



Building a New Foundation for Innovation: Industry Perspective

June 18, 2001

**National Science Foundation
Workshop**

Arlington, Virginia

Egils Milbergs

President

**National Coalition for Advanced
Manufacturing (NACFAM)**



NACFAM

*A nationwide community
focused on manufacturing
technology, workforce
quality and productivity
growth.*



Manufacturing is the Foundation of Economic Growth

- 17% of GDP, employs 18.5 million workers
- 45% of GDP and 41% of US employment, using input-output analysis (Cooper 1996)
- From 1992 -1997, manufacturing GDP grew by 5.2% annually, compared to 3.1% for the economy overall, and accounted for 29% of economic growth (real GDP) between 1992-1997
- Manufacturing creates high-wage/high-skill jobs
- 71% of U.S. exports are manufactured goods (Census 1999)



Presentation Components

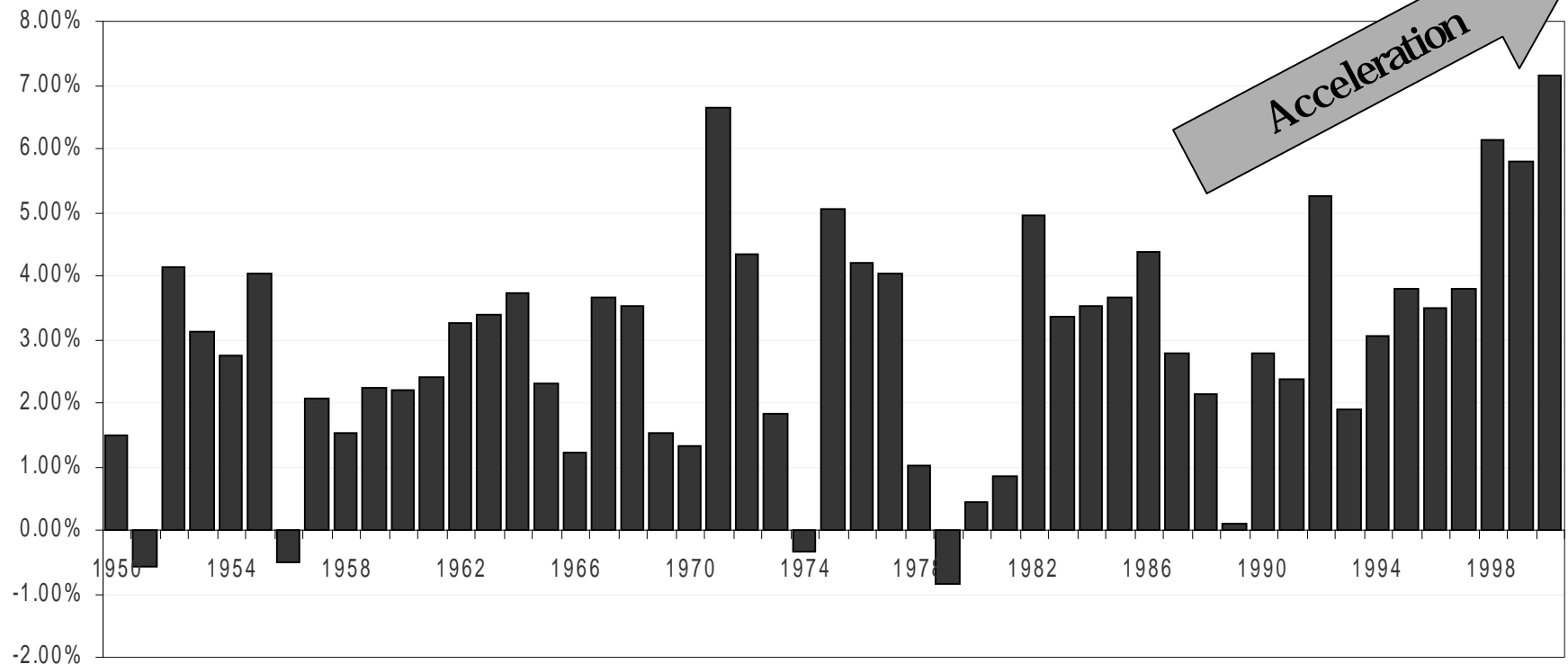
- The Prosperity Crisis--America as the World's Economic Superpower
- Technological Fusion—Old Economy and New Economy
- Industry Collaboration Trends
- Policy Strategies and Partnership Opportunities
- Prosperity Principles and Success Factors

US is the World's Economic Superpower

- Recovery from US competitiveness slump
- Technology is driving the *New OLD Economy*
- Is the economic boom over?
- Key proposition: Productivity Growth

Manufacturing Productivity Accelerating in the 1990s

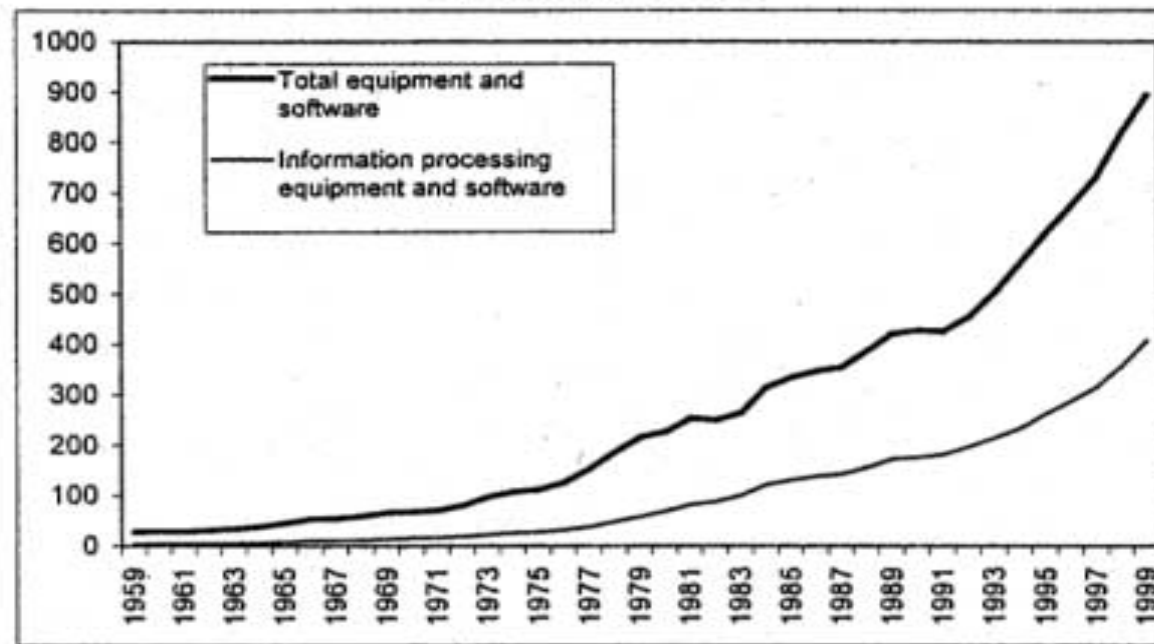
Annual Change in Manufacturing Productivity Growth



Source: BLS

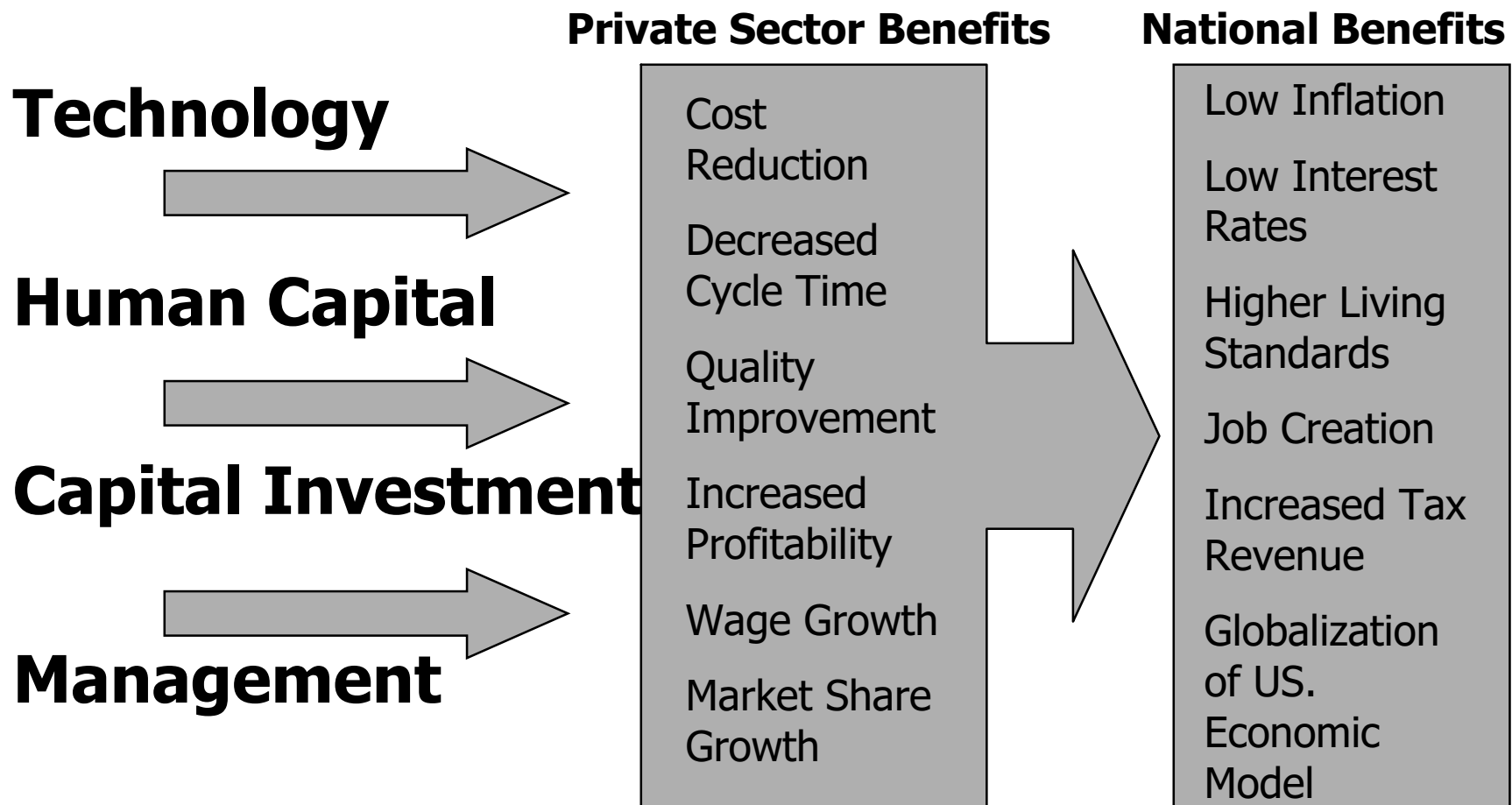
INFORMATION TECHNOLOGY INVESTMENT TRENDS

Figure 18. Private investment in equipment and software in the United States, 1959-99
Current USD billions



Source: United States from Bureau of Economic Analysis, March 2000.

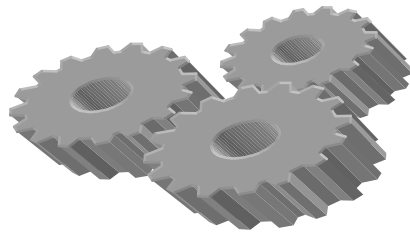
Productivity Drivers



Information Content

(1910-1980)

Mass Production Era



Standardized Parts and Processes

Economies of Scale

Producer-Centric Design, Mfg., and Delivery "Any color as long as its black."

Vertical Orientation

Required inventory buffers

Locally Oriented

(1980-2000)

Quality Management Era



Lean Manufacturing

Shift to Horizontal Structure

Focus on Core Competency

Reliability and Durability

Producer Led Design

Shifting towards Globalization

(2000-Future)

E-Manufacturing



Consumer Driven Design and Delivery

Flat Corporate Structures

Collaborative Virtual Networks

Mass Customization

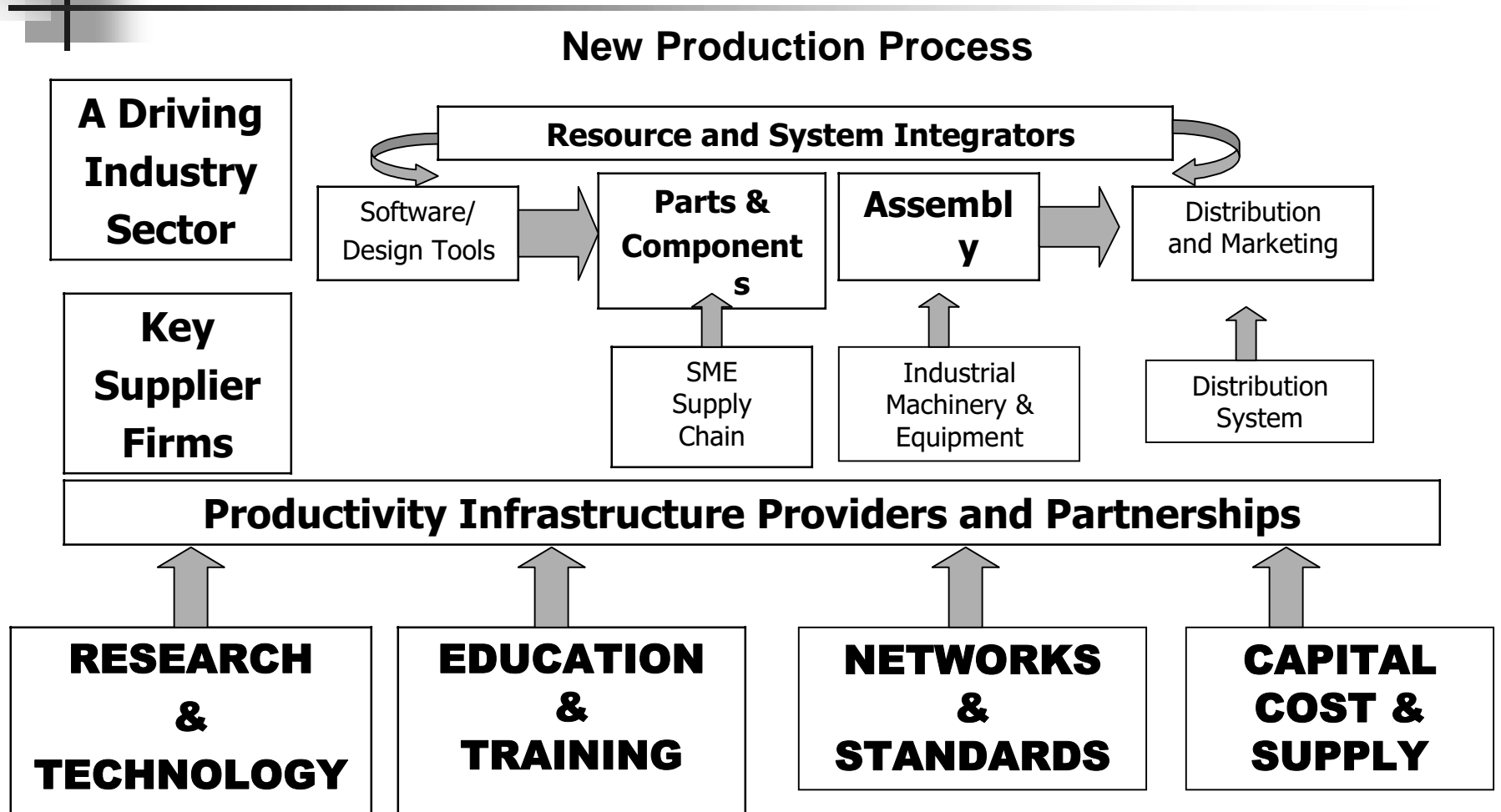
Transparency

Speed and Agility

Global Orientation

Responsiveness to Consumer

Productivity Infrastructure and Partnerships





Technology Initiatives

- Bayh-Dole Act and Stevenson-Wydler Technology Innovation Act of 1980
- Patent ownership by contractors (presidential directive 1983)
- Federal Technology Transfer Act of 1986
- Cooperative Research and Development Agreements (CRADAs)
- Intellectual property and inventor royalty sharing
- Cooperative Research Act of 1984
- National Competitiveness Technology Transfer Act
- Federal R&D tax credit
- Advanced Technology Program
- High Performance Computing
- Technology Reinvestment Program
- Manufacturing Extension Program

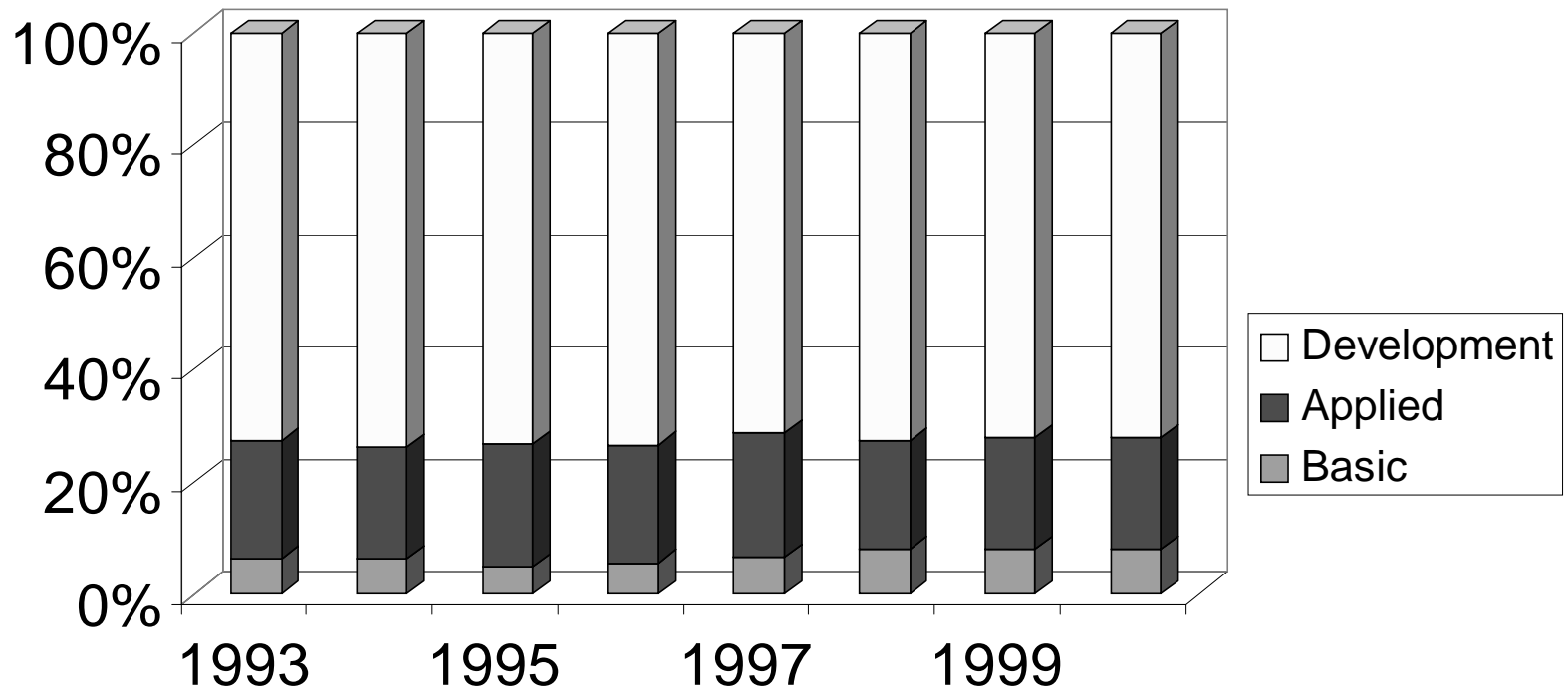


Models of Cooperation

- 1. Licensing of Government IP**
- 2. Cooperative R&D Agreements (CRADAs)**
- 3. Advanced Technology Program (ATP) & Similar Programs**
- 4. SEMATECH**

Industry R&D Rising, But Priorities Remain Short-Term

Shares of Industrial R&D Remain Constant





Outsourcing on the Rise

- Driven by intense global economic competition in the 1980s and 1990s, OEMs began “reengineering, downsizing, and outsourcing” their production, assembly, and fabrication operations and, in the process, increased their dependency on their supply chains.
- Many of the nation’s largest manufacturers are shifting the focus of their operations from production and assembly to product design and services.

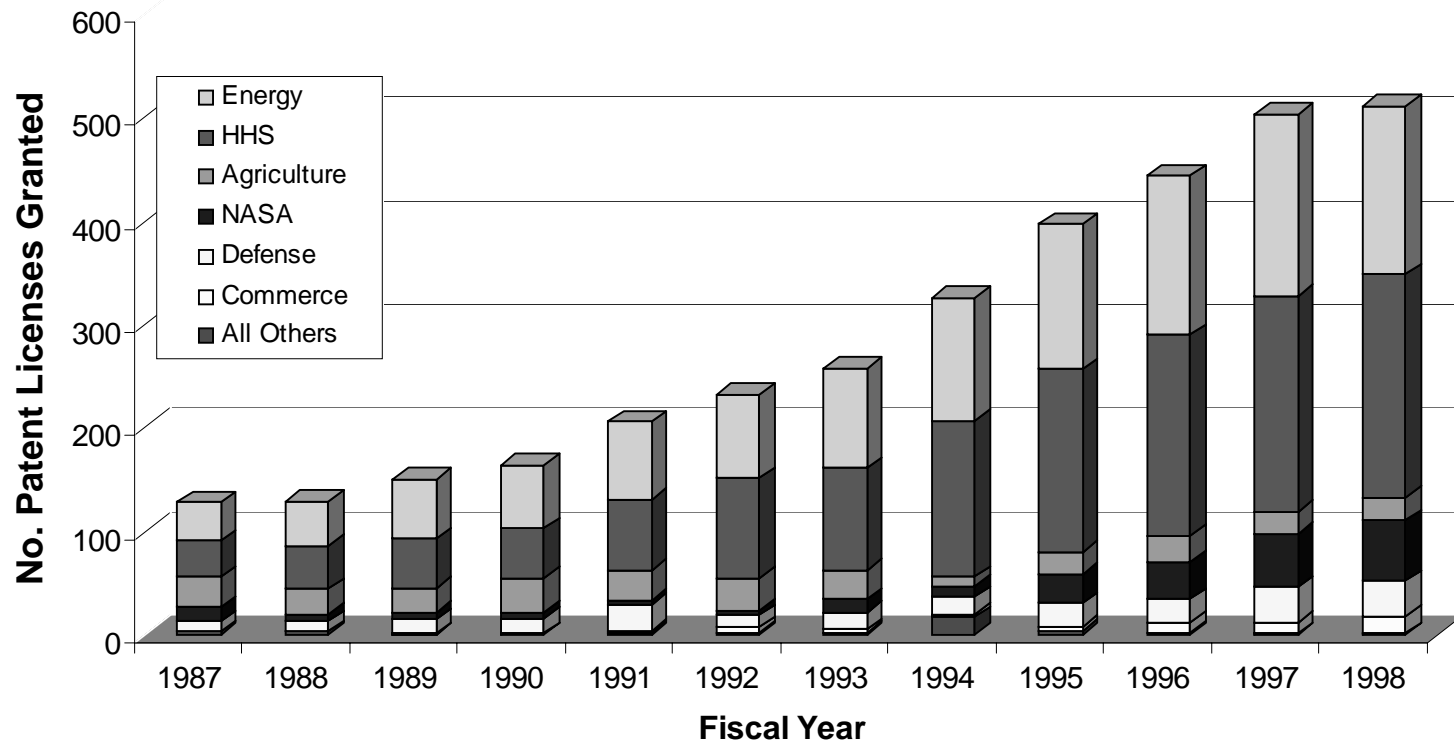


Collaboration Explosion

- Thousands of agreements now link industry with universities, federal labs, small business, incubators, state technology initiatives and non-US based organizations.
- Industry seeks external sources of technology and talent.

Trends in Federal Licensing

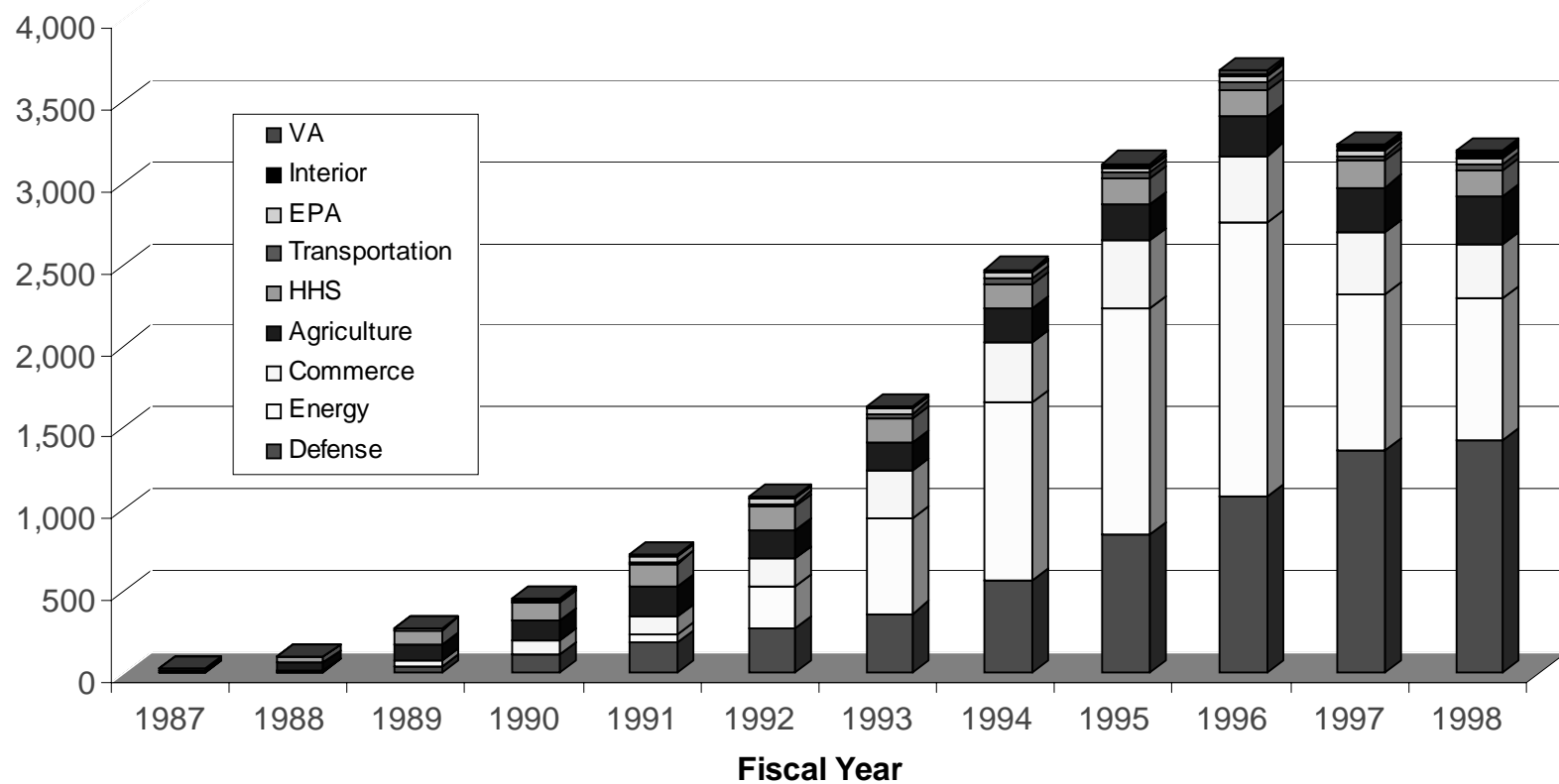
Licenses Granted by Federal Agencies



Source: DOC, Tech Transfer 2000

Trends in CRADAs

Active CRADAs by Federal Agency



Source: DOC, [Tech Transfer 2000](#)

Other Partnering Models

ATP-Like Model

- **Project-by-Project**
- **Cost-Shared**
- **Joint Ventures**
- **“Valley of Death” Focus**

Success or Failure?

- ✱ Report Satisfaction/ Benefit
- ✱ Provide Needed Capital
- ✱ Creating Culture for Cooperation
- ✱ Politically Controversial

SEMATECH Model

- **Industry Consortia**
- **Gov’t Funds Organization, Not Individual Projects**
- **Guided by Industry Roadmaps**

Success or Failure?

- ✱ Report Satisfaction/ Benefit
- ✱ Provide Needed Capital
- ✱ Created Culture for Cooperation
- ✱ Successfully Spun-Out of Gov’t Assistance



Collaboration Issues

- Benefits to industry include: new investment, higher productivity, product winners, revenues and employment.
- Issues: capturing spillovers, speed of tech transfer, IP protection, redundancy, management complexity. global relationships.



Smart Prosperity

- Recently completed a 20-month review of manufacturing productivity growth
- Six point national public policy agenda focused on basic research investment, workforce skills and supply chain optimization
- Industry collaboration and partnerships are fundamental for success

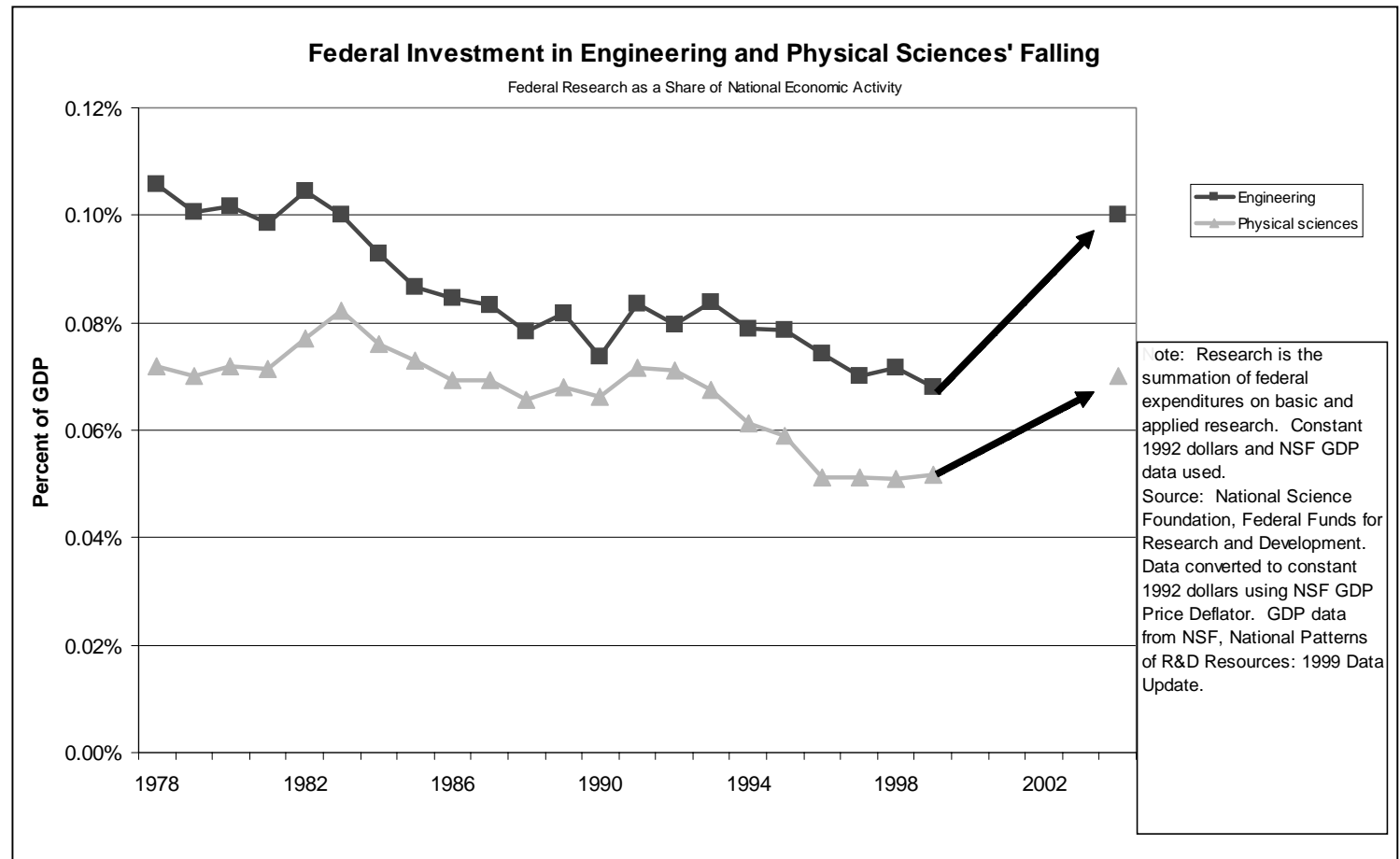
Smart Prosperity Agenda



- 1. Increase the federal commitment to research in the engineering and physical sciences, with an emphasis on basic manufacturing science and technology;**
- 2. Encourage tax credits for collaborative research or other mechanisms to promote collaboration;**
- 3. Build an industry-led nationwide system of skill standards, assessment, and certification;**
- 4. Adopt two federal technical training tax credits for entry-level and incumbent workers;**
- 5. Expand, refocus, and leverage manufacturing extension services; and**
- 6. Stimulate development of voluntary open business-led standards for e-manufacturing.**

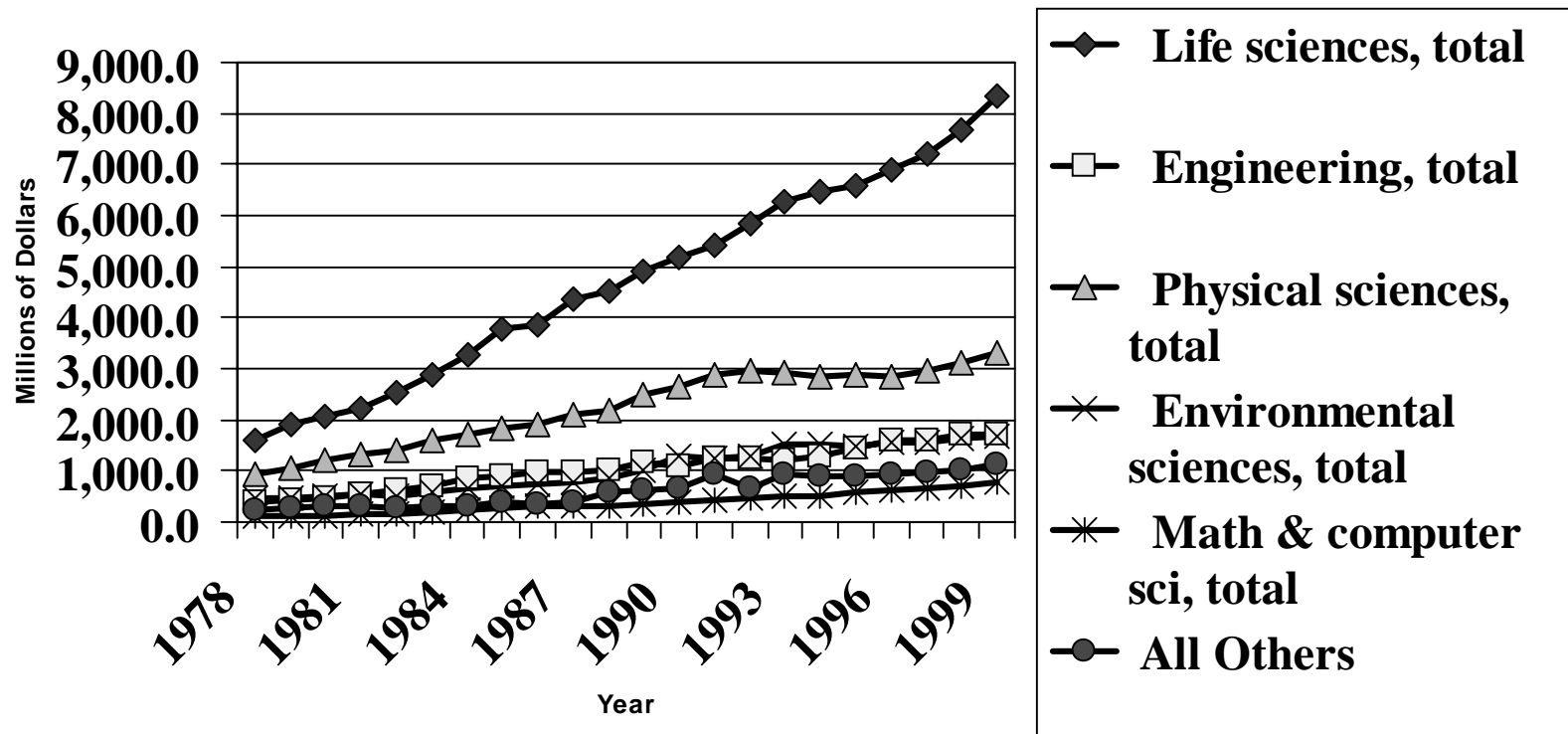
Manufacturing R&D Falling

Returns
Federal
Spending
to Same
Level of
GDP held
in the early
1980s



Budgets for Non-Health Sciences Nearly Constant

Federal Funds for Basic Research by Discipline



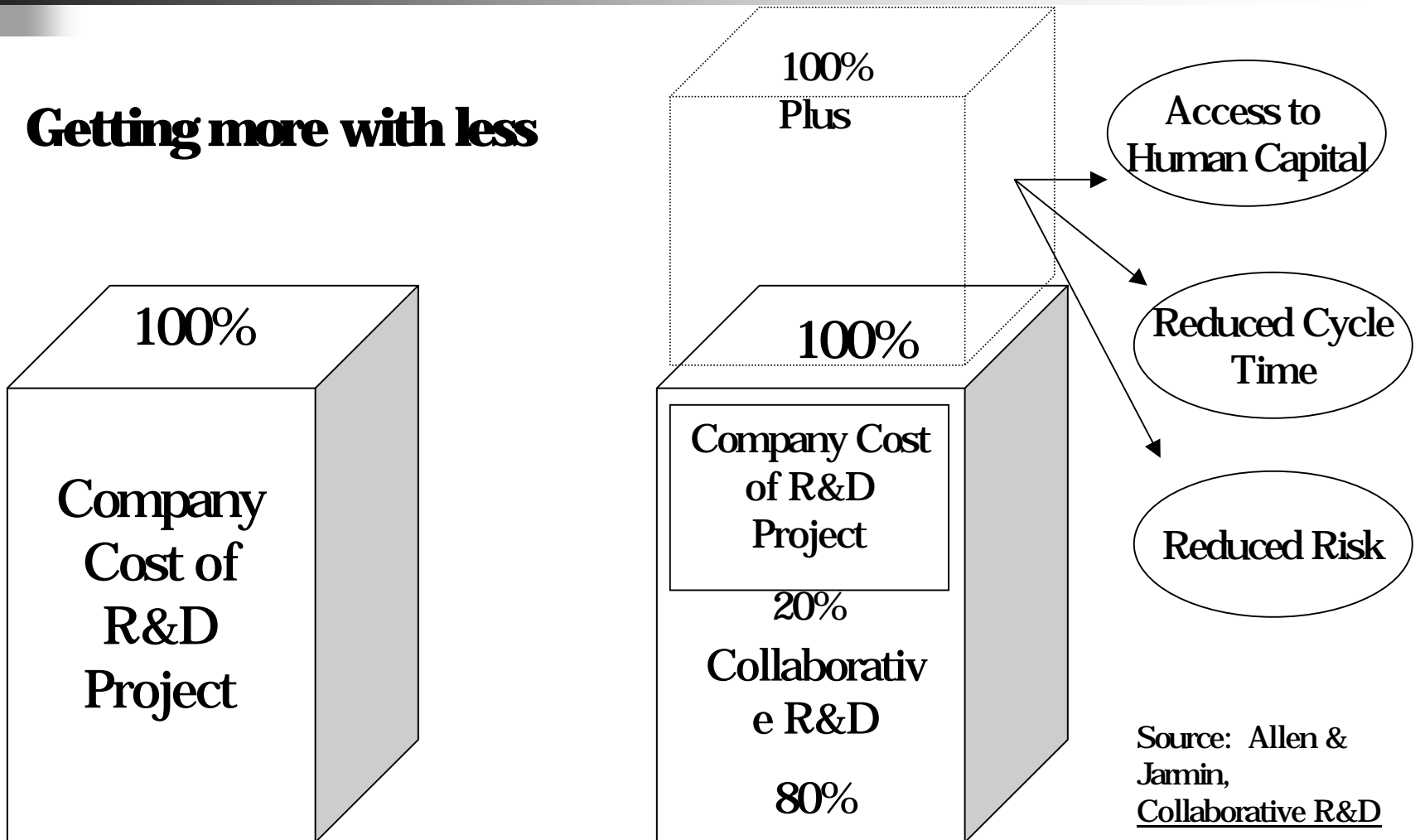
Source: National Science Foundation, *Federal Funds for Research and Development: FY 1997, 1998, 1999* (NSF 99-333)

Basic Manufacturing S&T Initiative

- Emerging Process Technologies
- Intelligent Controls/Systems
- Energy Efficiency and Environmental Quality
- Pervasive Modeling
- Knowledge Management and Learning Systems
- Software Interoperability
- Web-based Design and Manufacturing
- Electricity Technology Roadmap
- Others.....

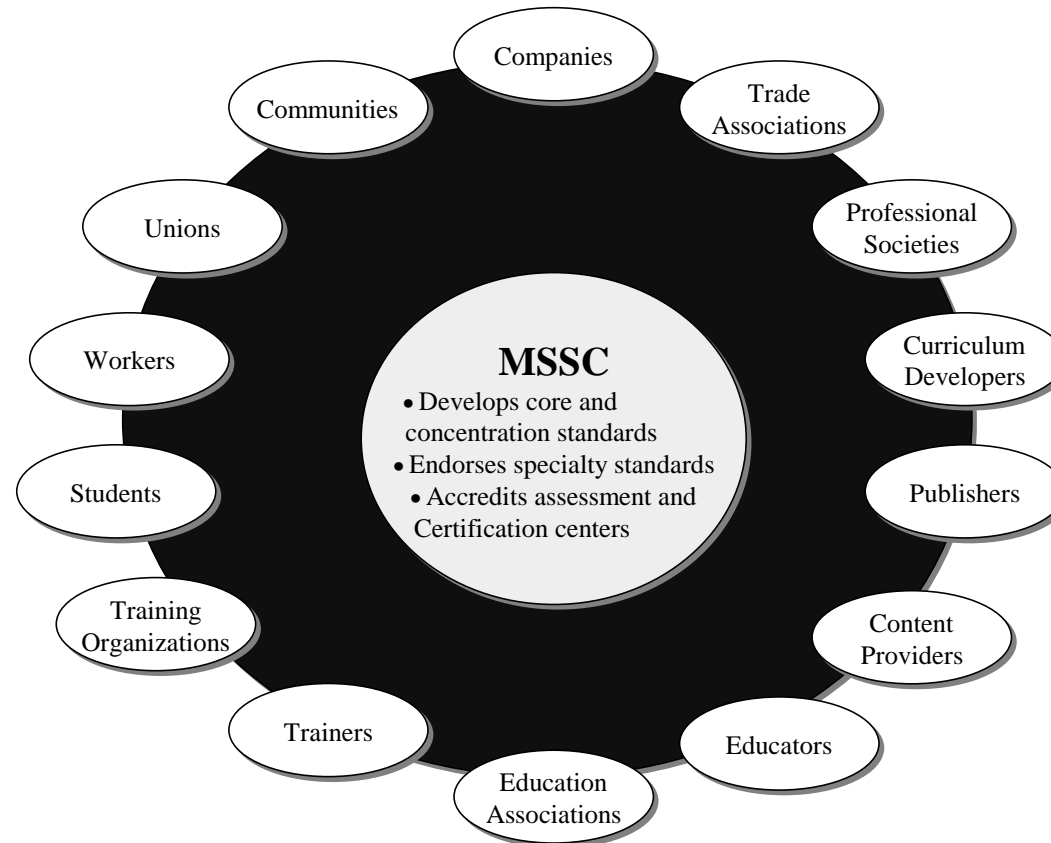
Leverage and Productivity Through Collaboration

Getting more with less



Uniting Manufacturing Community Around Skill Standards

Stakeholders in a Nationwide System of Skill Standards,
Assessment, and Certification for Manufacturing



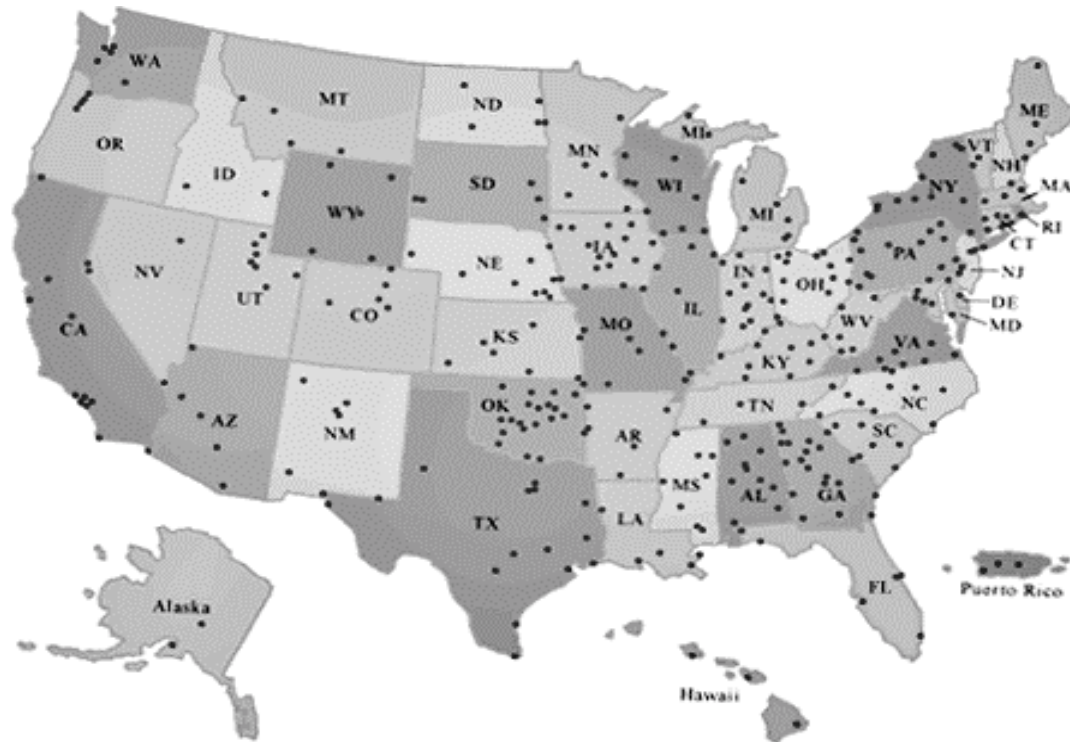


Shortage of Skilled Workers

- The number of companies reporting skilled worker shortages more than doubled between 1995 and 1998, from 27 percent to over 47 percent.
- Less than 5% of those currently in the labor force have ever participated in any basic skills training outside of their high school.
- Among those who have received some basic skills training since leaving school, only 4 out of 10 indicated that an employer or labor union provided the training.

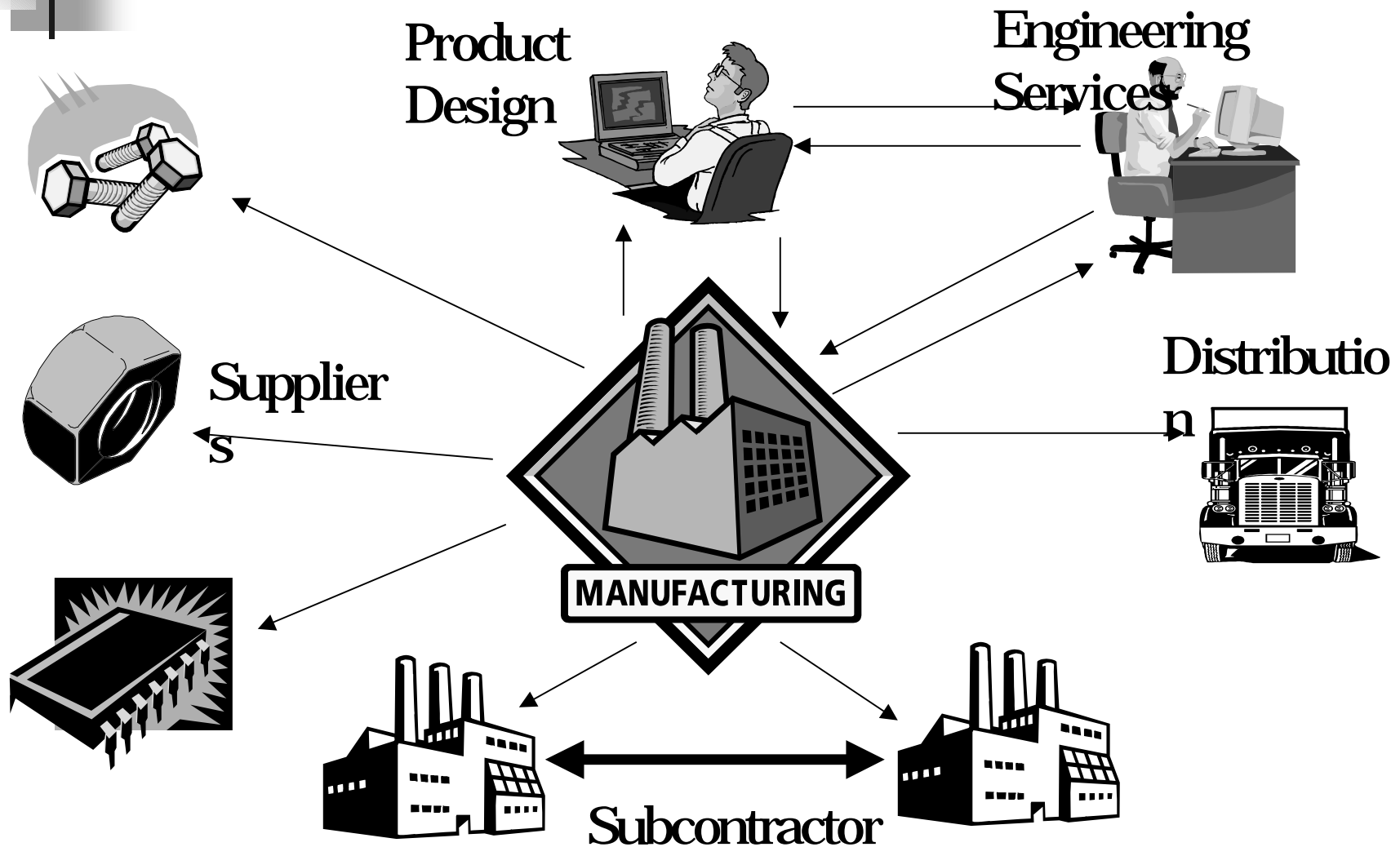
Greater Leverage of MEP's National Network

Based on a sampling of 2,852 client companies, MEP estimates that in FY 1998 alone MEP services generated at least \$327 million in new sales, \$33 million in labor and material savings, and \$24 million in inventory reductions, while also leveraging approximately \$266 million in additional capital investment by client firms.



Map from <http://www.mep.nist.gov/locations1/images/us-map.gif>

Interoperability Breakdowns Affect All Facets of Production Enterprise





Prosperity Principles

- Focusing on productivity inputs and outputs
- Access to and speed in adapting technologies
- Perpetual learning
- Value added partnerships and relationships
- Pursuing global opportunities



Success Factors

- Compelling political rationale
- Well grounded analysis
- Informed/active constituency
- Connecting regional initiatives to national framework
- Complementary public/private roles



Conclusion

- Historic opportunity for US and world prosperity
- US has the leadership and fundamental technological and human assets
- Future productivity growth depends on the partnerships we make today



THANK YOU!

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