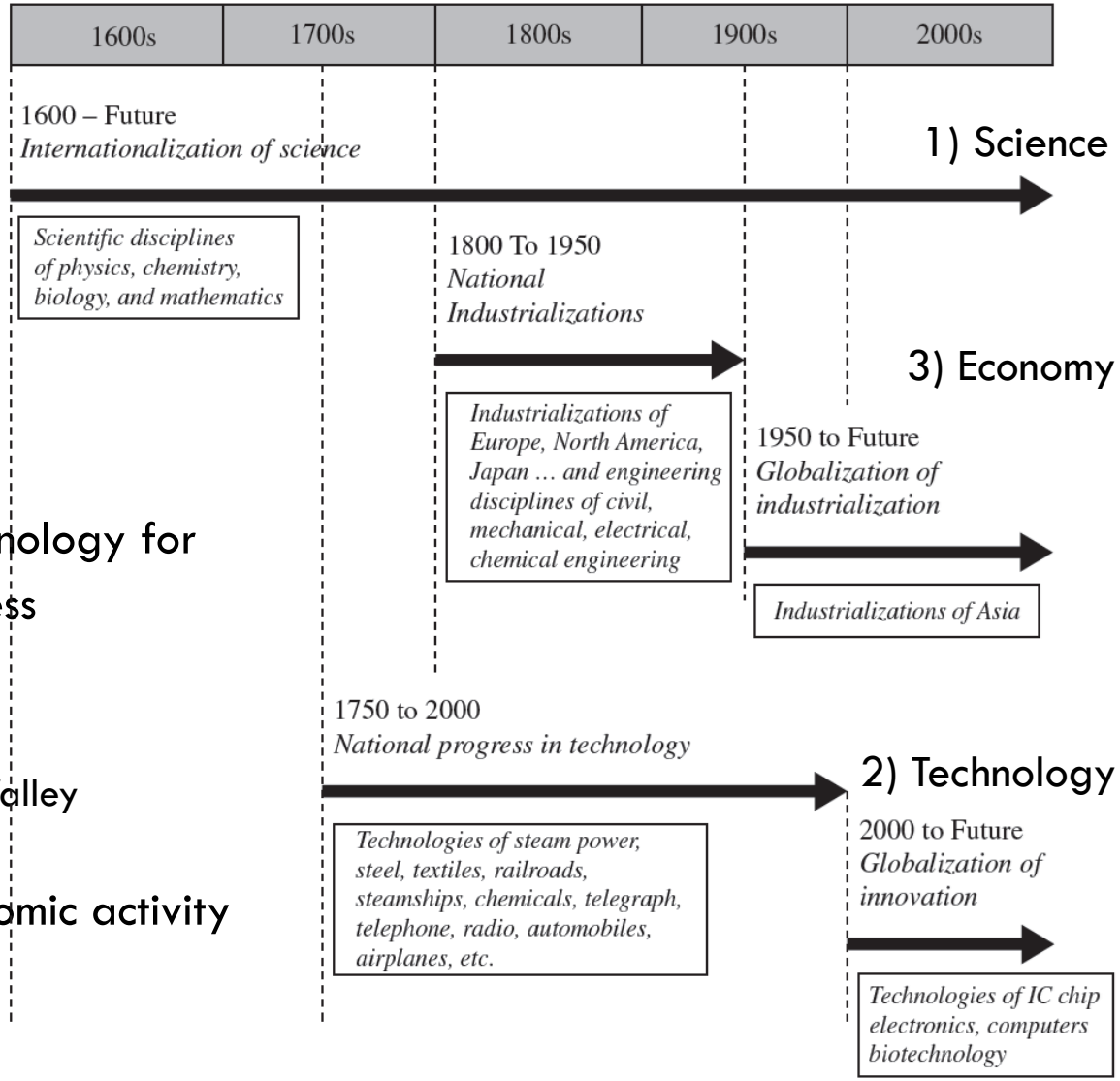
Timeline of events

1

- Gunpowder + printing press
- Invented in China
- Innovated in Europe
- Newton: physics+math
- Industrialization trends
  - (1765 – 1865) — Europe
  - (1865 – 1965) — North America
  - (1965 – 2065) — Asia
- Appreciation of science and technology for international economic competitiveness
- Strategic collaboration between academia and high-tech companies
  - Stanford and UCBerkeley: Silicon Valley
  - Singapore, Taiwan, South Korea...
- Global trade = 26% of all economic activity

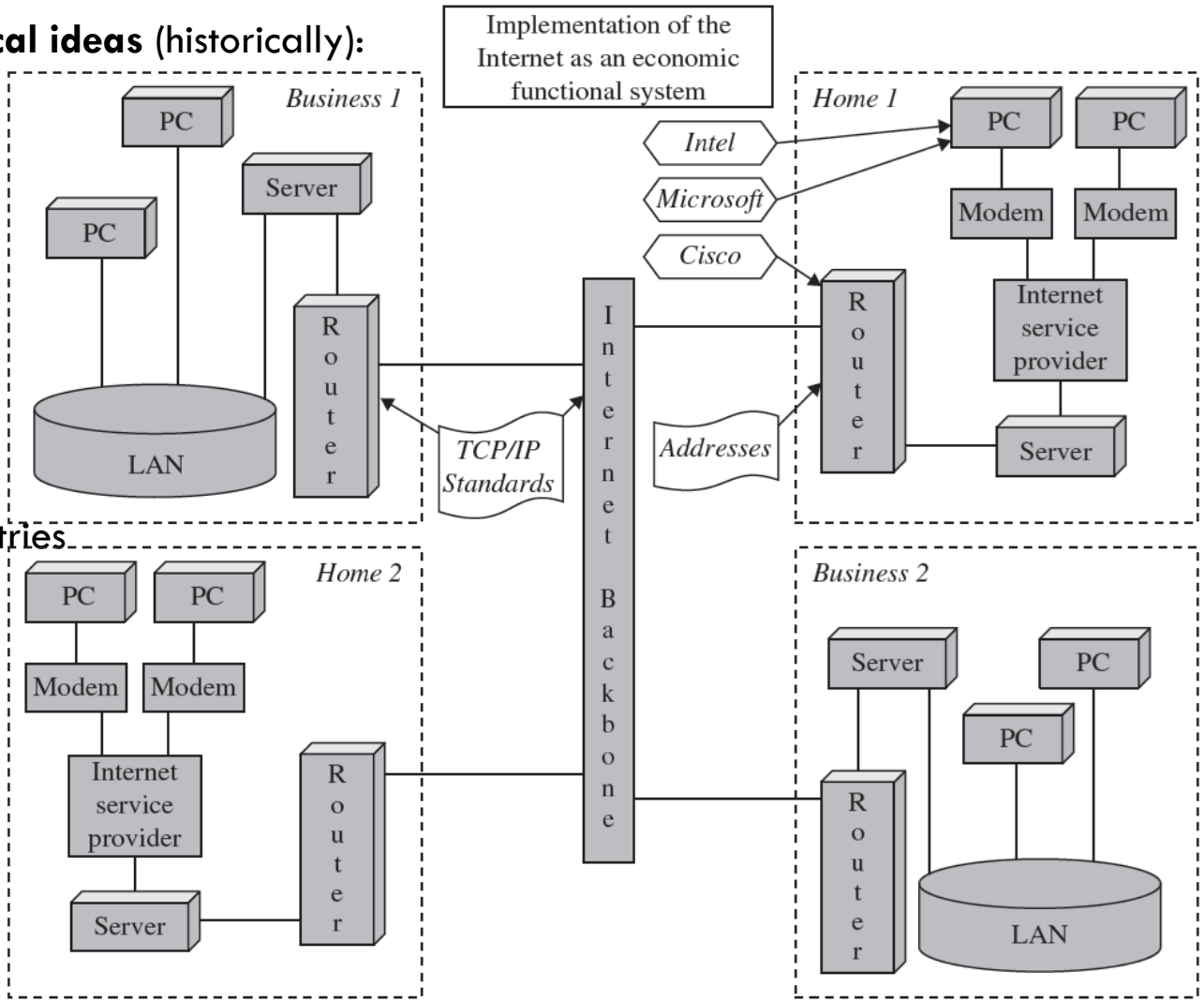


Always keep in mind: Key factors in globally effective industrialization

- political forms
- national and industrial infrastructures
  - police and judicial systems
  - public health and medical systems
  - energy systems
  - transportation systems
  - communication systems
- domestic markets
- firm strategies

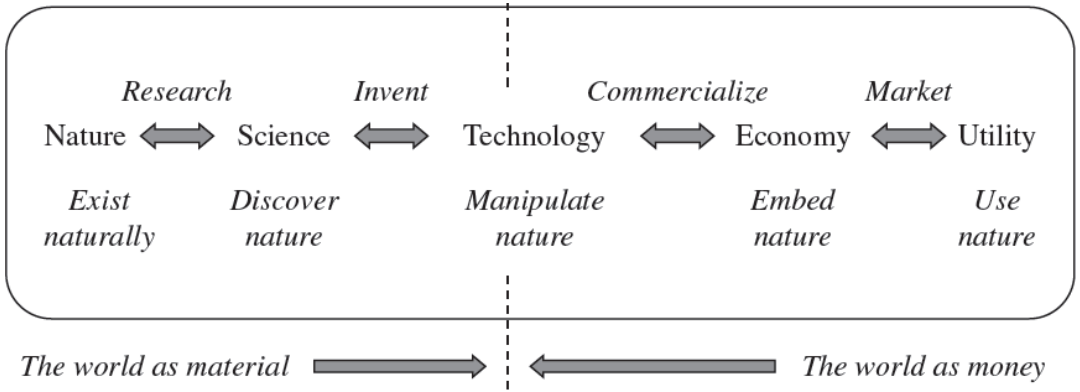
Case Study: (Macro-)Innovation of the Internet (~1960s-today)

- Two important components for an innovation
- Required invention of **technical ideas** (historically):
  - PC-PC comm.
  - Packet-switching
  - Standards, protocols
  - Routing
  - HTML
  - WWW
  - Browser
  - Search Engine
  - Web page publication
- Growth of **commercial** industries
  - PC's
  - Microproc.
  - OS
  - Modems
  - ISPs
  - Server+router
  - LAN, WAN
  - Backbones
  - Search services, etc.



Innovation Process - Overview

- **Nature**: Totality of the essential qualities of the observable phenomena of the universe. (Material, social, biological, etc.)
- **Science**: Discovery and explanation of nature
  - Knowledge about nature – what it is (discovery) and how it operates (expl.) - is gained by ***research***
- **Technology**: Knowledge of the manipulation of nature for human purpose
  - Scientific knowledge is used to create new technologies through the act of ***invention***
- **Economy**: Social process of the human use of nature as utility
  - Technical knowledge is embedded within a product through design. ***Commercialization*** is the act of embodying technology into the products/services/processes.



Characteristics of Innovations

- Innovations are new products, processes or services aimed to be **commercialized**.
- Innovations can be **offered in the market** (products or services) or applied **within a firm** (mainly as processes).
- Innovations result in a **considerable benefit** or **increase of efficiency** (leap in progress); this distinguishes them from improvements.
- Innovations generate substantial **benefits for the users**.
- Within innovations we differentiate between **incremental** and **radical** innovations. Radical innovations are breakthroughs with a major impact on production and application patterns. (i.e. drive by wire, biodegradable packages)
- Innovations include **high risks**.
- Innovations need **long time** to ripe and enter the market.
- The emergence of innovations is in most cases a **complex process**.

Case Study: (Micro-)Innovation of Google Inc.

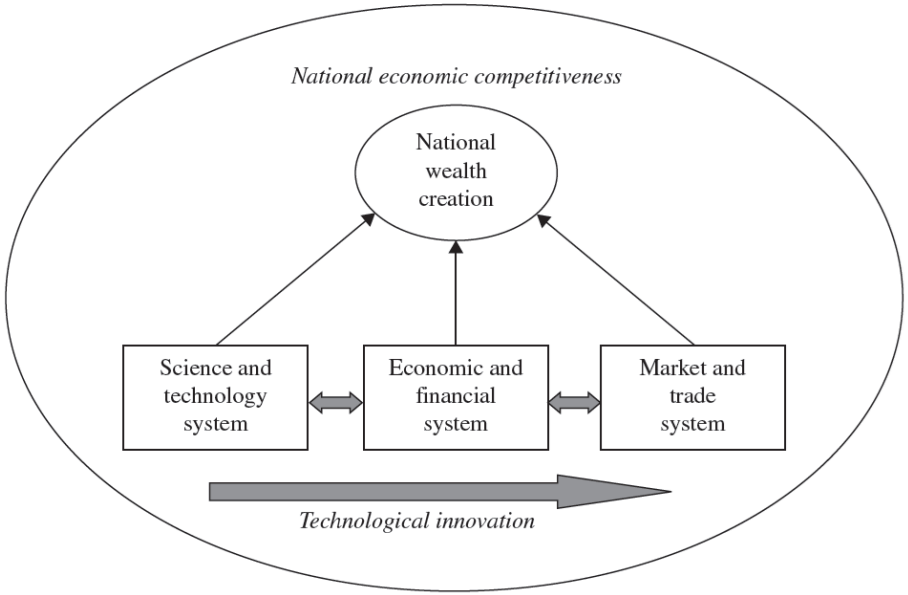
- The company used the **macro-level technology** of the Internet to begin a new business in the **micro-level technology** of a search engine.
- Founded in 1998 by Sergey Brin and Larry Page (PhD students in Stanford Uni.)
- Idea: The importance of the page is measured by the number of links pointing to it.
- Licensing at the university
- Spin-off company
- Funded by Sun Microsystems ($100,000)
- How to earn money?
- By 2005, advertising revenues: $6 bln. (98.8% of all)
- It started by licensing its «software», but later became an advertising company.
- Compared to Yahoo! (first search engine), accuracy, speed, ease of use, and objectivity was superior.
- It also charged the advertisers not on view but only on click-throughs.
- Business model: Provide values: (1) search value to its users (market base), (2) sales value to its advertisers (Google's customers)
- Always in search of new services → Improved brand name

Technology and Wealth

- Technological innovation is commercialized in economic systems to add value to markets and to international trade.
- Technological innovation provides a competitive advantage for exports and for the businesses in a nation, thus contributing to wealth creation.
- To create wealth, two stages are necessary in innovation:

(1) inventing new technology and

(2) commercializing new technology in high-tech products or services.



Innovations within Systems or System Products

Three types of innovations:

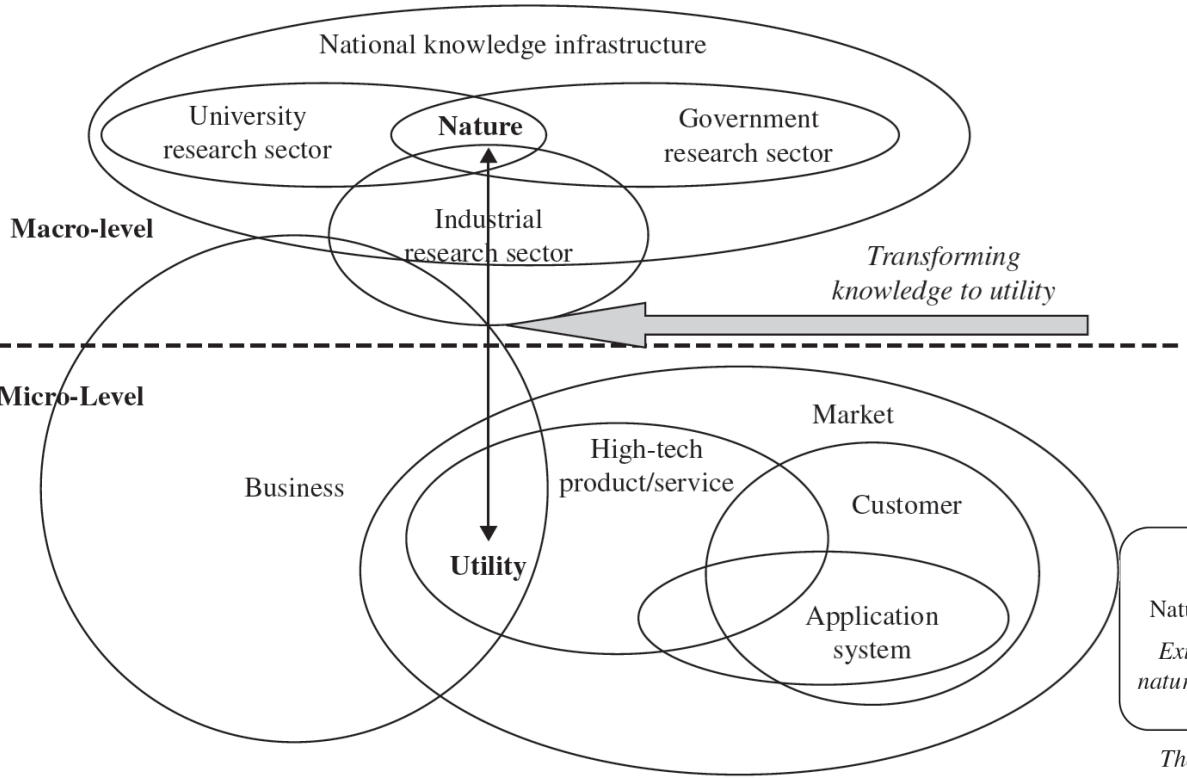
- *Radical innovation* — a basic technological innovation that establishes a new functionality (e.g., Internet, steam engine, or steamboat)
- *Incremental innovation* — a change in an existing technology system that does not alter functionality but incrementally improves performance or lowers cost (e.g., regulator on a steam engine)
- *Next-generation technology innovation* — a change in an existing technology system that does not alter functionality but dramatically improves performance, features, safety, or quality, or lowers cost — to open new applications (e.g., substitution of jet propulsion for propellers on airplanes, transistors for electron vacuum tube)
- Discuss the innovation on computers throughly 1950-201X.

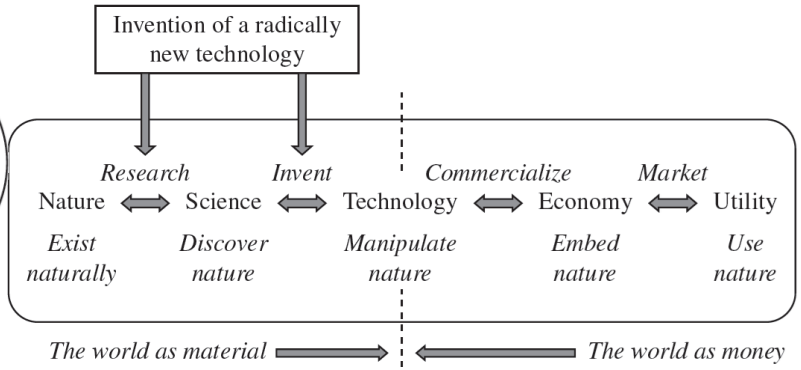
Economic Scale of Innovations

- Radical innovations occur as (1) basic new technologies or (2) next – generation technology innovations.
- Incremental innovations occur as small but significant improvements in an existing technology.
- Discontinuous technological innovation provides the competitive conditions for displacing older businesses — by beginning new businesses and growing a new industry.
- Continuous (incremental) technological innovation enables an existing firm to defend against competitors and to grow its markets.

Transforming knowledge to utility

- The process of radical innovation consists of many interactions between (1) national research sectors of university and government and industry; and between (2) high-tech firms and markets of customers.

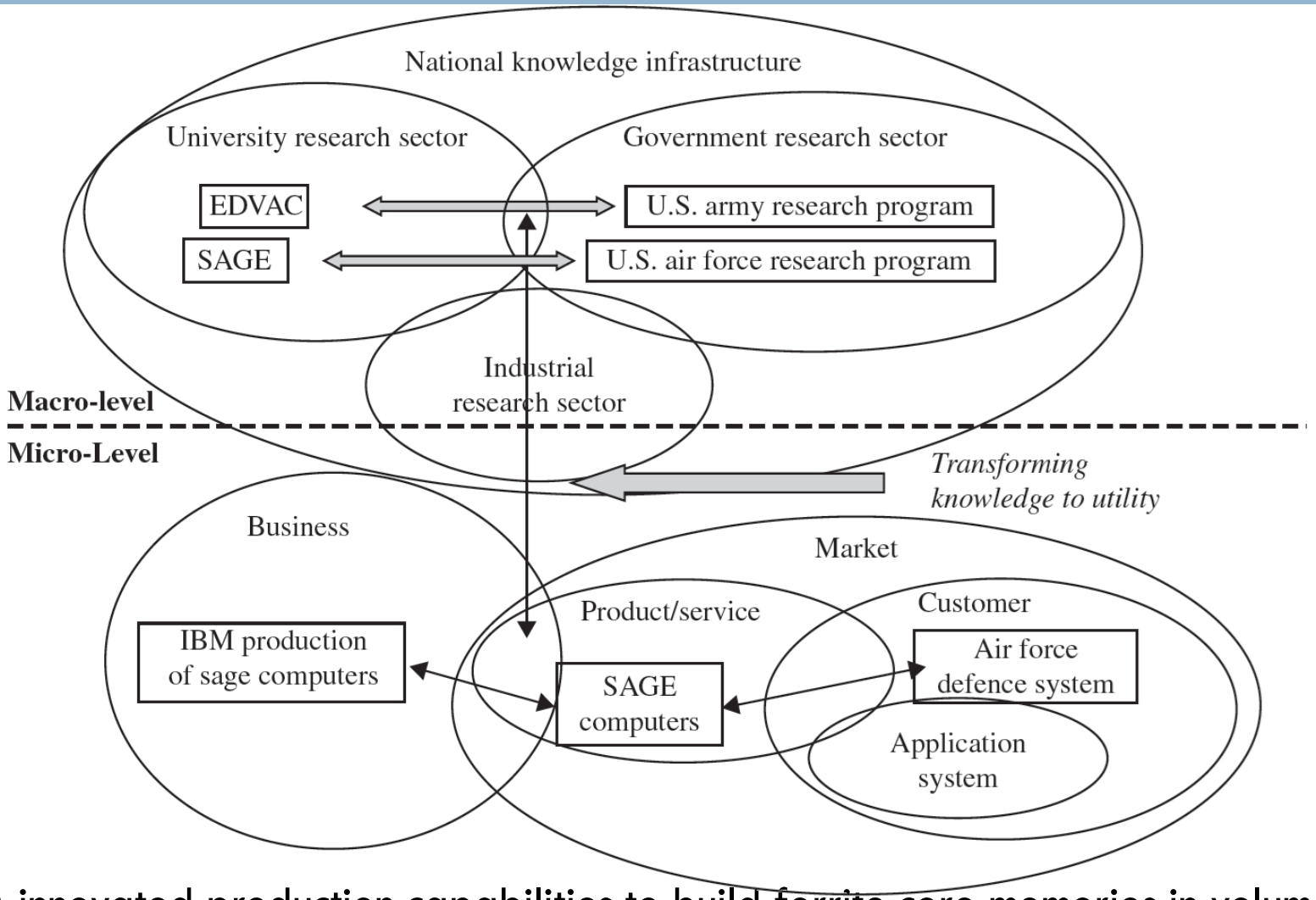




3 highlights from the national innovation system

- The technological sophistication of a high-tech business is bounded by the ***research capability*** of the industrial, university, and governmental R & D infrastructure.
- The research and technological capability of a business is known to a customer only through the **business's products**. In a high-tech business, research and technical capability that do not directly contribute to **product performance, quality, or price** are not valuable to the business because they are not seen by a customer.
- Since the satisfaction of a customer with a product depends on its performance in an application (and since a business does not directly experience the application), it is the ***application*** that is the greatest source of uncertainty about commercial success in the design of a product.

Case Study: Radical Innovation of Computer

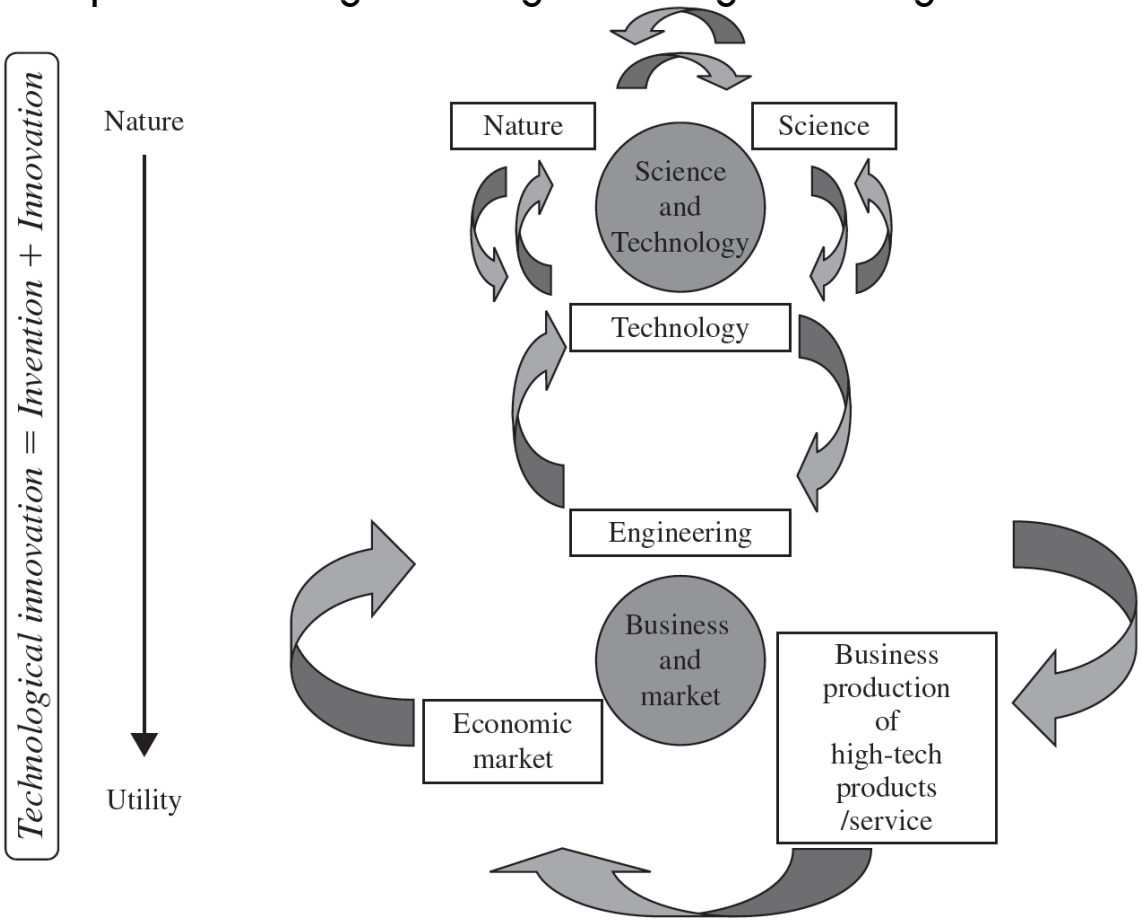


- IBM innovated production capabilities to build ferrite core memories in volume

Circular Interactions in an Innovation System

The flow of knowledge in the process of radical technological innovation is ***linear***, in that knowledge does ultimately flow from nature into utility.

Yet the infrastructure processes of generating and using knowledge are **interactive and *circular***



Performance of National Innovation Systems

- A national innovation system should have **strong research capabilities** in its **industrial sectors.**
- A national innovation system should have a **high-quality research-oriented university** sector.
- A national innovation system should have **at least one strong internationally competitive industrial or service sector.**
- A national innovation system should have a **culture of valuing high quality of performance.**
- A national innovation system should be **supported by government** policies that strongly fund appropriate R&D activities in universities and selected mission areas.
- A way to identify **cutting-edge science** (which can help surpass current technology) should be a national science and technology policy priority.
- Science and technology policy must support research for technology improvement in current industries, and research **to establish new internationally competitive industries** in new technologies.

Case Study: Innovation of Xerography

- Good example for the importance of commercialization and management challenges
- The inventor of xerography was a technical person, Chester F. Carlson, and the commercialization of xerography was accomplished by a businessperson, Joseph Wilson.
- Carlson had backgrounds in physics and chemistry of carbon and understood the market need for copying.
- Like all new inventions, it was not commercially efficient, cost-effective, or easily usable.
- **The development of a new technology usually costs a great deal of money, takes time, and requires skilled resources.**
- From 1939 to 1944, he was turned down by twenty major companies.
- Wilson was looking for new technology for his company for new products. At the time, Wilson' s main customer was Kodak, which could at any time eliminate his small business if it chose.
- Finally, all the innovative pieces for Carlson had fallen in place

— inventions, patents, R&D, commercialization. Wilson subsequently changed the name of his company to Xerox

- Take-home message: For technological innovation, two roles are always required: (1) an inventor (invention) and (2) an entrepreneur (commercialization).

Innovation Management

- What made Carlson an outstanding inventor was that he had **two kinds of skills**
  - an understanding of a technical need
  - scientific background to invent a process to accomplish the technical goal
- What made Wilson an outstanding business leader was that he had two kinds of skills
  - Technical savviness
  - Business savviness
- A technically savvy manager needs to know how to manage the business process of innovation — planning, financing and assembling a good technical team for innovation strategy.

- Innovation management means management of innovation processes.
  - setting up the internal environment and conditions for innovation processes
  - designing a frame and a standard innovation process
  - carrying out the individual innovation projects

Innovation Management

Two phases:

1. Idea management → To find the right product (project) (effectivity)
2. Project management → To develop the product efficiently (to achieve the goals, targeted costs and schedule)

Thus, to understand the whole of innovation, one needs to understand: (1) how engineers and scientists think and (2) how marketing, production, and financial managers think.

Effectivity and Efficiency

- To be successful with innovations effectivity and efficiency have to be ensured.

Effectivity: To do the right things.

Efficiency: To do the right things in a good effort/result relation

- Efficiently organized innovation processes only pay out, when the strategically right topics and projects have been chosen (effectivity).

Departments at a business for commercialization of a radical innovation

Within a business at this micro-level, there are several business functions for operating the business and innovating new products/services:

- Hard-good businesses require a ***production function*** for producing a hardware product; this is usually organized as a factory, or production unit.
- Businesses require a ***marketing function*** of selling their products/services; and this is usually organized as a marketing department.
- Businesses require a ***finance function*** of controlling the finances of the business operation; and this is usually organized as a finance department.
- Businesses require an ***administration function*** for managing the personnel and operations in a business; and this is usually organized as an administration department.
- Businesses now require an ***information function*** to acquire and manage information and communication technologies for business operations, and this is usually organized as an information technology (IT) department.
- Businesses require an ***engineering function*** for the capability to design new products and services; and this is usually organized as an engineering department.
- High-tech businesses also require a ***research function*** for the capability of inventing and developing new technology, and this is usually organized as a corporate research laboratory.

Case Study: How DuPont invented Nylon

- **DuPont was a small explosives manufacturer and had in this century become a diversified chemical company.**
- Charles Stine listed four reasons why DuPont should spend its money on this new kind of industrial chemical research
  - The scientific prestige and public relations value to be gained through the presentation and publishing of papers.
  - Interesting scientific research would improve morale in the department and make the recruiting of Ph.D. chemists easier.
  - The results of DuPont's pure science work could be used to trade for information about research in other institutions.
  - Pure science might give rise to practical applications.
- Beginning in April 1927, fundamental research in DuPont's new research center was to receive $25,000 a month. (Microsoft monthly R&D budget $ 1bln)
- Stine received $115,000 to build a new laboratory for fundamental research.
- With the new building under construction, Stine began to look for twenty-five scientists.
- A central management responsibility of laboratory director is the establishment of proper procedures by which scientists are selected as research project leaders.
- Nylon= artificial silk: chaining smaller molecules into longer chains of molecules synthetically
- Finally, nylons went on sale nationally in May 1940, and the demand was overwhelming.
- Convinced that nylon would prove superior to silk, DuPont initially set its price 10% higher than that of silk

Tablo 142: Ar-Ge Harcamalarının GSYH'ya Oranı Açısından ilk 10 Ülke ve Türkiye

Sıralama	Ülke	Ar-Ge Harcamasının GSYH'ye Oranı
1	İsrail (2011)	4,39
2	Finlandiya (2011)	3,78
3	Güney Kore (2010)	3,74
4	İsveç (2011)	3,37
5	Japonya (2010)	3,26
6	Danimarka (2011)	3,09
7	İsviçre (2008)	2,87
8	Almanya (2011)	2,84
9	Avusturya (2012)	2,79
10	ABD (2011)	2,77
38	Türkiye (2010)	0,84

Kaynak: WIPO, Global Innovation Index 2012, Sayfa 298

2011 Patent Sayıları

SIRA	ÜLKE	GSYH 2011 (US$ trilyon)	PATENT BAŞVURU 2011 (*)	VERİLEN PATENTLER 2011 (**)
1	ABD	15.09	503.582	224.505
2	Çin	7.29	526.412	172.113
3	Japonya	5.86	342.610	238.323
4	Almanya	3.57	59.444	11.789
5	Fransa	2.77	16.754	10.213
6	İngiltere	2.41	22.259	7.173
7	Brezilya	2.49	22.686	3.251
8	İtalya	2.19	9.721	6.380
9	Rusya	1.85	41.414	29.999
10	Kanada	1.73	35.111	20.762
11	Hindistan	1.67	42.291	5.168
12	İspanya	1.49	3.626	2.812
13	Meksika	1.15	14.055	11.485
14	Güney Kore	1.11	178.924	94.729
15	Türkiye	0.778	4.113	803

TÜRKİYE DURUM DEĞERLENDİRMESİ

- Türkiye'de buluş faaliyeti yapan ve buluş iddiasını bir buluş bildiriminde tanımlayan kişilerin **buluşlarının patent başvurusuna ulaşım oranı yaklaşık %25** ve **patent başvurusundan patente ulaşım oranı yaklaşık %20** kadardır.

- Patent alan buluşların **ticarileşme oranı** konusunda veri bulunmamaktadır. (Bu oran, Türkiye için binde bir buçuk olarak tahmin edilmektedir) **Birleşik Devletlerde ise yaklaşık %3** kadar olup, bir yılda 200 bin patent verildiğine göre ticarileşen buluş sayısı 6 bin olarak tahmin edilmektedir.

- Konunun önemini bu sayısal değerler göstermektedir. Teknik sorunları önceden saptanmış, planlı ve programlı bir Ar-Ge faaliyeti ile ne kadar çok buluş yapılır ise alınan patent sayısı da buna paralel olarak artacaktır. Buluşların ticarileşmesi, patent korumasına bağımlı olduğu için ticarileşme şansı da o kadar artacaktır.

BİLGİSAYAR PROGRAMLARI VE YAZILIMLAR

- Bilgi toplumunun önemli unsurlarından olan «bilgisayar programları», söz konusu fikir ürünlerinden «ESERLER» içinde yorumlanmaktadır.

- Bilgisayar programları, teknik özellik içermedikleri ve sanayiye uygulanabilirlik ölçütünü taşımadıkları gerekçeleriyle «buluş ve patent» konusu dışında kabul edilmiştir. (WTO-TRIPS: Article 10)

- Computer Programs and Compilations of Data 1. Computer programs, whether in source or object code, shall be protected as library works under the Berne Convention (1971).

BİLGİSAYAR PROGRAMLARI VE YAZILIMLAR

- Birleşik Devletlerde ve Avrupa Patenti Sistemi'nde bilgisayar programlarına, bazı özel durumlarda, patent verildiği bilinmektedir.

- Ancak patent başvurusunun genellikle «Apparatus for .....» vb., olarak sunulduğu da görülmüştür.

- Bunun anlamı, «..... için cihaz» konusunda patent talep edilmektedir.