In 1996 in the United States, 14% of the population used the Internet, 22% in 1997, 31% in 1998, 38% in 1999, and 44% in 2000
- It was believed, Internet was creating a “new economy”, just market growth mattered
- But in the year 2000 this stock bubble burst. The “new economy” fell back to the principles of the old economy, which require profitable businesses.
- The Internet stock bubble was just one of many examples of excessive *financial enthusiasm* about technological innovation.

NAS/NMS compsite (Nasdaq stock
as of 22-May-2009)



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Lessons to be learned from Dot.com Bubble

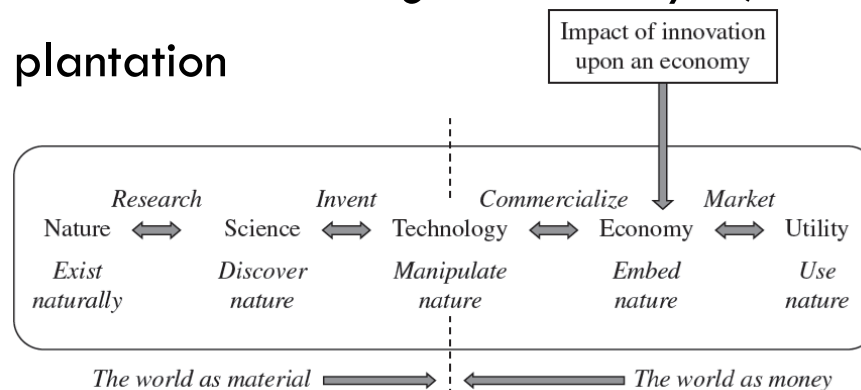
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- ❑ Scientific research provides the knowledge base for the invention of new basic technologies.
- ❑ New basic technologies create new economic opportunities.
- ❑ The path to wealth in economic opportunities is often rocky.
- ❑ However, rocky the entrepreneurial path, economic development from technological innovation does become a permanent feature of societal structures — for example, despite that stock bubble, the Internet and electronic commerce was there to stay.
- ❑ Technological innovation and economic development is neither simple nor inevitable.
- ❑ If progress in technology is to occur and be successfully implemented as a business opportunity, then technological innovation needs to be carefully managed.

Innovation and Economy

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- The dot.com bubble was based on financial estimates of the impacts of the discontinuous innovation of the Internet — a **radical** innovation.
- This pattern of radical innovation stimulating financial investments and economic growth is a basic pattern in the history of modern economies.
- Nikolai Kondratiev asked the question: How was capitalism in England periodically renewed and overall expanding? Answer: *technology*.
- He plotted a correlation between times of basic innovation to times of economic expansion. Overall, the capitalistic economies were expanding rather than contracting because of periodic innovations of new technologies.
- This economic idea is now called a *long economic cycle*, or a *Kondratiev wave*.
- E.g. Kiwi and onion plantation



Economic Long Waves

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- Economic innovations can be of five kinds:
 - ▣ The introduction of a new good (product or service or new quality in a good) to a consumer (e.g., telephone, radio, airplanes, automobiles, plastics, computers, etc.),
 - ▣ The introduction of a new method of production of a good (e.g., new semiconductor chip production processes)
 - ▣ The opening of a new market to the sales of a good (e.g., e - commerce by means of the Internet)
 - ▣ The obtaining of a new source of supply (inventing or finding or developing new material or energy sources) (e.g., seismic techniques for discovering oil deposits or horizontal drilling techniques)
 - ▣ The implementation of a new form of organization in a business that provides a competitive advantage to the business (e.g., lean-manufacturing or Toyota Production System) (Schumpeter 1939).

New Technology Industries and Early Economic Expansion in Industrialization

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1770 – 1800

The beginning of the Industrial Revolution in England and next in Europe was based on the new technologies of steam - engine power, coke - fueled steel production, and textile machinery factories.

1830 – 1850

A second acceleration of the European Industrial Revolution was based on the innovation of the new technologies of railroads, steamships, telegraph, and coal - gas lighting.

1870 – 1895

Contributions to a third wave of economic expansion were made by innovations of new technologies in electrical light and power, telephone, and chemical dyes and petroleum production.

1895 – 1930

A fourth wave of economic expansion in both Europe and North America was based on innovations of new technologies in automobiles, airplanes, radio, and plastic materials.

Now, the economic contractions...

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1800 – 1830

Temporary excess production capacity in iron production, steam engine production, and textile production increased economic competition and drove prices down for an economic recession.

1850 – 1870

excessive investments in the new industries of railroads, steamships, and telegraph industries

1913

The third economic expansion from 1893 – 1913 was interrupted by the First World War in Europe.

1935

Then the economic expansion was renewed in North America and Japan, only to end in a worldwide depression — due, in part, to a collapse in the stock market in the United States and excessive inflation in Germany. The global depression did not end in several countries until military production in their economies restarted their industries — for weapons production.

Back to Kondratiev long wave

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1. Science discovers phenomena that can provide for a new manipulation by technological invention of nature.
2. New basic technology provides business opportunities for new industries.
3. A new high-tech industry provides rapid market expansion and economic growth.
4. As the new industry continues to improve the technology, products are improved and prices decline and the market grows toward large volume.
5. Competitors enter the growing large market, investing in more production capacity.
6. As the technology begins to mature, production capacity begins to exceed market demand, triggering price cuts.
7. Excess capacity and lower prices cut margins and increase business failures and raise unemployment.
8. Turmoil in financial markets may turn recession into depression.
9. New science and new basic technologies may provide the basis for a new economic expansion.

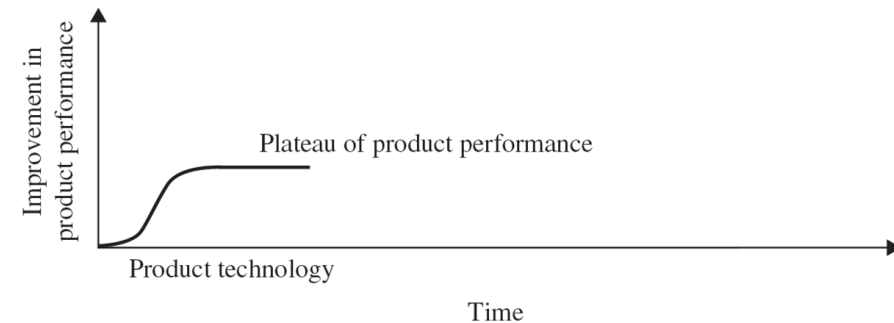
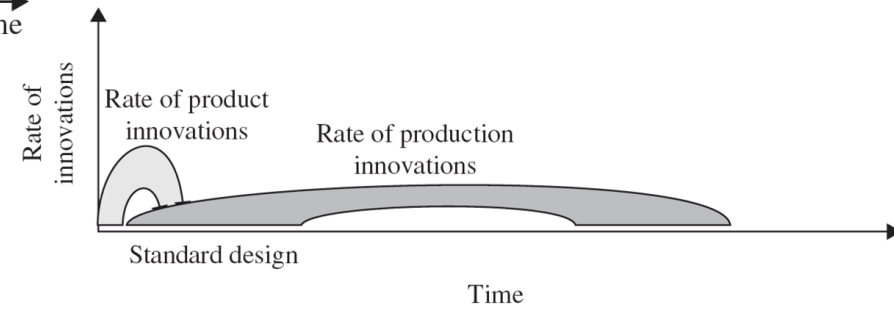
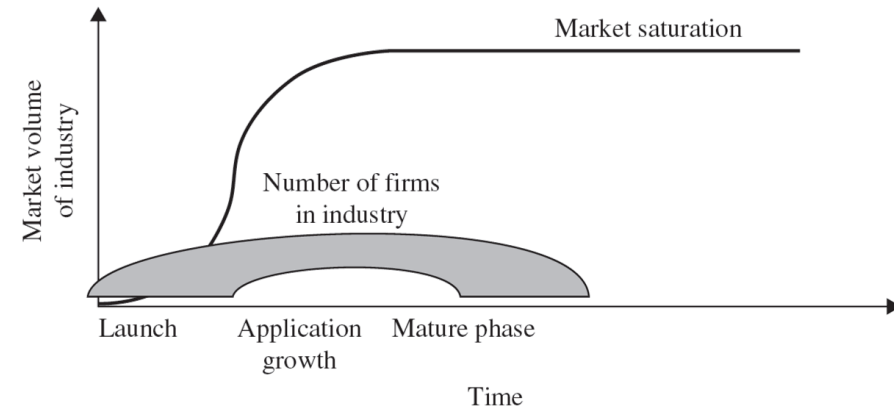
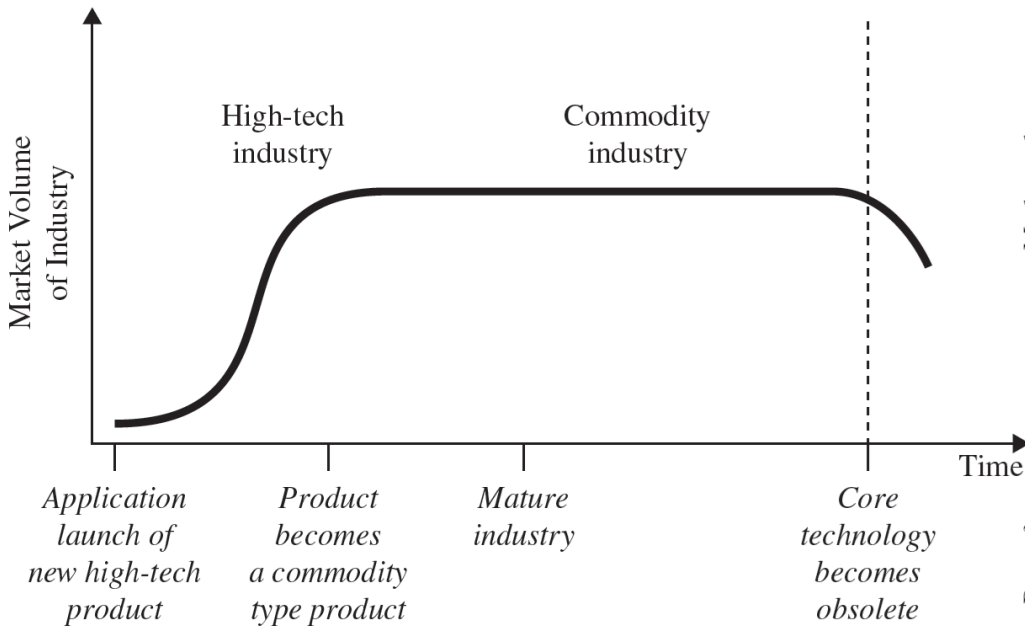
Case Study: US Auto Industry

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- The auto industry was created by the radical innovation of putting an engine onto the bicycle technology.
- J. Frank Duryea made and sold thirteen identical cars in Springfield, Massachusetts.
- In 1902, a gasoline-powered car defeated electric and steam cars at a racetrack in Chicago, establishing the dominance of the gasoline engine.
- Ford had in mind a large market — a car for people living on farms (50%).
- His commercial strategy was price and his technical strategy was durability.
- The key to his technical innovation would be in the weight and strength of the chassis of the automobile structure.
- It was a technological breakthrough that allowed Ford to imagine an innovative new product design: In 1905 he saw a French automobile wrecked in a smash - up. Looking over the wreck, he picked up a valve stem, very light and tough . . . it proved to be a French steel with vanadium alloy.
- Result: the overall weight of the **model T** was about half that of existing automobiles.
- Ford maintained about a 50 percent market share through 1924
- Take-home message: Performance, timing, market, price are the four factors for commercial success in innovation.

Industrial Life Cycles and Dynamics

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Industrial Standards

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- In a new industry, a product-design standard defines the standard features, configuration, and performance of a **product line** in a new industry.
- A product-design **standard** is necessary for the high-volume growth of a new market around that product.
- Sometimes design standards arise not from an innovative product but from a deliberate act of cooperation between industry and government to set safety standards.
- Do you remember how long it took and how complex it was for Turkey to start the 3G era?

First movers

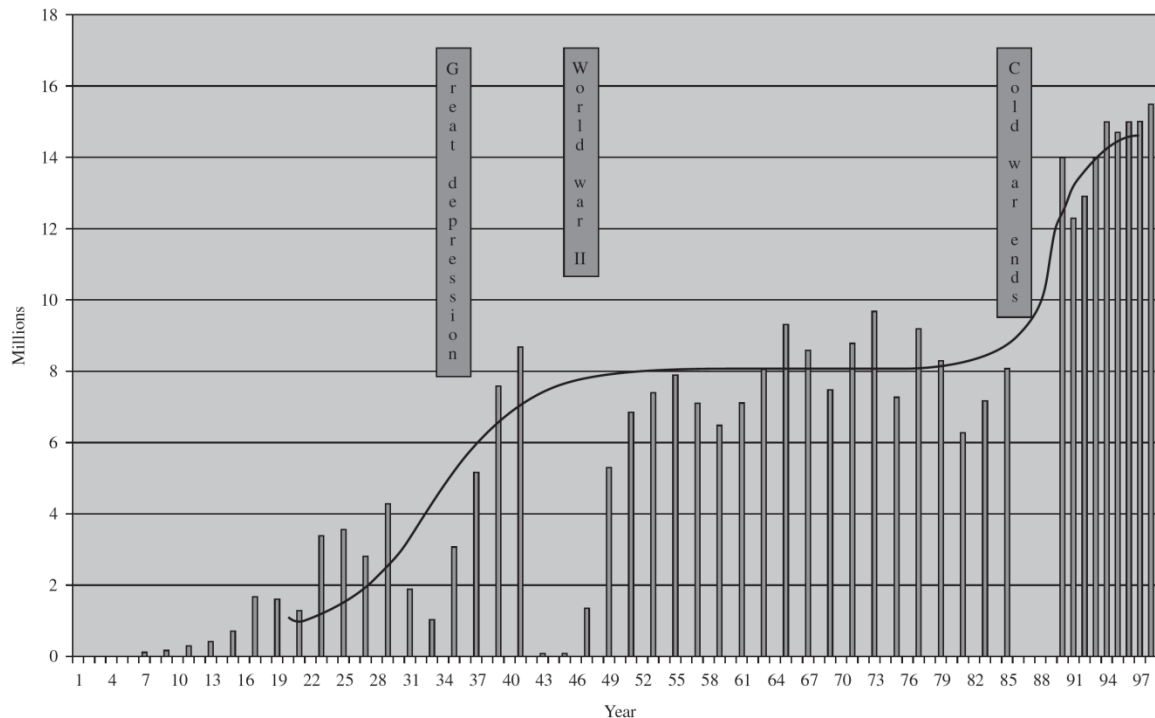
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- In a new-technology industry, a first-mover firm is the first to complete its national business system to gain economic advantages of scale and scope.
- The necessary investments for a firm to become a first mover in a new industry are:
 - ▣ Investments in advancing technology
 - ▣ Investments in large-scale production capacity
 - ▣ Investments in national (and international) distribution capability
 - ▣ Investments in developing management talent to grow the new industry
- What are the advantages and disadvantages of a first mover company?
- How about second movers? Books.com vs. Amazon.com

Case Study: US Auto firms over time

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- Management focus from 1950 turned to refining existing technology, automating production techniques, styling and reducing numbers of parts.



Japanese cars +
effect of end
of cold war +
introduction of
electronics in control

- 1923: 8 firms (GM, Ford, Chrysler, American Motors) survived, 24 failed
- 1960: 4 companies remaining, 1980: 3 remaining, 2008: all saved by the government
- Take-home message: How a company manages innovation and its product development process is critical to its competitiveness and to its long-term survival.

Any other industries with the same pattern?

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- autos,
- televisions,
- vacuum tubes,
- typewriters,
- supercomputers,
- calculators, and
- IC chips

Commodity industries

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- As the core technologies in an industry mature in performance, products become relatively undifferentiated technically.
- Then, price and quality of the production become the primary competitive factors.
- *High-tech industries*: when the core technologies in their products and production are rapidly changing.
- *Mature (commodity) industries* : when the technologies in their products and production are no longer changing rapidly or much at all.

Commodity industries cnt'd

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- Is the car industry a commodity industry? What can revolutionize it?
- Businesses in high-tech industries can compete based on their superior technical performance of product, whereas businesses in commodity industries can only compete on price and quality.
- The profit margin for any firm's product lines are determined by two conditions:
 - ▣ The internal conditions consist of the efficiency of the firm and the strategy of management.
 - ▣ The external conditions are the balance of supply to demand in the industry.
 - the number of competitors,
 - how rapidly technology is changing, and
 - how rapidly the market is growing.
- For all industries, there are two different business strategies over time, due to technological innovation: first a high-tech product strategy and later a commodity product strategy.