

Deloitte.

2016

Global Manufacturing Competitiveness

National Competitiveness Forum

Washington, D.C.
December 4, 2015

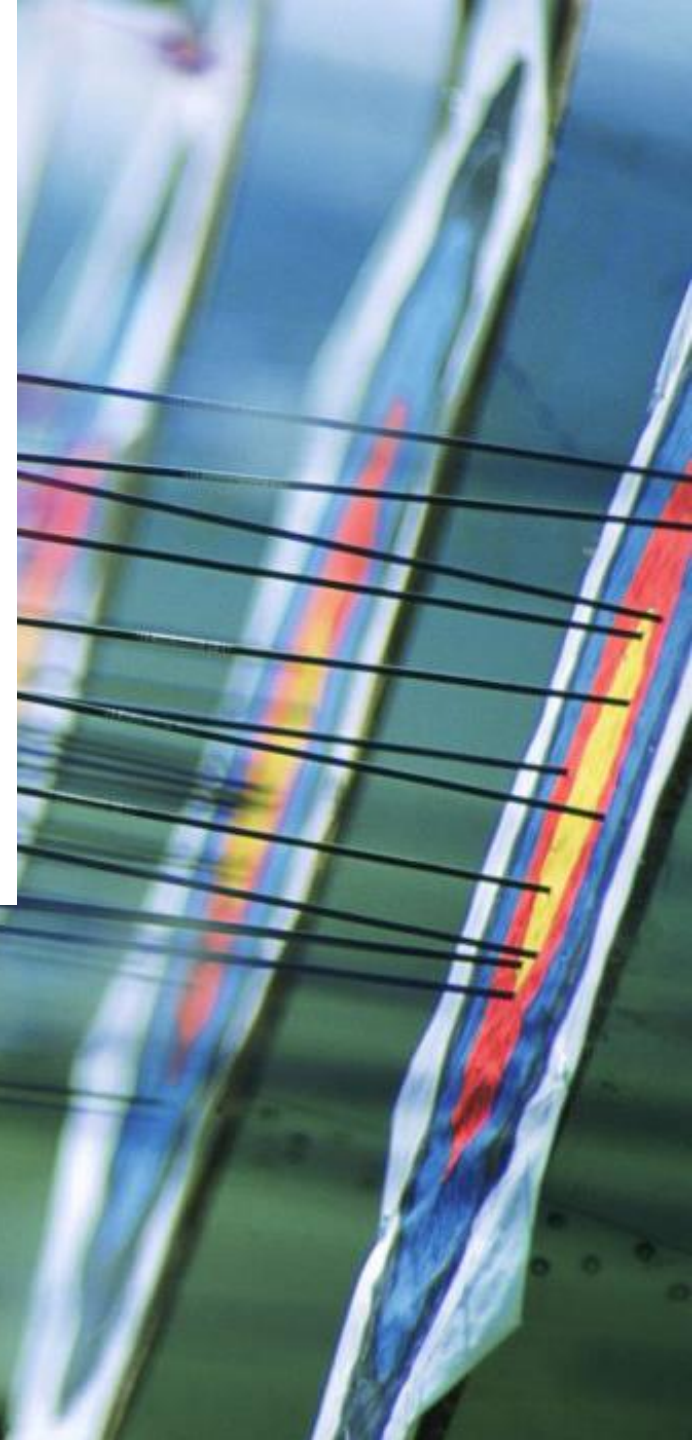
Craig A. Giffi

Vice Chairman
U.S. Leader, Manufacturing Practice
Deloitte LLP



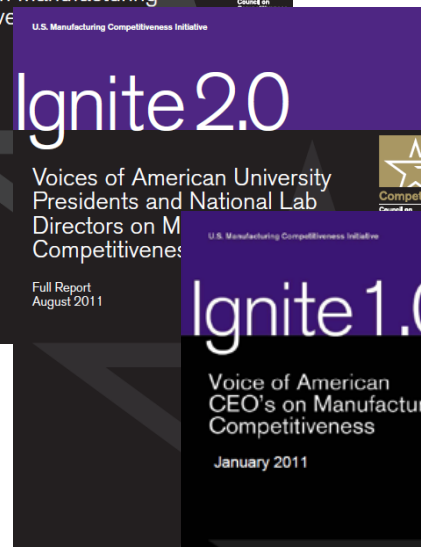
Compete.

Council on
Competitiveness



Years of Successful Collaboration

The Council and Deloitte have collaborated on the topic of Manufacturing Competitiveness and our findings are moving the national dialogue forward



Bringing Critical Insights Together

Leveraging findings from two simultaneous research initiatives: the **Advanced Technology Initiative** and the **2016 Global Manufacturing Competitiveness Index**



- Based on nearly three dozen interviews with senior technology leaders to identify the most promising forward technologies and key challenges facing the US technology ecosystem
- 2016 analysis based on survey findings from 550+ global executives
- Ranks 40 nations on key aspects of global manufacturing competitiveness

www.deloitte.com/globalcompetitiveness

Advanced Technologies Initiative

Listened to the Voice of Industry

- **Le Tang, Ph.D.**—Vice President & Head of US Corporate Research Center, ABB
- **Darlene Solomon, Ph.D.**—Senior Vice President & Chief Technology Officer, Agilent Technologies
- **Christine Tovee**—Chief Technology Officer, Airbus North America
- **Barbara Burger, Ph.D.**—President, Chevron Technology Ventures
- **Carmelo Lo Faro, Ph.D.**—Vice President & Chief Technology Officer, Cytec Industries
- **Klaus G. Hoehn, Ph.D.**—Vice President, Advanced Technology & Engineering, Deere & Company
- **A.N. Sreeram, Ph.D.**—Corporate Vice President & Chief Technology Officer, The Dow Chemical Company
- **Stephen G. Crawford**—Senior Vice President & Chief Technology Officer, Eastman Chemical Company
- **Ram Ramakrishnan**—Executive Vice President & Chief Technology Officer, Eaton Corporation
- **Ken Washington, Ph.D.**—Vice President, Research & Advanced Engineering, Ford Motor Company
- **Mark M. Little, Ph.D.**—Senior Vice President, Director of Global Research & Chief Technology Officer, General Electric Company
- **Gregory Powers, Ph.D.**—Vice President of Technology, Halliburton Company
- **I.P. Park, Ph.D.**—Executive Vice President & Chief Technology Officer, Harman International
- **Alex Dickinson, Ph.D.**—Senior Vice President, Strategic Initiatives, Illumina, Inc.
- **Tilak Agerwala, Ph.D.**—Research Emeritus & Former Vice President, Data Centric Systems, International Business Machines Corporation (IBM)
- **Jan Ziskasen**—Chief Technology Officer, Kraft Foods Group, Inc.
- **Paul J. de Lia**—Corporate Vice President of Science and Technology & Chief Technology Officer, L-3 Communications Corporation
- **John B. Rogers, Jr.**—CEO and Co-Founder, Local Motors
- **Ray O. Johnson, Ph.D.**—Former Senior Vice President & Chief Technology Officer, Lockheed Martin Corporation
- **Ajay P. Malshe, Ph.D.**—Founder, Executive Vice President and Chief Technology Officer, NanoMech, Inc.
- **Mehmood Khan, Ph.D.**—Vice Chairman & Chief Scientific Officer, Global Research & Development, PepsiCo, Inc.
- **Diego Olego, Ph.D.**—Senior Vice President & Chief Strategy and Innovation Officer, Philips Healthcare
- **Kurt G. Olson, Ph.D.**—R&D Fellow, PPG Industries
- **Cyril Perducat**—Executive Vice President, Digital Services and IoT, Schneider Electric S.E.
- **Patrick J. Byrne**—President, Tektronix, Inc.
- **Douglas H. Smith**—Product Line Vice President, Tapered Roller Bearings, The Timken Company
- **David L. Britten**—Senior Vice President & Chief Technology Officer, United States Steel Corporation
- **J. Michael McQuade, Ph.D.**—Senior Vice President, Science and Technology, United Technologies Corporation
- **Martin Thall**—Executive Vice President & President, Electronics, Visteon Corporation
- **Timothy D. Leuliette**—Former President & CEO, Visteon Corporation

Advanced Technologies Initiative

Listened to the Voice of National Labs

National labs conduct a significant portion of the basic as well as applied research in the United States. While some have specific focus areas like renewable energy, others carry out multifaceted R&D work, and in some cases with private sector companies. In all cases the Laboratories possess significant research capabilities, dedicated facilities and outstanding R&D resources. Interviews were held on an individual basis at the laboratory facilities and occasionally over the telephone.

- **Peter B. Littlewood, Ph.D.**—Laboratory Director, Argonne National Lab
- **Dean Bartles, Ph.D.**—Executive Director, Digital Manufacturing and Design Innovation Institute
- **Horst Simon, Ph.D.**—Deputy Laboratory Director, Lawrence Berkeley National Lab (LBNL—‘Berkeley Lab’)
- **William Goldstein, Ph.D.**—Laboratory Director, Lawrence Livermore National Lab (LLNL)
- **Dan Arvizu, Ph.D.**—Former Laboratory Director & Chief Executive, National Renewable Energy Lab (NREL)
- **Thomas E. Mason, Ph.D.**—Laboratory Director, Oak Ridge National Laboratory (ORNL)
- **Steven Ashby, Ph.D.**—Laboratory Director, Pacific Northwest National Laboratory (PNNL)
- **Paul Himmert, Ph.D.**—Former Laboratory Director, Sandia National Laboratory and Distinguished Fellow, Council on Competitiveness

Advanced Technologies Initiative

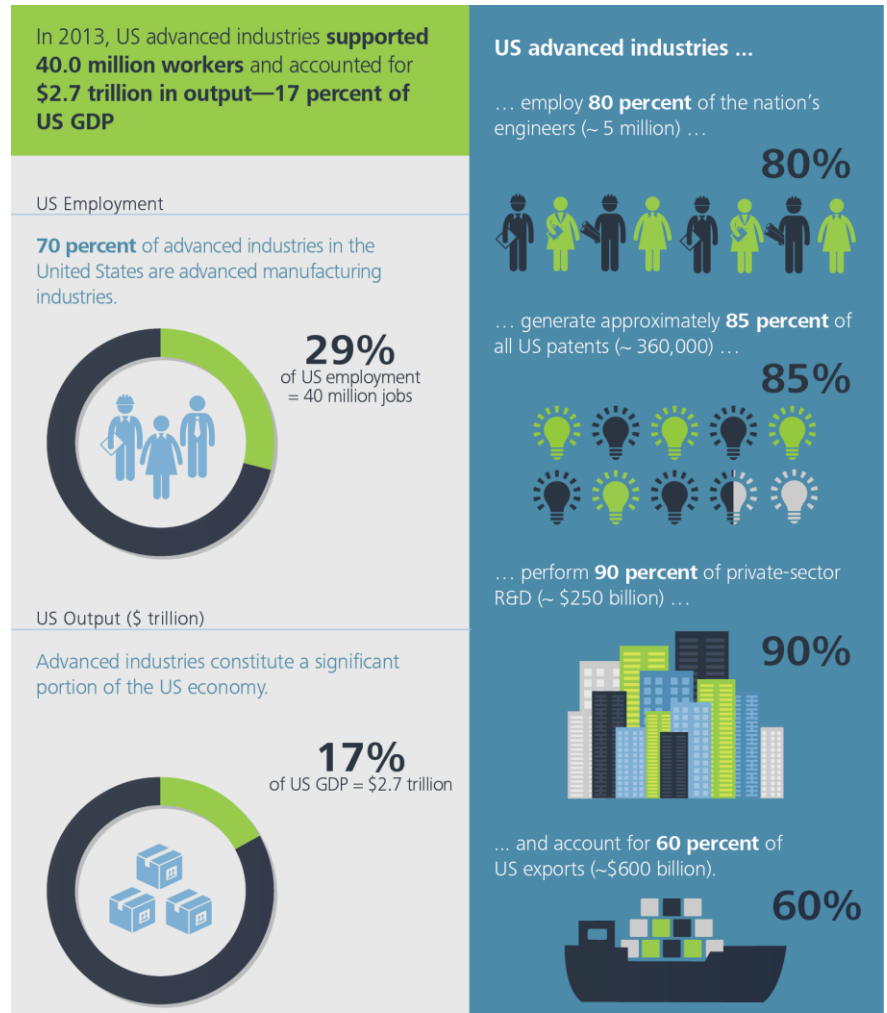
The following topics were explored with both Industry Leaders and National Laboratory Leaders:

- Prospects for US technology innovation within the domestic and global innovation environment.
- Top concerns about the prospects for US technology leadership over the short- and long-term.
- Most promising, attractive, and impactful technologies, and the challenges associated with developing such technologies.
- Level of engagement between Industry and National Laboratories and recommendations for improving interactions.
- Important areas the United States must address to remain technologically competitive in the long term.

Manufacturing and Advanced Technologies Matter

Manufacturing is a path towards national economic prosperity

- A nation's overall GDP growth is closely tied to the health of its manufacturing sector
- The US manufacturing industry is increasingly propelled by advanced technologies, driving prosperity through increased productivity, high-value exports and higher income jobs
- Advanced technologies and innovation also enables differentiation and competitive advantage by creating premium products, processes, and services that capture higher margins

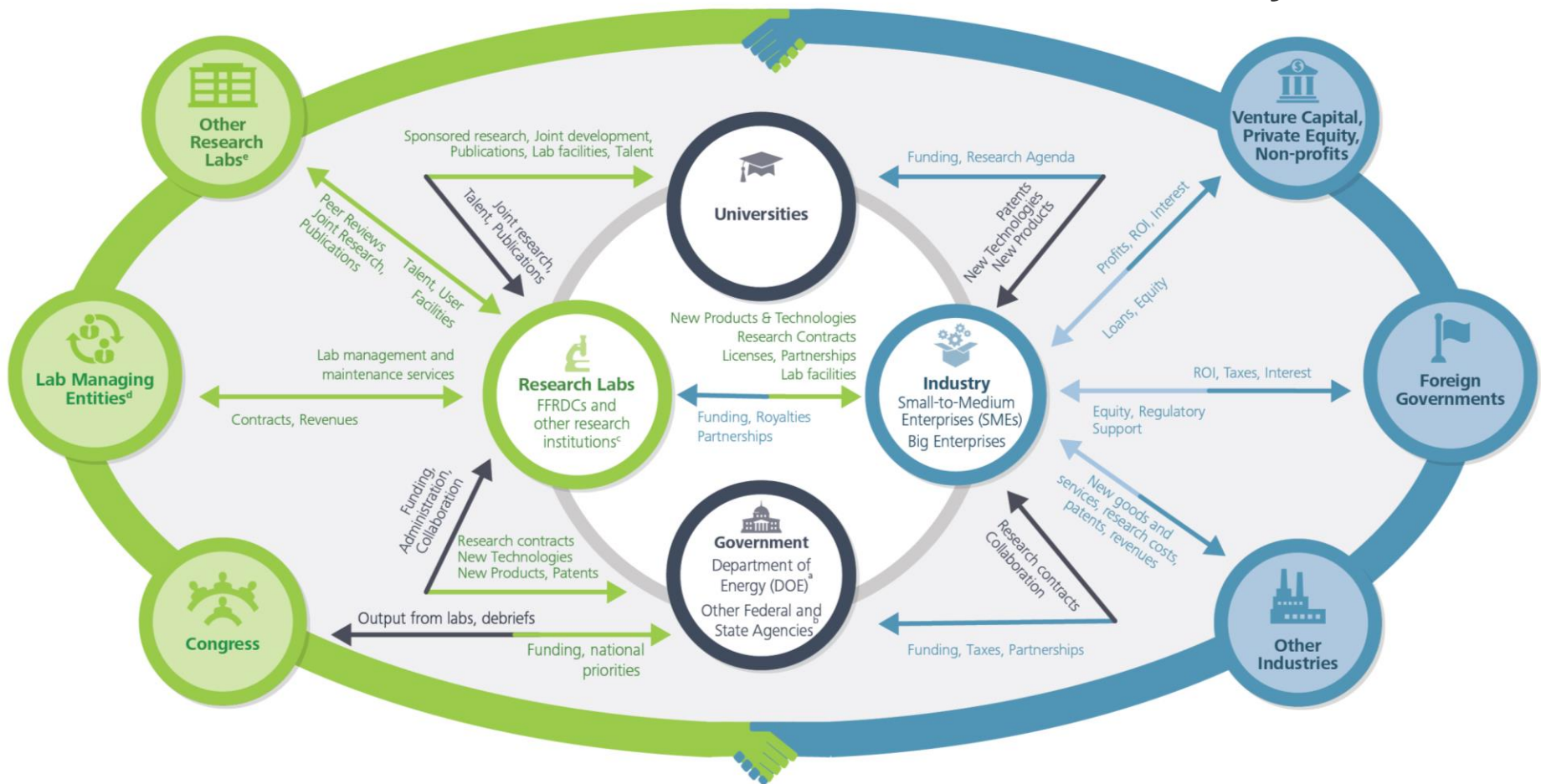


Source: Brookings Institution, World Bank and Bureau of Labor Statistics.®

...But Innovation Requires Collaborative Support

Many nations have invested heavily in ecosystems to connect people, policies and organizations to translate ideas into commercial products and services

An Illustration of the Current US Innovation Ecosystem

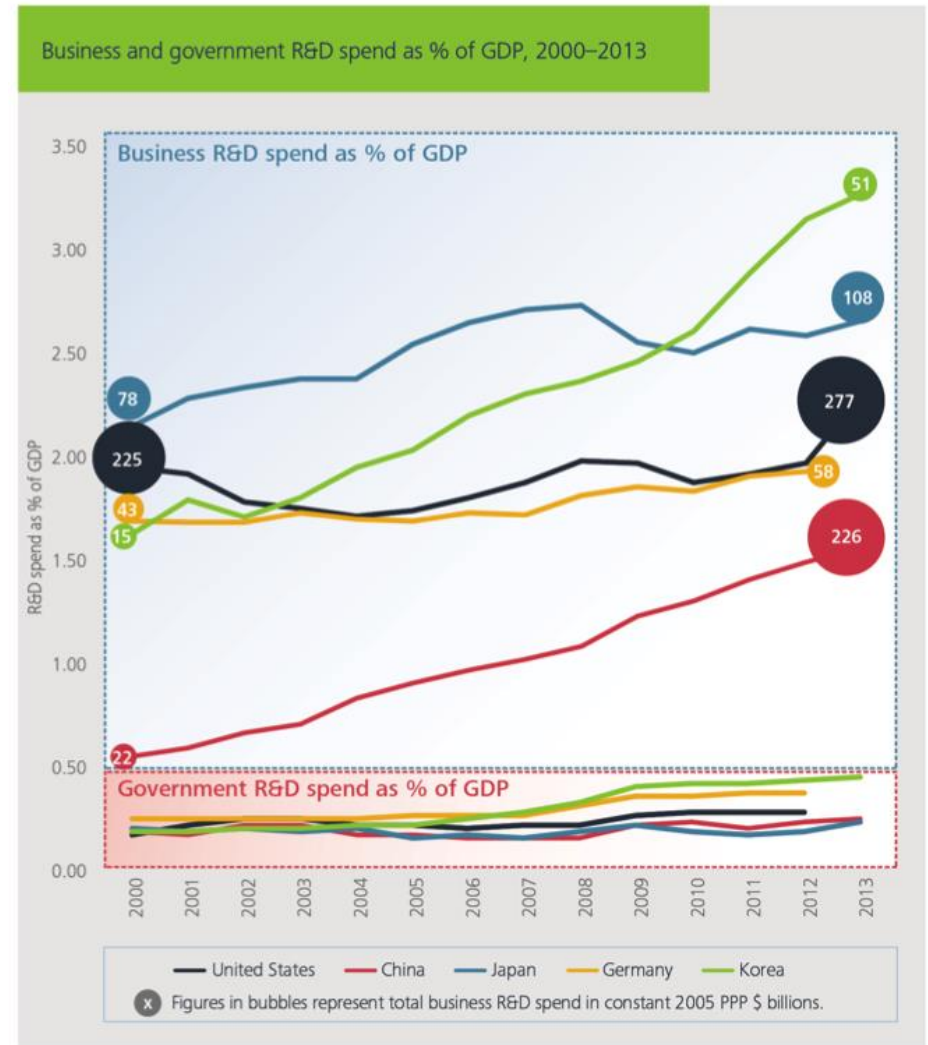


Businesses Are Driving R&D Spending

An accelerating trend among leading nations

(U.S. is Black; China is Red)

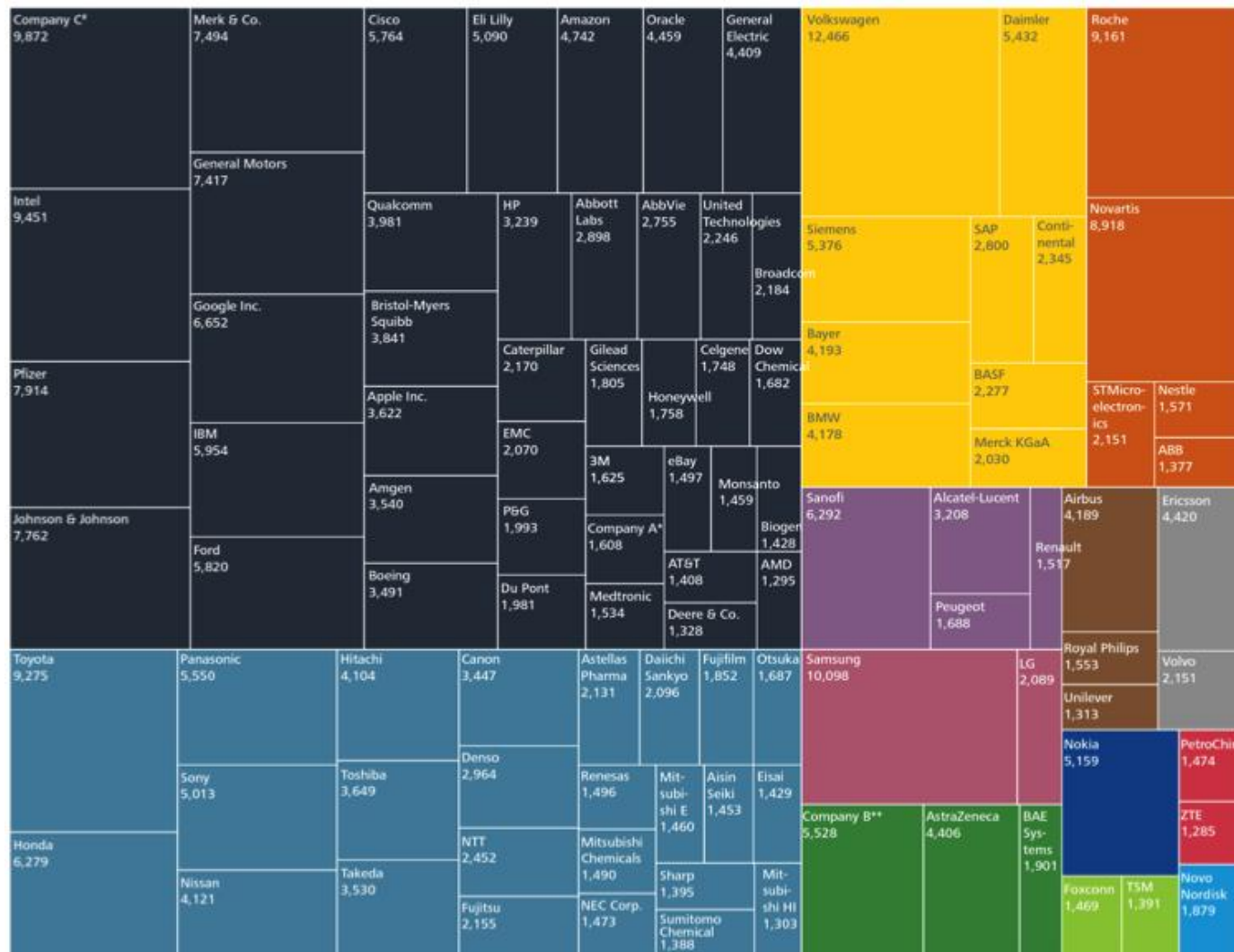
- US government spending on R&D has declined as a percentage of the total federal budget in the past decade, putting basic and applied research performed at government-sponsored labs at risk
- Businesses are accounting for more and more financing of R&D activities while also carrying out most of the commercialization work
- However, companies from increasingly competitive nations, like China, have been aggressively pursuing advanced R&D activities and some experts are projecting China will overtake the U.S. in R&D spend by 2019



Source: Deloitte analysis based on data from OECD. Note: For US and Germany, the latest data is 2012.

Currently, US Companies Dominate the Landscape

41 of the Top 100 Global R&D companies are from the U.S. (shown as Black)



Out of top 100 global R&D companies, **41 are from the United States** and **86 belong to the manufacturing sector.**



* A leading software provider.
 * A leading semiconductor company.
 ** A leading pharmaceutical company.

Note: Figures inside the boxes are "Average R&D spend over 2010-2014" in \$ millions.

Source: FactSet.⁽¹⁾

Note: Top 100 global R&D spending companies (based on five-year data) by country, 2010-2014

What Are Companies Investing In?

New world of advanced hardware and software, sensors, big data, and analytics results in smarter products, processes, and more closely connected value chains



Digital and Physical Worlds are Converging

Across dozens of interviews (ATI) and hundreds of surveys (GMCI), senior executives consistently stressed the importance of digital technology, including the use of advanced sensors, the ‘Internet of Things’ (IoT), as well as ‘Predictive Analytics’ in driving their future competitiveness.

We also found:

- Nations have different research strategies and approaches. Both the United States and China have spread their R&D investments across various industries including: computers & electronics, pharmaceuticals, and industrial machinery
- However, other countries take a more focused approach – e.g., both Japan and Germany center their R&D efforts on the automotive and computers & electronics sectors, while more than half of South Korea’s manufacturing R&D expenditure is in computer & electronics alone

Innovation Expected To Unlock New Opportunities

The path to future manufacturing competitiveness through advanced technologies with look similarbut not exactly the same for leading global markets

Advanced Manufacturing Technologies	US	China	Europe
Predictive Analytics	1	1	4
Smart, Connected Products (IoT)	2	7	2
Advanced Materials	3	4	5
Smart Factories (IoT)	4	2	1
Digital Design, Simulation, and Integration	5	5	3
High Performance Computing	6	3	7
Advanced Robotics	7	8	6
Additive Manufacturing (3D Printing)	8	11	9
Open-Source Design / Direct Customer Input	9	10	10
Augmented Reality (to improve quality, training, expert knowledge)	10	6	8
Augmented Reality (to increase customer service & experience)	11	9	11

United States

Predictive Analytics, Smart Products (IoT), and Advanced Materials are considered the most promising

China

Prioritizing Predictive Analytics to close the gap with the US and creating competitive advantage through HPC

Europe

Integrated priorities very much aligned with “Industry 4.0” paradigm, creating closed loop design/build process