February 17, 2013

Advanced Manufacturing: Today, Tomorrow, and Beyond

Policies to Support Advanced Manufacturing

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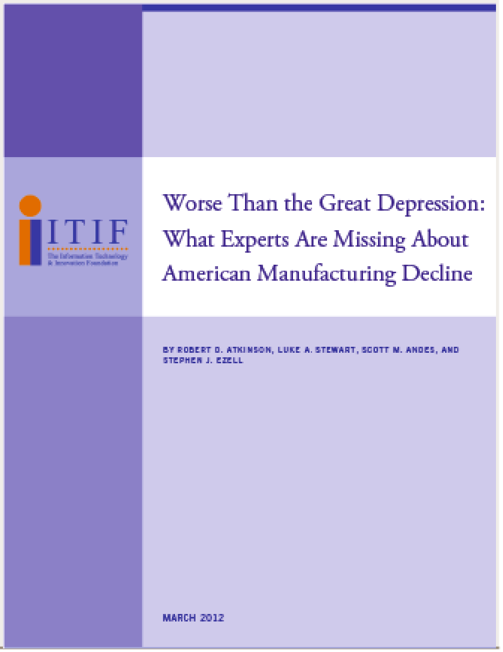
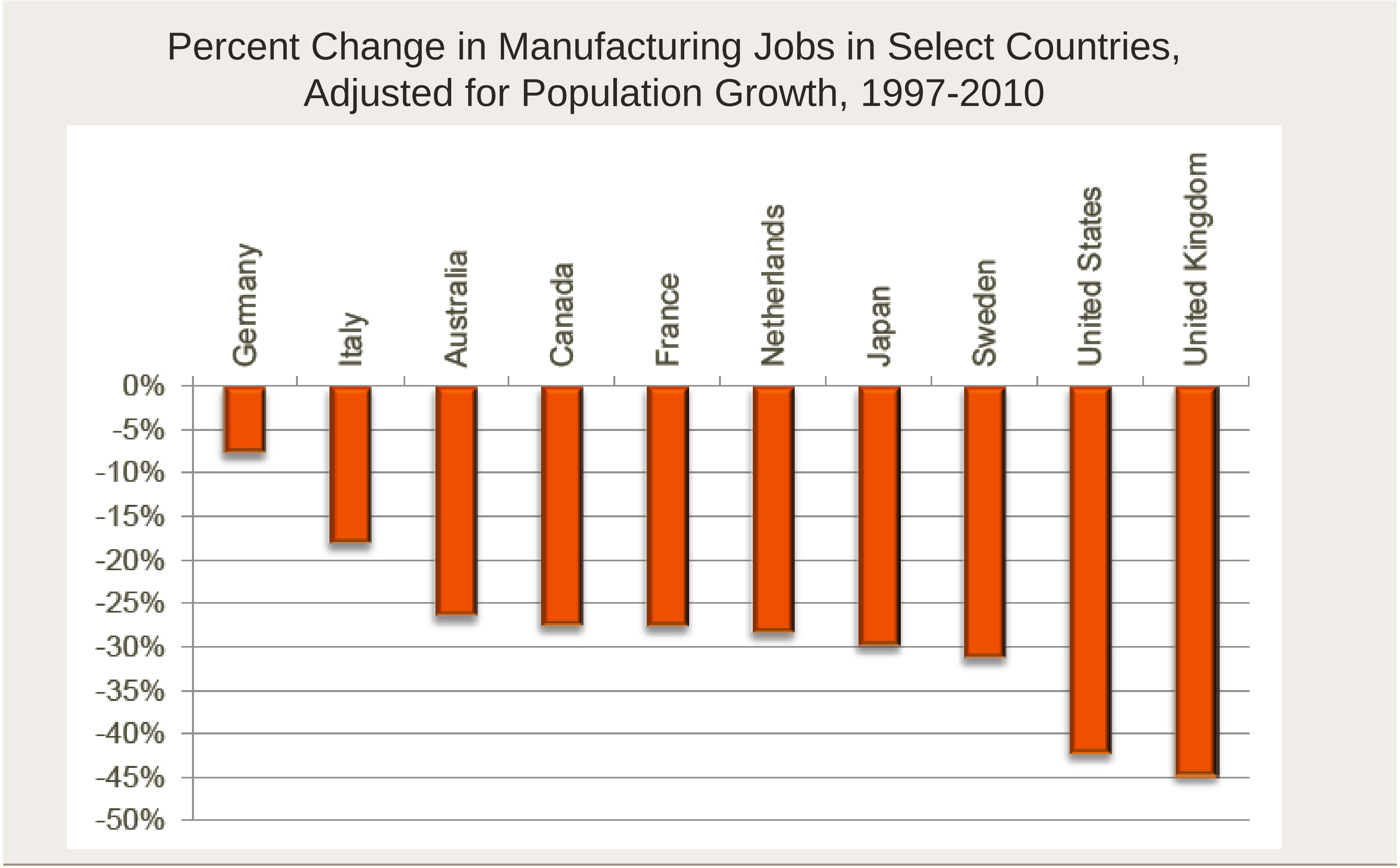
Core Principles for U.S. Manufacturing Renewal

- Focus on traded sector competitiveness.
- Recognize that science-based innovation isn't enough; U.S. needs to re-embrace an engineering culture.
- Recognize that U.S. manufacturing has not been healthy.

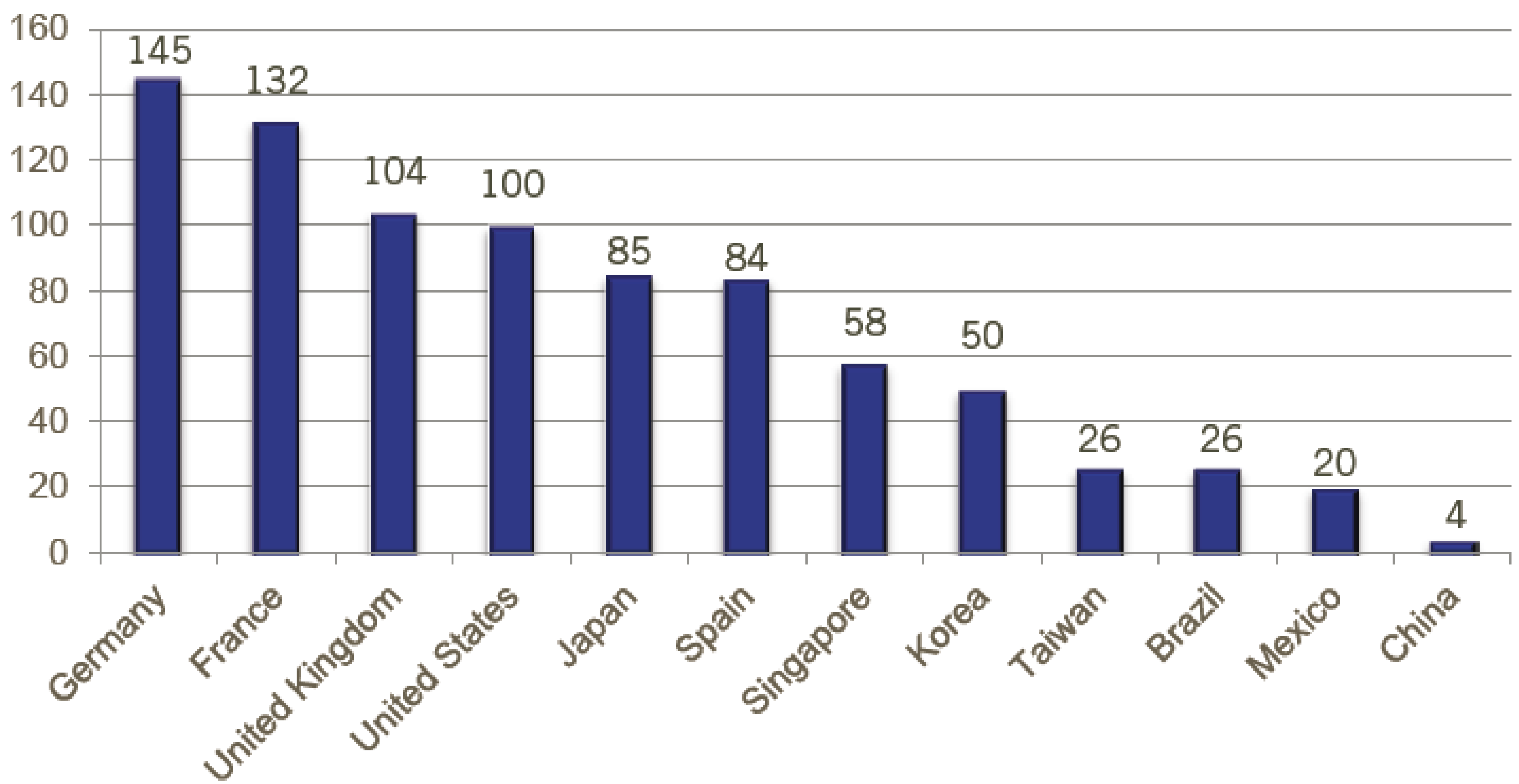


Germany Has Experienced a Fraction of U.S. Manufacturing Job Loss

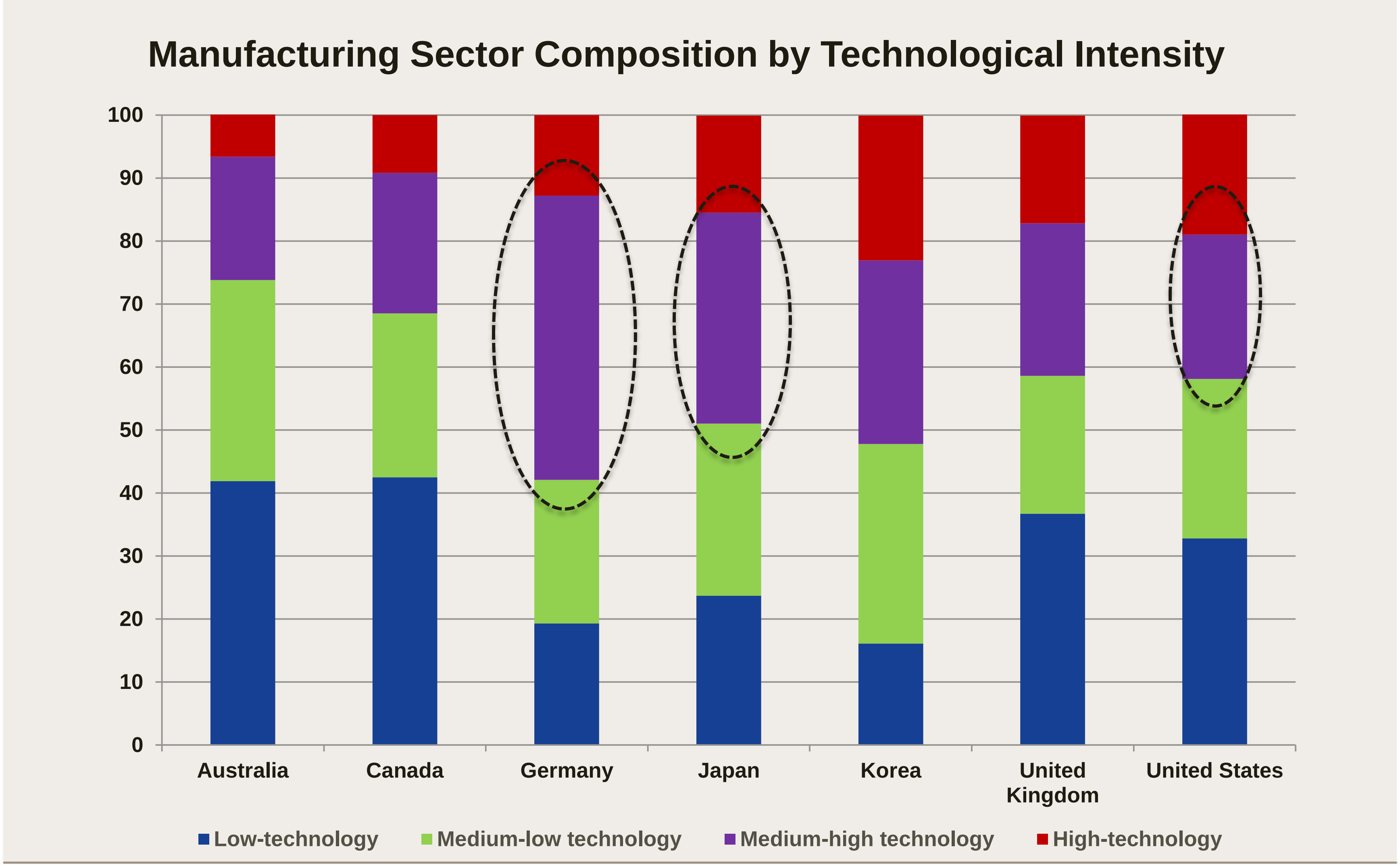


While Paying Over 40% More Per Labor Hour

Hourly Manufacturing Compensation Costs (United States = 100), 2008



U.S. Manufacturing Lags in Technological Intensity



U.S. Failing to Commercialize Technologies it Invents

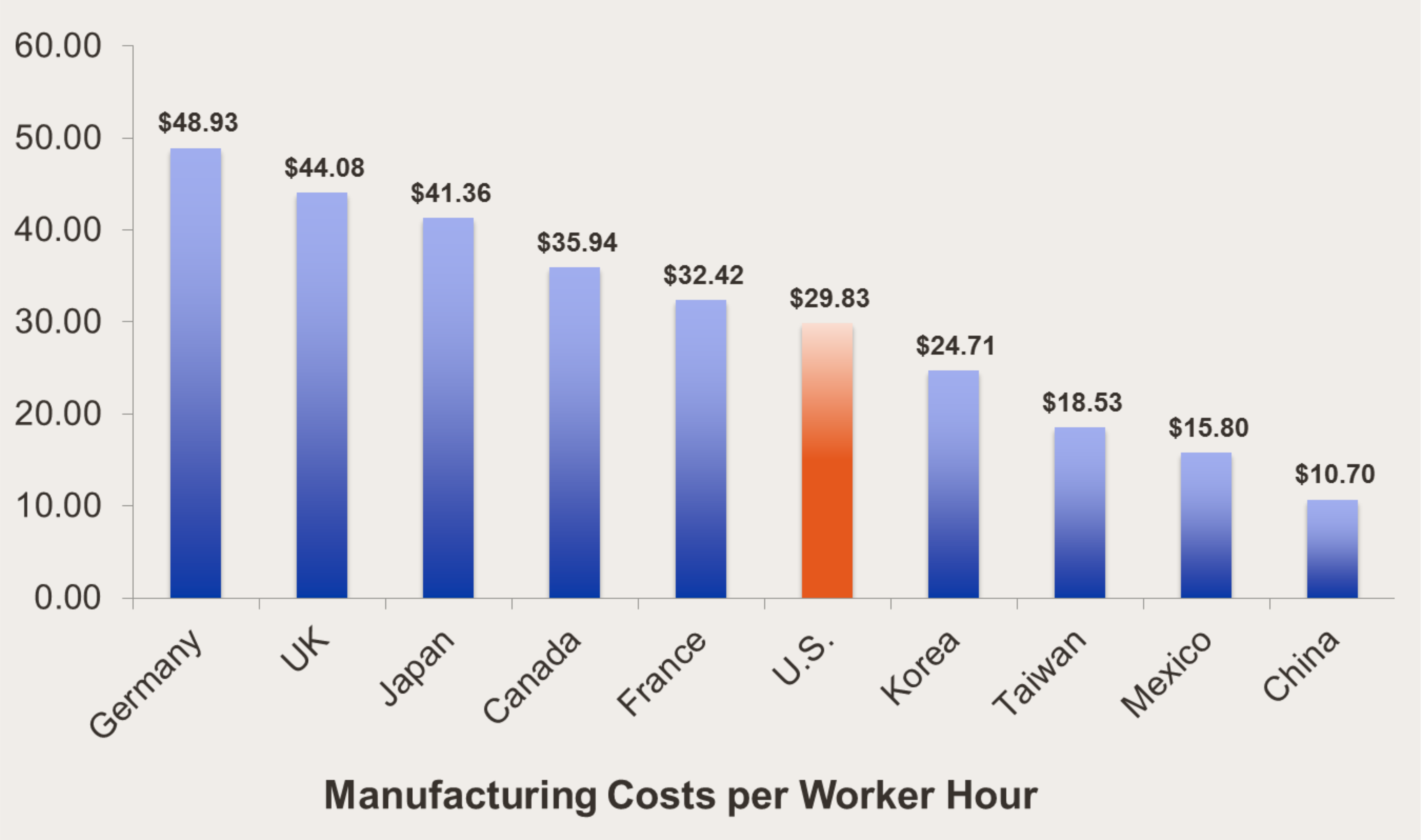
The U.S. has been the “first mover” and then lost virtually all market share in a wide range of material and product technologies, including:

- Semiconductor memory devices
- Semiconductor production equipment such as steppers
- Lithium-ion batteries
- Flat panel displays
- Robotics
- Solar cells
- Advanced lighting
- Oxide ceramics

Two Camps About What to Do About This

1. If we just get our costs low enough, American manufacturing will be fine

U.S. Manufacturing Costs Not the Problem



Source: Numbers Based on Analysis of Data from on MAPI and Manufacturing Institute 2011 Report on The Structural Cost Of U.S. Manufacturing. October, 2011

- Two Camps About What to Do About This

2. Put in place a robust manufacturing and innovation infrastructure.

What To Do: We Need a "RAFTTTT"

- Regulatory reform
- Analysis
- Financing
- Technology
- Tax
- Talent
- Trade

Technology: Increase Federal Investment in R&D

The federal R&D portfolio is not optimized for economic growth:

- 81% goes to “mission-oriented” activities in defense and health.
- 75% of fed R&D $ allocated to manufacturing goes to just two industries: aerospace and instruments.
- Academic R&D spending in engineering and physical sciences flat.
- If investing as much as we did in 1983 (as a share of GDP), federal government would invest $60 billion more in R&D annually.
- Underinvesting in applied/translational research.

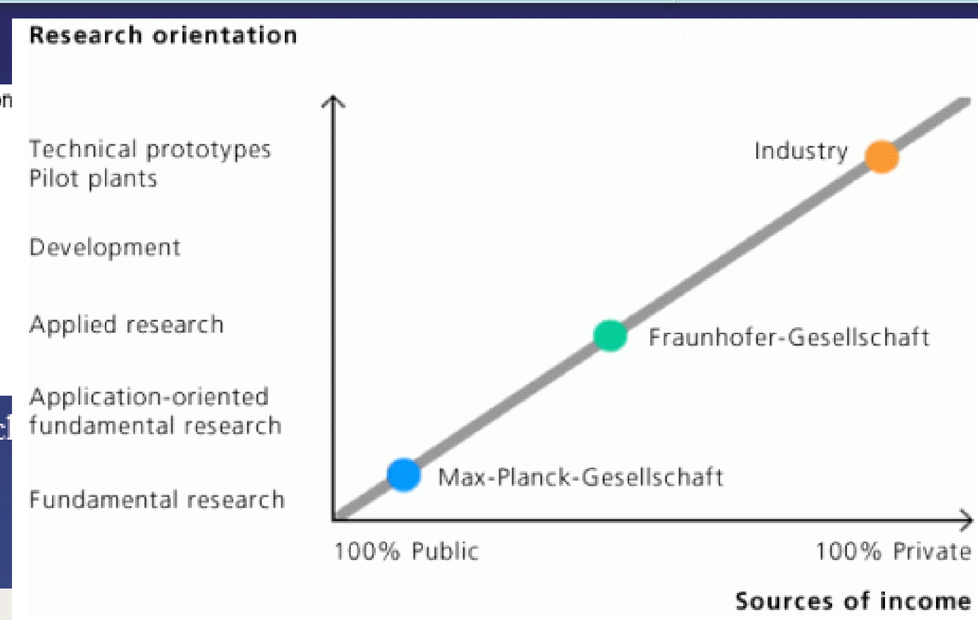
Lacking an Institutional Framework for Pre-competitive, Industrially Relevant Applied Research

Fraunhofer

- 59 Institutes, 17 000 employees
- Non-profit organisation
  - ≈ 33 % basic funding by goverment
  - ≈ 33 % public funded projects
  - ≈ 33 % direct contracts by industry

- Information and Communication Technology
- Life Sciences
- Microelectronics
- Light & Surfaces
- Production
- Materials and Components - MATERIALS
- Defense and Security

Fraunhofer-Gesellschaft: Undertakes applied researcl of direct utility to private industry.
Clustered approach with pilot production centers to close the gap between research and products



Approach Being Increasingly Adopted Internationally

- Germany invests $2.5 billion/yr in Fraunhofer System
  - 60 Centers and 18,000 staff for 80M Germans
- Japan’s New $117B Stimulus Package (1/10/13)
  - $2 billion to promote university-industry collaboration, including $ to equip universities to conduct industrially relevant research
- UK Catapults (January 2013)
  - £1bn investment in technology and innovation centers
  - The High-Value Manufacturing Catapult will be “a catalyst that transforms brilliant manufacturing ideas into valuable products and services”
- Finland’s SHOKs (Strategic Centers of Science, Tech, and Inn)

Create a National Network for Manufacturing Innovation

- 15-20 Manufacturing Institutes bringing together cutting-edge research in an industrially relevant way across key sectors and manufacturing process technologies.
  - Mission: Enhance U.S. industrial competitiveness by supporting development of technologies enabling U.S. production facilities to gain global market share.
- Industry should bring NNMI proposals forward and provide at least 50% funding (matched by feds and states).

NAMII NATIONAL ADDITIVE MANUFACTURING INNOVATION INSTITUTE

What NNMIs Would Do

- Provide a platform for joint pre-competitive applied research;
- Develop sector & technology-specific roadmaps that identify technical hurdles and work to solve them;
- Provide shared facilities for rapid prototyping and demonstration; libraries & databases; and validation and testing equipment;
- Develop and disseminate training technologies/curricula; support credentials, certifications, and skills standards development;
- Help restore the industrial commons in key manufacturing product and process technologies.

NNMIs Could be Established Across a Range of Key Cross-Cutting Technologies

- Advanced Materials/Composites
- Additive Manufacturing
- Bio Manufacturing and Bioinformatics
- Nano-Manufacturing
- Flexible Electronics Manufacturing
- Industrial Robotics
- Advanced Forming/Joining/Welding Technologies
- Advanced Sensing, Measurement, & Process Control
- Visualization, Informatics and Digital Manufacturing Technologies
- Advanced Manufacturing & Testing Equipment
- Chemical Processing

Why America Needs an NNMI

- Numerous market failures afflict manufacturing innovation:
  - Firms underinvest in risky technologies with long-term time horizons.
  - Substantial externalities from firms' investments in capital equipment and machinery.
  - Complementarity between public and private R&D investment.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Why America Needs A National Network for Manufacturing Innovation

BY DAVID M. HART, STEPHEN J. EZELL, AND ROBERT D. ATKINSON | DECEMBER 2012

A National Network for Manufacturing Innovation (NNMI) could play a pivotal role in spurring U.S. industrial competitiveness and revitalizing American manufacturing.

The United States lacks an integrated, well-funded national network of large-scale, industry-led manufacturing innovation centers. Leading manufacturing nations around the world, from Germany to Taiwan, have such centers, which accelerate technology deployment, operate demonstration facilities and test beds, support education and training, and perform applied research on new manufacturing processes, among other activities. The proposed National Network for Manufacturing Innovation (NNMI) would fill this void. This report explains why action on this proposal is vital to U.S. manufacturing competitiveness and worthy of investment even in a time of tight budget constraints. It then articulates key principles that should guide the development of the NNMI.

Technology: Designate 25 Manufacturing Universities

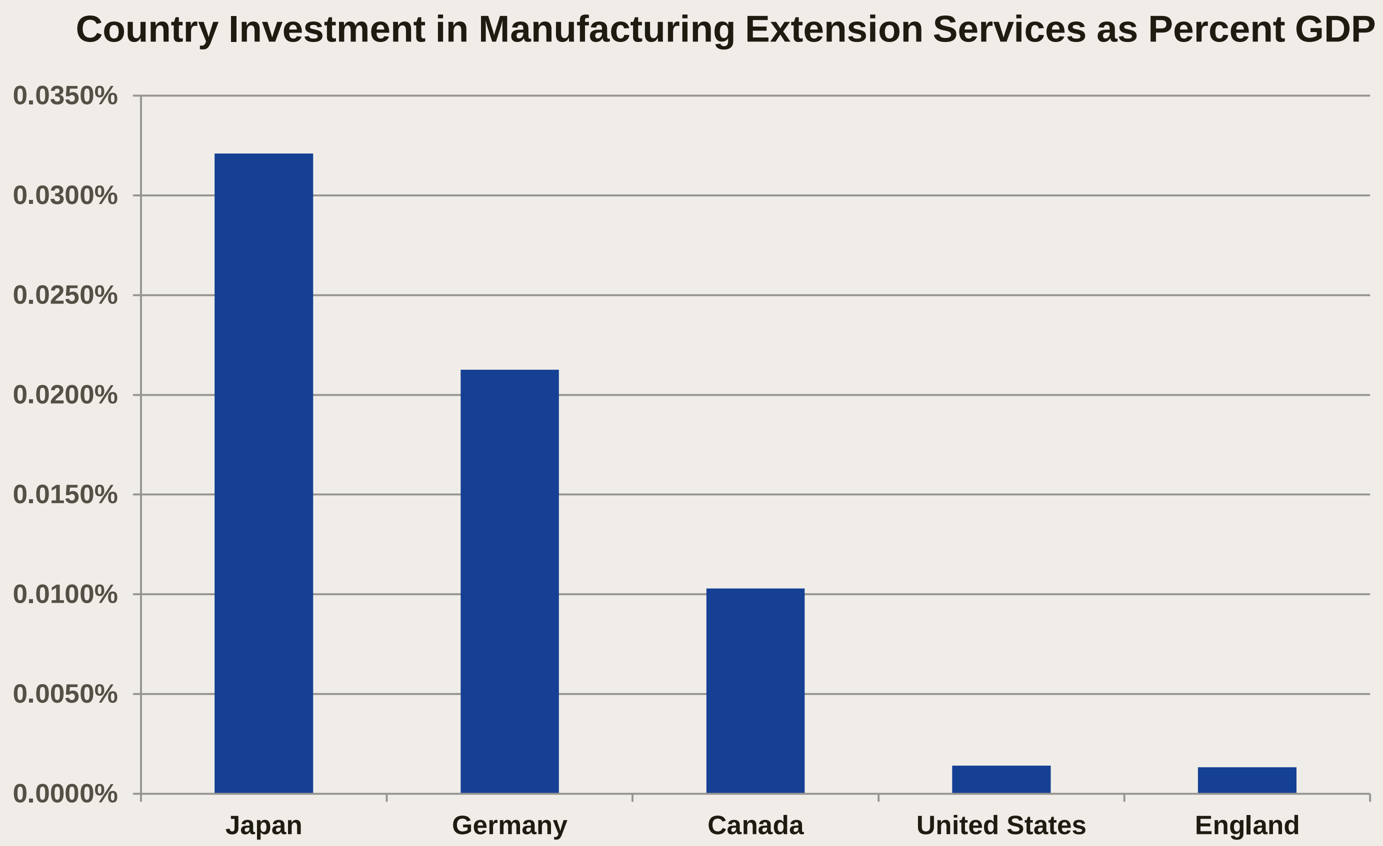
- Revamp engineering programs to focus on manufacturing engineering and work that is more relevant to industry.
- More joint industry-university research projects and student training incorporating manufacturing experiences (co-ops).
- Receive annual award of at least $25M from NSF plus priority on universities' applications for NSF grants.

Technology: Ramp up ERC & I/UCRC programs

- Get more ERCs & I/UCRCs focused on manufacturing:
  - Currently only 4 of 17 ERCs and 7 of 56 I/UCRCs are.
- Double funding for both programs.
- Require all ERCs to have at least a 40% industry match by 2017 or lose their federal funding.

Technology: Increase Funding for MEP

- Despite tremendous returns, U.S. underinvests in MEP compared to peer countries (and historical U.S. levels).



Tax Policies

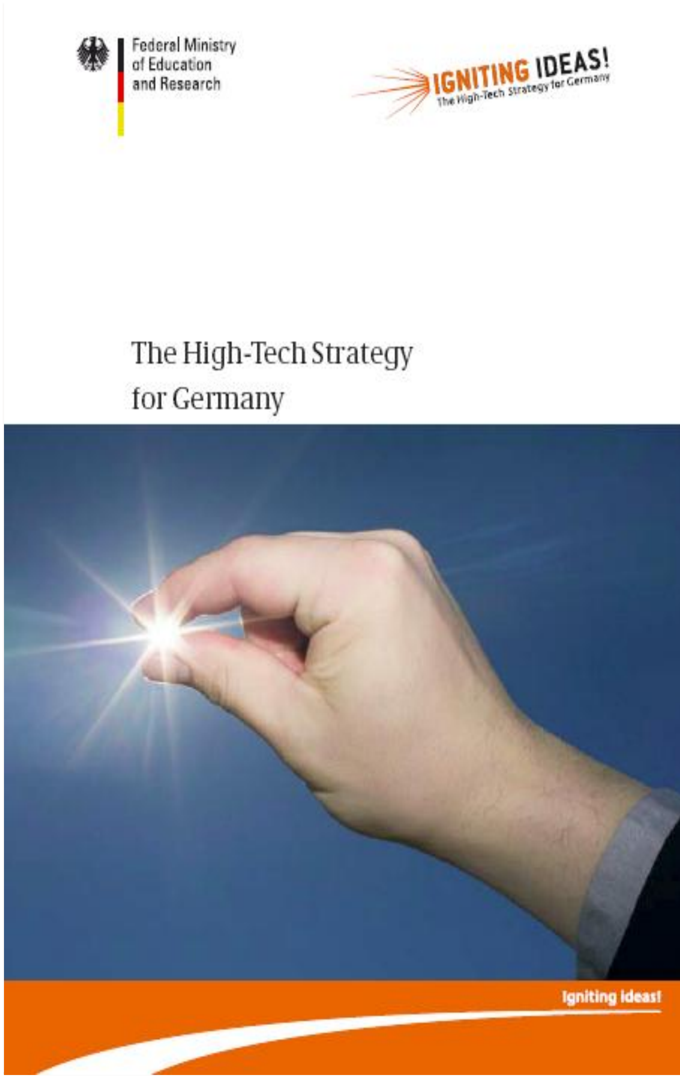
- Preserve and enhance key manufacturing tax incentives (e.g., R&D tax credit; accelerated depreciation; domestic production deduction).

- Implement a quasi-incremental *American Innovation and Investment Tax Credit.*

Talent Policies

- Increase adoption of industry-recognized, nationally portable credentials, such as those produced by the MSSC.
- Fund engineering co-op programs between universities and industry.

Conclusion: Smart Policies Matter



30% of all German companies attribute their innovations “to improved research and innovation policies at the federal level.”

Strengths	Opportunities
• **Strong user industries:** Automobile industry, medical technology, mechanical engineering and, increasingly, biotechnology, agriculture and logistics are technology drivers. • **Materials and equipment suppliers:** High level of expertise. • **Highly competitive:** Operations are seldom relocated to other countries. • **Skilled labour:** Germany has a unique initial and continuing education and training system at both industrial and academic level.	• **New research fields:** Enormous potential offered by polymer microsystems and micro/nano integration. • **Growth market:** Large number of SMEs with above-average, often double-digit growth rates. High-volume markets for security technology, logistics and health monitoring.
Weaknesses	**Threats**
• **Mass markets:** There is no mass production in Germany except in the automobile sector. • **Integration of microsystems technology in products:** Many SMEs in potential user sectors lack the necessary expertise. • **Provision of capital:** Technology companies – which are generally capital-intensive – have cautious, national-level financial backers.	• **Shortage of skilled labour:** Early action must be taken to prevent a possible shortage of new recruits. • **Product-oriented R&D infrastructure needed:** Support on the basis of developed microsystems technologies needed, particularly for SMEs. • **Establishment of more networks:** Germany needs more collaborative, production-oriented networks between research units, suppliers and systems producers.

Thank You

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