

# Economic growth and competitiveness in the I-Cubed Economy: Information-Innovation-Intangibles

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# Factors of production aka sources of economic growth

- labor (L- number of workers and hours worked)
- capital (K - land, plant and equipment)
- technology/knowledge/innovation (A - originally the residual, now “total factor productivity”)

$$Y = AK^{\alpha} L^{1-\alpha}$$

## Industrial Age

## Information Age

### Asset base

Capital and labor  
(K &L)  
Resources

Skills and knowledge  
(A+)  
Innovation

### Production characteristics

Mechanical  
Mass production – mass consumption  
Standardization  
Economies of scale and scope

Digital  
Flexible production  
Customization  
Economies of flexibility  
and speed

### Organizational structure

Centralized command and control  
Hierarchy and bureaucracy  
Internal control

Decentralized coordination  
Network  
Alliances and partnerships

Historical example: the industrial age boom just before the civil war through the turn of 20th Century

## The Railroad Age

The economic boom came only in part from the massive building (and overbuilding) of the railroads. More important is how the railroads changed other parts of the economy:

- opened up new markets
- increased machine-based manufacturing
- created new managerial processes, including governmental processes

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*"We have lots of information technology. We just don't have any information."*

# Information/knowledge is:

- formal (codified) and informal (tacit)
- data specific (know-what) and process (know-how)
- individual (human capital) and group (social capital)

# What is new (economics)?

- information/knowledge assets are different  
non-rival, non-excludable, non-diminishing
- network effects  
more and different is better

“Increasingly, the human being does not work in mass production, but in what might be called ‘team production.’ And that means that increasingly the producing human being is a knowledge worker. Workers as they did before the Industrial Revolution, own the means of production. The means is between their ears.”

Peter Drucker as quoted in Patricia Panchak, “The Future of Manufacturing: An exclusive interview with Peter Drucker”, *Industry Week*, September 21, 1998, pp.. 102-104.

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# “Indigenous” Knowledge

**Local**, in that it is rooted in a particular community and situated within broader cultural traditions; it is a set of experiences generated by people living in those communities

**Tacit** knowledge and, therefore, not easily codifiable

**Transmitted orally**, or through imitation and demonstration. Codifying it may lead to the loss of some of its properties

**Experiential rather than theoretical knowledge**. Experience and trial and error

**Learned through repetition**, which is a defining characteristic of tradition even when new knowledge is added

**Constantly changing**, being produced as well as reproduced, discovered as well as lost; though it is often perceived by external observers as being somewhat static

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*intellectual capital*  
“We have lots of information ~~technology~~. We just don't have any ~~information~~.”

# Intangibles aka Intellectual Capital

Information (codified) is a type of intangible

Intangibles embody codified information  
and tacit knowledge

# Managers' list of intangibles

## Human Capital

Employees — competencies, experience, longevity, attitude  
Managers

## Relationship Capital

Customers; Partners; Reputation

## Structural Capital

Process; Culture; Organizational Knowledge;  
Intellectual Property

# Accountants' list of intangibles

## A. Marketing-related intangible assets

- (1) Trademarks, tradenames
- (2) Service marks, collective marks, certification marks
- (3) Trade dress (unique color, shape, or package design)
- (4) Newspaper mastheads
- (5) Internet domain names
- (6) Noncompetition agreements

## B. Customer-related intangible assets

- (1) Customer lists
- (2) Order or production backlog
- (3) Customer contracts and related customer relationships
- (4) Noncontractual customer relationships

## C. Artistic-related intangible assets

- (1) Plays, operas, ballets
- (2) Books, magazines, newspapers, other literary works
- (3) Musical works such as compositions, song lyrics, advertising jingles
- (4) Pictures, photographs
- (5) Video and audiovisual material, including motion pictures, music videos, television programs

## D. Contract-based intangible assets

- (1) Licensing, royalty, standstill agreements
- (2) Advertising, construction, management, service, or supply contracts
- (3) Lease agreements
- (4) Construction permits
- (5) Franchise agreements
- (6) Operating and broadcast rights
- (7) Use rights, such as drilling, water, air, mineral, timber cutting, and route authorities
- (8) Servicing contracts, such as mortgage servicing contracts
- (9) Employment contracts

## E. Technology-based intangible assets

- (1) **Patented technology**
- (2) Computer software and mask works
- (3) Unpatented technology
- (4) Databases, including title plants
- (5) Trade secrets, such as secret formulas, processes, and recipes.

## Economists' list of intangibles

### Computerized information

1. Computer software: own use, purchased, and custom software.
2. Computerized databases

### Scientific and creative property

3. Science and engineering research and development (costs of new products and new production processes, usually leading to a patent or license):
4. Mineral exploration (spending for the acquisition of new reserves)
5. Copyright and license costs (spending for the development of entertainment and artistic originals, usually leading to a copyright or license): Development costs in the motion picture industry, development costs in the radio and television, sound recording, and book publishing industries.
6. Other product development, design, and research expenses (not necessarily leading to a patent or copyright): New product development costs , new architectural and engineering designs, R&D in social sciences and humanities

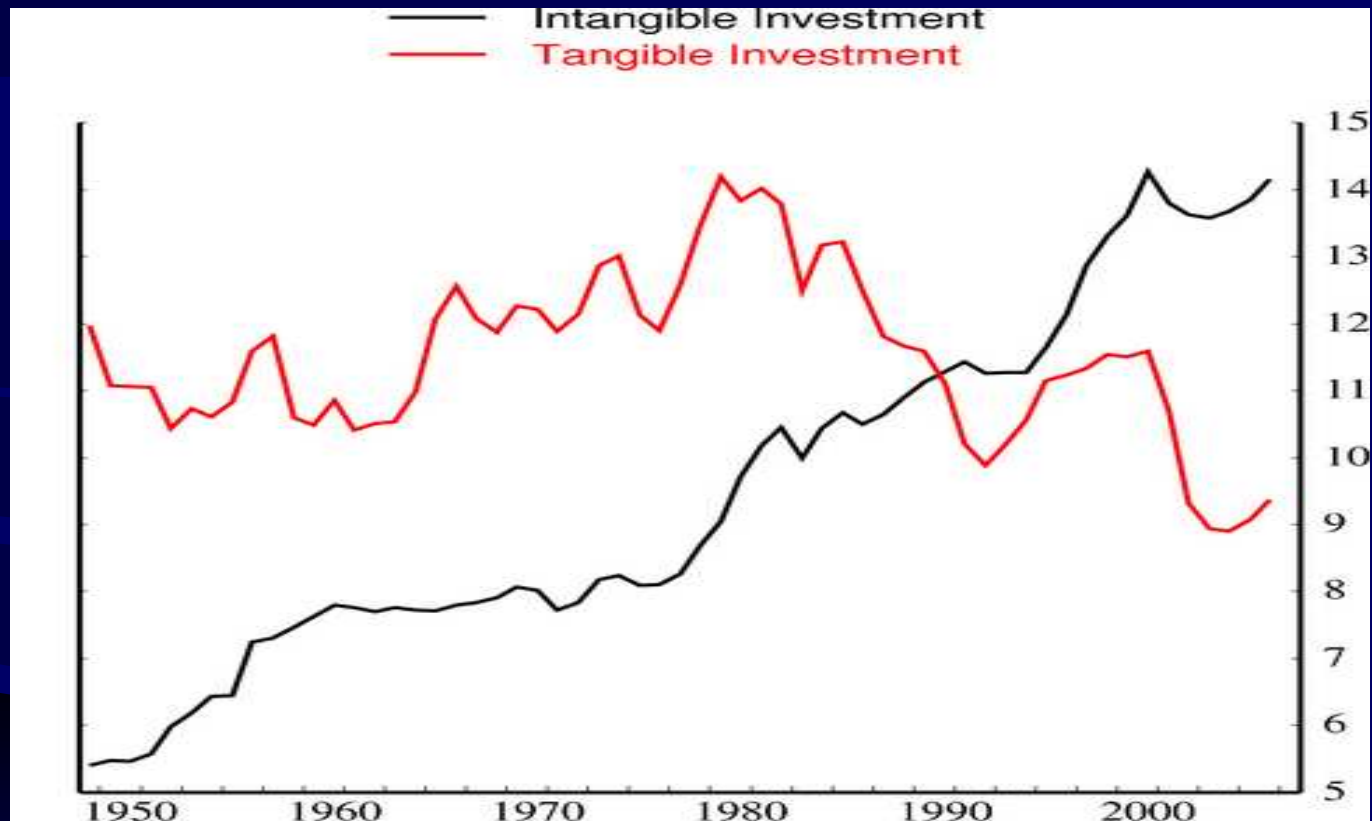
### Economic competencies

7. Brand equity (advertising expenditures and market research for the development of brands and trademarks)
8. Firm-specific human capital (costs of developing workforce skills, i.e., on-the-job training and tuition payments for job-related education)
9. Organizational structure (costs of organizational change and development; company formation expenses)

See Carol A. Corrado, Charles R. Hulten, and Daniel E. Sichel, "Measuring Capital and Technology: An Expanded Framework," Federal Reserve Board, August 2004, and  
... "Intangible Capital and Economic Growth" NBER Working Paper No. 11948 January 2006

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## Business investment in the US, tangible and intangible investment (% business output)



From OECD, *Intellectual Assets and Value Creation*, March 23, 2008

Based on Carol A. Corrado, Charles R. Hulten, and Daniel E. Sichel, "Measuring Capital and Technology: An Expanded Framework," Federal Reserve Board, August 2004, and

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*"We have lots of ~~information~~ technology. We just don't have any <sup>innovation</sup> ~~information~~."*

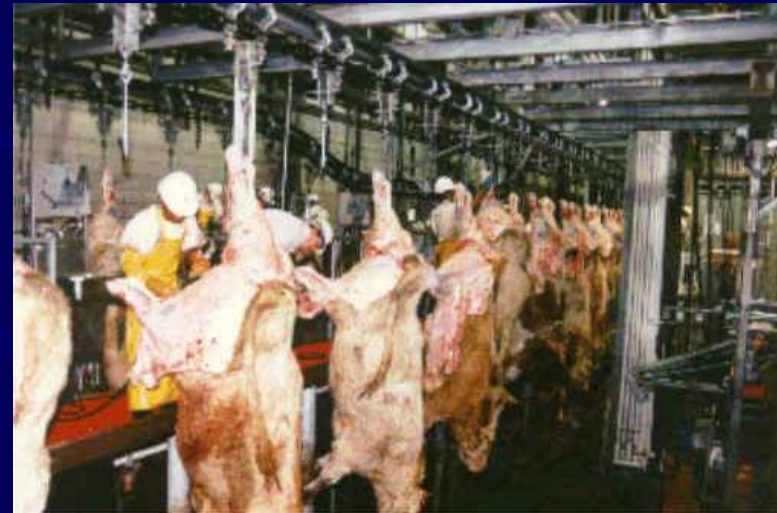
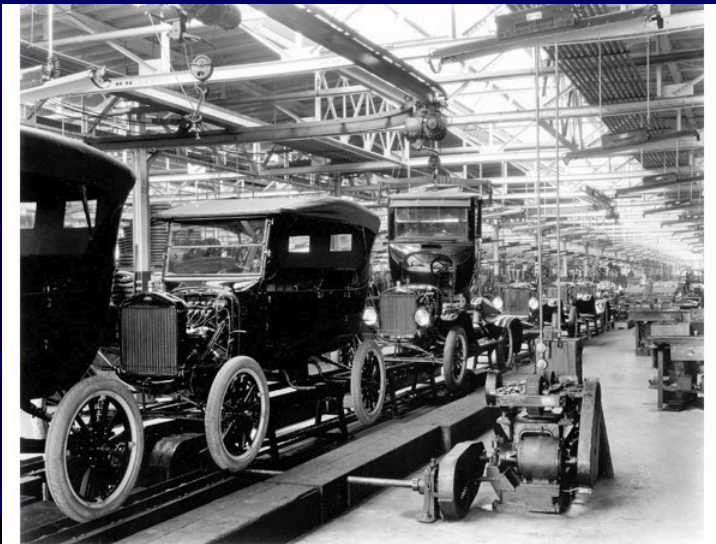
# What is Innovation?

- Technological
- Marketing
- Organizational
- Financial
- New to company
- New to market
- New to world

## 2002 RAND report on innovation:

(W)e immediately think of scientists and engineers working sometimes on their own but most often in laboratories or R&D facilities operated by private industry, by universities, and to some extent by the government. Yet, much innovative activity occurs outside the formal precincts of R&D labs. R&D departments tend to be an artifact of large firm organization. But in all company settings much “fixing” that amounts to innovation is done on the line by employees not principally charged with the innovation task. This type of informal activity too is an element of the national innovation system.

# Who is innovative?



# Where is the innovation?





Antikythera mechanism



Hero's engine

# Context is important

- *Climate change*
- *Health care needs*
- *Demographics*

*BUT focus on the transformation and the factors driving it:*

- *Information*
- *Innovation*
- *Intangibles*

For Further Information

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