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Excellence at all Levels

April 7, 2005

Julio M. Ottino, Dean

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Departments (plus much more…)

- Biomedical Engineering
- Chemical and Biological Engineering
- Civil and Environmental Engineering
- Computer Science
- Electrical and Computer Engineering
- Engineering Sciences and Applied Mathematics
- Industrial Engineering and Management Sciences
- Materials Science and Engineering
- Mechanical Engineering

Products? Customers? PL?

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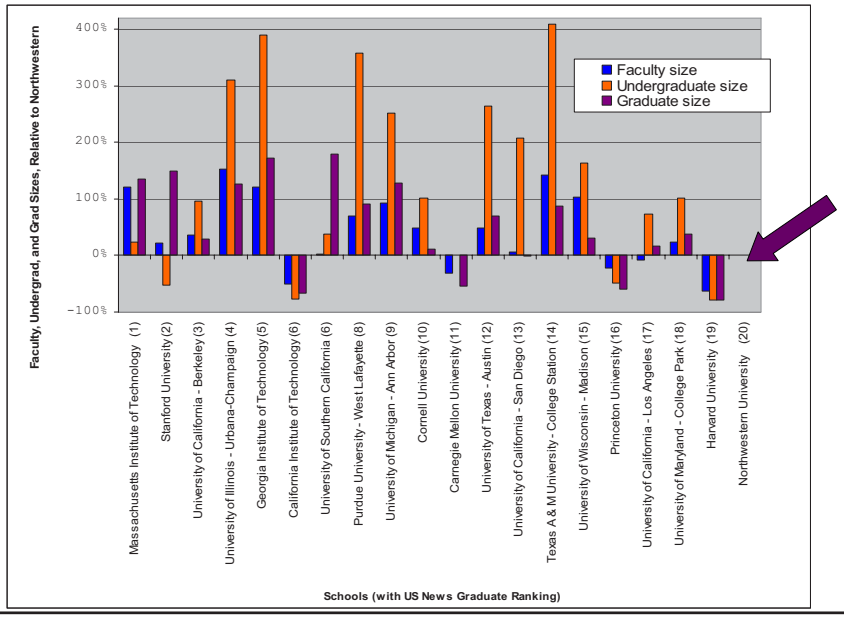
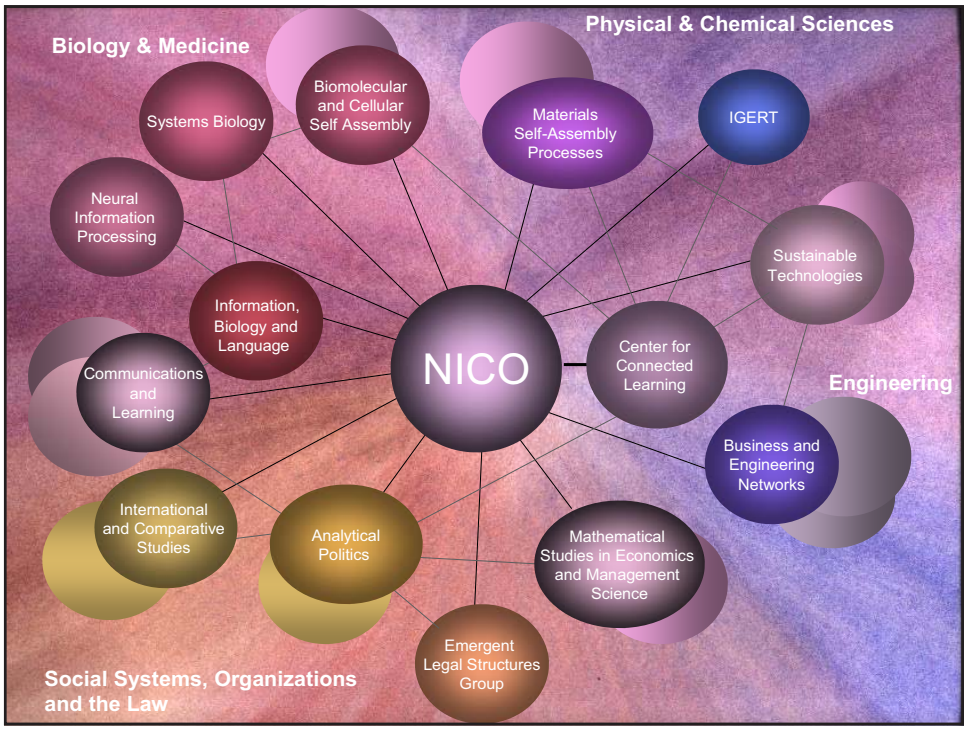
The Competition Landscape





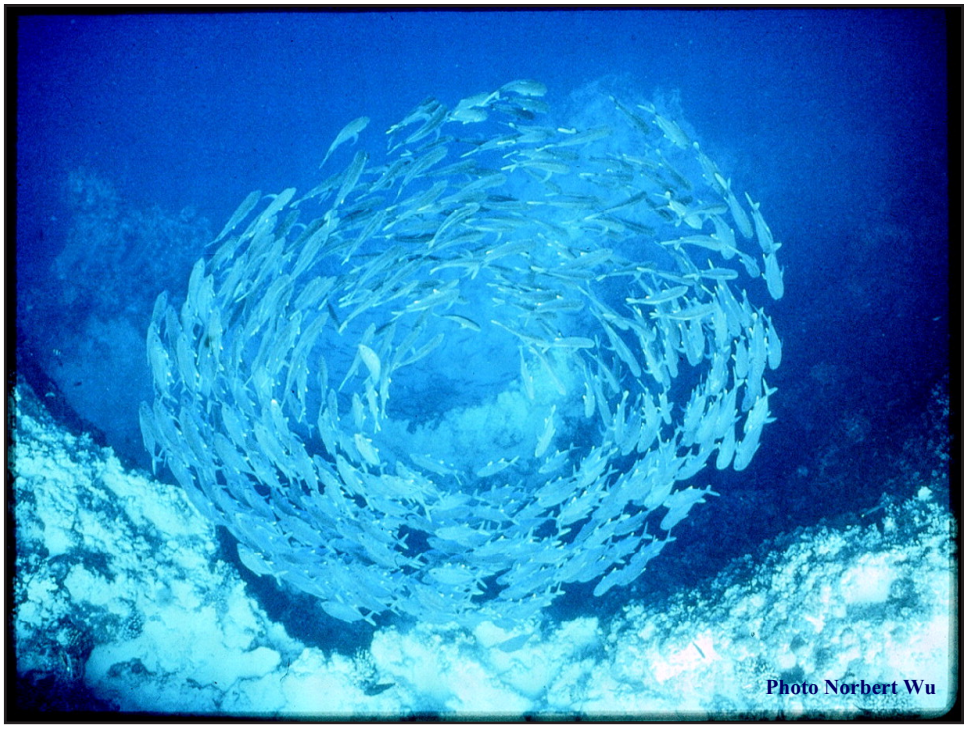
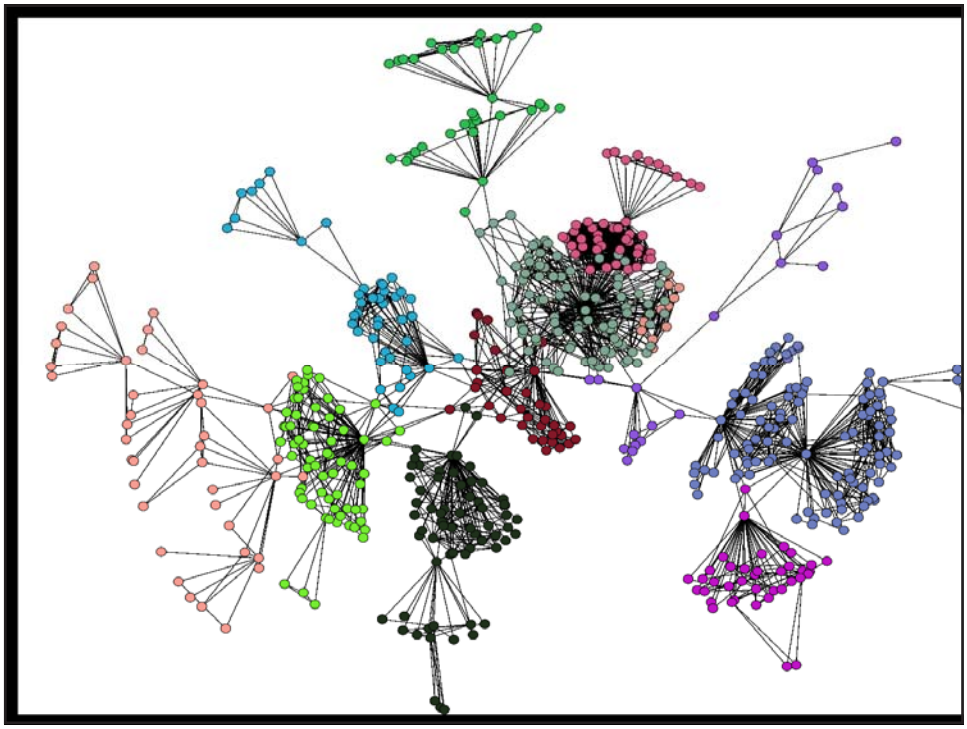


Photo Norbert Wu



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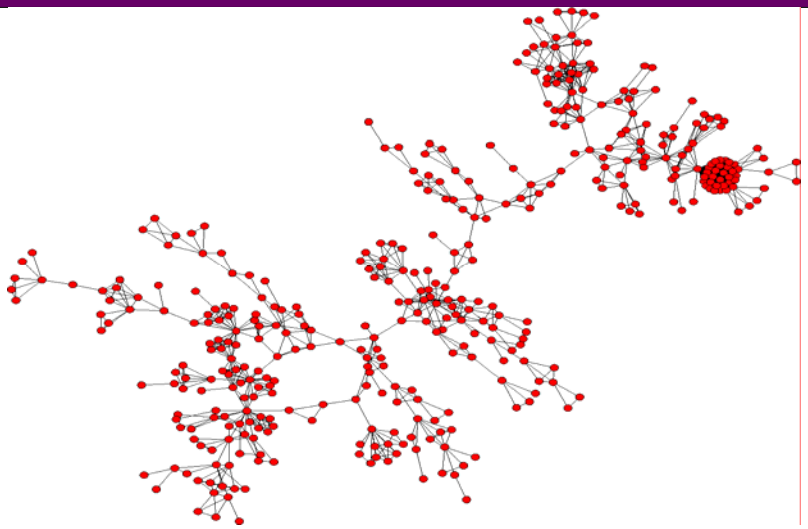

Collaboration network in Social Psychology as obtained from the *Journal of Personality and Social Psychology*. The data cover the period 1965-2003, and includes 9112 researchers and 7865 collaborations (Luis Amaral et al. 2004)

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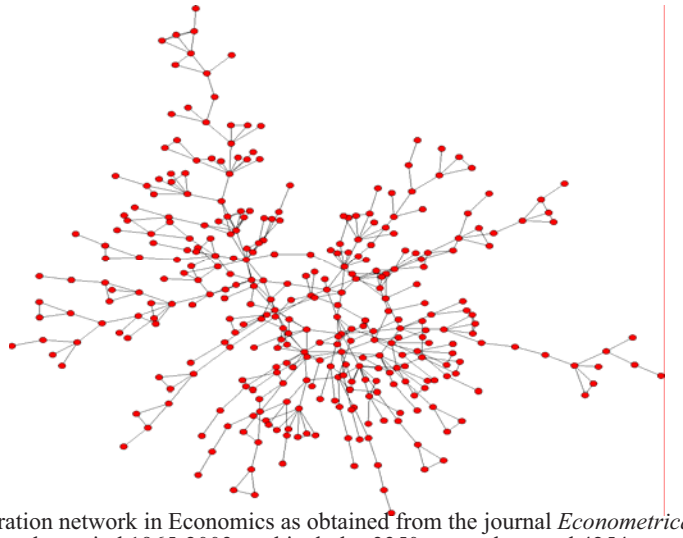

Collaboration network in Economics as obtained from the journal *Econometrica*. The data cover the period 1965-2003, and includes 3350 researchers and 4254 collaborations (Luis Amaral et al. 2004).

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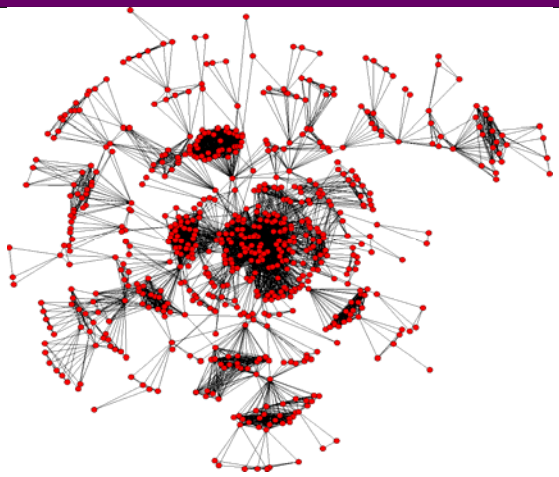
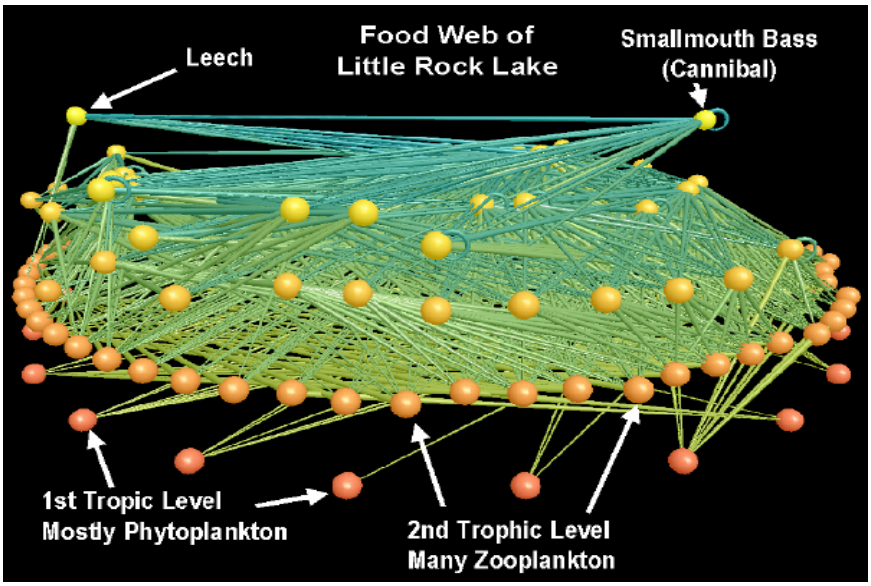
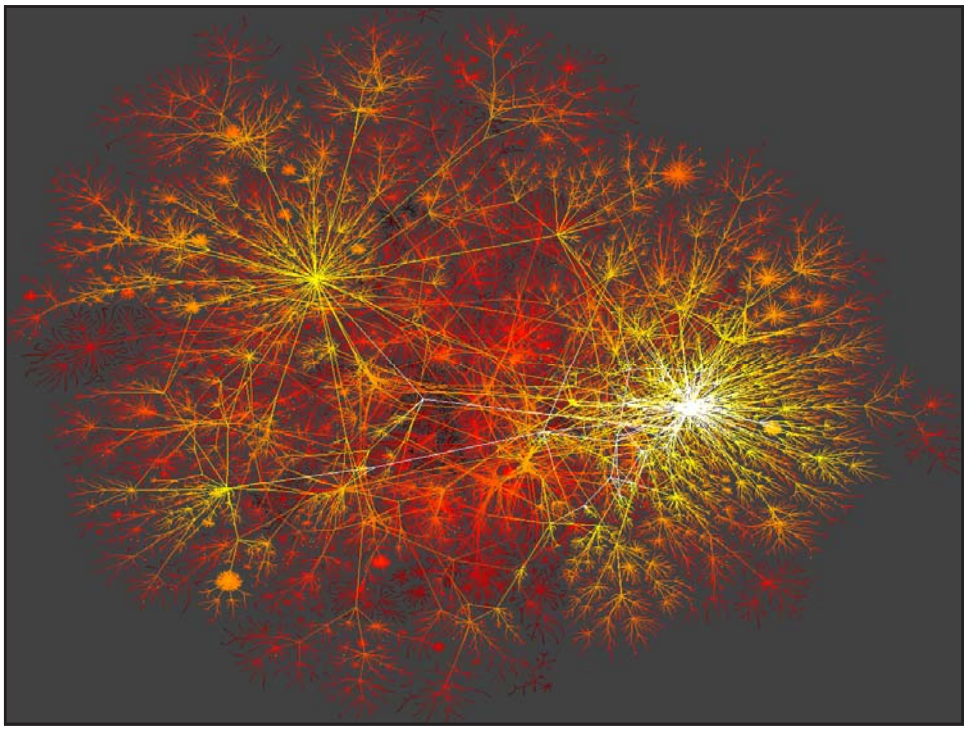


Collaboration network in Astronomy as obtained from the *Astronomical Journal*. The data cover the period 1965-2003, and includes 10832 researchers and 13016 collaborations (Luis Amaral et al. 2004).



R.J. Williams, N.D. Martinez, *Nature* (2000).



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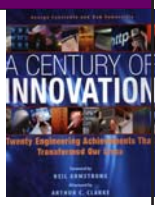
A century of innovation: twenty engineering achievements that transformed our lives.



Imagine a world without Engineering and Technology…

- Electrification
- Airplanes
- Radio and Television
- Computers
- Telephony and Electronics
- Spacecraft (and GPS, etc.)
- Automobiles and Highways
- Petroleum and Petrochemical Technologies
- Advanced materials
- Medical technologies
- Internet
- Water Supply and Distribution

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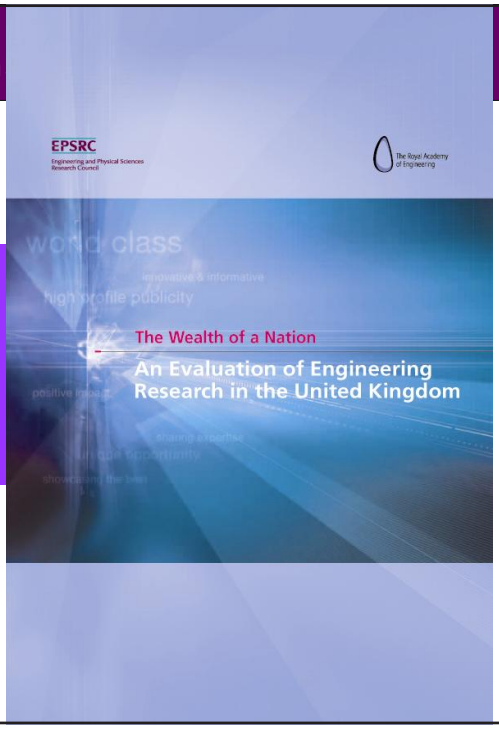

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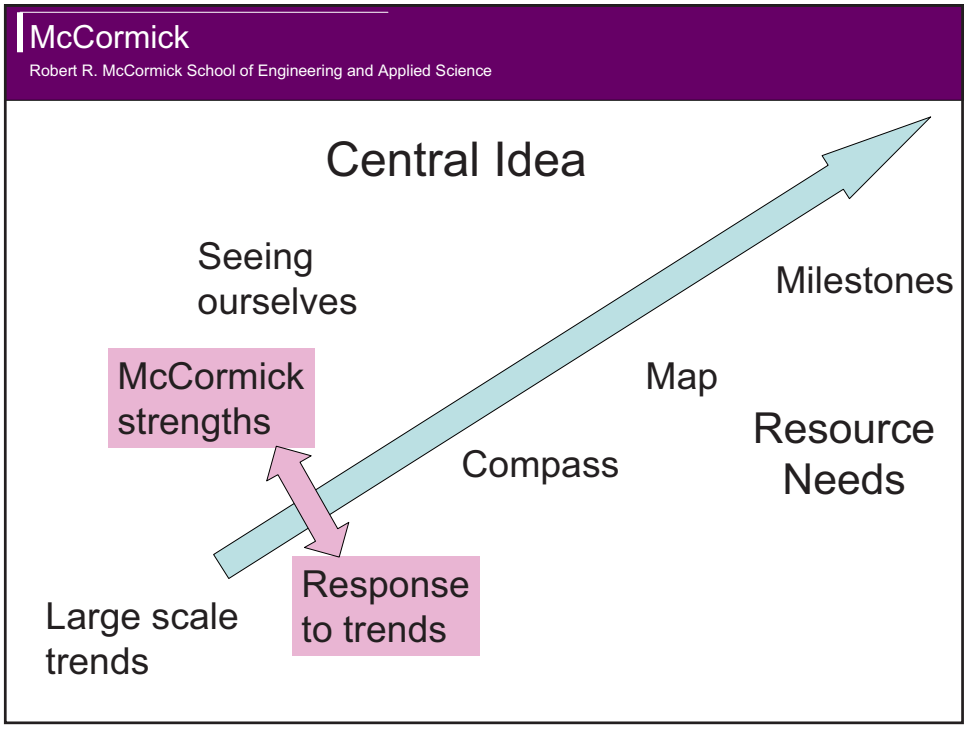

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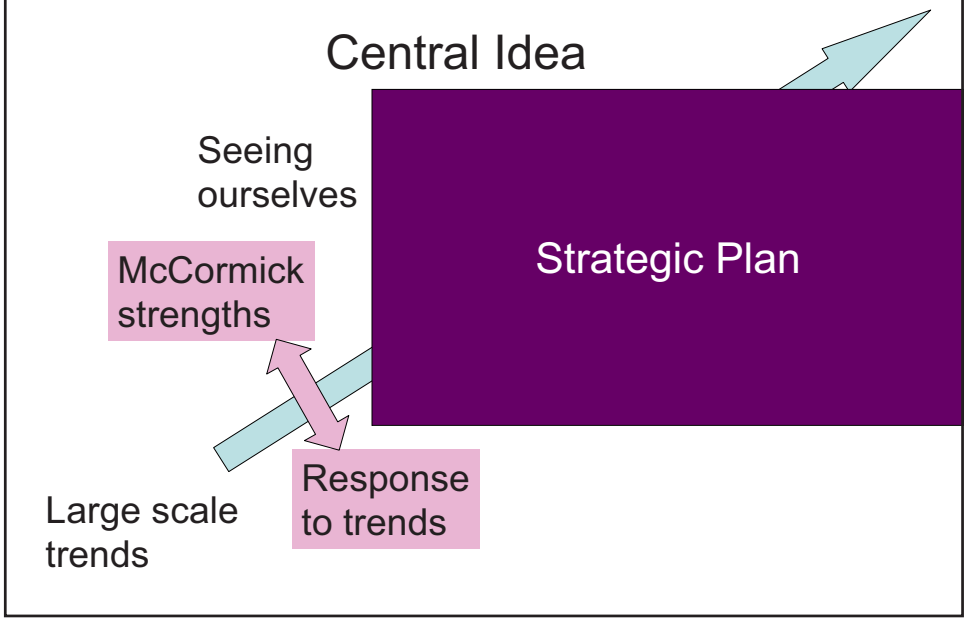

Trends

Energy
Environment
Health
Information
Security…

Not very useful…

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Large Scale Trends

(1) The boundary between science, engineering, technology, and medicine is being completely blurred into a seamless chain.

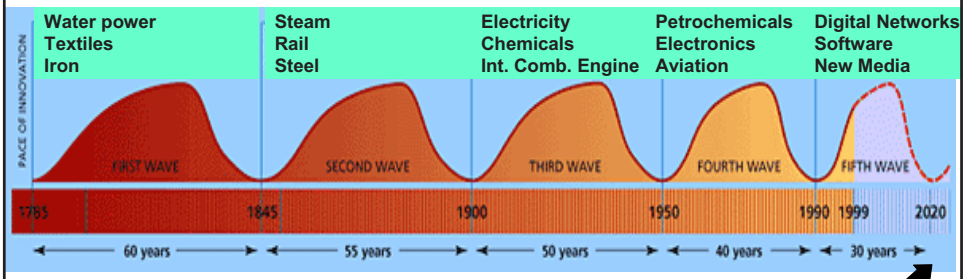
(2) The waves of innovation are becoming shorter.

(3) Technology is permeating all areas of society

Technological literacy essential ingredient of 21st century humanistic education;

Essential to informed public-policy decisions.

A Picture of Innovation: Schumpeter waves accelerate



Nano, Bio, Info

The Economist, 1999

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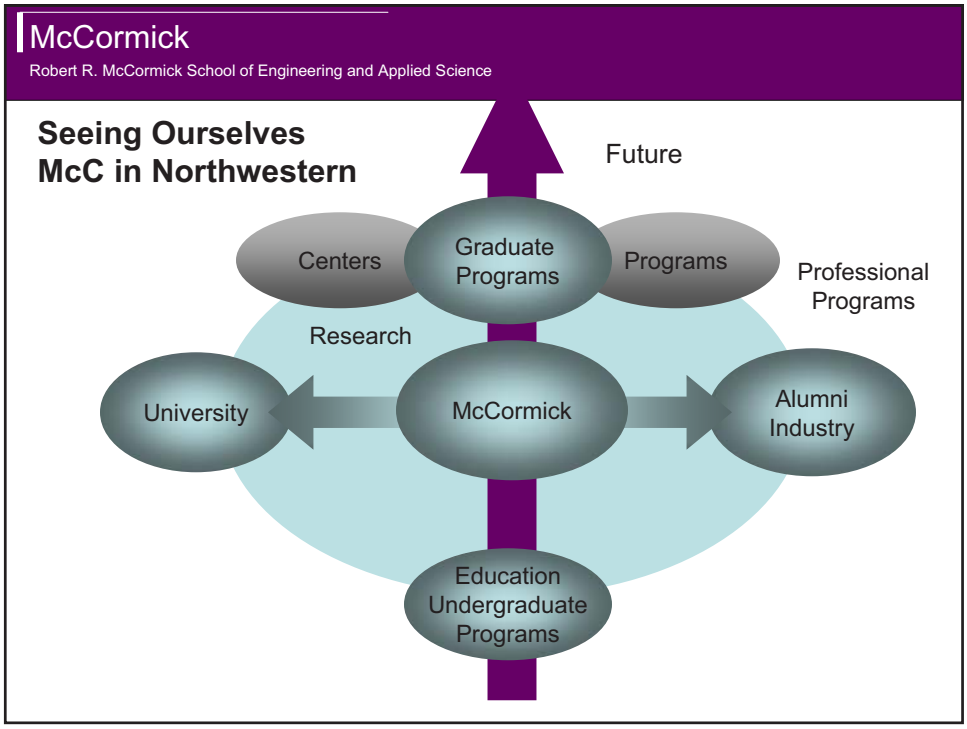
Large-scale trends: Needs

(1) The boundary between science, engineering and technology is being completely blurred into a seamless chain. → **Broad Perspective; Interdisciplinary Outlook**

(2) The waves of innovation are becoming shorter. → **Adaptability**

(3) Technological literacy; 21st century humanistic education; public-policy decisions. → **Broadly educated engineers**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Seeing Ourselves
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Future
Centers
Graduate Programs
Programs
Professional Programs
Research
University
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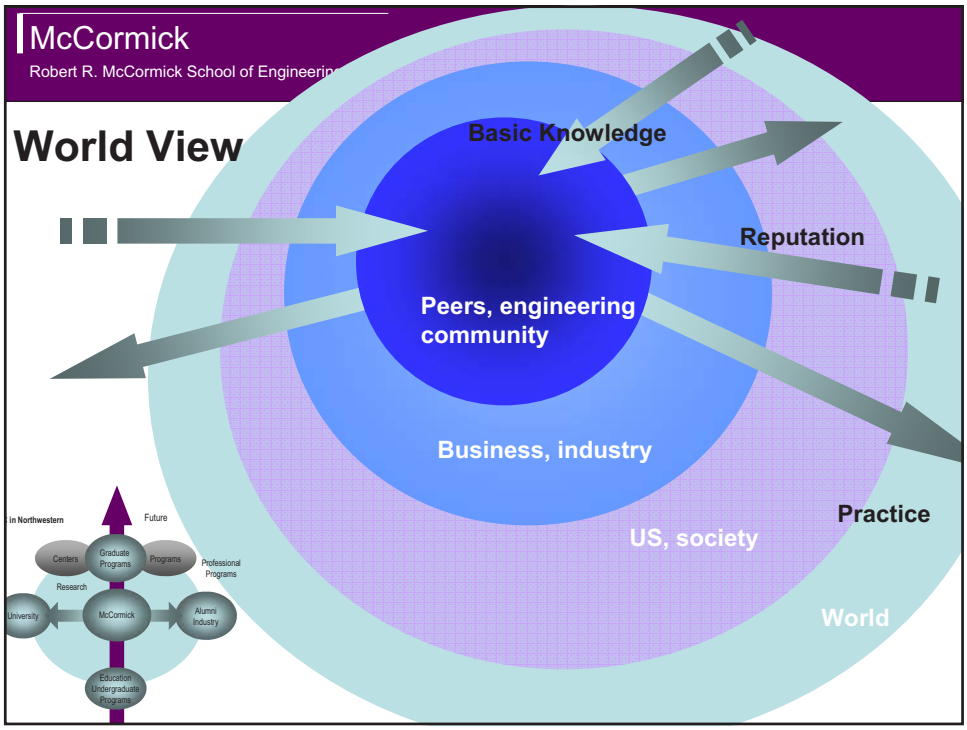
Alumni Industry
Education Undergraduate Programs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World View
Basic Knowledge
Reputation
Peers, engineering community
Business, industry
US, society
Practice
World

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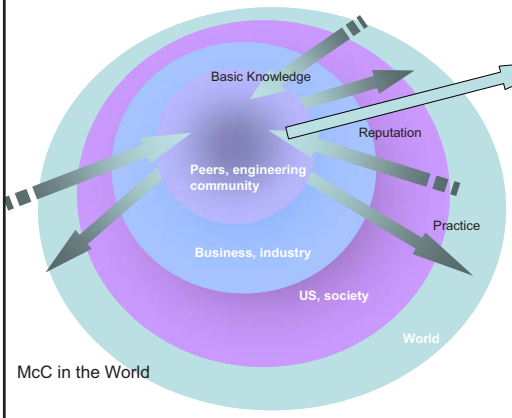
Recognition, Reputation



(1) Largest component of reputation, e.g. US & World Report, NRC, depends critically on top-ranked peers. **Placing people in academia**

(2) Core, size matter

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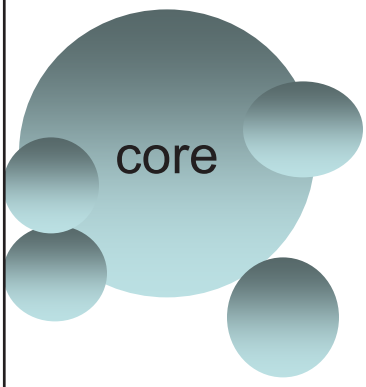

dynamic periphery

..matching needs to strengths

- Core, the one-to-one areas where we are compared with others must be first rate
- Adopt Matrix view of faculty; excellent people who can be counted twice
- "Growth" strategy: synergistically leveraging small size across schools WCAS, Kellogg, SoC, Medill, and Law

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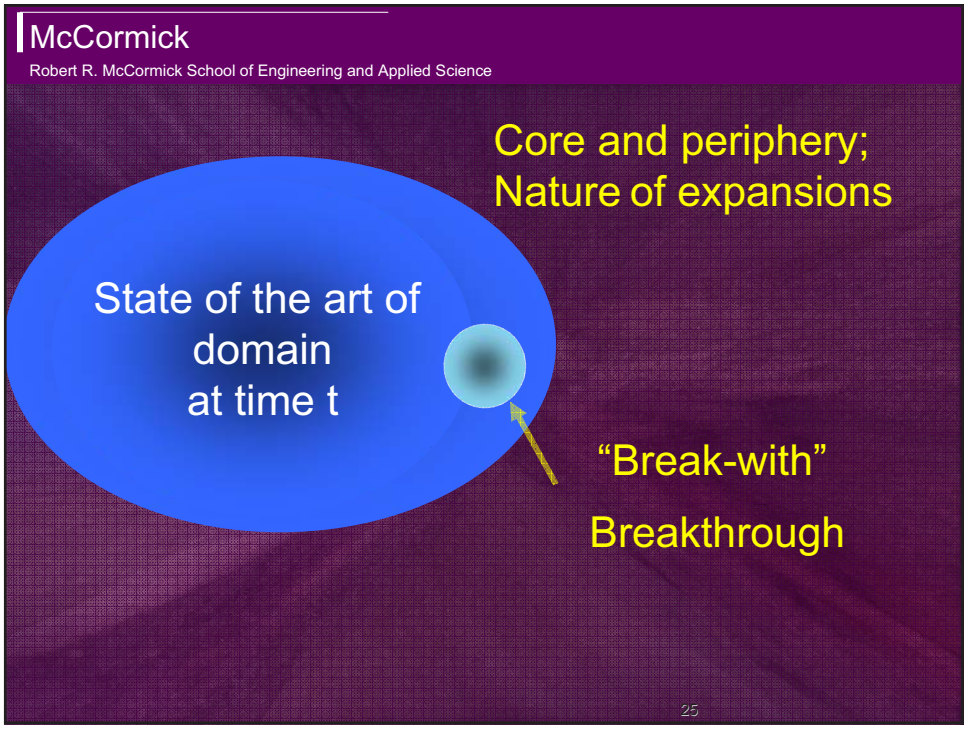

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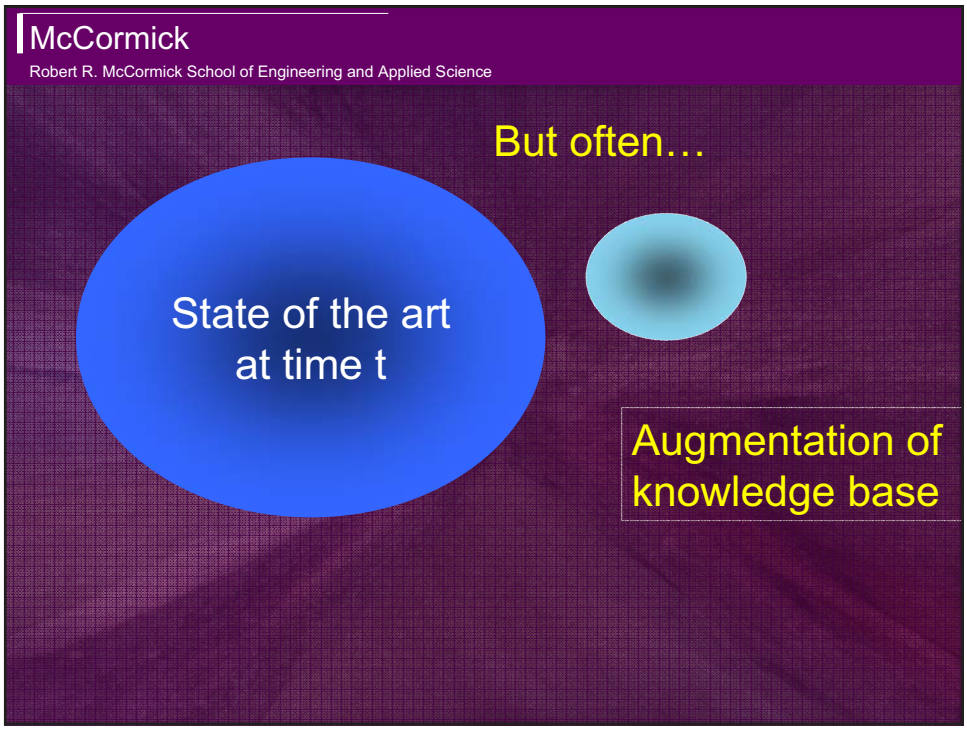

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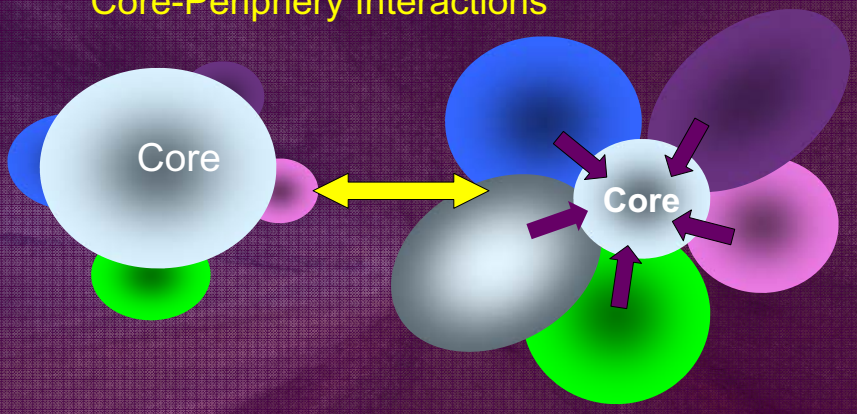
Core-Periphery Interactions



Core unifies structure

Core may be formed by periphery

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Recognizing Hurdles: The Faculty Pipeline

Career Span Longer, Waves of Innovation Shorter

40 year career span (and getting longer)

Assistant Professors
6 years

problem

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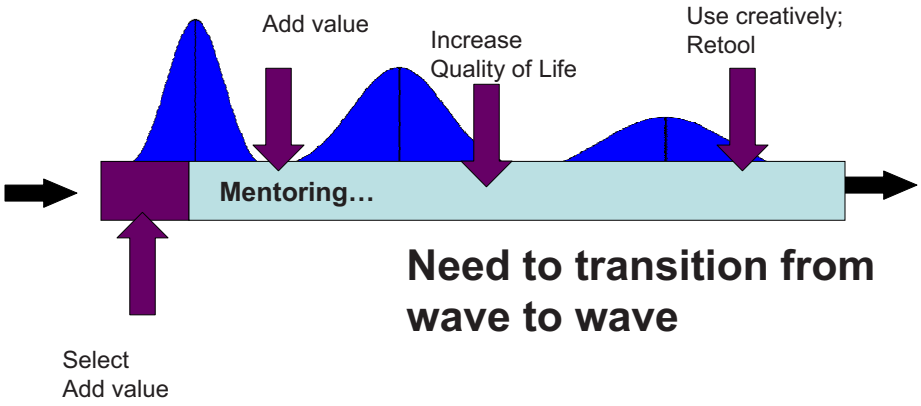
Actions



Need to transition from wave to wave

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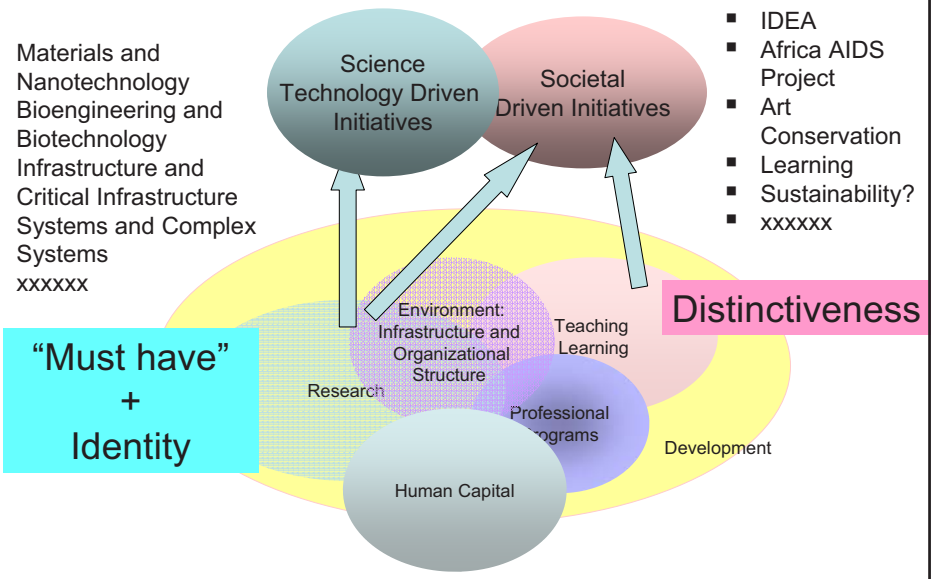
- Materials and Nanotechnology
- Bioengineering and Biotechnology
- Infrastructure and Critical Infrastructure
- Systems and Complex Systems
- xxxxxx



- IDEA
- Africa AIDS Project
- Art Conservation
- Learning
- Sustainability?
- xxxxxx

"Must have" + Identity

Distinctiveness

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Consequences: McCormick's Positioning

Students:	…leading edge engineering/science education with a big picture component
Faculty:	…where interdisciplinary work can flourish
Academia:	…faculty candidates trained in emerging areas and capable of adapting in times of change
Industry:	…source of knowledge, future human resources, research collaborations
Recruiters:	…undergraduate students who have superior technical knowledge, and innovation and team leadership skills
	…graduate students who are not narrow but have a broad outlook
Alumni:	…source of networking, a source of life-long knowledge…

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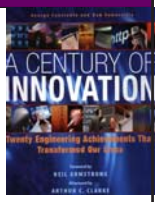

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Imagine the world 20 years from now

How will the list look like?

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Well prepared if…

Cannot do everything…

People

Deep knowledge, but adaptable

Ability to traverse across domains, science-technology

How will system look like?

- Dynamic environment that encourages emergent structures and risk taking

Strategy

- Strengthening the core
- Enlarging the periphery
- Work on “changing the rules”

“Excellence at all Levels”

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…approaches…

- **Massive buildup**…Purdue adding 75 positions
- **Emergence in the midst of strong surroundings**…Harvard adding 45 positions
- **Strengthening excellence**…Caltech, keeping faculty constant but adding resources

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Can we become one of the (small) leading engineering schools in the world?

Do we have the will?