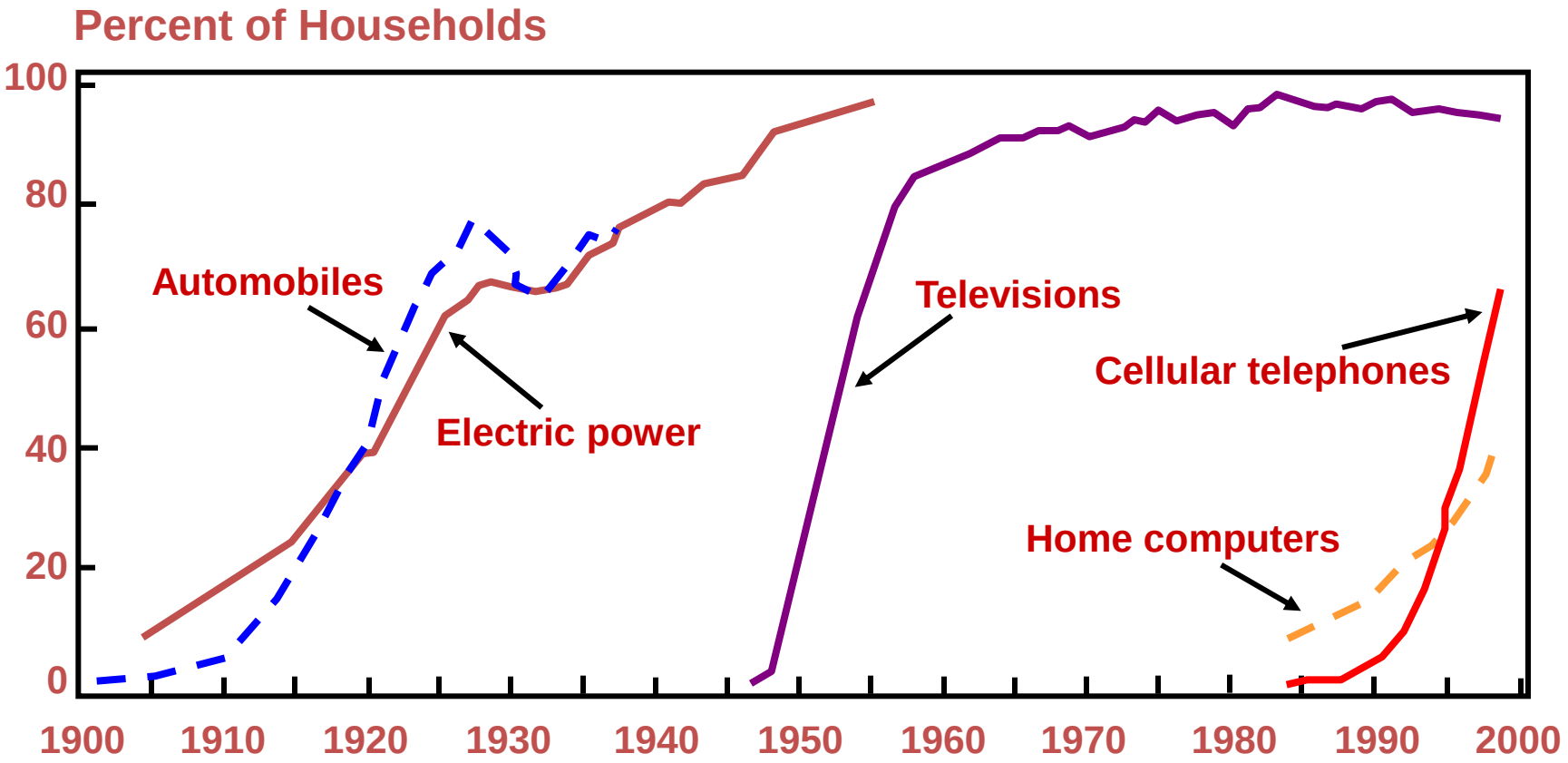
SOCIOLOGIAL DIMENSIONS OF TECHNOLOGICAL POLICIES

by

Pal TAMAS

Technology and Society [20c. US]



Household Adoption of Selected Technologies Since 1900

Source: Office of the President. 2000. *Economic Report of the President: Transmitted to the Congress, February 2000.* Washington, DC: U.S. Government Printing Office, p. 100.

Greatest Engineering Achievements of the 20th Century

- The National Academy of Engineering published a list of the 20th century's most notable engineering achievements. Some of the top achievements include:

- electrification --automobile
- airplane --water supply and distribution
  electronics --radio and television
- Computers --agricultural mechanization
- Spacecraft --household appliances
- internet; telephone --highways; imaging
- health technologies --petroleum technologies
- high-performance materials.

Defining Engineering

- “ Scientist discovers that which exists. An engineer creates that which never was”
  - » Theodore von Karman (1881-1963)

Defining Engineering

- “Engineering is that profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.” (The Accreditation Board for Engineering and Technology – ABET, 1992)
- “Engineering is the application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems.”
- “Engineering is the art of directing the great sources of power in nature for the use and the convenience of people. In its modern form engineering involves people, money, materials, machines, and energy. It is differentiated from science because it is primarily concerned with how to direct to useful and economical ends the natural phenomena which scientists discover and formulate into acceptable theories. Engineering therefore requires above all the creative imagination to innovate useful applications of natural phenomena. It seeks newer, cheaper, better means of using natural sources of energy and materials.” (Science and Technology Encyclopedia, McGraw Hill)
- Engineering is the professional art of applying science to the optimum conversion of the resources of nature to the uses of humankind. (Encyclopedia Britannica)
- Engineering is the application of science and mathematics by which the properties of matter and the sources of energy in nature are made useful to people (Merriam-Webster Dictionary)

The Intrinsic Nature of Engineering

The Broad Definition

- The engineer is one who is claimed to possess specialized knowledge, esp. as regards the treating of human problems by scientific or technical means.
- "Engineering is the professional art of applying science to the optimum conversion of natural resources to the benefit of man.“
- Engineering is the profession that puts power and materials to work for the benefit of mankind

The Intrinsic Nature of Engineering

The Broad Definition

- *Engineering is the application of science to the common purpose of life.*
- *Engineering is the art of directing the great sources of power in nature for the use and convenience of man.*
- *Engineering is the art of organizing and directing men and controlling the forces and materials of nature for the benefit of the human race.*
- *Engineering is the profession in which a knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind.*

--Engineers Council for Professional Development (1961/1979)

The Intrinsic Nature of Engineering

The Broad Definition

- *The engineer is the key figure in the* material progress of the world*. It is his engineering that makes a reality of the potential value of science by translating scientific knowledge into tools, resources, energy and labor to bring them into the service of man ... To make contributions of this kind the engineer requires the imagination to visualize the needs of society and to appreciate what is possible as well as the technological and broad social…understanding to bring his vision to reality.*

A NEW DISCIPLINE?

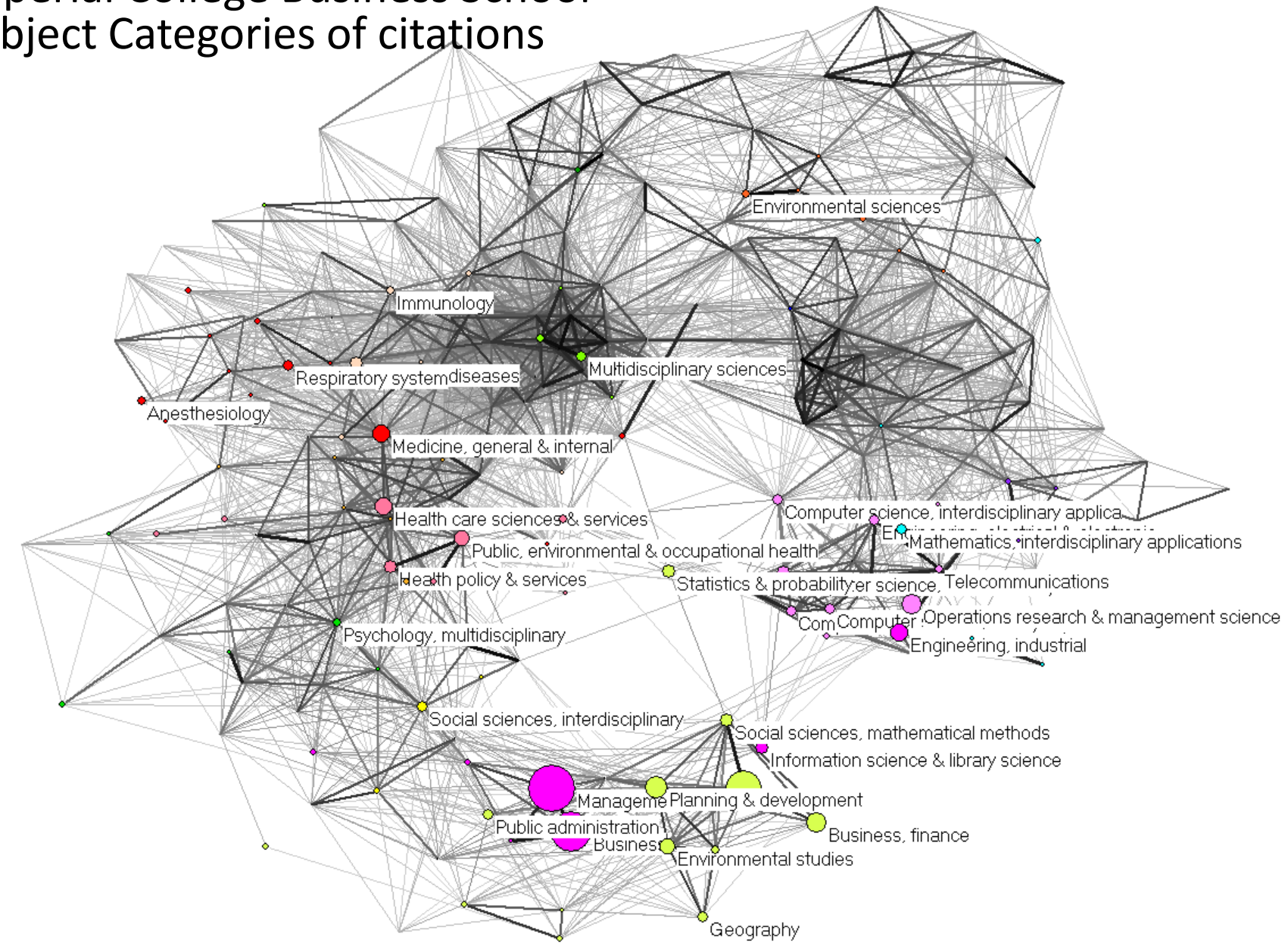
STS –SOCIAL STUDIES OF SCIENCE AND TECHNOLOGY

SCIENCTOMETRICS

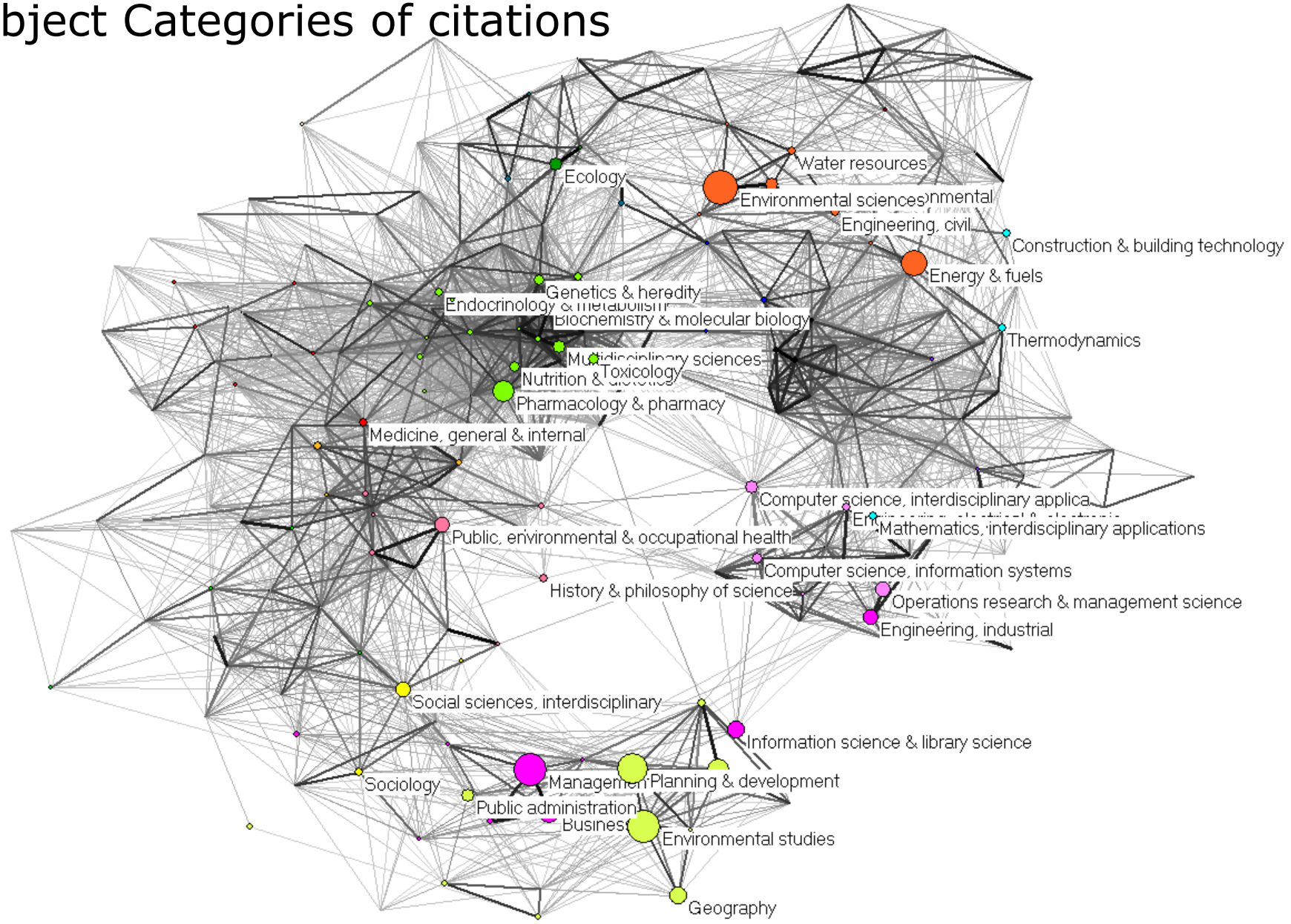
TECHNOLOGY POLICY STUDIES

INNOVATION STUDIES

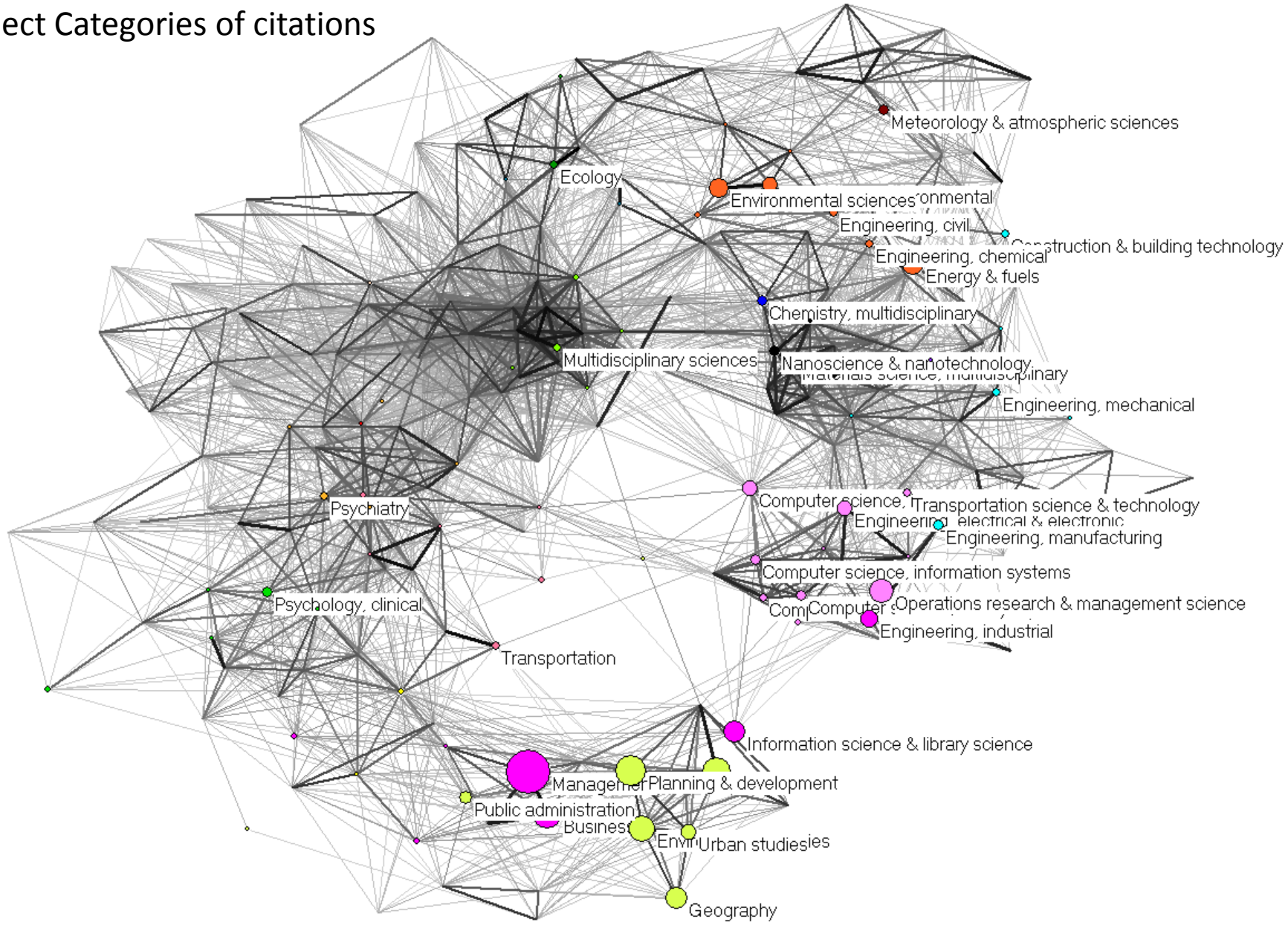
Imperial College Business School
Subject Categories of citations



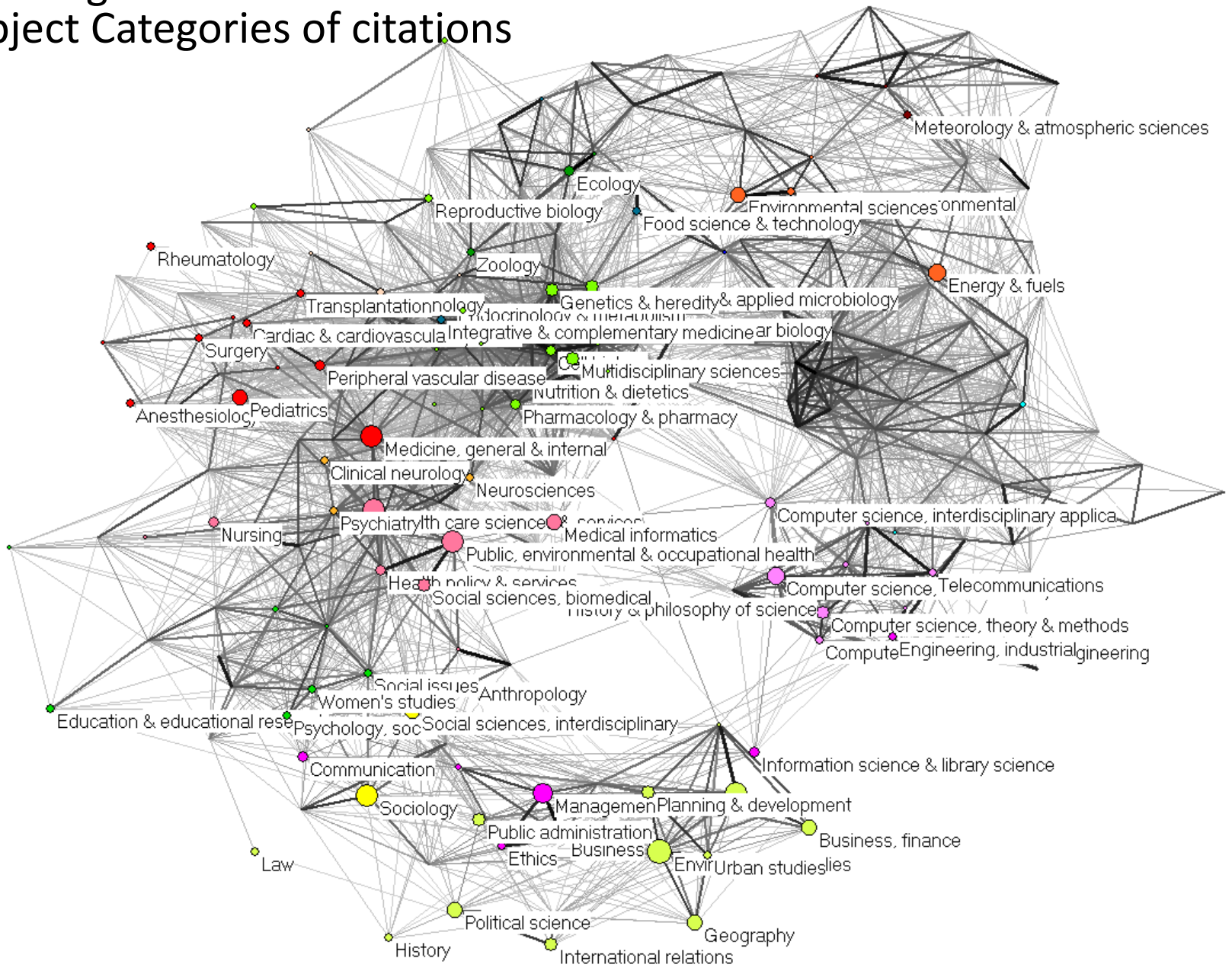
Sussex SPRU
Subject Categories of citations



Manchester MIoIR
Subject Categories of citations



Edinburgh ISSTI
Subject Categories of citations



Professionalism

WHAT IS A PROFESSIONAL?

Originally, one who professed adherence to monastic vows of a religious order.

- *a free act of commitment to a specific way of life
- *allegiance to high moral standards
- *skill, knowledge, practice of an art

WHAT IS A PROFESSIONAL?

Today, it is one who is “duly qualified” in a specific field

- *special theoretical knowledge or education
- *appropriate experience
- *knowledge and skills vital to the well-being of a large potion of society
- *Professional organization and a code of ethic
- *special social sanction

Models of Professionalism

Business Model

* professional status provides economic gain
* monopoly provides for high pay
* self-regulation avoids government regulation

MODELS OF PROFESSIONALISM

Social Contract Model

- Professionals are guardians of the public trust
- Professions are social institutions—they are organized by some act of society and are granted special powers in return for socially beneficial goods and services (Licensure)
- An implicit, unstated agreement exists between professional and society
- Society may subsidize training of professionals

The Implicit Contract Between Society and the Engineering Profession

Society agrees to:

*allow a certain autonomy
- freedom of self-regulation
- freedom to choose clients

*social status
- respect from society, titles

*high remuneration
- reward for services
- attract competent individuals

- Society grants the professions the autonomy to define their own norms of behavior and action because it values their knowledge and the discretion to use it towards some socially recognized ends
- Society gives professions and professionals special powers not granted to ordinary citizens to perform their socially defined roles

The Implicit Contract Between Society and the Engineering Profession

Professionals agree to:

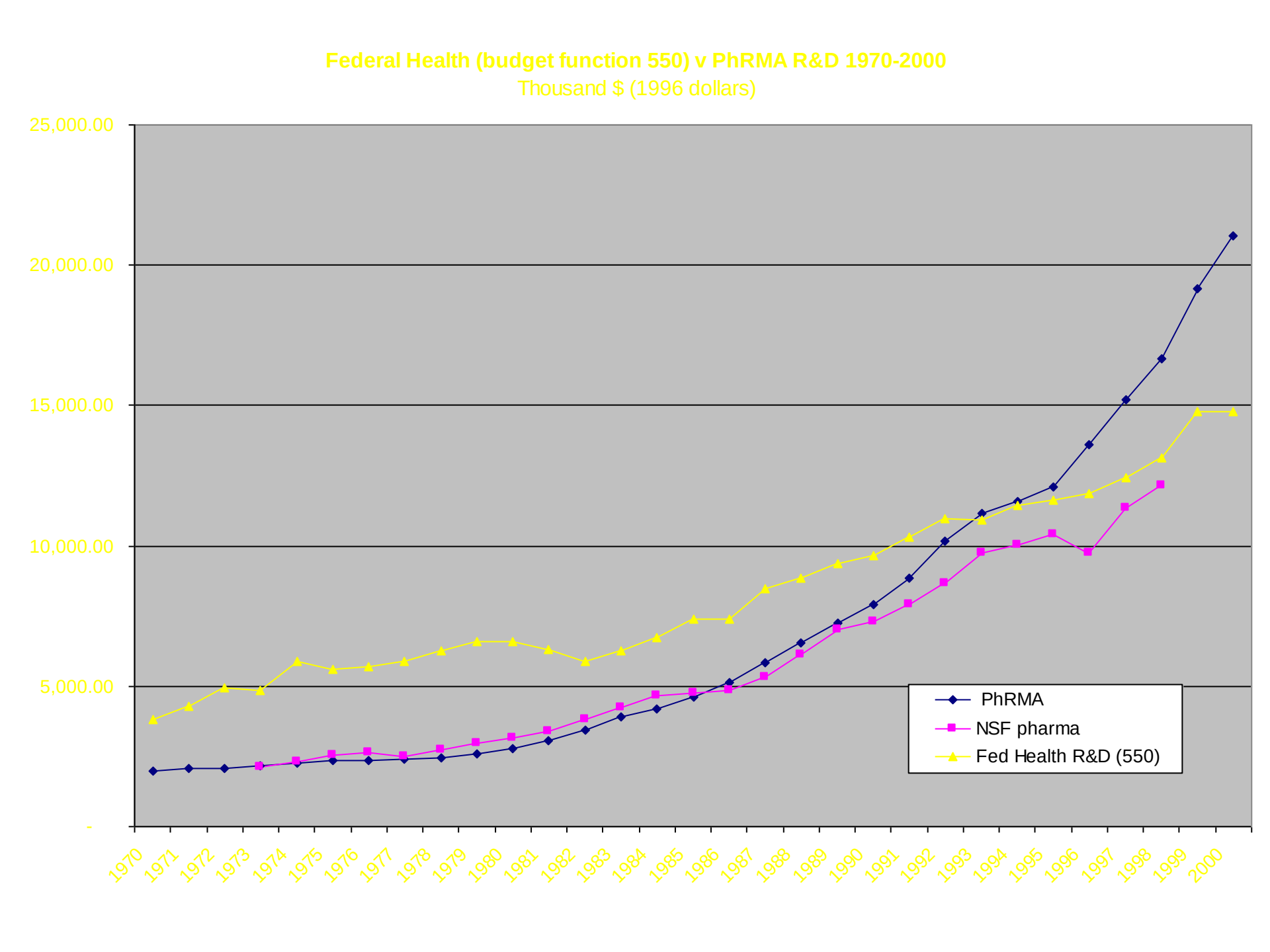
* provide a service
  - for the public well-being
  - promote public welfare, even at own expense
* self-regulation
  - enforce competence
  - enforce ethical standards

The Implicit Contract Between Society and the Engineering Profession

- Self regulation places the burden of proof collectively on the organization to ensure that individual members are technically competent to perform their duties according to high ethical standards and that engineers have genuine concern for how technology impacts society, both negatively as well as positively
- To voluntarily claim the benefits of a profession a member of that profession is obligated to follow the rules and norms of that profession—If not, they would be taking unfair advantage of a voluntary cooperative practice

Upcoming Grand Challenges?

- Big data, knowledge and information infrastructures
  - Dynamics of e-science/open science
  - Data in biomedical research
  - New business and work models
  - Digital Social Research
- The Brain programme: The next post-genomics edgy technoscience?
- ????


Federal Health (budget function 550) v PhRMA R&D 1970-2000
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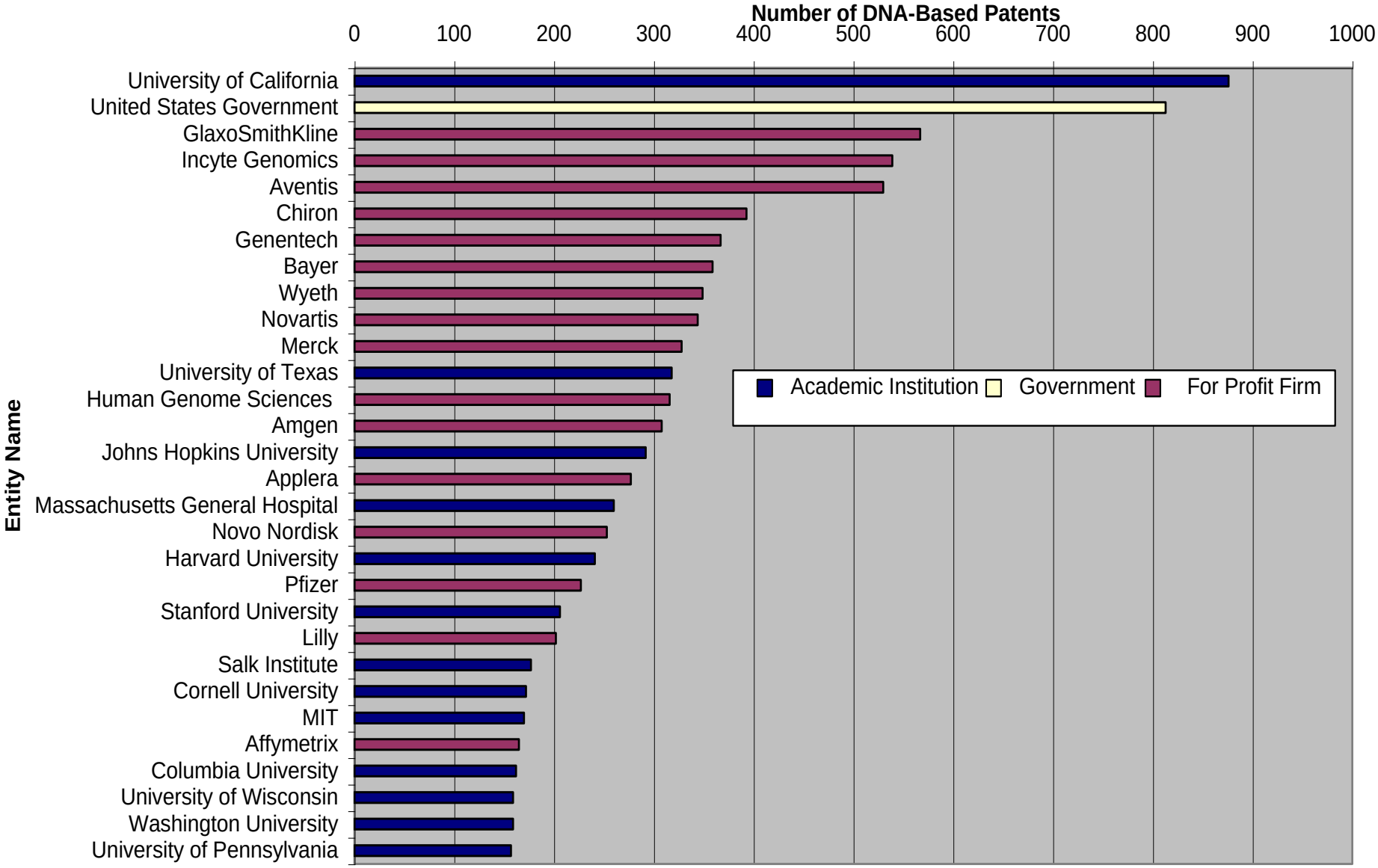
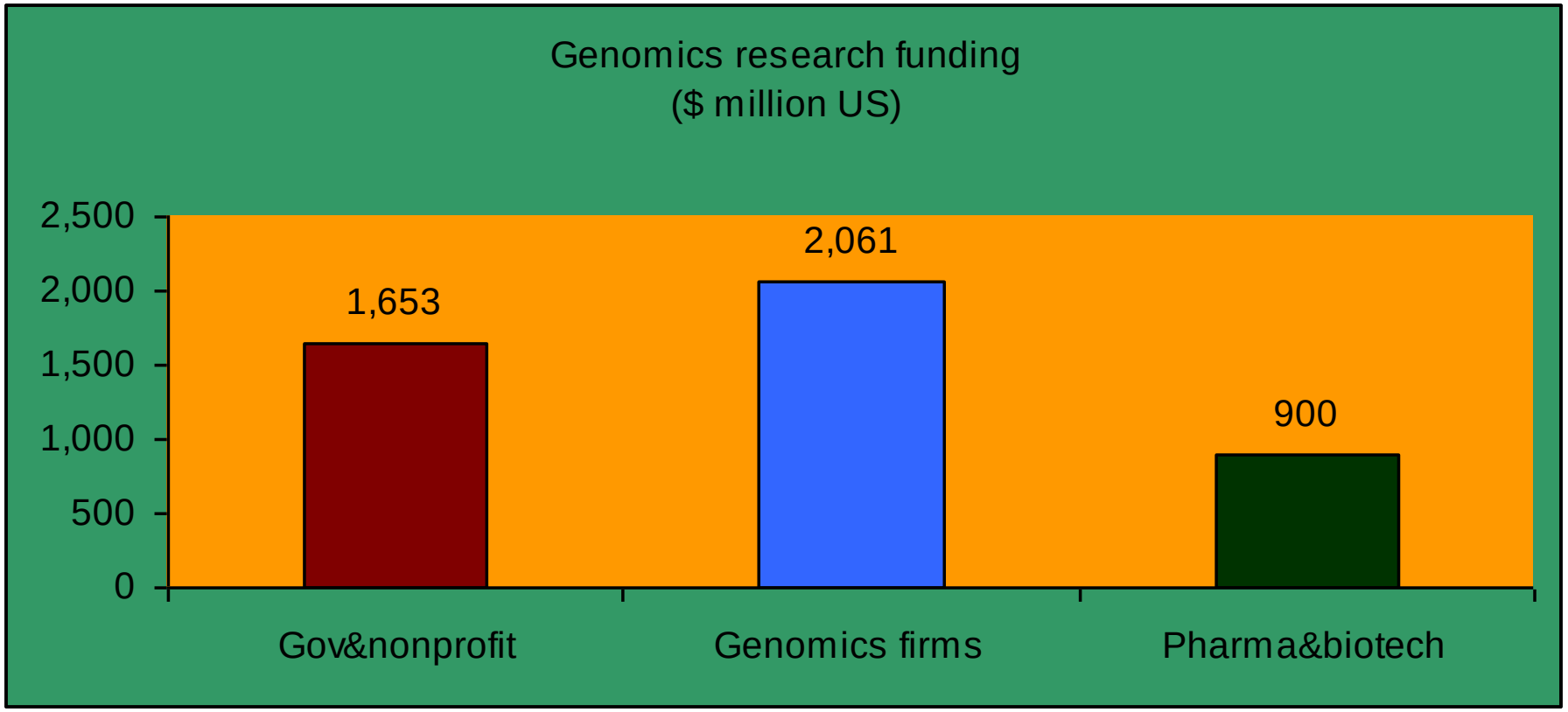
Fed Health R&D (550)

Preliminary Data about the 30 Entities Holding the Largest Numbers of DNA-Based Patents (as of 02-05-04)



This research was supported by Grant No. R03 HG02683-02, "DNA Patent Policies at Academic Institutions," from the National Human Genome Research Institute, NIH, and Grant No. DE FG 02 01ER63171, "Enhancing the DNA Patent Database," from the U.S. Department of Energy. Io Nami Wolk 03-03-04

Genomics Funding: private>public (Year 2000)

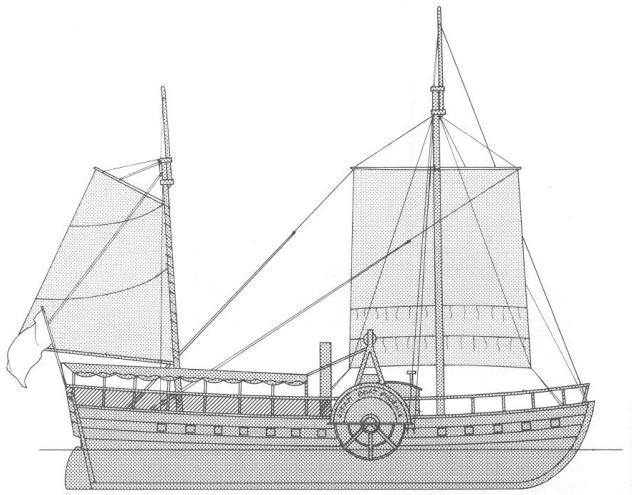


Source: World Survey of Funding for Genomics Research
Stanford in Washington Program
http://www.stanford.edu/class/siw198q/websites/genomics/

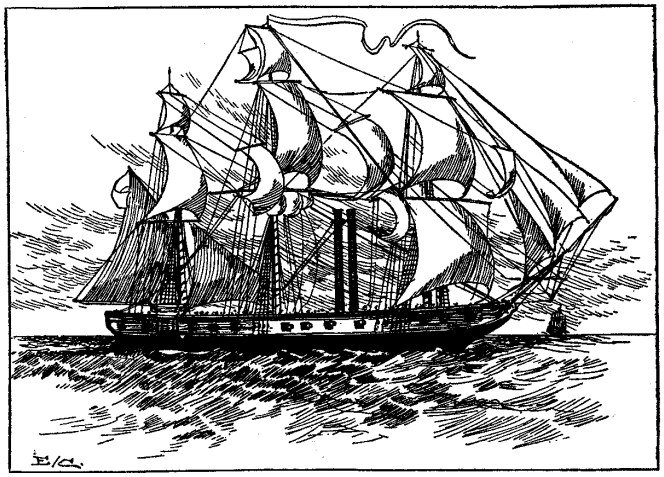
PATTERNS OF TECHNOLOGICAL CHANGE [FRANK GEELS, SPRU]

1. Add-on and hybridization
2. Fit-stretch pattern
3. Hype-disappointment cycles
4. Niche-accumulation pattern

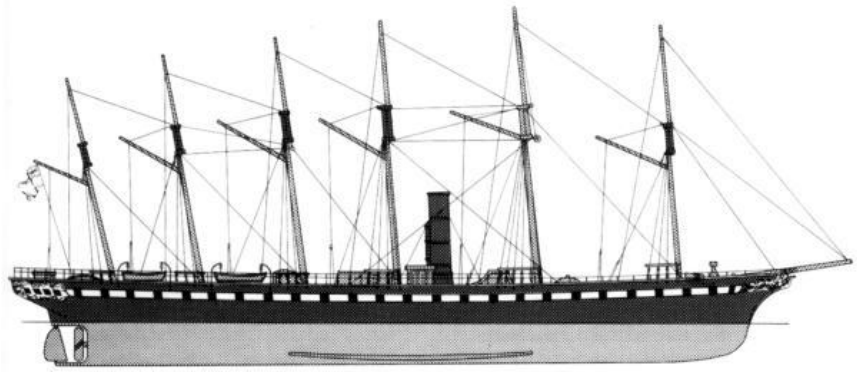
1. Add-on and hybridization



Comet (1812)



Rising Star (1822)

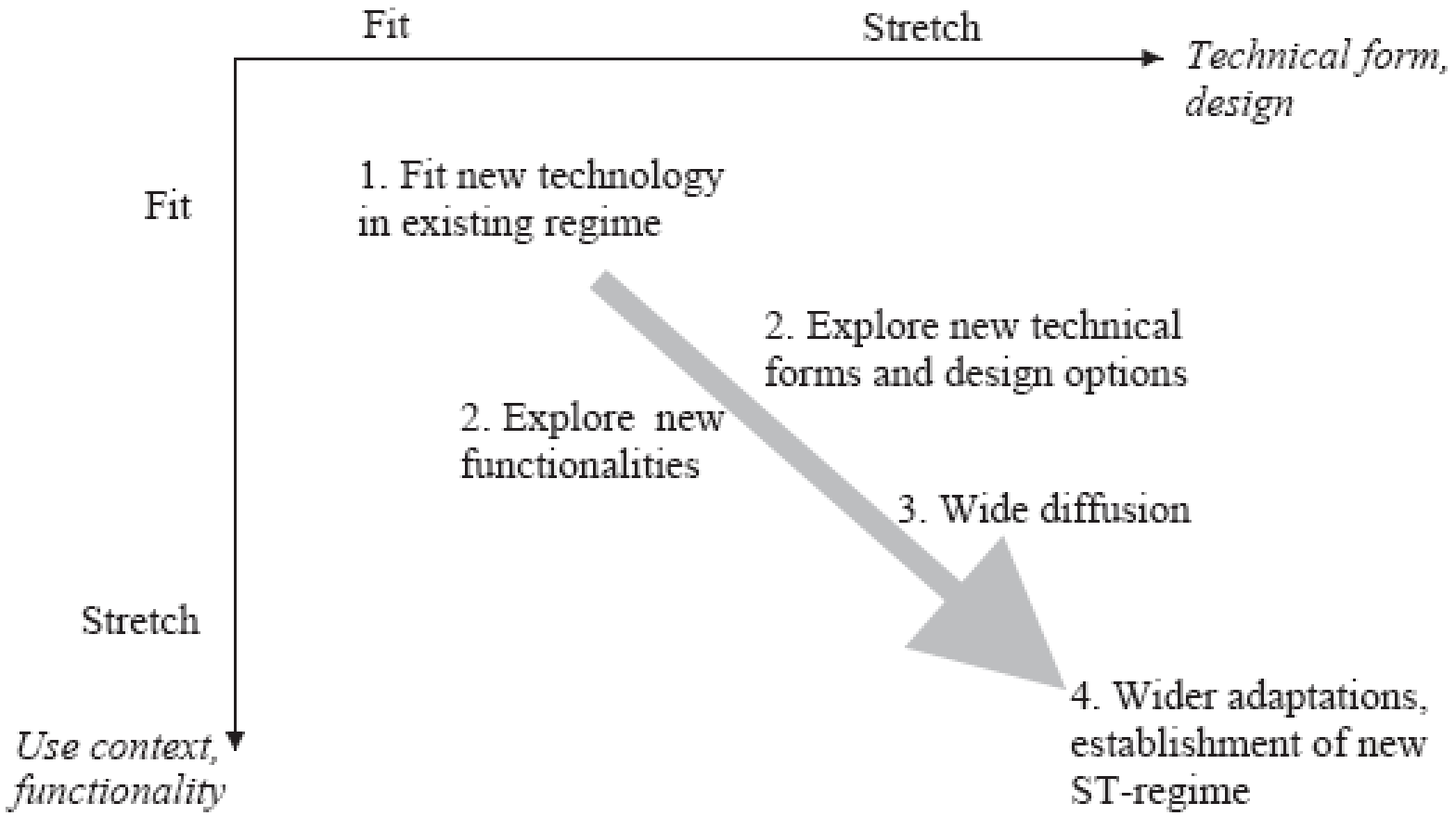


Great Britain (1843)

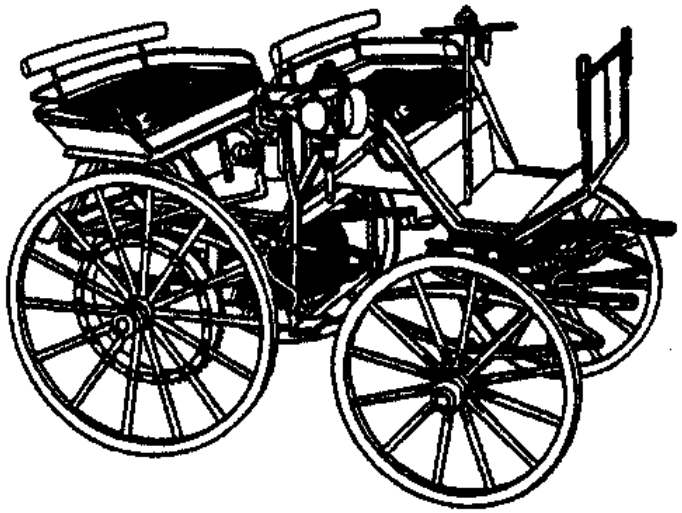
Great Eastern (1858)

2. Fit-stretch pattern:

- Changing beliefs about form and function
- Learning, negotiation, debate

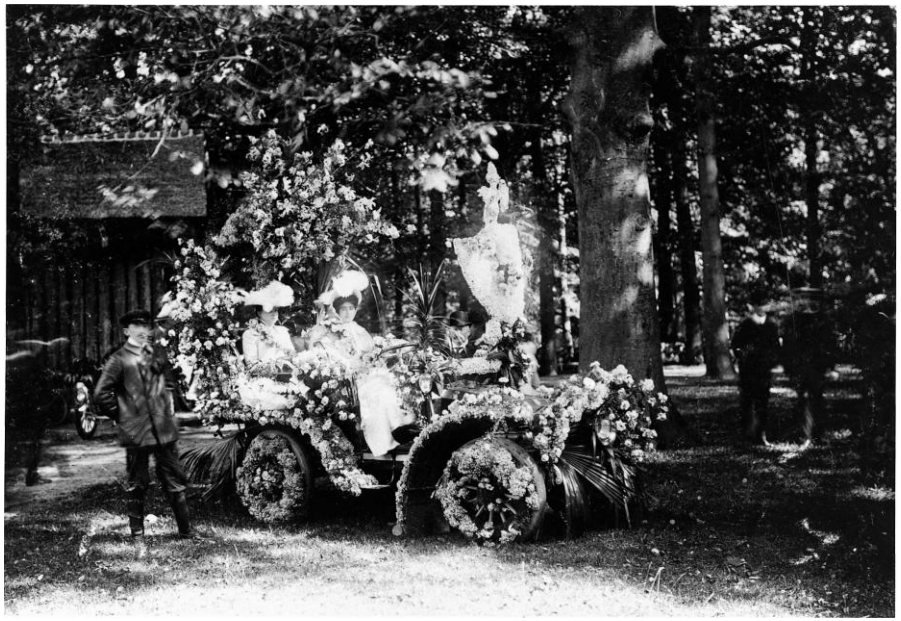


Technical novelty + showing off (1880s)

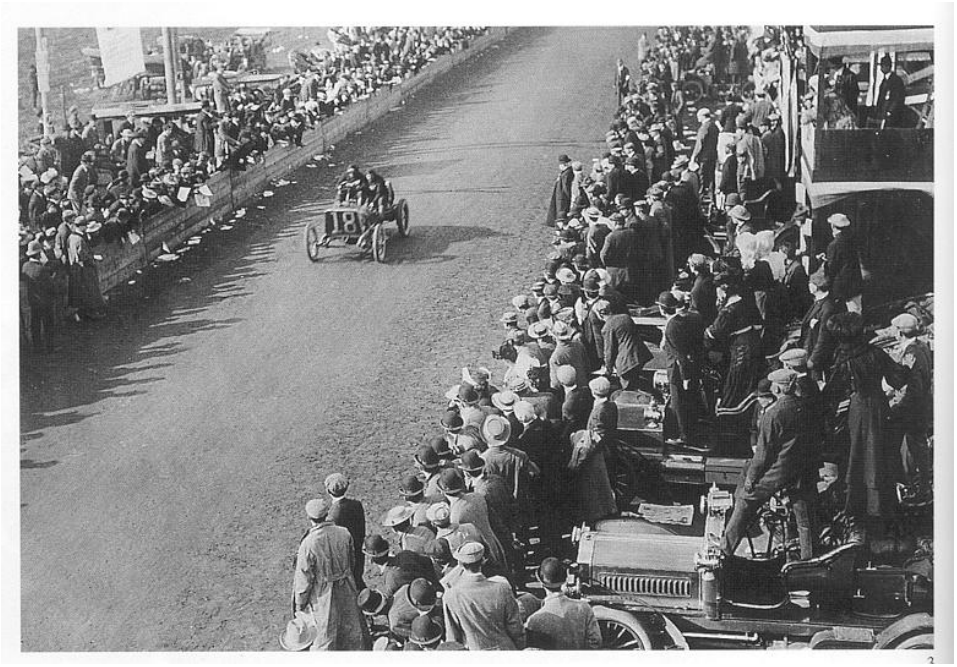


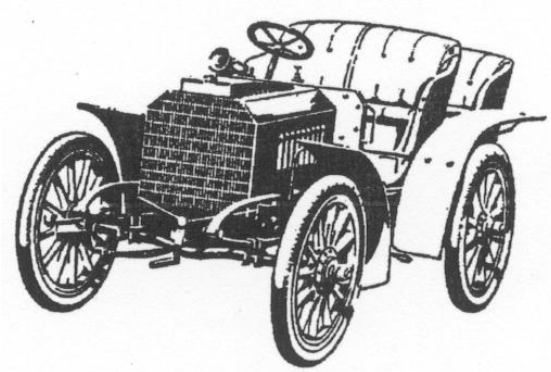
Daimler's horseless carriage (1885)

Electric car (1880s)
used in parks, promenading



Adventure machine (1895-1910): Racing + touring

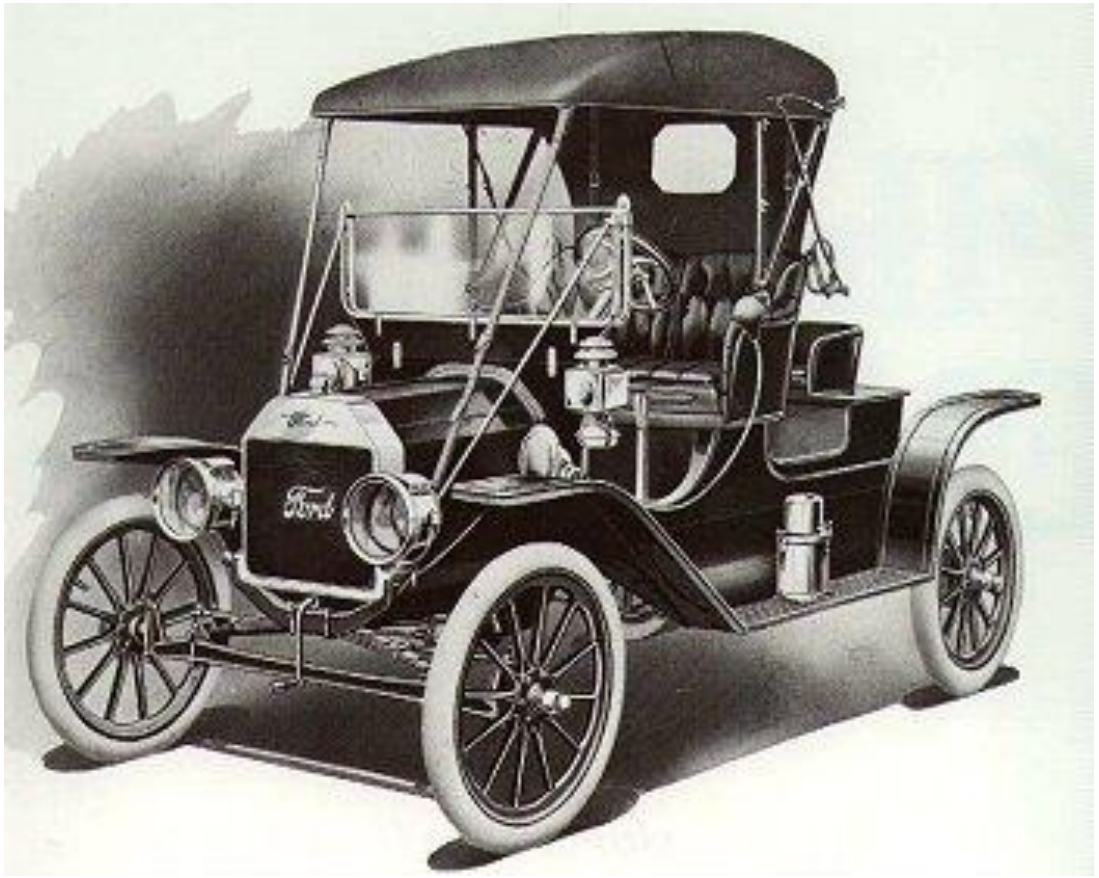




Mercedes from 1901.

Utilitarian automobile (1910-1920)

Practical use by professionals (not 'fun', pleisure)



T-Ford (1908): strong, sturdy, cheap

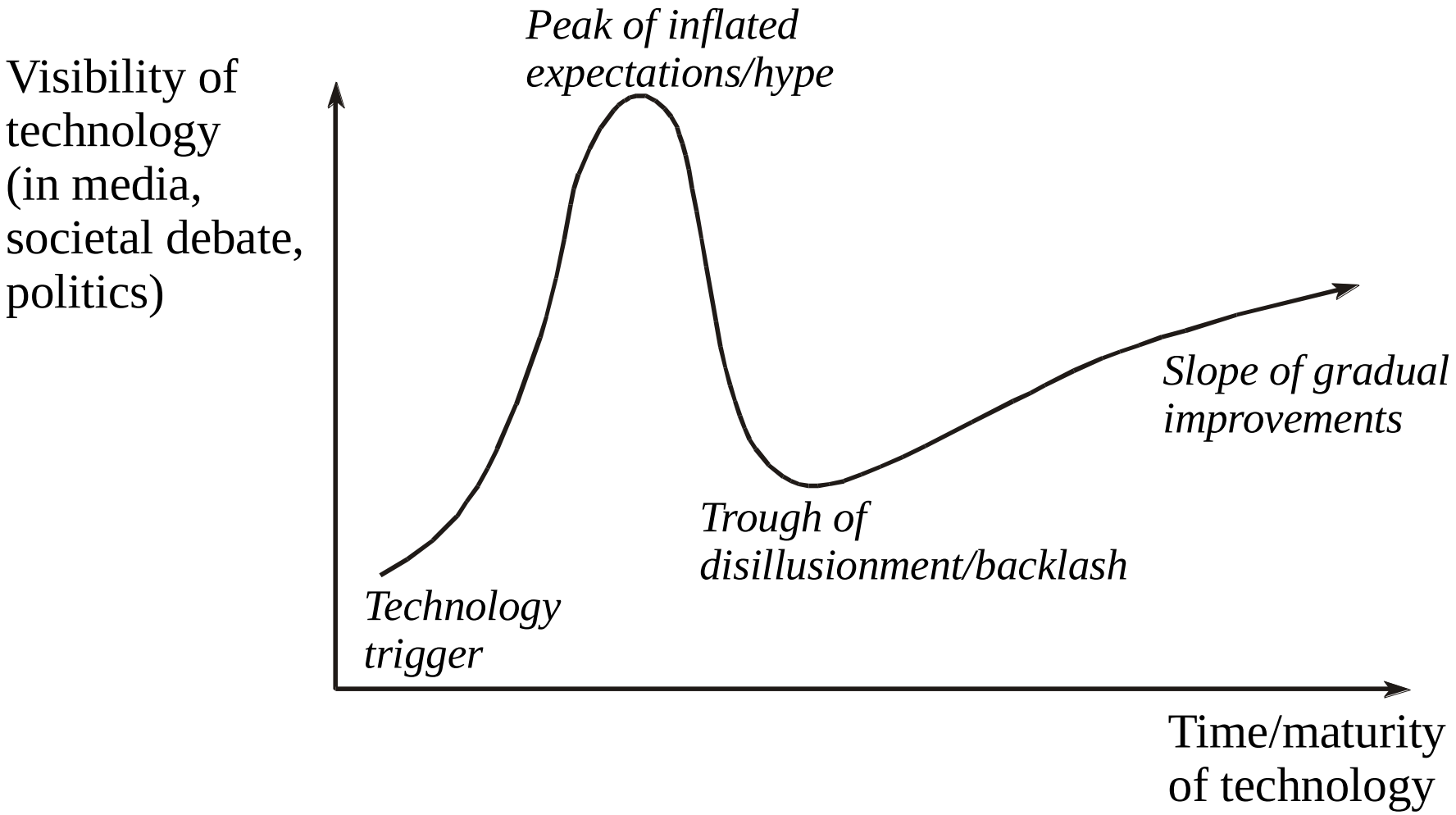
Multifunctional automobile (1920-1940)

* Commuting

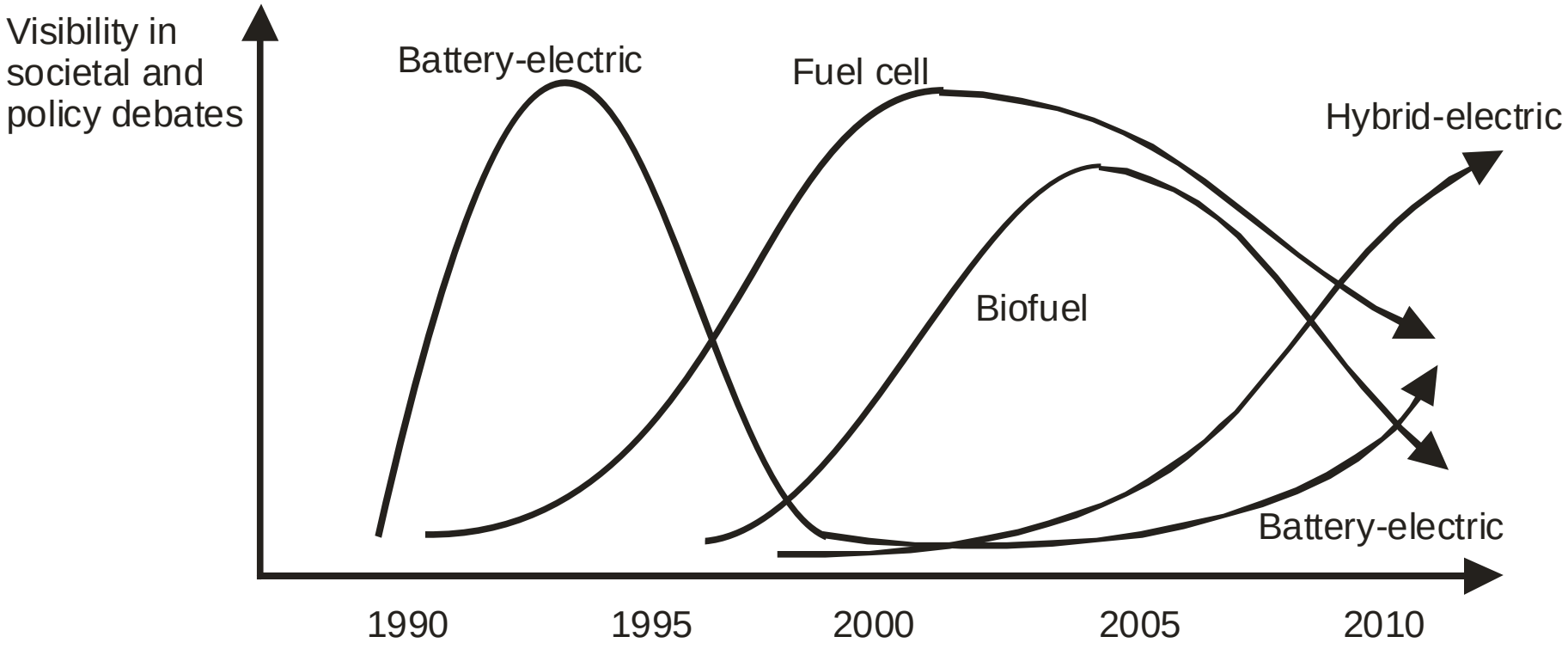
* Tourism

* Professions

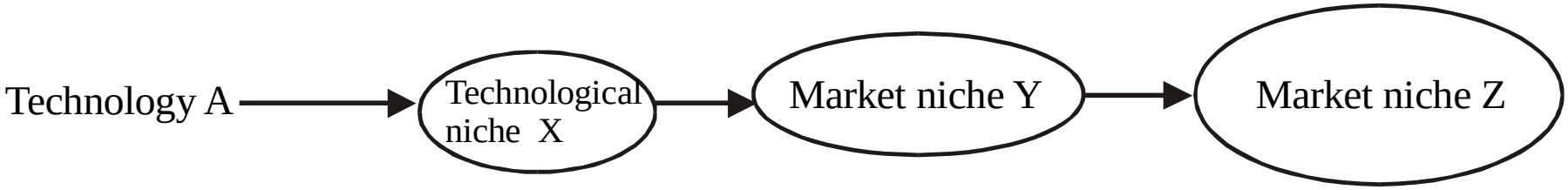
3. Hype-disappointment cycles (Gartner)



Hype-cycles in debates of 'green' car propulsion systems

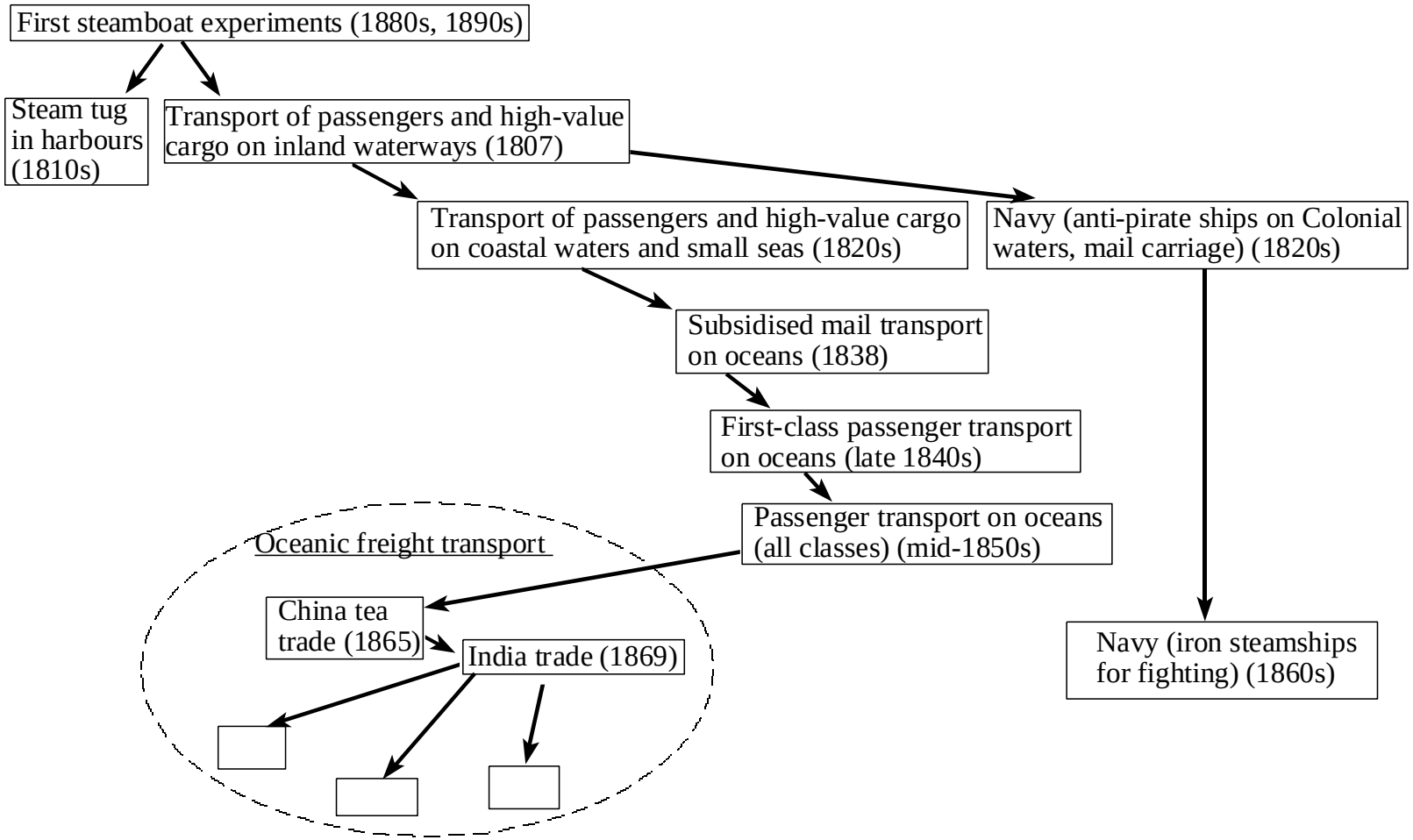


4. Niche-accumulation pattern



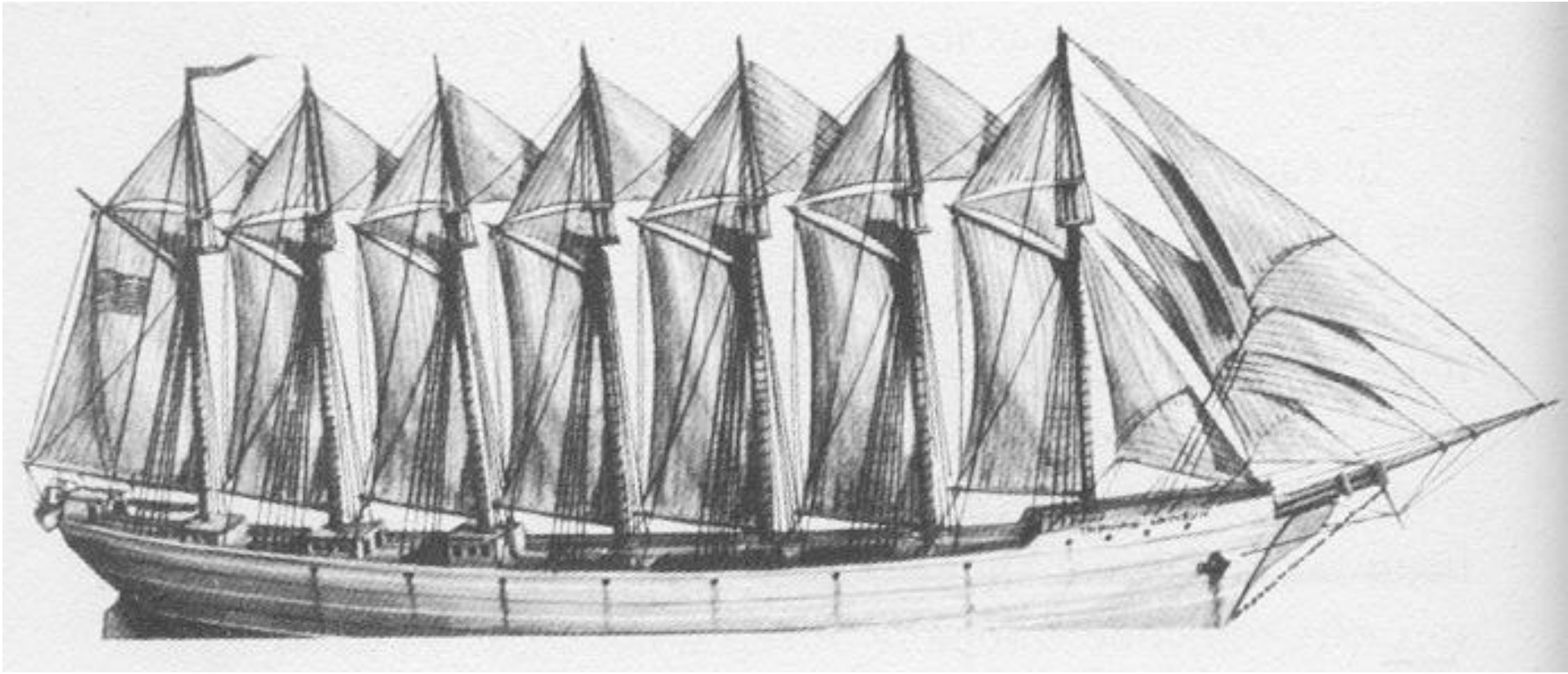
Example of cars

Steamship niche-trajectory



RISKS OF INNOVATION

- Cartel of fear (first-mover risks)
- Innovation race (Toyota Prius)
- New entrants overthrow established firms
- Sailing ship effect



The Thomas Lawson (1902-1907)

CONCLUSIONS; Three Theories of the Technology- Society Relationship

- Technological Optimism – All technology is good ("you can't stop progress")

- Technological Pessimism – Luddite rejection of the excesses of technology (Luddites were English crafts workers in the nineteenth who destroyed the new machines that were taking their jobs)

- Technological Democratism – Value-Laden Technology must be controlled democratically

Technological Optimism

- Thesis: Technology gives rise to powerful enabling factors which greatly enhance human powers and helps maximize human freedom, decreases human disease, and creates abundant material wealth and well-being which heightens improved social standards

Technological Pessimism

- Antithesis: Technological Determinism
- Technology can have a life of its own
- It exhibits an inner logic or momentum of development that makes it autonomous and beyond human control
- Technological development takes place without a plan and without regard to values and to the final “ends” and purposes of technology
- The influence of technology is all-pervasive
- The level of technology in any period in history determines the way in which the majority of people can earn their living and spend the majority of their time
- The comforts and advantages of technology are like addictions that “hook” us
- Those who try to rebel are rendered ineffective and ultimately destroyed

Technological Democratism

- Synthesis: Technology is mediated, both acting on and acted upon by society. Technology is so powerful that philosophical thought about its development and use is seriously needed
- Responsibility of being accountable for the effects of technology on our lives and the ways in which technology may involve values and possible hidden social agendas
- Responsibility for engineers, corporations, and society to deliberate together about how technology can best be developed and used to promote the social and human good