

The World Is Flat: Globalization of Materials R&D

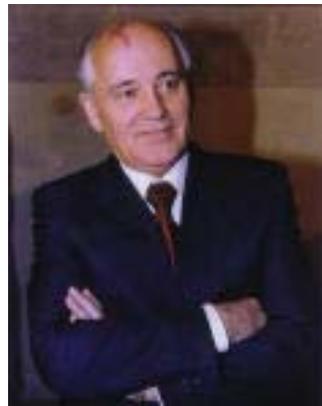
Implications for the Manufacturing Industry

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OUTLINE

- ***Context, Issues, Threats***
- *What has not Worked*
- *What we need to do*

The End of the Cold War Era



***USA the only remaining superpower ...
Our Responsibilities ? Societal context?***

Historical Context

- *1970's - stagflation in USA*
- *Japanese Industries Investing in R&D
... and fierce competition*
- *Omnibus Trade and Competitiveness Act
of 1988; NIST charged to establish
ATP (Advanced Technology Program)*
- *1990-2000 focus on efficiency and quality*

U.S. Bicycle Distribution Split Between Mass Retail Channel and Independent Bicycle Dealers (IBD) Channel

Mass

(Wal-Mart, Target, Kmart
Sports Authority, etc.)

- *14.5 Million units/year (growing).*
- *80% Kids Bikes.*
- *Typical Retail Price Points: \$24 - \$150.*

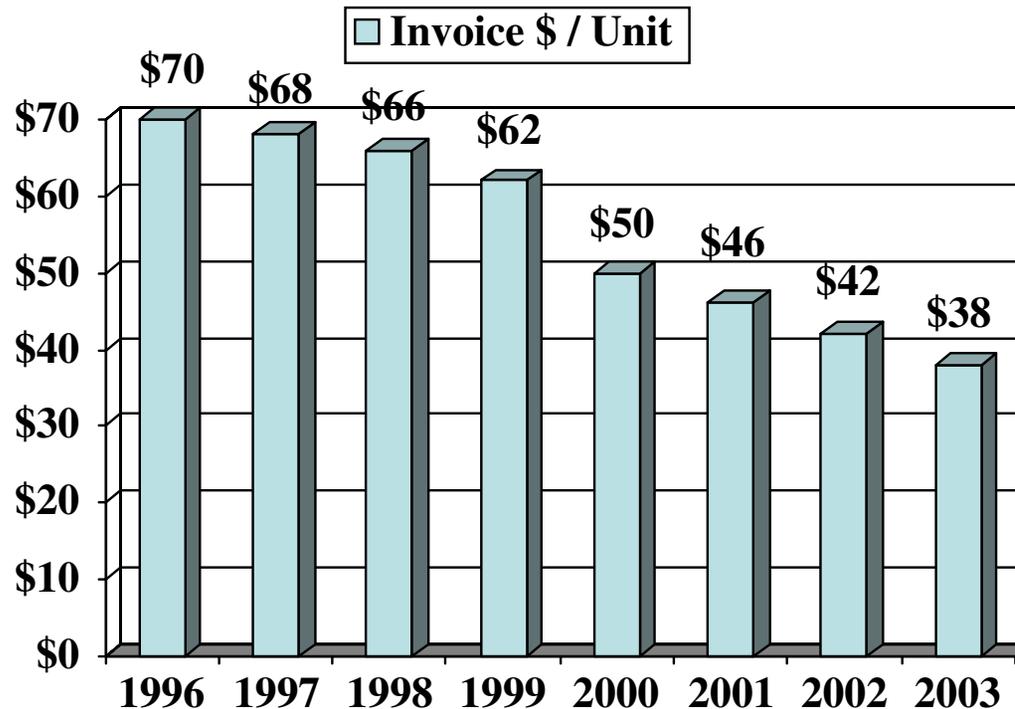
Independent Bicycle Dealers

("Mom & Pop" Operations:
4,000 - 5,000 outlets)

- *2.5 Million units/year (declining).*
- *80% Adult Bikes.*
- *Typical Retail Price Points: \$199 - \$6,000.*

As Mass Distribution Has Grown, Retail Price Points have Declined Significantly Driven Primarily by Impact of “Wal-Mart and China”

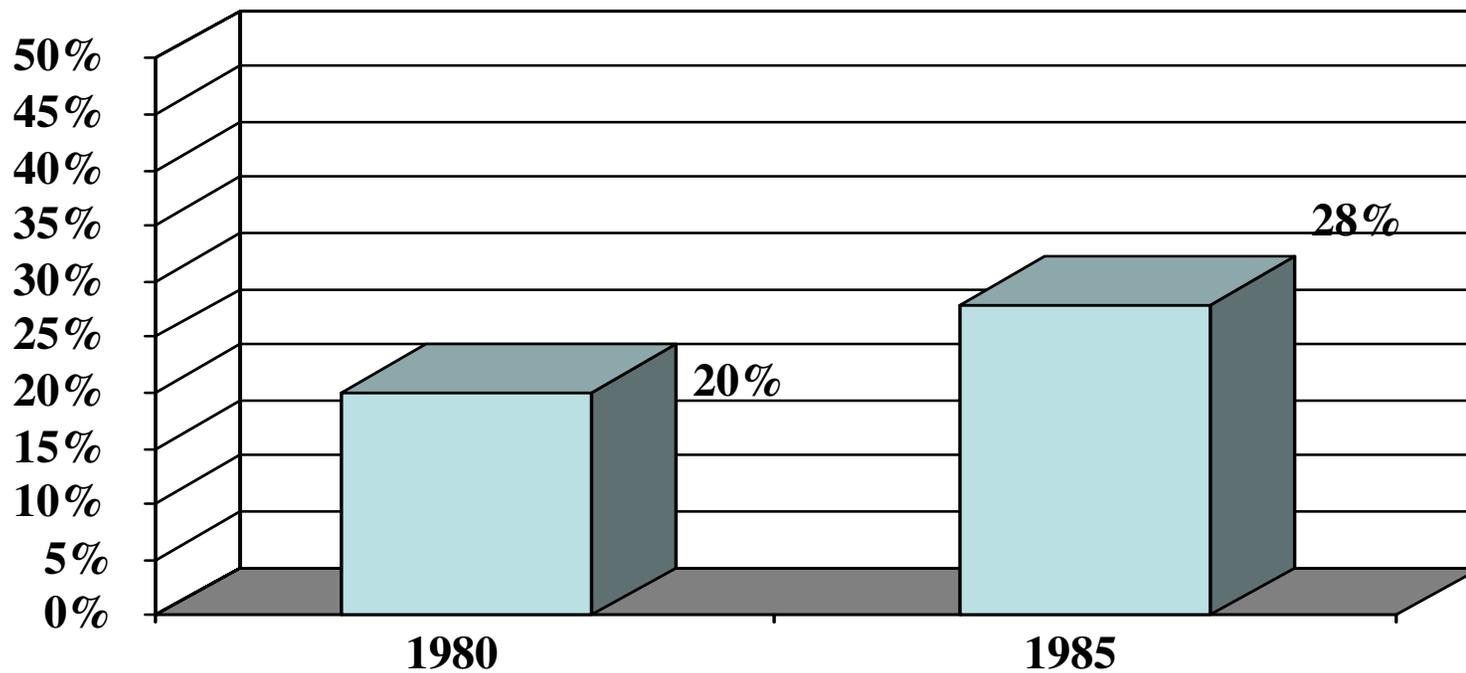
Average Invoice Prices to Retailers (\$)



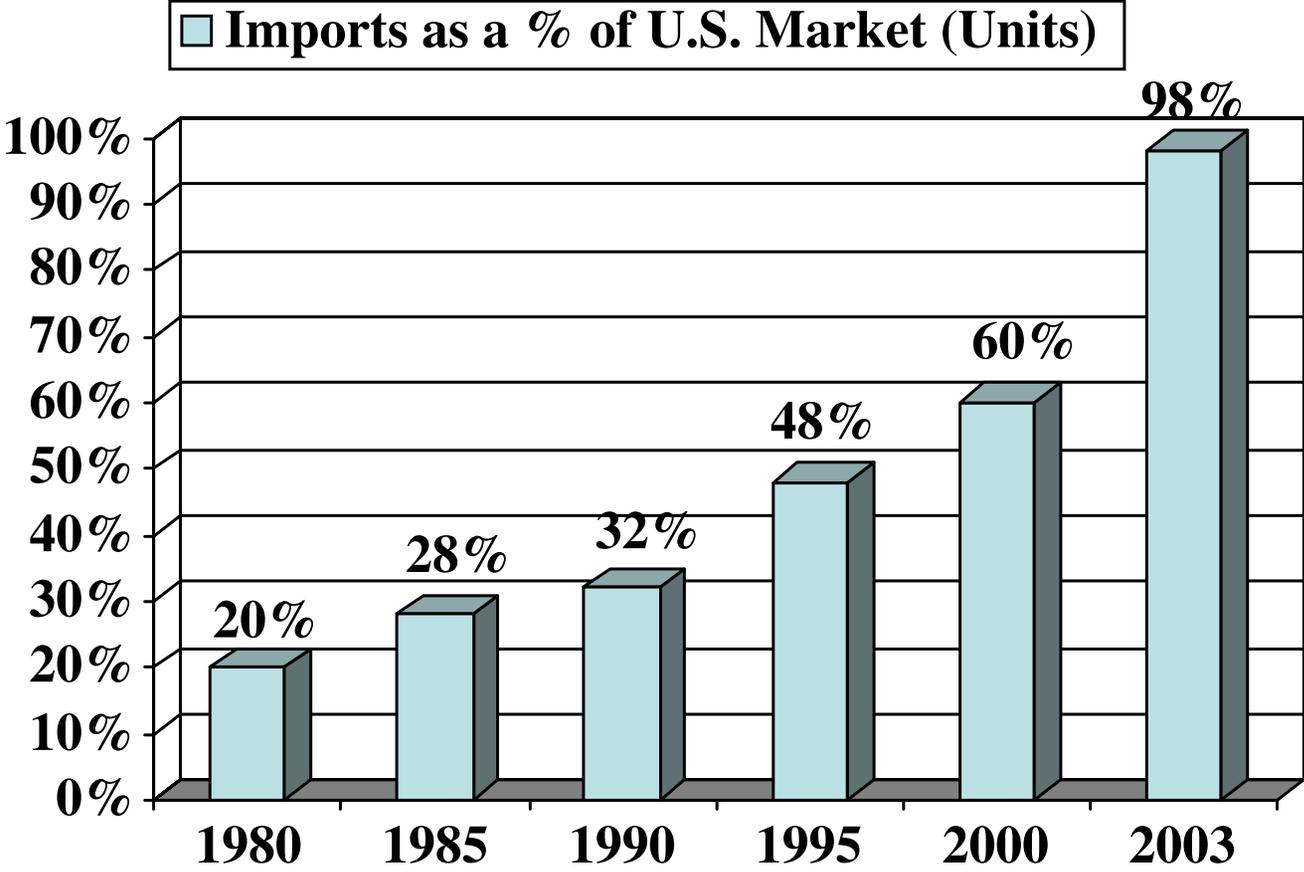
Down 46%
Since 1996!!

Until Mid-1980's 75% of the Bikes Sold in the U.S. Market Were Made in the U.S. Market

Imports as a % of U.S. Market (Units)



However, Things Started to Change in the 90's



U.S. Consumer, Retailers Have Supported & Driven the Transformation

In Summary, China has Won the Bicycle Manufacturing War With:

- *Cheap Labor*
- *Lower Factory Overheads*
- *Government Export Rebates*
- *Currency (Probably Undervalued)*



Which More Than Offset Higher:

- *Ocean Freight*
- *11% Import Duties*



Plus, Quality and Response Time are Competitive

China Rapidly Penetrating Other Metal Processing Industries Historically Done in the United States - Examples:

- **Automotive** - *General Motors Sourced 9% of Their Aluminum Wheels for the U.S. Market, From China in 2003. Hope to Source 40% by 2006.*
- **Aerospace** - *Lower Technology Castings for Jet Engines are Being Produced in China - you can Expect Higher Technology Parts to Follow.*

***China, at the Current Time, is not
without its issues as a supply base
- current top five are:***

- Raw Material Inflation (*Steel, Resins, etc.*)
- Export Rebates Being Reduced
- Infrastructure Lagging (*Power Shortages, etc.*)
- Currency (*Probably Undervalued*)
- Political Uncertainty

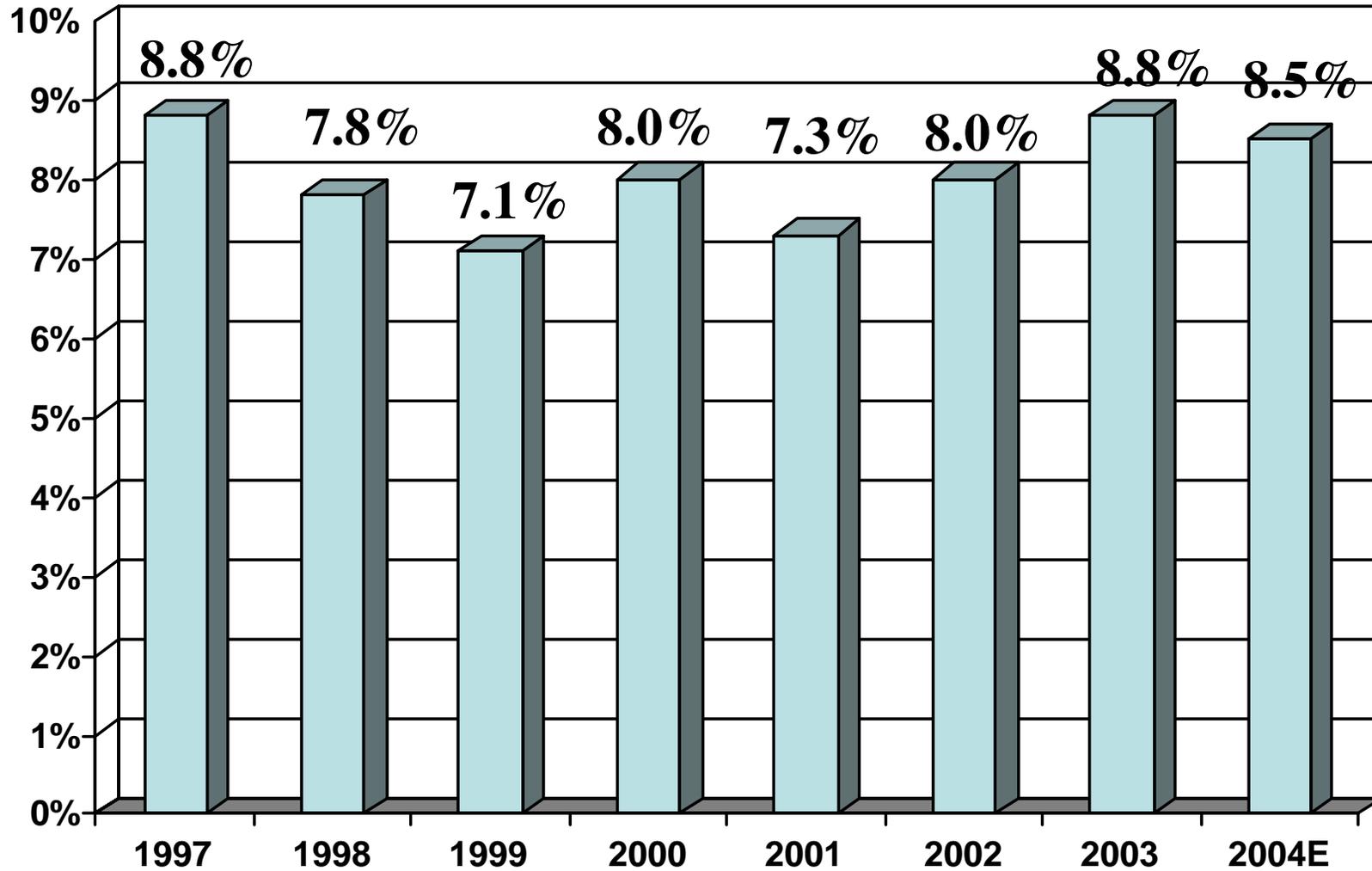


Ipsen International Process Heating Manufacturing in China

Mr. Mario Ciampini
President & CEO
**Ipsen International,
Inc.**

Wednesday, May 26, 2004 Metal Processing
Institute - MPI

Annual GDP Growth in China



Market Study — *Bain & Company*

- In 1994 Ipsen commissioned Bain & Company to perform a detailed market study (\$0.5 million) for the Process Heating Industry
- Results denoted that market would *Quadruple* for the period 1996 to 2005 (10 years) due to very fast growth in the *Automotive, Aerospace, Steel and Aluminum sectors*
- Significant offshore demand and manufacturing base established by American and European global companies

Development of Automotive Industry

Year	1992	2000	2002	2003
Vehicle production	1,000,000	2,000,000	3,000,000	4,000,000
Period	36 years (1956~1992)	8 years (1993~2000)	2 years (2001~2002)	1 year (2003)

Restructuring of the Automotive Industry

Three Giants:

***FAW** Group in Northeast China*

***SAIC** in Shanghai*

***Dongfeng Group** in Middle of China*

*These three groups cover about 50%
of total vehicle production in China.*

MPI CHINA DELEGATION VISIT

December 8-17, 2004

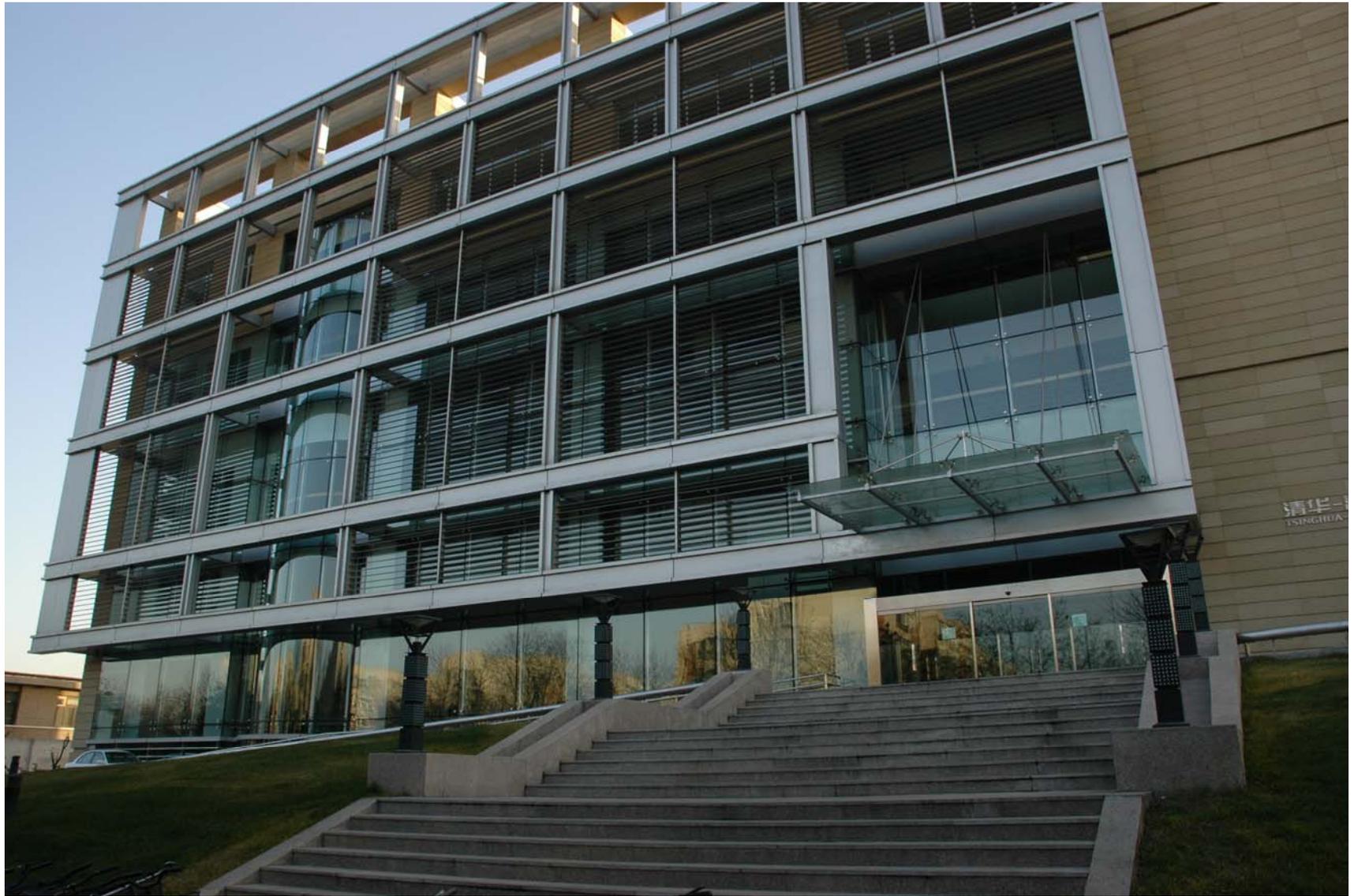


*MPI DELEGATION VISIT TO CHINA'S RESEARCH &
EDUCATIONAL CENTERS IN METAL PROCESSING*











Shanghai Jiao Tong University

Xuhui Campus - *Haoran Research Building*



Shanghai Jiao Tong University

Minhang Campus (New Campus)



Shanghai Jiao Tong University

Minhang Campus - *Library*



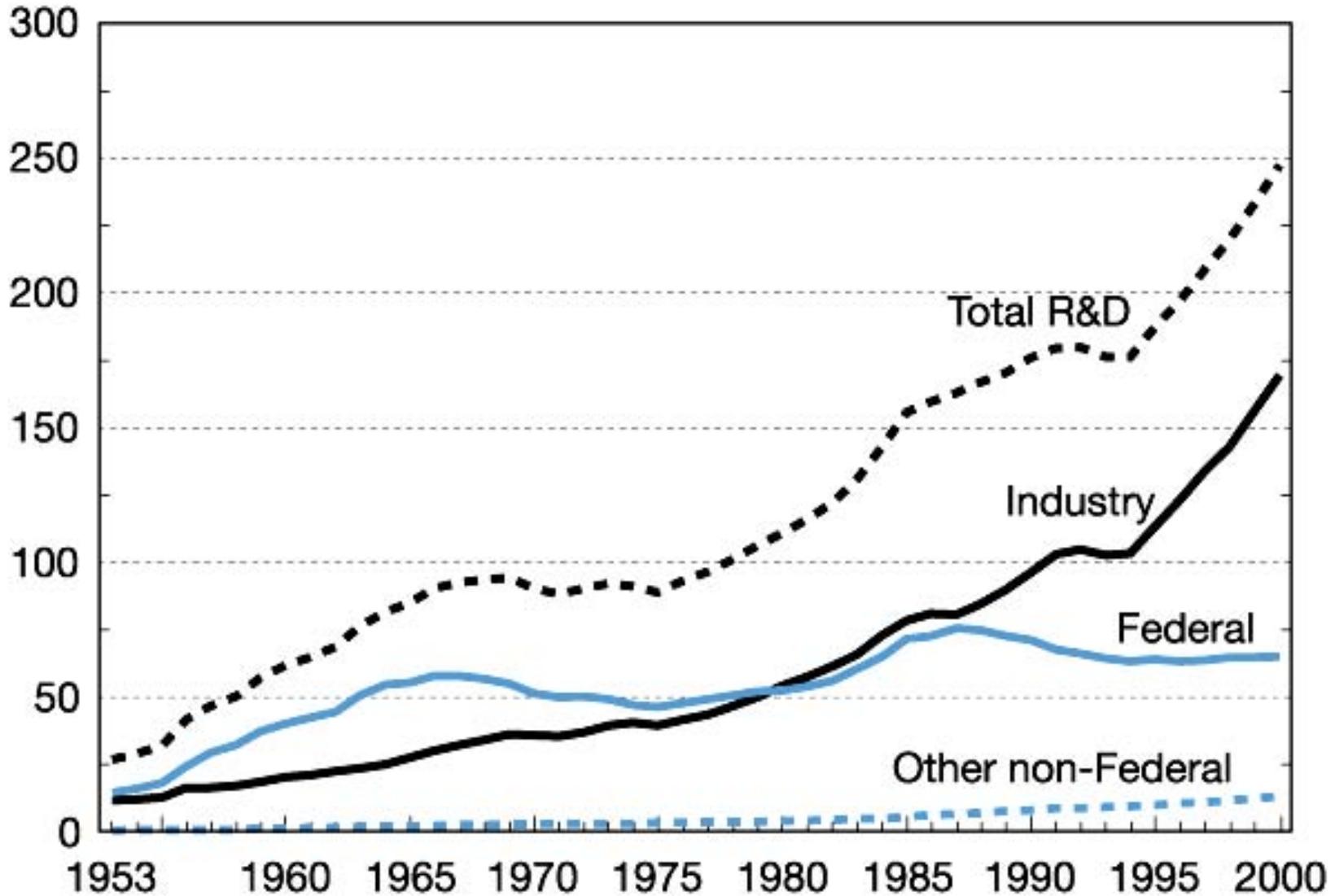
SHARE DATA

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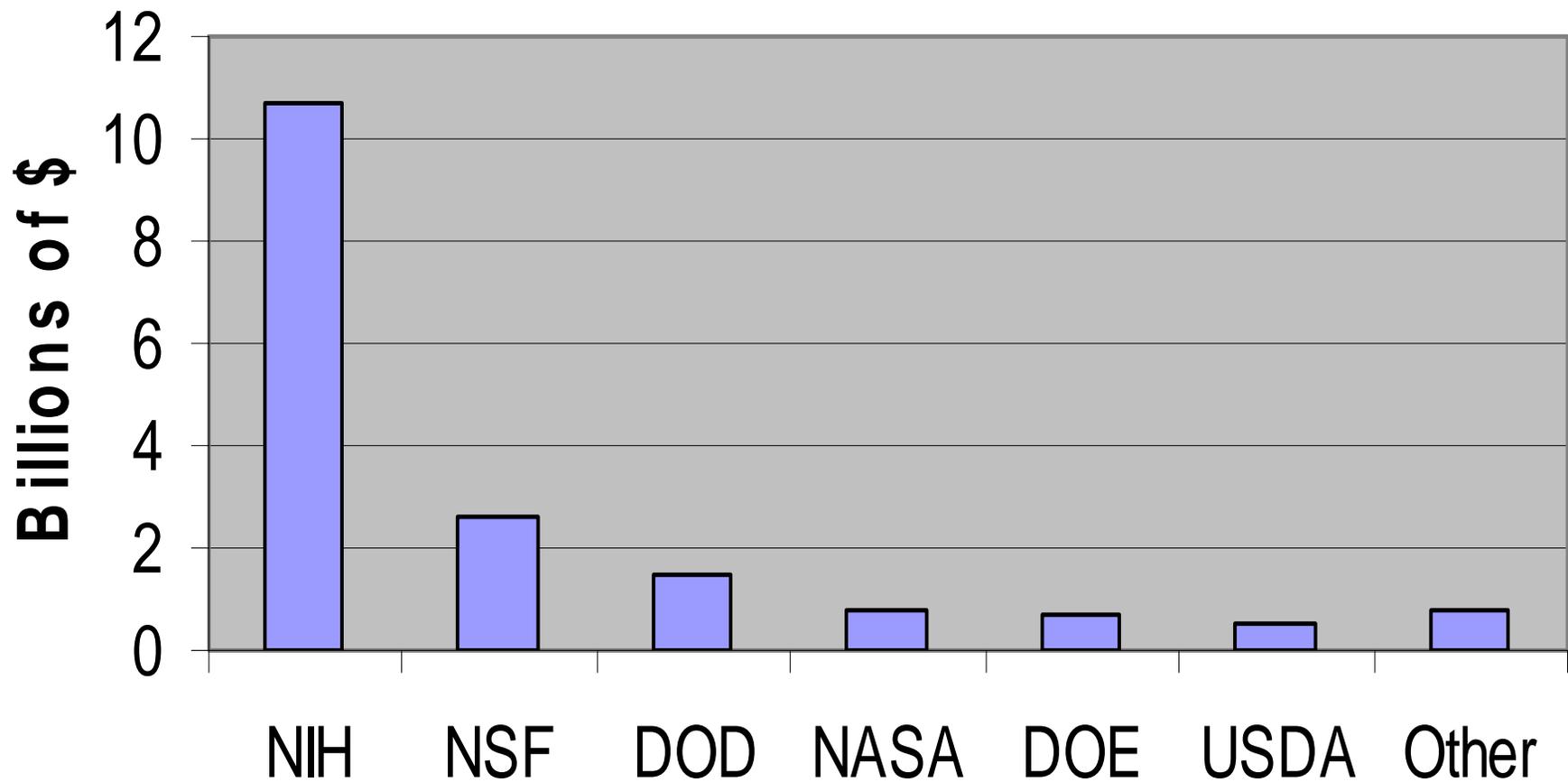
U.S. R&D Funding

Billions of constant 1996 dollars



Federal Basic Research

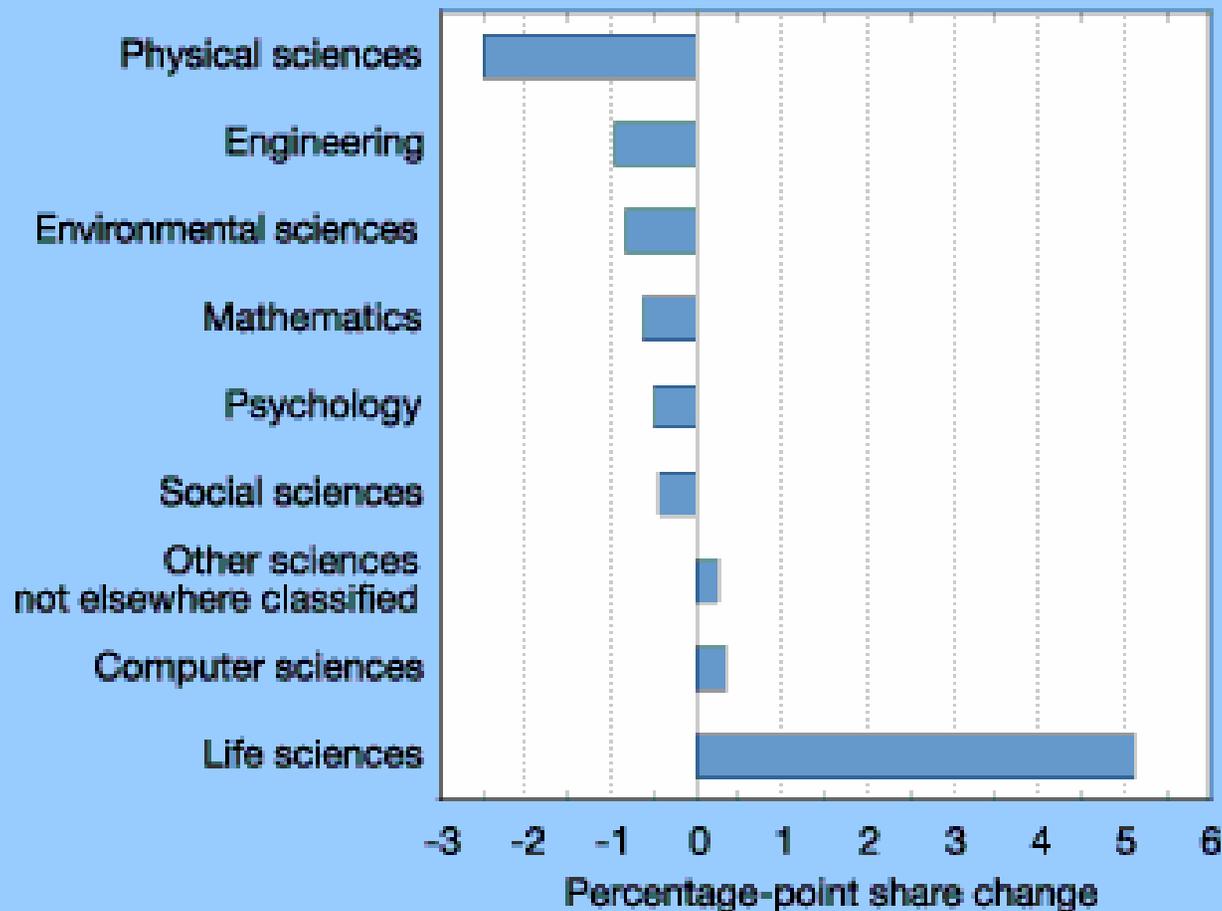
Basic Research in 2001



Disciplinary Research

Overview Figure 2.

Changes in share of Federal academic research obligations, by field: 1990–99

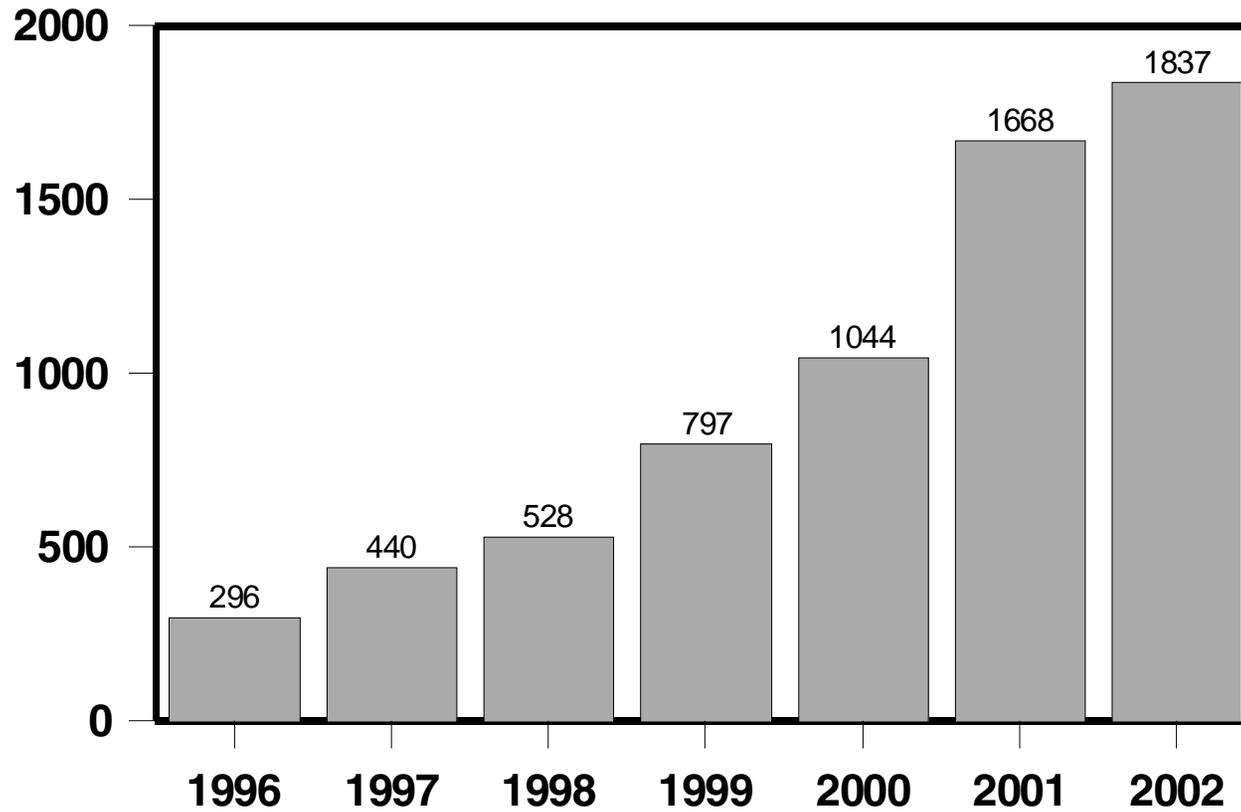


SOURCE: NSF/SRS, Survey of Federal Funds for Research and Development

Science & Engineering Indicators – 2002

Funding for Academic Earmarks

Millions of Dollars



Source: *The Chronicle of Higher Education*.

Peer Review Process

"The peer review advisory process for the allocation of federal government support for scientific research has served our nation well over many decades and...should be maintained as the principal factor in determining how federal research funds are awarded."

*NRC Committee's
Recommendations for the Future
of Physics, July 2001*

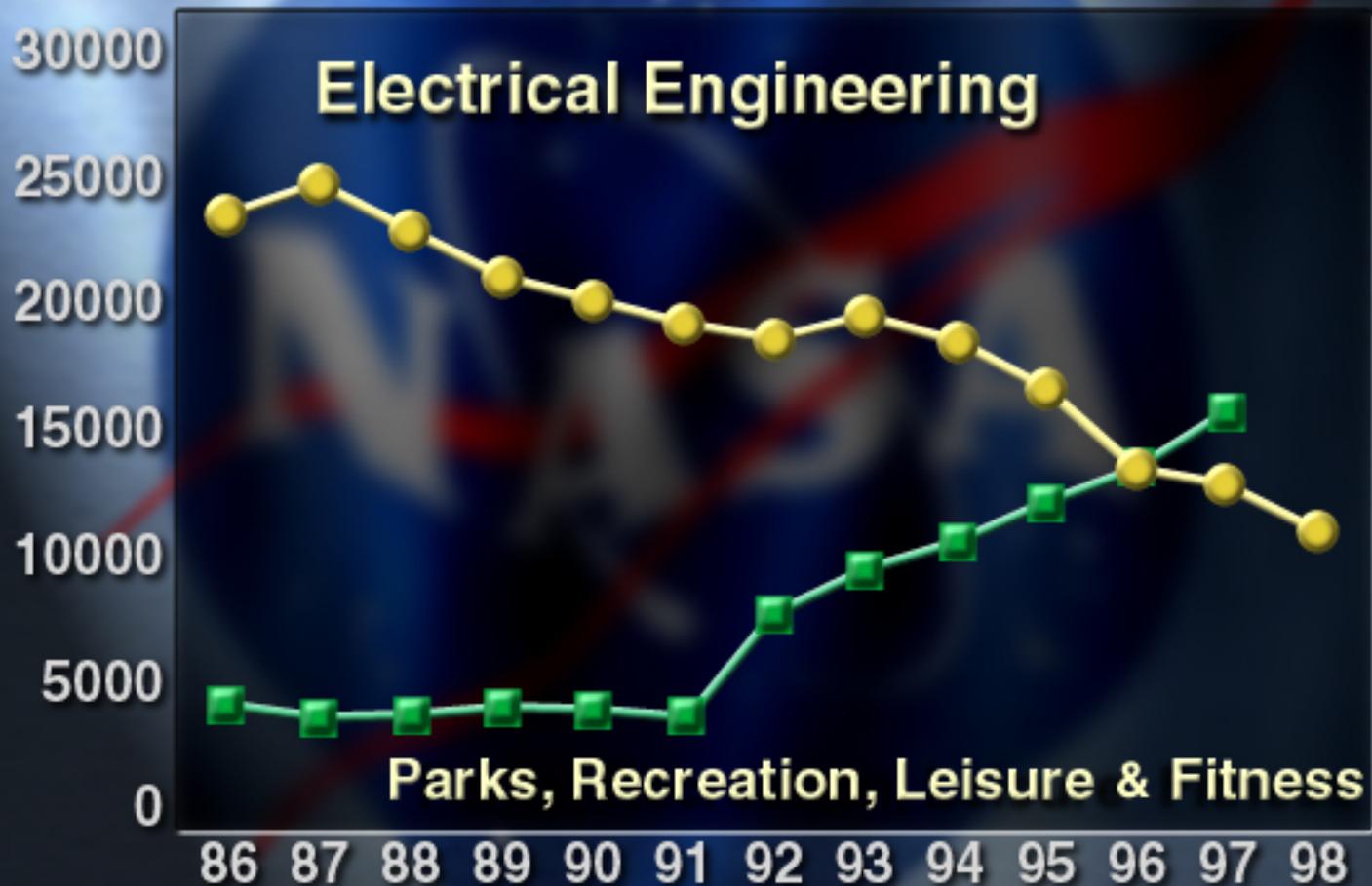
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Challenge: Workforce Issues

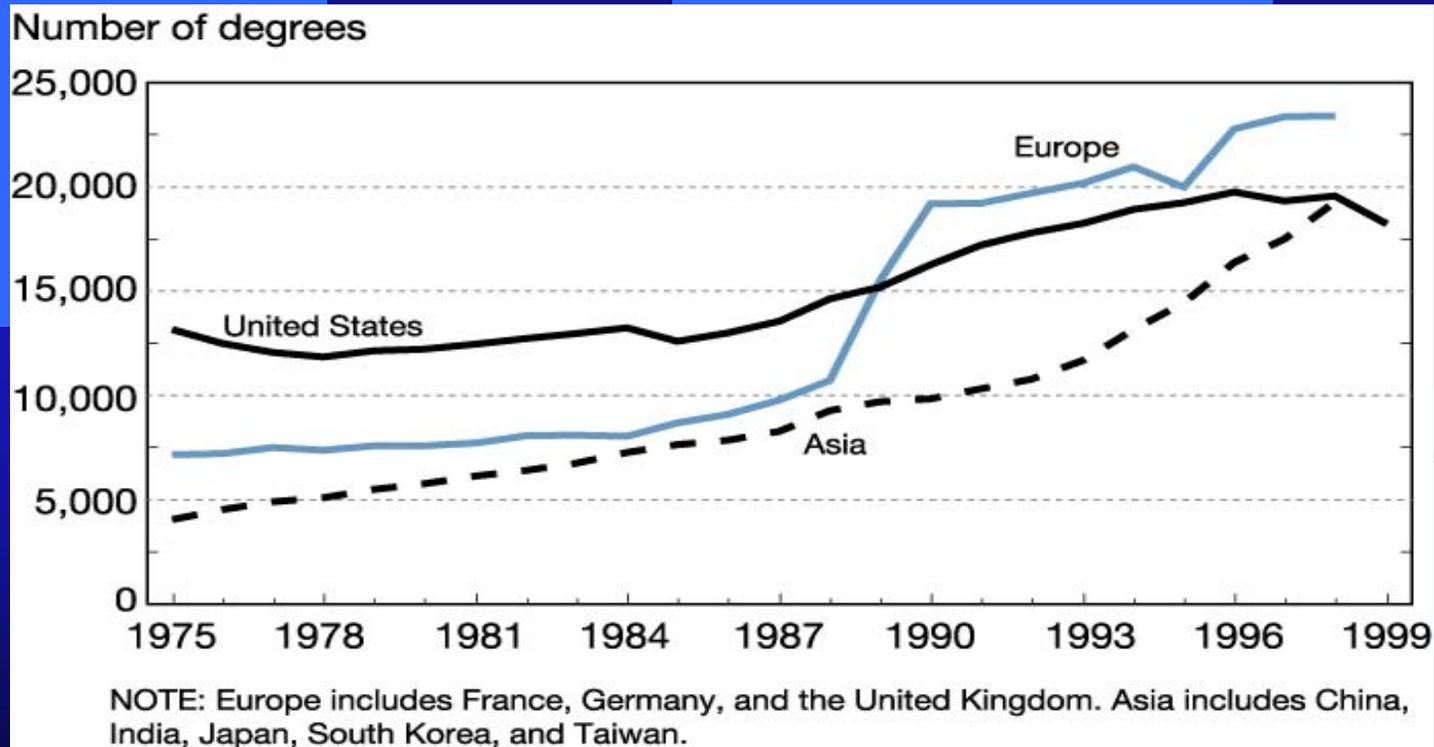
- Decline in US college-age population
 - *U.S. education system needs to improve*
- Heavy reliance on foreign-born scientists--
One in Four
 - *Academia*
 - engineering (40%), computer science (35%) and mathematics (28%)
 - *Industry*
 - 33%-overall, engineering & computer (50%), mathematics (33%)
 - *Federal Government*
 - 16%

Credit: Dr. Kathie Olsen -ASTRA

BACHELOR'S DEGREES Awarded by Institutions of Higher Learning



Global Context: Natural Sciences and Engineering Doctoral Degrees 1975-2000: U.S. Stagnant, Europe and Asia Surge



Source: *Science & Engineering Indicators 2002*

The Impact on Society

Innovation Impact



73% of the citations in U.S. industry patents are from research conducted ~~at~~ publicly supported institutions

Economic Growth Impact



Approximately a dozen economic studies (including those of Nobel Laureate Robert Solow) show ~~that~~ technological progress accounts for 50% of economic growth, for all time periods studied (various intervals from 1869-1979) ~~is~~

Workforce Impact



Strong correlation ~~is~~ between federally R&D ~~and~~ funding and creation of ~~the~~ technically trained workers

Something to Ponder É

If there are not enough trained people in the U.S., corporations will have to move R&D operations to where the trained people are. The pilot plant follows, because you need the R&D people nearby to help make it work. The manufacturing plant follows the pilot plant. Distribution, sales, and management follow the manufacturing. Once this process is started, it is not reversible.

Corporations may not like it but they will survive if there is no R&D in the U.S. They will just go overseas. The U.S. economy, however, will not recover from the loss of this business.Ó

**Š Quoted with permission from Bill Joyce, CEO of Hercules
and previously CEO of Union Carbide**



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- *Context, Issues, Threats*
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National Innovation Initiative

- *study and recommendations**

"...For the past 25 years, we have optimized our organizations for efficiency and quality. Over the next quarter century, we must optimize our entire society for innovation..."

* December 2004 - ISBN 1-889866-20-2

National Innovation Initiative

- *study and recommendations**

Recommendations - Three Categories

Talent - support a culture of collaboration, a symbiotic relationship between research and commercialization, and life-long skill development.

Investment - Give innovators the incentives and resources to succeed.

Infrastructure - support a new industry-academia alliance, Flexible IP regime, bolster manufacturing enterprises...etc.

* *December 2004 - ISBN 1-889866-20-2*

Innovation is Key

*“**Research** is the transformation of
money into knowledge;*

***Innovation** is the transformation of
knowledge into **MONEY**”*

Geoffrey Nickelson, 3M