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Innovation, U.S. Competitiveness and STEM Education

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Information Technology and Innovation Foundation

ITIF is public policy think tank committed to articulating and advancing a pro-productivity, pro-innovation and pro-technology public policy agenda internationally, in Washington and in the states. ITIF focuses on:

- Innovation processes, policy and metrics
- Science policy related to economic growth
- E-commerce, e-government, e-voting, e-health
- ICT and economic productivity
- Innovation and trade policy

The Information Technology & Innovation Foundation

ITIF

Today's Presentation

1. Why is Innovation Important?
2. How is the U.S. Doing?
3. The Role of STEM Education
4. Thoughts on STEM Reform

This is Innovation

So Is This

- John Deere CEO Bob Lane says he doesn't make tractors but rather "sophisticated mobile information factories."

- GPS shows where it is
- Microwave sensors measure cotton flow
- RFID tags let processors know origin of each bundle
- Wireless communications
- Computing power of 8 PC's

Why Does Innovation Matter?

- Because economic transformation is constant and innovation is required to continually renew a region's economy.

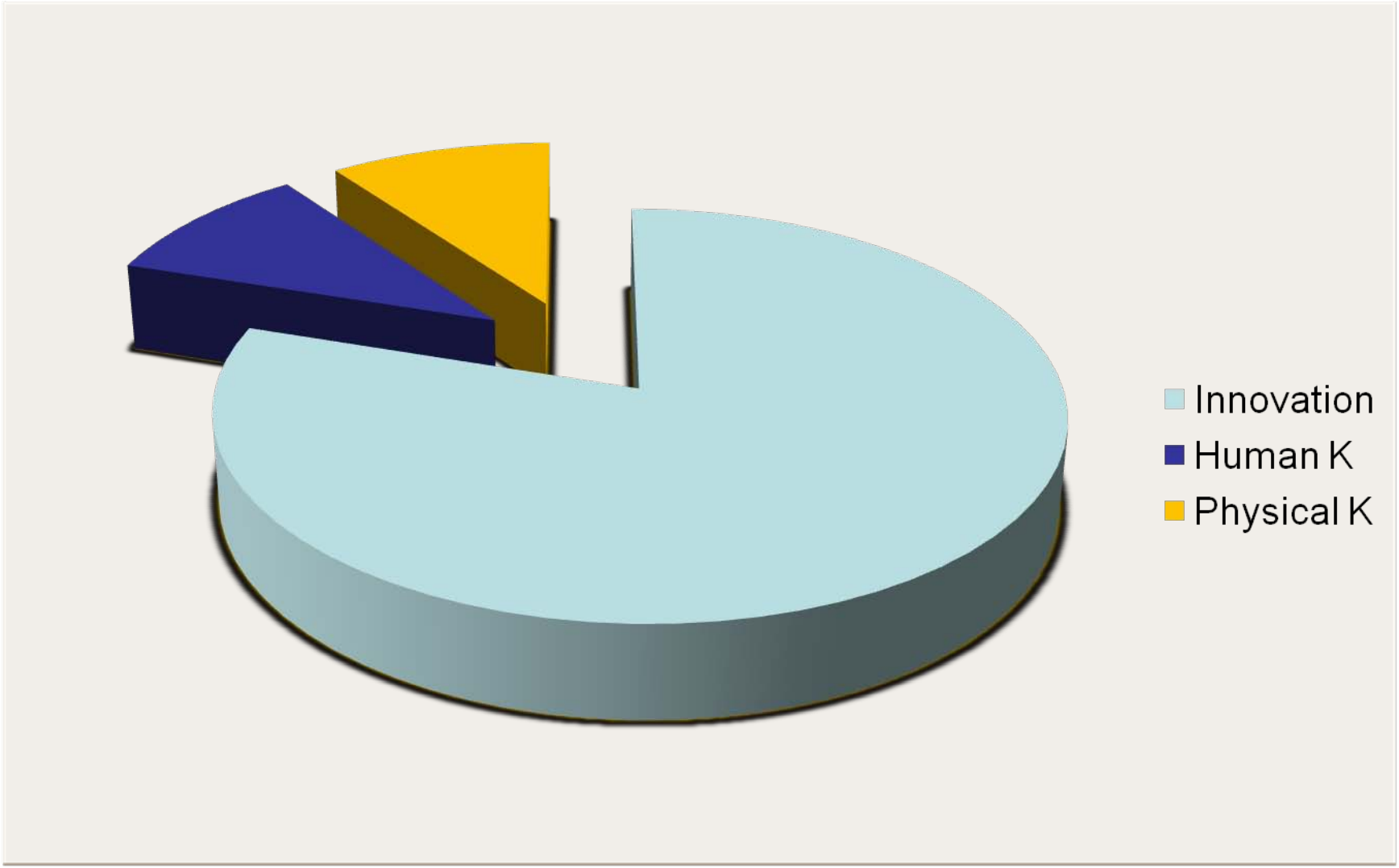
The essential point to grasp is that in dealing with capitalism we are dealing with an evolutionary process... the fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers' goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates."

(Joseph Schumpeter, Capitalism, Socialism and Democracy, 1942)

Innovation Drives National Economic Growth

- The societal rates of return to R&D are between two to four times private returns.
- At least two-thirds of increase in per-capita GDP is attributable to innovation.
- Jobs in technology industries pay approximately 70 percent more than other jobs.
- Innovation is the key source of competitive advantage against low-wage nations.

Innovation Drives Growth



Innovation Drives Regional Economic Prosperity

- Differences in patenting intensity accounts for 30% of the variation across U.S. regions in the average wage (Porter).
- Patenting and R&D support greater gains in regional per-worker earnings (Goldstein).
- Average wages in U.S. high-tech clusters are $63,970 versus $43,180 in non-high tech trade clusters.
- Strong correlation between state per-capita income and innovation factors:

High tech jobs: 0.52	Venture capital: 0.43
R&D investment by industry: 0.46	Scientists and engineers: 0.50

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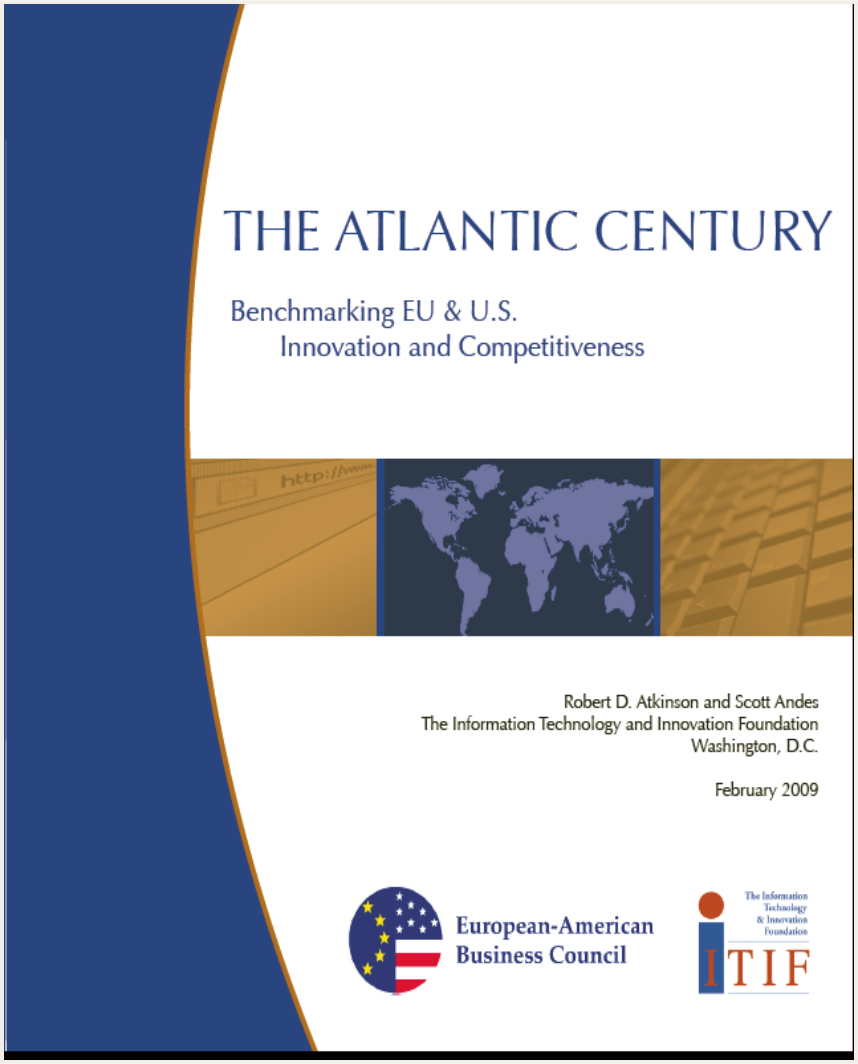
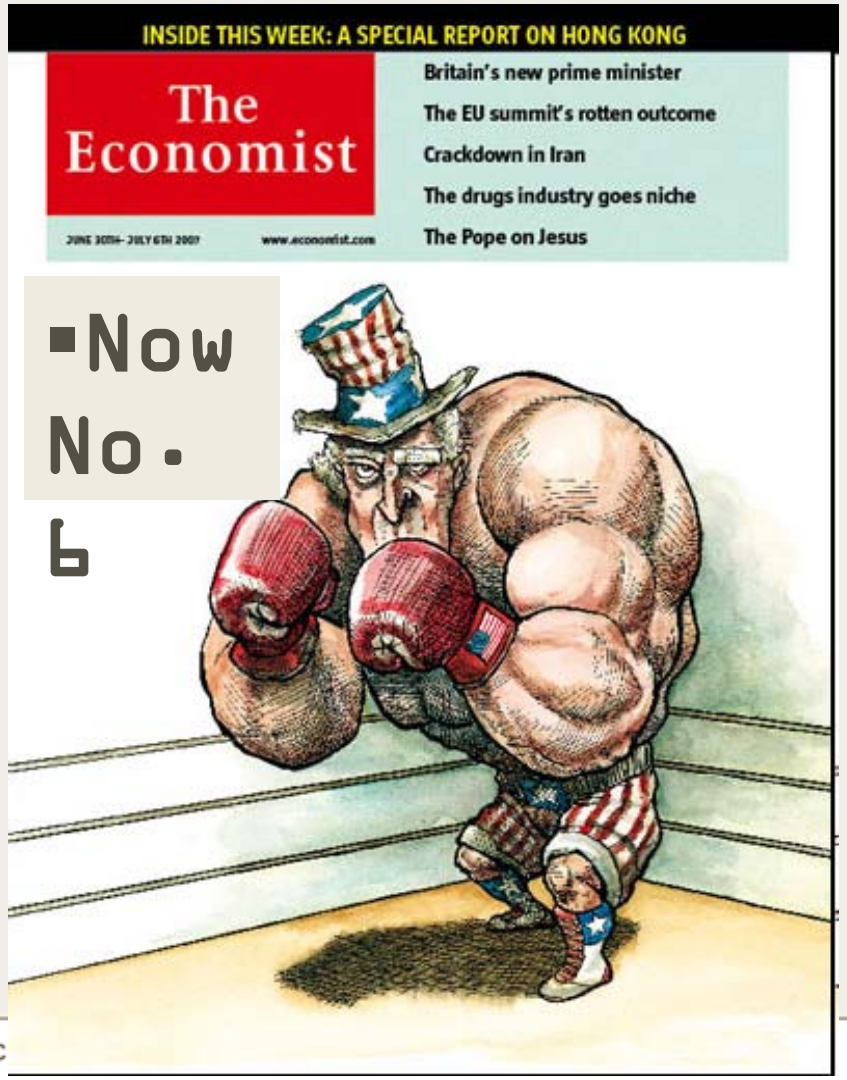
Aren't We Number 1?



- Economic Structure
  - human capital (college education; researchers)
  - innovation capacity (corporate R&D; government R&D; scientific publications)
  - entrepreneurship (new firms; venture capital)
  - IT infrastructure (e-government; corporate IT investment; broadband)
- Economic Policy (corp. tax; ease of doing business)
- Economic Performance (trade balance, FDI, productivity)

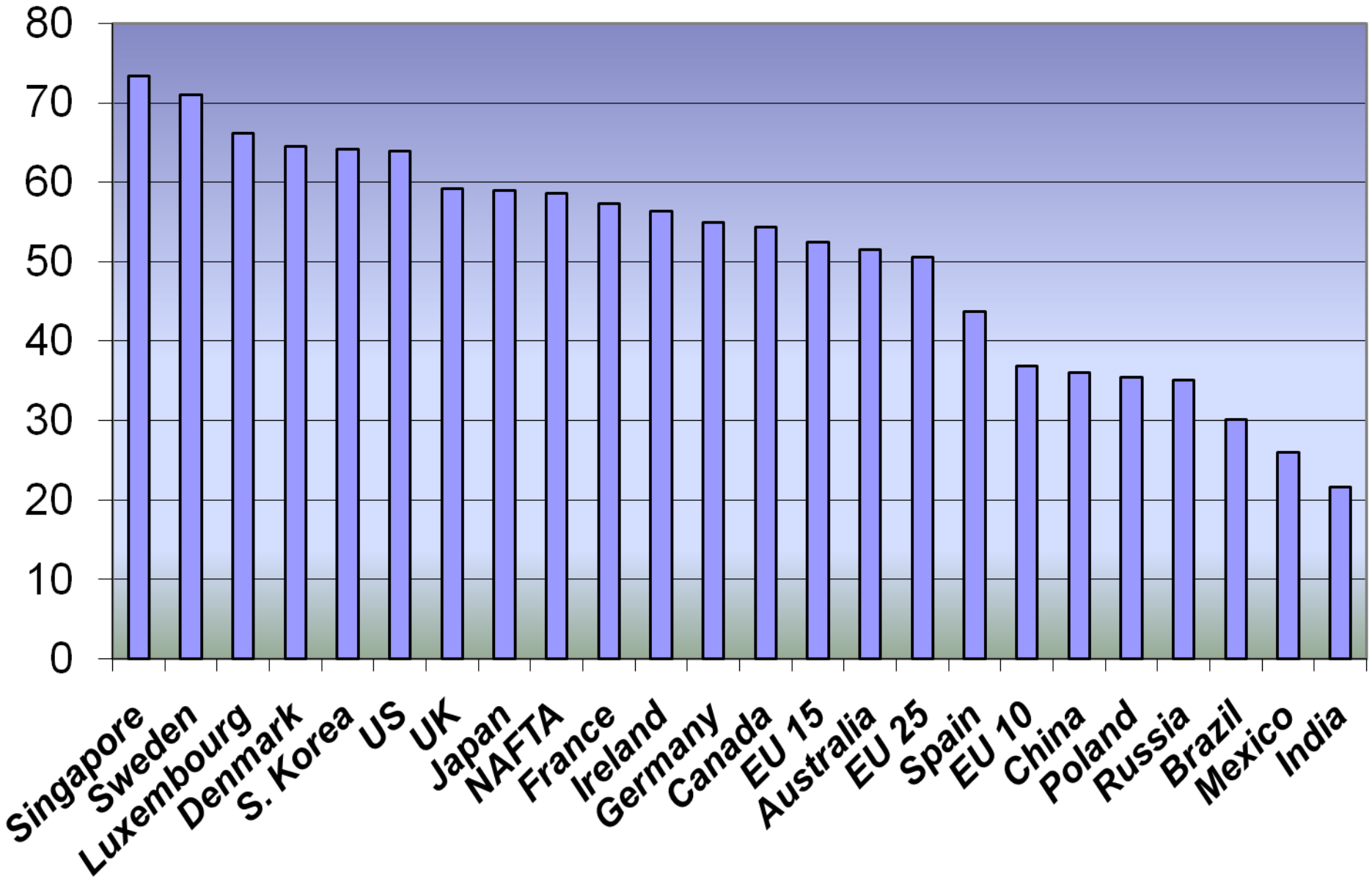
Actually, We're Number 6



Behind…

1. Singapore
2. Sweden
3. Luxembourg
4. Denmark
5. South Korea

Overall Score



Benchmarked Change from the Beginning of the Decade

The U.S. is Behind….

1. **China**
2. **Singapore**
3. **Estonia**
4. **Denmark**
5. **Luxembourg**
6. **Slovenia**
7. **Russia**
8. **Lithuania**
9. **Cyprus**
10. **Japan**
11. **Hungary**
12. **Slovakia**
13. **Czech Republic**
14. **India**
15. Latvia
16. Austria
17. S. Korea
18. Ireland
19. EU-10
20. Spain
21. Sweden
22. France
23. Portugal
24. Malta
25. Belgium
26. EU-25
27. Poland
28. UK
29. EU-15
30. Mexico
31. Netherlands
32. Australia
33. Finland
34. Canada
35. Germany
36. Italy
37. NAFTA
38. Greece
39. Brazil
40. United States

Many of Our Competitors Have Developed and Implemented Innovation Polices

What is a National Innovation Strategy?

- *"Those elements of science, technology, and economic policy that explicitly aim at promoting the development, spread, and efficient use of new products, processes, and services."*

- A well-conceived, strategic approach that proactively anticipates and articulates the interactions among policies in science and technology, R&D, education, workforce training, immigration, tax, trade, intellectual property, and digital infrastructure investments in driving innovation to create social and economic welfare.

- Intentionally links science, technology, and innovation with economic (and employment) growth.

- Pays particular attention to supporting the innovation capabilities of institutions, including businesses and government agencies, and to promoting the creation and diffusion of technology throughout society.

Comparing Countries' National Innovation Strategies

- September 2009

Country	Existence of National Innovation Foundation (s) or Agency	Definitively Articulated National Innovation Strategy/Policy	Stated Commitment to Lead the World in Transitioning to a Digital Economy	Implemented a National Broadband Strategy
Denmark	Yes	Yes	Yes	Yes
Finland	Yes	Yes	Yes	Yes
Ireland	Yes	Yes	Yes	Yes
Japan	Yes	Yes	Yes	Yes
The Netherlands	Yes	Yes	No	Currently Being Written
Portugal	Yes	Yes	No	Yes
Singapore	Yes	Yes	Yes	Yes
South Korea	Yes	Yes	Yes	Yes
Sweden	Yes	Yes	Yes	Yes
United Kingdom	Yes	Yes	No	Yes
United States	**No**	**No**	**No**	Currently Being Written

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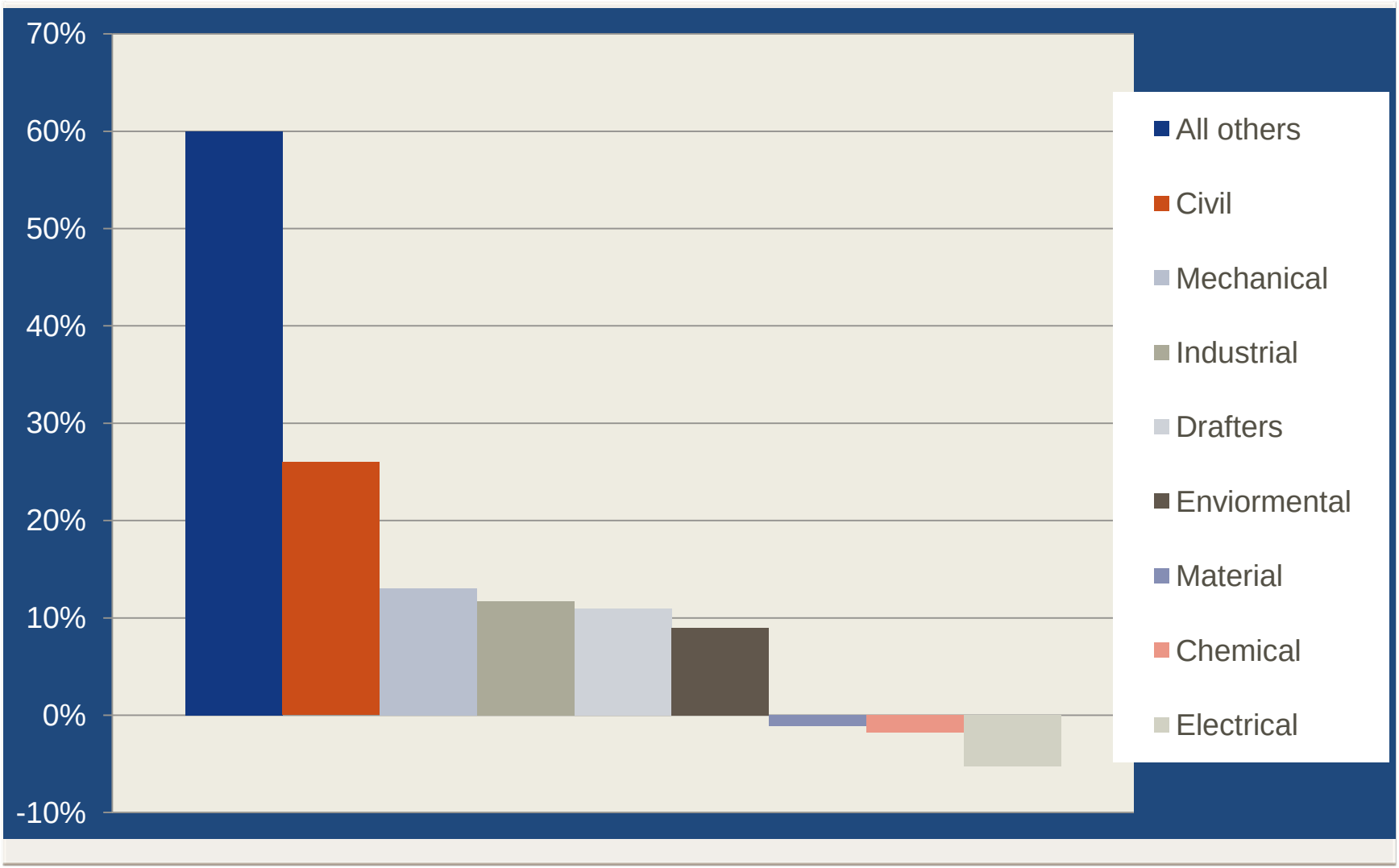
Work changed from this…

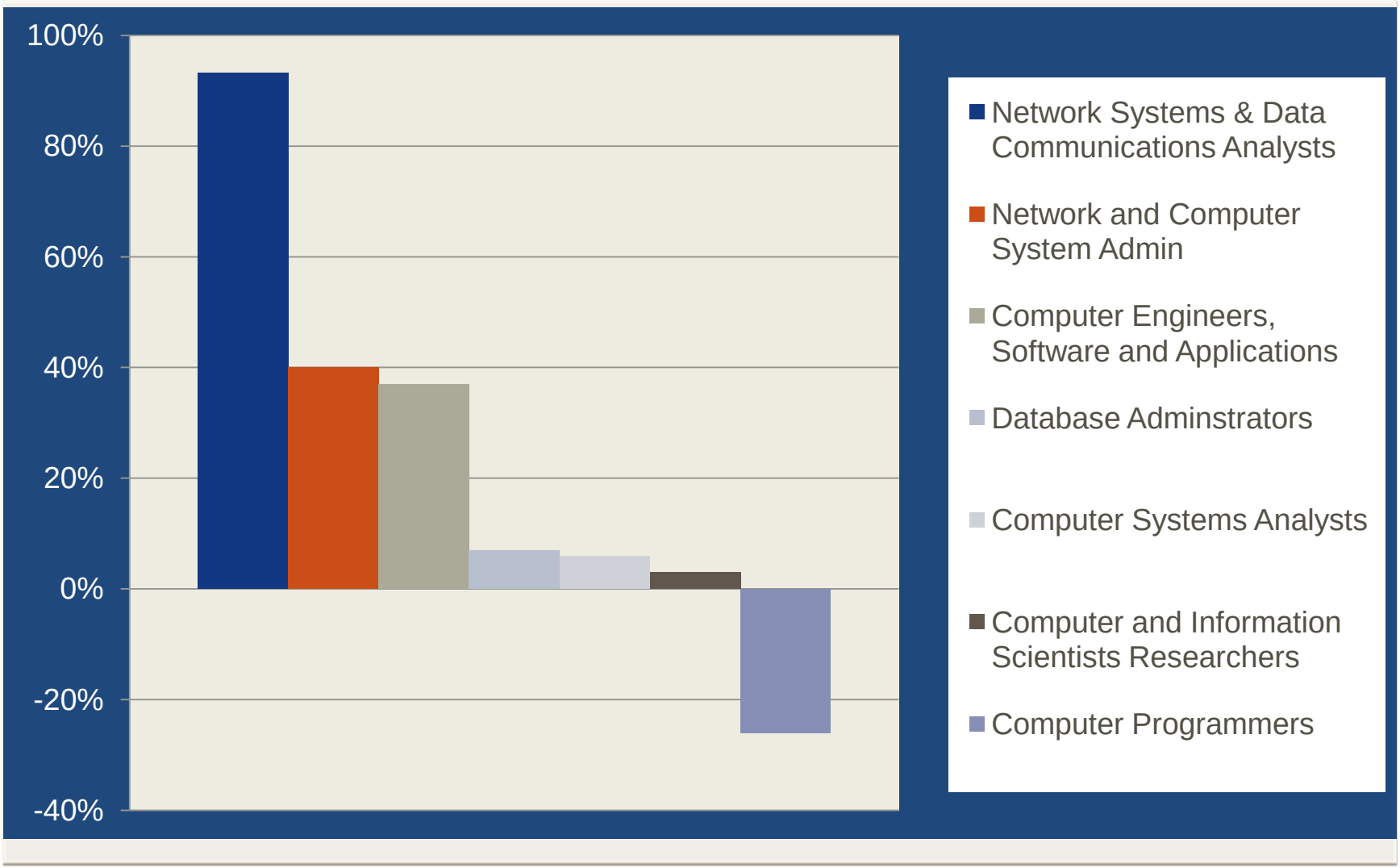
To this…

… To This.

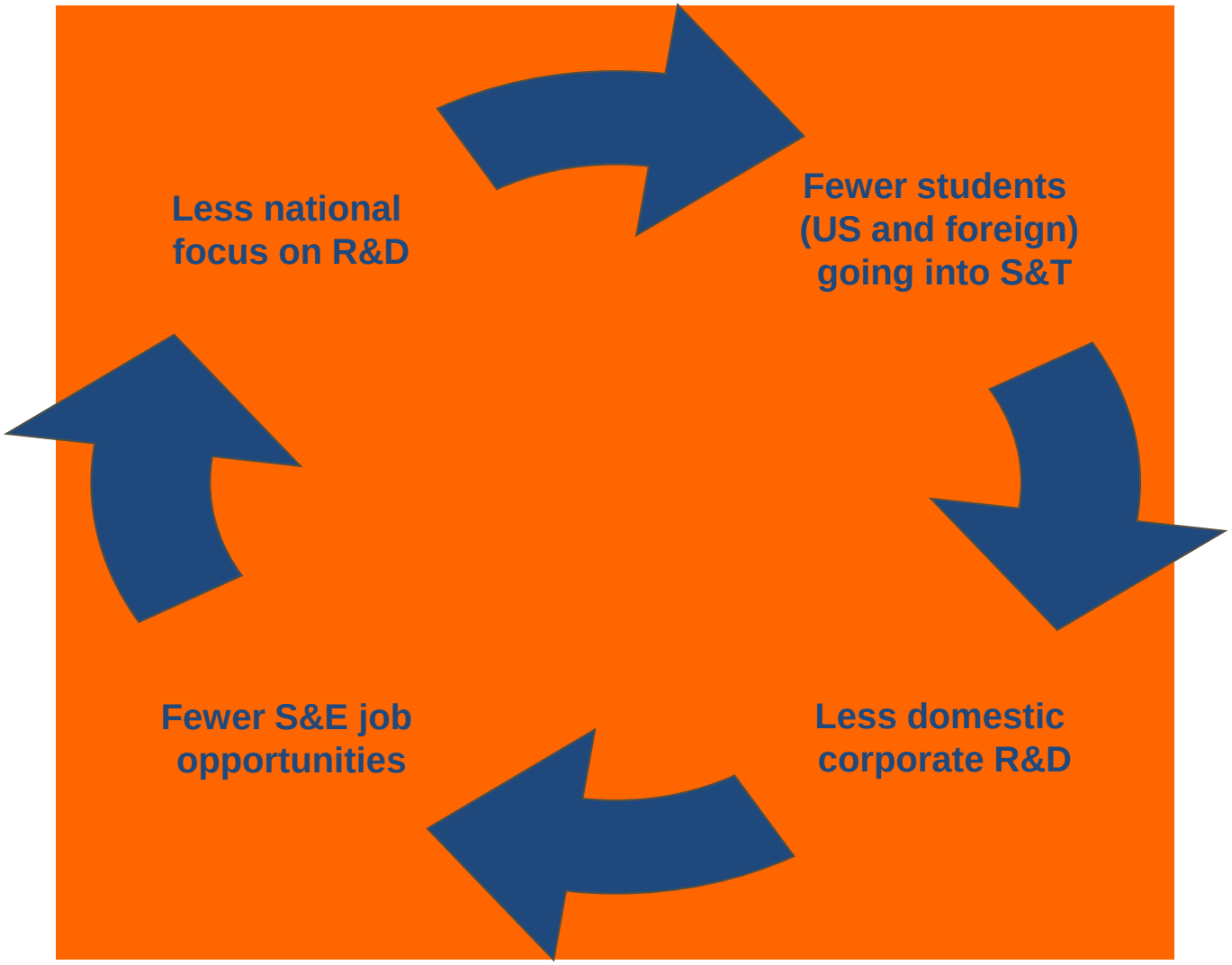
Engineering Job Growth 1999-2008



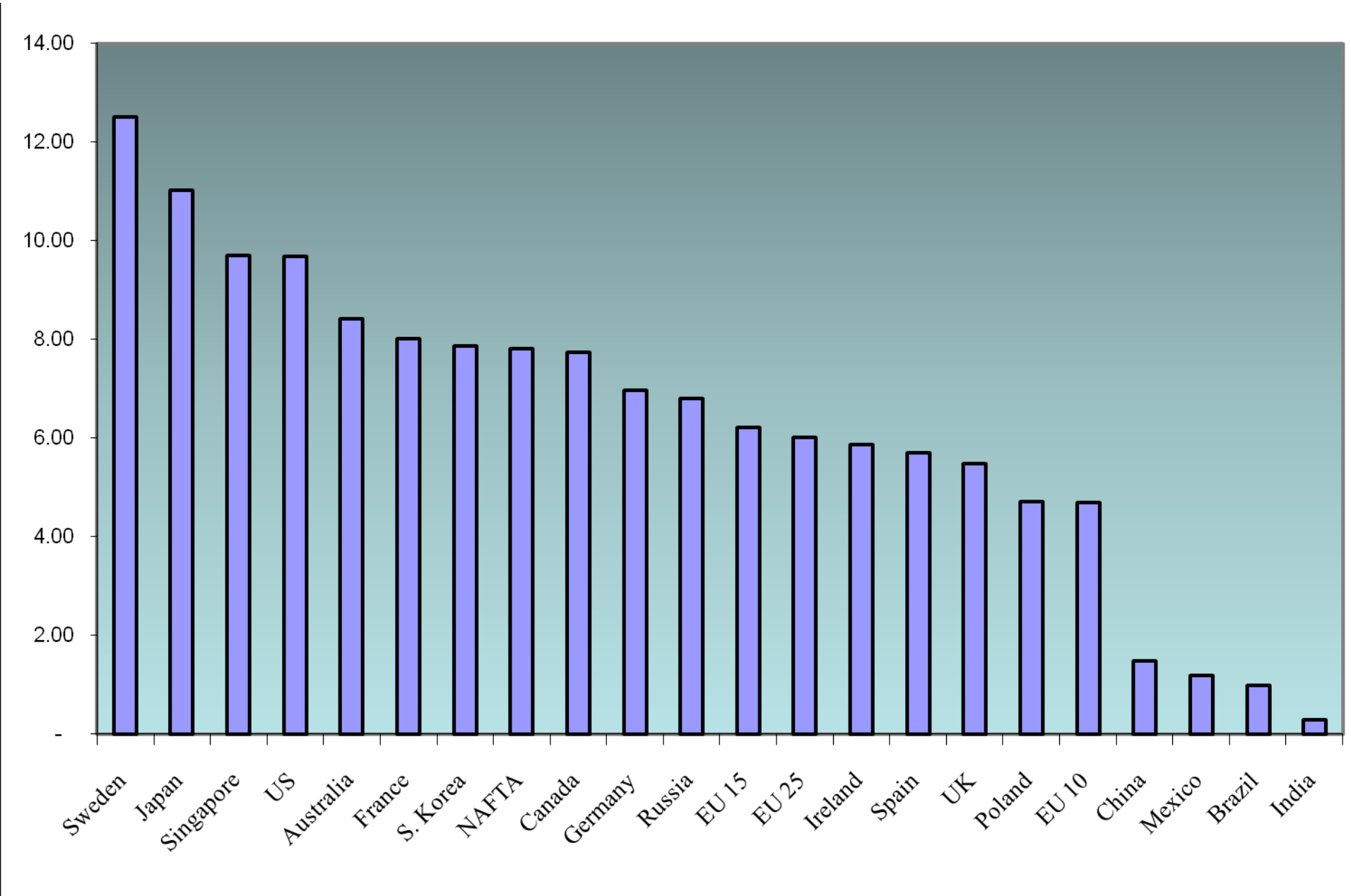
IT Job Growth 1999-2008



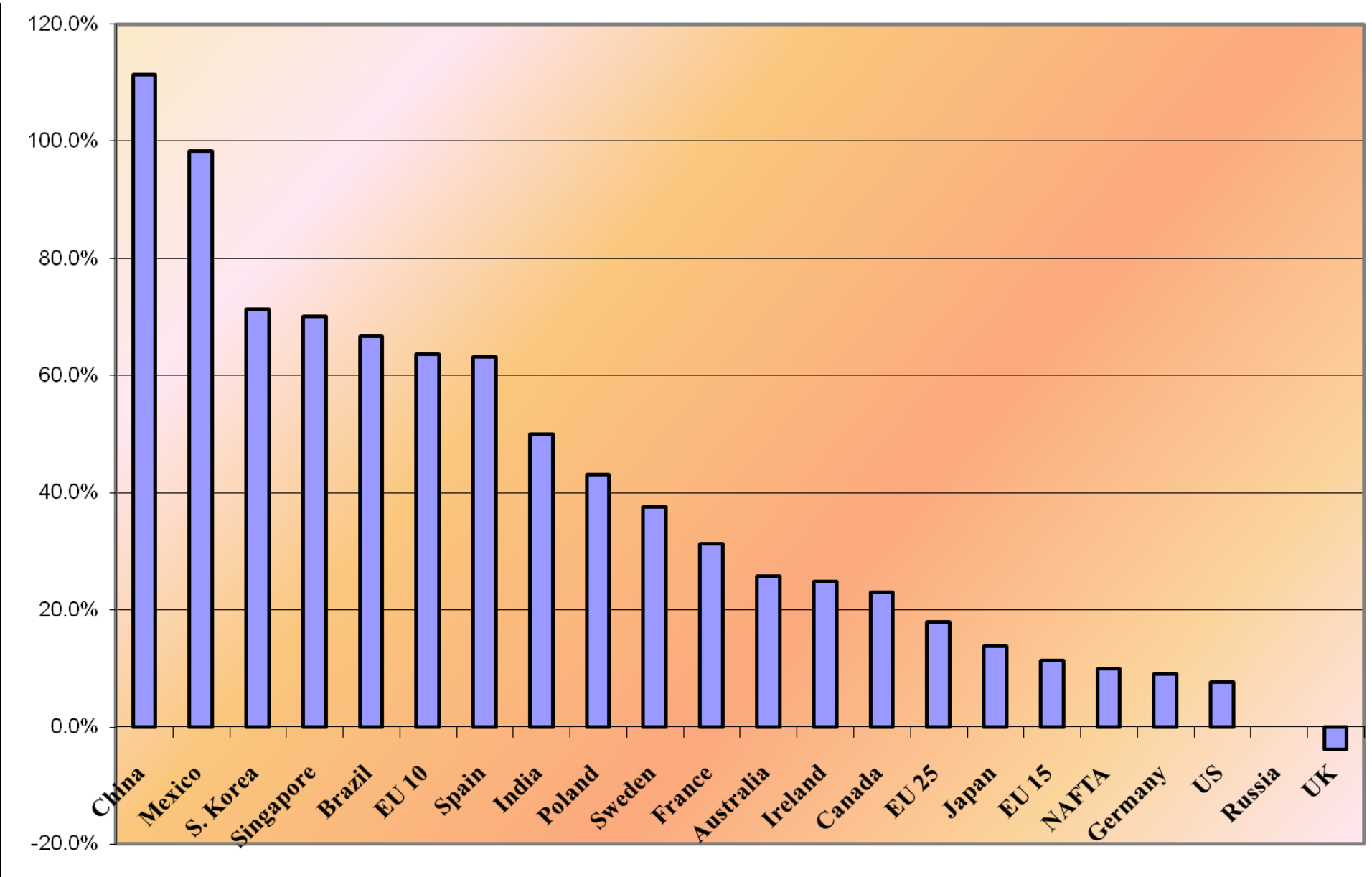
A Downward Innovation Cycle?



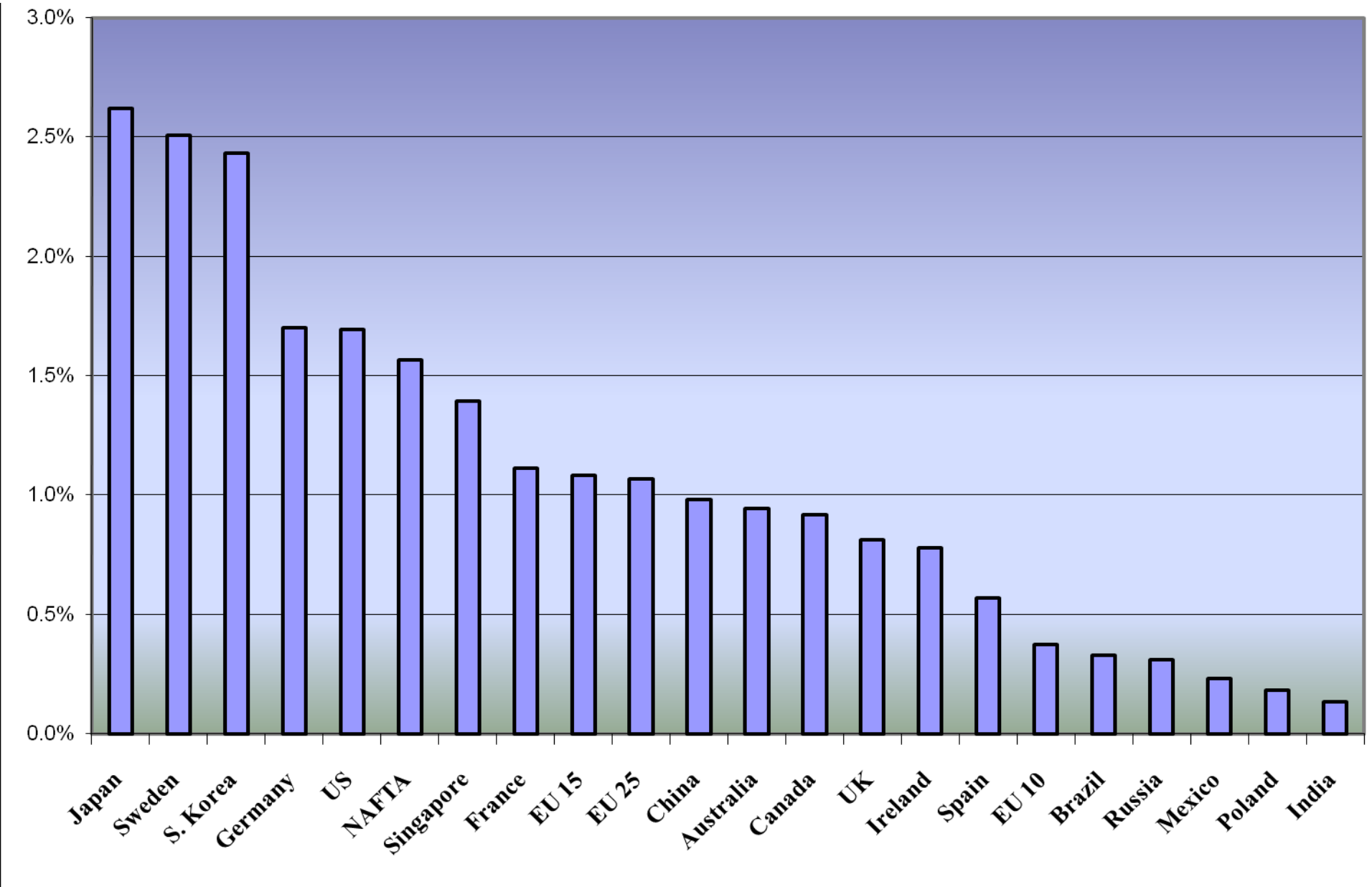
Researchers



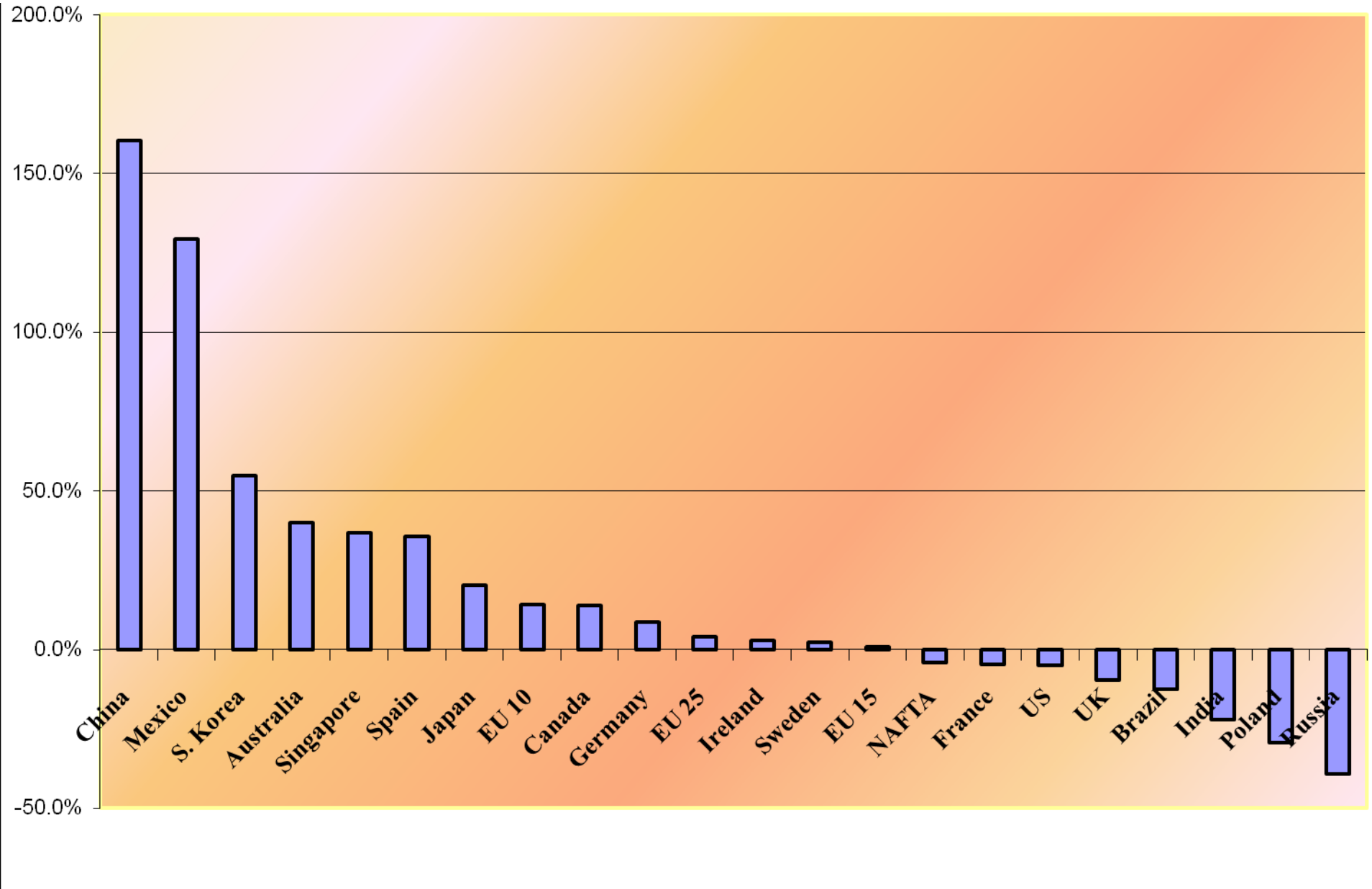
Researchers Change: 1999-2005



Corporate R&D



Corporate R&D Change: 2003-2007



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Recent ITIF publications on technology and education

- *The Role of Specialty Math and Science High Schools*
- *The Role of Technology in Reshaping American High Schools.*

Are Current Approaches Enough?

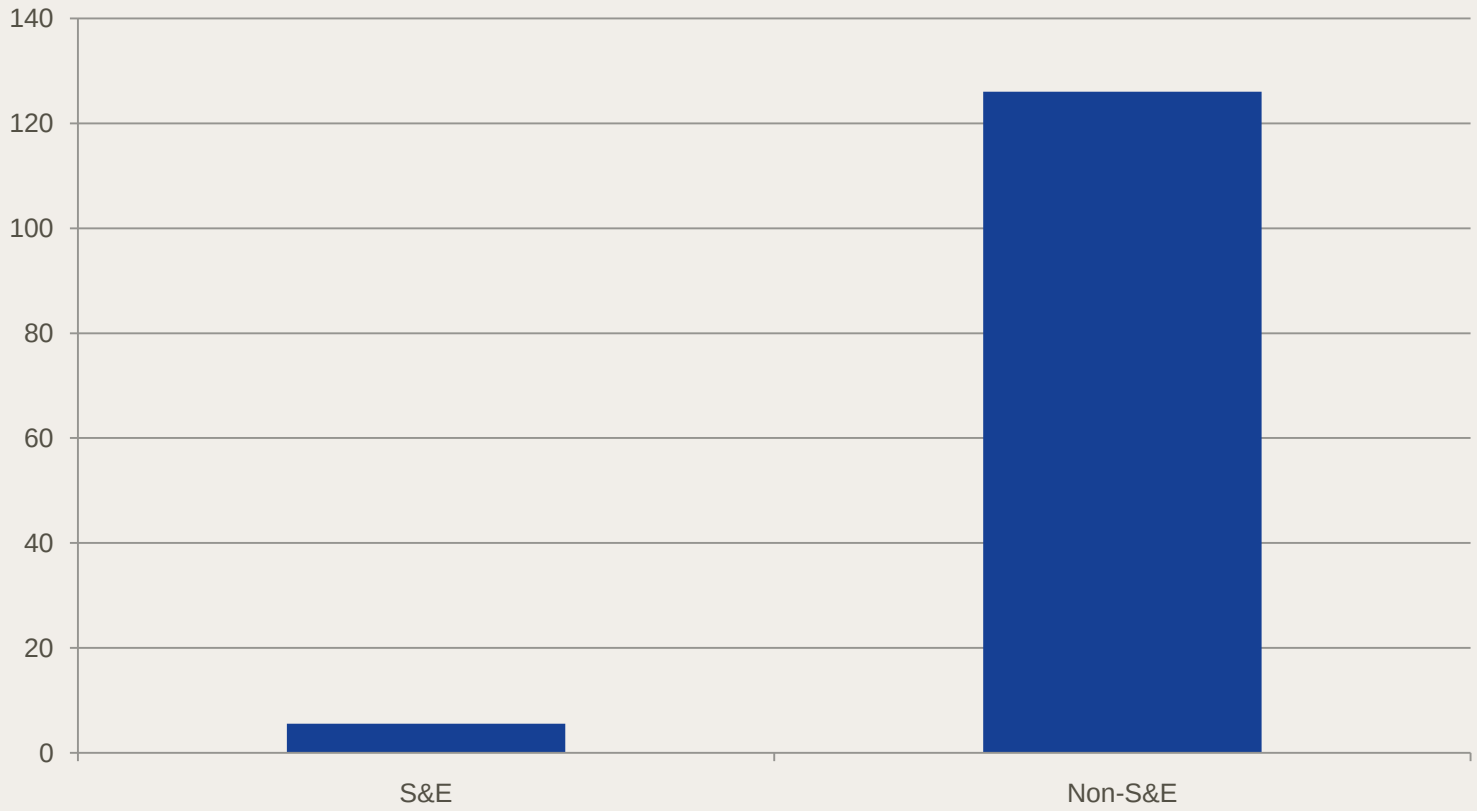
- Current analysis of the problem focuses on:
- Overall STEM Scores
- Teacher Quality (education, preparation time, salaries, etc.)
- Amount of instructional technology

Are Current Approaches Enough?

- The analysis of the problem should focus on:

- Number of students with strong STEM skills translated into STEM college degrees.

Scientists and engineers make up a small portion of the workforce



Are Current Approaches Enough?

- The analysis of the problem should focus on:

- Number of students with strong STEM skills translated into STEM college degrees.

- **Institutional and pedagogical design**

- How instructional technology is used.

Are Current Approaches Enough?

- The analysis of the problem should focus on:

- Number of students with strong STEM skills translated into STEM college degrees.

- Institutional and pedagogical design

- **How instructional technology is used.**

Are Current Approaches Enough?

	Current Approach	A New Approach?
Scope of STEM	Some STEM for all	All STEM for some
	STEM as science literacy	STEM as innovation engine
Schools	Stem in all High Schools	Specialty STEM HS's
Pedagogy	Delivering information	Students learning
Subjects	Competence in many	Depth and mastery of a few
Process	Everyone Learns the Same thing (Batch processing)	Learning is customized (e.g. project-based learning) mass customization
Teacher Role	Instructors	Advisors/Facilitors
Technology	As Textbook	As Research tool

Thank you

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