

# Meeting the Global Innovation Imperative: The Path to Growth, Jobs, and Competitiveness



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# Current Global Mega-Challenges

- Fostering Economic Growth through Innovation
  - Driving domestic Growth and Employment
- Developing New Sources of Energy
  - Commercializing renewable alternatives to oil
  - Increasing the capacity to fuel growing global demand for electricity
- Addressing Climate Change
  - Growing a Green Economy; A major Growth opportunity
- Delivering Global Health
  - Transforming large investments in research to affordable and personalized treatment and care
- Improving Security
  - Through all of the above
- Addressing these Global Challenges requires Innovation

# Leading Countries and Regions are Responding to the Innovation Challenge

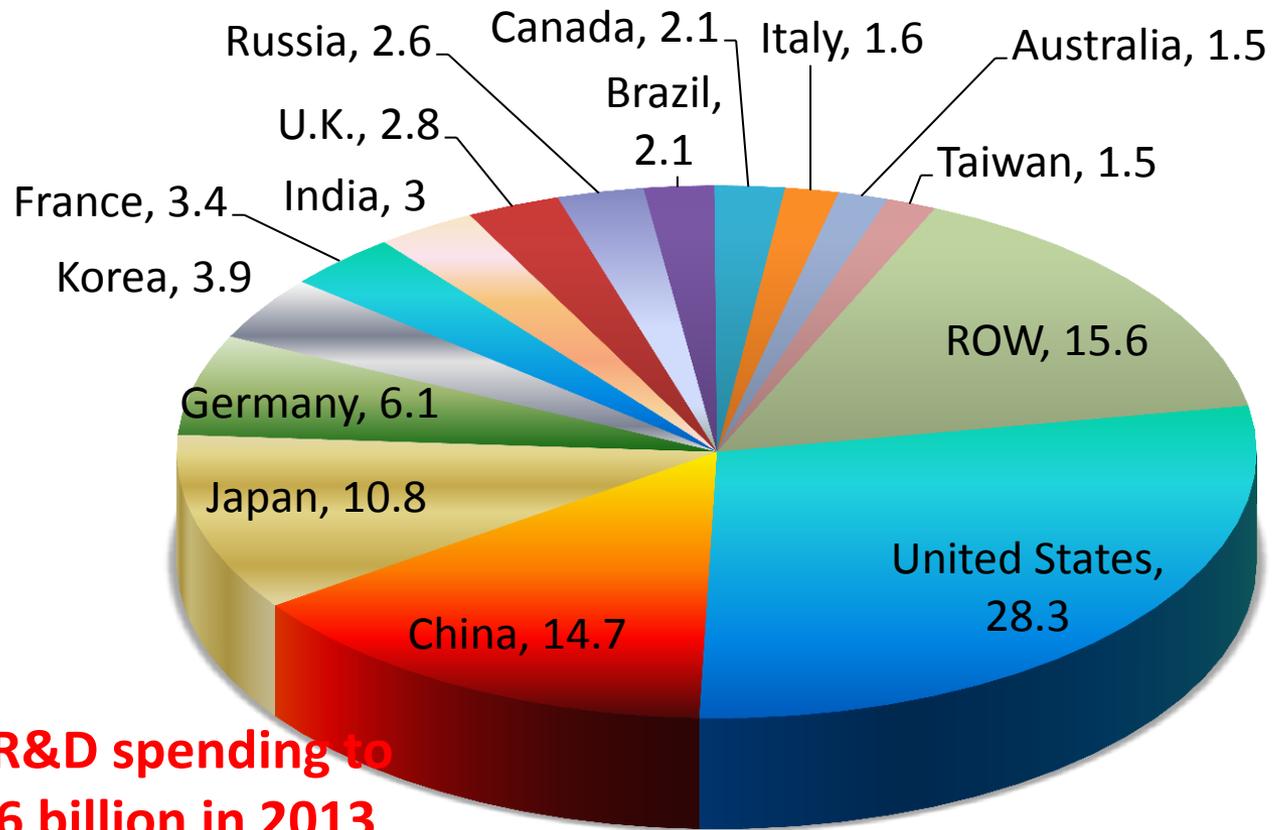
- They are providing five things:
  - High-level **Focus** on Growth and Strength
  - Sustained **Support** for Universities
  - Rapidly Growing **Funding for Research**
  - Support for Innovative **Small Businesses**
  - Government-Industry **Partnerships** to bring new products and services to market
- They are investing very substantial resources to create, attract and retain the industries of today and tomorrow.



# Innovation in the United States

## Strengths and Challenges

# Good News: The U.S. has a Large Share of Global R&D



**Total global R&D spending to reach \$1,496 billion in 2013**

**SOURCE: Battelle and R&D Magazine, 2013 Global R&D Funding Forecast (December 2012).**

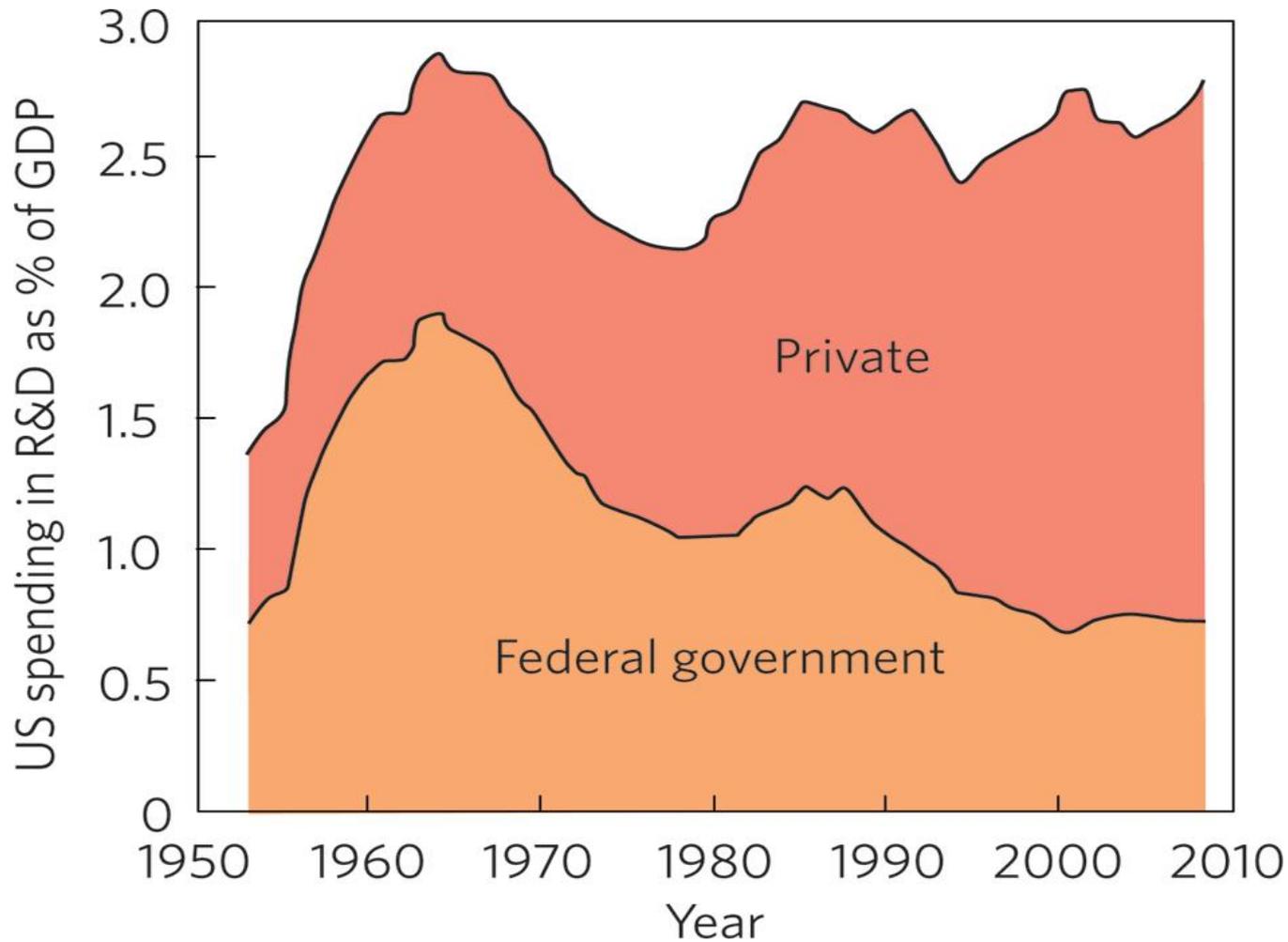
# Traditional Pillars of the U.S. Innovation System

- **Government investments in R&D:** ~\$150B a year
- **Private investments in R&D:** ~\$270B a year
- **Research Universities:** some with a culture of innovation
- **Entrepreneurial spirit** and laws to support it
- **Talent:** from the U.S. and from around the world
- **Capital:** Broad, deep, and efficient capital markets with significant angel (\$22.5 Billion\*) and venture funding (\$28.4 Billion\*\*)

– Sources:

\* Jeff Sohl, UNH Center for Venture Research; \*\* 2012 Money Tree Report

# Federal R&D Spending: A Declining Share of GDP



Source: *Nature Materials* 10, 407 (2011)

# Falling Support for U.S. Universities: Less Funding and More Regulations

- Per-student funding for major public research universities has dropped by 20 percent during the past decade (NSB,2012)
- At the same time, U.S. Research Universities face a growing regulatory burden.
  - Source: NRC, *Research Universities and the Future of America: Ten Breakthrough Actions Vital to Our Nation's Prosperity and Security*,2012.
- These developments are undercutting a principal pillar of the U.S. innovation system.

# The Major Risks to the U.S.

- **Complacency** about our competitive position
- Focus on **current consumption** rather than investment for the future
  - A lack of investment in R&D on the scale of our fathers and our competitors
- Limited attention to the **composition of the economy**, including trade and investment policy
- Failure to focus on the **commercialization** of research and on manufacturing

## Paradigm Shift:

Innovation in the U.S. no longer automatically translates into production in the U.S.

**A New National Academies Report  
Calls for Greater Policy Attention-**  
*Rising to the Challenge;  
US Innovation Policy for the Global Economy*

To address this challenge, many states  
have launched multiple programs

We have reviewed a rich variety of  
innovation initiatives underway  
across the nation.

# Competing in the 21st Century: Best Practice in State and Regional Innovation Initiatives

This initial study:

- **Highlighted new initiatives** to strengthen existing industries and develop new technology focus areas.
- **Identified best practices** with regard to their goals, structures, instruments, modes of operation, synergies across private and public programs, funding mechanisms and levels, and evaluation efforts.
- **The next phase of this work is underway.**

# This Study has significantly enhanced our knowledge of this important topic

- Nine Workshop reports document a wide range of initiatives at the state and regional level and significantly enhanced policy development.
- A Consensus report: “Best Practices in State and Regional Innovation Initiatives; Competing in the 21<sup>st</sup> Century.”
- What are the key take-aways?

# Surviving in today's global economy: A new Awakening in the States

- Elected officials, university presidents and industry leaders recognizing the need to:
  - Grow and draw in a skilled workforce
  - Support and grow universities and grow their connections to their regional economy
  - Leverage complementary federal programs
  - Identify and support new industries & companies
  - Establish conditions to grow and maintain a manufacturing base
  - All to support the development of regional centers of innovation, entrepreneurship, and high-technology

# New Partnerships Support Innovation-led Growth

- Leading Role of Community colleges:
  - Work with industry to identify needs and train a workforce able to adapt to changing technologies.
- Public-private partnerships foster Collaboration
  - Federal grants provide infrastructure support and catalyst for state based innovation
  - Provide shared research facilities to develop and commercialize new products for the market
- Catalytic role of philanthropic foundations
  - Important role in initiating, complementing, and sustaining action, by regional and state authorities.

# New Focus in the States on Growing Innovation Clusters

- Recognition that successful clusters are based on more than just co-locating universities, labs, and firms.
- To grow regional clusters, states and regions are:
  - **Building on local expertise** and regional strengths: e.g., NE Ohio's focus on flexible electronics builds on expertise in polymer engineering
  - **Partnering with industry** to pool resources and share risks: e.g., New York State and IBM in growing NY's nano cluster
  - **Investing in education** and a trained workforce
  - **Demonstrating long-term policy commitment**



# A More In-depth View

State innovation initiatives in  
Ohio and New York

# The State Government Role in Ohio

- Significant State Investment
  - The **Ohio Third Frontier Program** is an internationally recognized technology-based economic development initiative
  - Funded in 2002 by a \$1.6 billion bond issue
  - Ohio voters voted in 2010 to invest an additional \$700 million
- Leveraging Federal Investments
  - Building on federal support for university research, for Magnet as an MEP Center, for clusters through EDA, for additive manufacturing

# Growing Ohio's Innovation Ecosystem

- **The Role of Industry**

- Timken has cut losses, consolidated assets, invested in the workforce, and cooperated with universities--Jim Griffith, Timken

- **The Role of Universities**

- Universities must function as “a broad-based and robust platform for economic engagement.”--Luis Proenza, University of Akron

- **Agile Innovation Intermediaries**

- NorTech: fostering regional clusters
- BioEnterprise: Growing the biomedical sector
- Jumpstart: Resources to grow new high potential firms
- Magnet: Support for Ohio-based manufacturing

# Timken and the University of Akron are Partnering for Innovation

- Timken transferred its coating laboratory, equipment and researchers to the University of Akron
- With resources from Timken and the State, UA initiated new graduate degree programs, and a new consortium on coatings and engineered surfaces
- New technologies can be developed by potential start-ups, supported by in-house mentoring.

# New York's Nanotechnology Initiative

- **Collaboration:** Private and university based collaboration to set up world class research programs and state-of-the-art research laboratories
- **State Leadership:** Substantial and sustained state investments; bi-partisan, long-term commitment
- **New Institutions:** CNSE, Sematech, Academic programs at RPI and SUNY
- **Workforce development:** Industry is working with local community colleges to develop training programs
- **Results:** These investments are now attracting high value manufacturing, and jobs focused on nanotechnology and semiconductor technologies

# Characteristics of the Albany Model

- **Sustained Leadership**, at Multiple Levels:
  - Initiative was launched by Governor Pataki, but has subsequently been strongly supported by Governor Andrew Cuomo, and others.
- **Major Players**:
  - IBM, RPI, & SUNY, then CNSE, & now GLOBALFOUNDRIES
- **Shared Investments in Facilities**:
  - Joint investment by the state and IBM of the world's only university-based 300-millimeter semiconductor wafer fabrication facilities and clean room attracted other microelectronics firms to Albany
- **Training a new Workforce**
  - In 2004, SUNY at Albany launched the College of Nanoscale Sciences and Engineering (NanoCollege) to train a specialized nanotechnology work force

# Growing NY's Nanotech Cluster

Year	Key Developments	Initial Investment
2001	Center of Excellence in Nanoelectronics and Nanotechnology (CENN) established at SUNY Albany \$100 million from IBM + \$50 million from NY State	\$150 million
2002	International SEMATECH Research Center	\$405 million
2004	College of Nanoscale Science and Engineering (CNSE) established	
2005	ASML establishes research center	\$400 million
2005	Multi-partner Center for Semiconductor Research established	\$500 million
2005	CNSE establishes a collaborative center for nanolithography research with AMD, ASML, IBM, and Micron	\$600 million
2006	International SEMATECH relocates to NY	\$760 million
2007	IBM expands operations at CNSE	\$1.64 billion
2009	GLOBALFOUNDRIES breaks ground in Malta, NY	\$6.6 billion

OVERNIGHT SUCCESS!

# Payoffs for New York

- Establishment of a globally recognized center in a key enabling industry
- Billions in investment have been drawn into the state as supply chain follows the fabs
  - Companies such as IBM, AMD, Applied Materials, and Tokyo Electron are making significant investments in the region.
- Economic Activity and High Value Jobs are moving to New York State
  - 3500 direct jobs were created in the Albany region alone: there is a 3 to 5x multiplier
  - New economic activity is driving the revitalization of the region
  - Center for advanced research for 450mm fabs.

# These Payoffs illustrate that Policy Matters and so does Manufacturing

U.S. based manufacturing is essential to sustain high-value employment, growth, and national security

# U.S. based Manufacturing is Important

- Manufacturing dominates the U.S. **Innovation System**
  - 70% of industrial R&D, 80% of patents, employs 64% of scientists and engineers
- An important Source of **Employment**
  - Manufacturing supports an estimated 18.6 million jobs in the U.S.—about one in six private sector jobs
- An essential element in U.S. **National Security**:  
Having on-shore production capacity matters

Source: National Association of Manufacturers, 2009

# A Review of Policies to Support Manufacturing

- What are leading countries doing to support on-shore innovation and manufacturing?
- What can we learn from global best practices?
- How can we improve programs to address today's manufacturing challenge

# What are Best Practices in Global Manufacturing Programs?

- **Substantial and sustained funding**
- **Long-term focus** on applied research manufacturing
- **Well equipped facilities** and Highly trained staff
- **Training** of Graduate and Undergraduate students in a hands-on environment; co-located with universities
- These foreign programs offer **customized and flexible field services** directly to firms
  - information, diagnostics, mentoring, technology support, prototyping, demonstration, networking, and referral and expert personnel

# Best Practices from Leading Programs

- **Substantial Autonomy** in establishing strategies and deploying resources but with long-term accountability
- **Links to local clusters**, including partnerships with universities and long-term collaboration with private firms
- **Support for start-ups**: Space; equipment; legal, IP and technical assistance; management advice and business connections for funding and markets
- **Regular assessment**, learning, program adaptation, shifts in priorities over time

# The New U.S National Network of Manufacturing Institutes is drawing on these Best Practices



# What can we learn about these Leading National Programs?

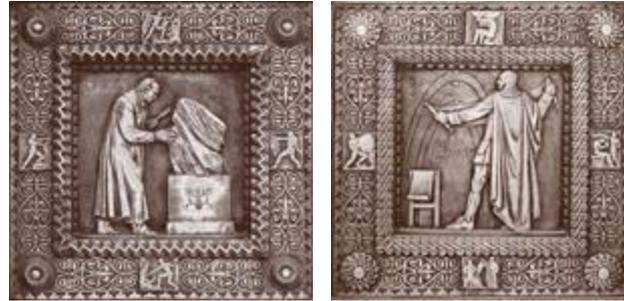
- Key features, functions
- Funding, policy support
- Facilities, expertise, staff
- Technological focus areas
- Linkages with universities
- Workforce development
- Program limitations
- Best practice lessons

# Conclusions

This ECE Innovation Group is addressing issues that are key to nations' innovation-led development and competitiveness.

The analyses of the UNECE Innovation Program support this critical mission.

# Thank You



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