



JOB CREATION, INNOVATION AND COMPETITIVENESS: MORE BANG FROM THE FEDERAL R&D BUCK

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USA R&D Policy Committee; however, the conclusions
and recommendations have not yet been approved by
this committee.**

US Economic Facts

- 2011 **GDP** = \$15.1 trillion; Estimated 2013 GDP = \$ 16.3 trillion
- Current **GDP Growth Rate** = 2.1 percent
- 2012 **Federal Income** = 2.47 trillion or 15 percent of GDP
- 2012 **Federal Expenditures** = \$3.80 trillion or 24 percent of GDP
- Outstanding **Public Debt** = \$16.7 trillion or \$52,000 per person
- 16 percent or 49.7 million live below the **poverty line** (\$11,702/\$23,201)
- The **jobless** rate is between 7.7 and 11 percent of workforce
- 12 percent of the employed workforce is **seeking full-time** employment
- **Tuition charges at public universities** have increased from 4 percent of 1970 median family income to 10 percent of 2009 median family income
- The Gini Coefficient, a measure of **income inequality**, has increased 30 percent since 1980
- **Middle class income** is stagnant or decreasing - the inflation-adjusted income of a typical family has dropped to mid-1990 Levels

TAKE AWAY: WE NEED A 3.5 PERCENT GDP GROWTH RATE AND A BALANCED FEDERAL BUDGET

2013 Projected Spending by Federal, State & Local Gov'ts

Source: usgovernmentspending.com Projected 2013 GDP = \$16,355 billion

CATEGORY	FEDERAL	STATE	LOCAL	TOTAL	% GDP
PENSIONS	\$878.5 B	\$190.8 B	\$43.5 B	\$1,112.8 B	6.80%
HEALTH CARE	\$916.1B	\$498.3 B	\$134 B	\$1,182.4 B	7.23%
EDUCATION	\$136.1 B	\$270.9 B	\$518.1 B	\$820.6 B	5.02%
K-12	\$59.9 B	\$6.4 B	\$464.3 B	\$426.2 B	2.61%
POST HS	\$16.6 B	\$219.6 B	\$43.1 B	\$279.3 B	1.71%
OTHER	\$59.6 B	\$44.8 B	\$10.7 B	\$115.2 B	0.71%
DEFENSE	\$901.4 B	\$1.2 B	0	\$902.6 B	5.52%
WELFARE	\$422.3 B	\$180 B	\$98.9 B	\$646.8 B	3.95%
PROTECTION	\$62.8 B	\$91 B	\$188.9 B	\$342.7 B	2.10%
TRANSPORTATION	\$114.2 B	\$111.6 B	\$144 B	\$308.9 B	1.89%
GENERAL GOVT	\$28.1 B	\$31.7 B	\$54.6 B	\$113.6 B	0.69%
OTHER SPENDING	\$96.2 B	\$86.2 B	\$355.3 B	\$488.4 B	2.99%
INTEREST	\$247.7 B	\$49.8 B	\$65 B	\$362.5 B	2.22%
TOTAL SPENDING	\$3,803.40 B	\$1,511.30 B	\$1,602.20 B	\$6,281.3 B	38.4%
FEDERAL DEFICIT	\$901.4 B			\$901.4 B	5.51%
GROSS PUBLIC DEBT	\$17,547.9 B	\$1,153.5 B	\$1,848.4 B	\$20,549.8	125.65%

Only Two Issues to Debate

- **Appropriate Level for Federal Spending as Percentage of GDP: Current Thinking Is 18 Percent**
- **Number of Years to Reach Balanced Budget: Current Thinking Is 10 Years**



TAKE AWAY: THERE ARE NO FREE LUNCHES FOR THE NEXT 10 YEARS.

Vision for Federal R&D

The US GDP annual growth rate will exceed 3.5 percent and lead to a job creation rate by firms exceeding the 2005 rate of 3 million jobs/year. Electrical engineers will continue to make innovations that (1) drive long waves of economic growth and (2) lead to incremental product and process advancements that create US jobs

Definition of Innovation

Innovation is the introduction of something new; from the perspectives of economics and public policy, innovation is **advancements in technology, management or business practices** – or all three - that lead to sustainable private sector job creation.

TAKE AWAY: INNOVATION IS ABOUT JOB CREATION IN THE PRIVATE SECTOR

Innovation In Economic System

Inputs

- Labor
 - Management
 - Engineering
 - Workforce
- Capital
 - Private
 - Public
- Technology
 - ExistingTech
 - R&D
 - Private
 - Public
- Infrastructure

Economic System

R&D

Outcomes

- **Innovation**
 - Competitive Companies
 - Start-Up Companies

R&D Outputs

- **Universities**
 - Papers
 - Citations
 - Patents & Licenses
 - Conference Presentations
 - More R&D Funding
 - Graduates
- **Government Labs**
 - Mission Success
 - Papers
 - Patents
 - Licenses
 - Presentations

TAKE AWAY: SHIFT EMPHASIS FROM R&D INPUTS AND OUTPUTS TO INNOVATION OUTCOMES

Properties of High Innovation Rate

- **Most Occur in Economic Ecosystems**
 - High People Density
 - High Professional Diversity
 - Scientists
 - Business People
 - Engineers
 - Venture Capitalists
 - Start-Up Experience
 - Intellectual Capital Law
 - Facilitates Interactions
- **Focus on Intersection of Disciplines**
- **Innovation Management Strategy**
 - Risk-Taking
 - Innovation Outcome Focus
 - Non-Hierarchical

TAKE AWAY: USE FEDERAL R&D TO GROW MULTIPLE, SELF-SUSTAINING ECONOMIC ECOSYSTEMS AND EMPHASIZE HIGH RISK, HIGH-PAYOFF, MULTI-DISCIPLINARY PROJECTS

Two Major Classes of Innovation

- **Long or Schumpeterian or Kondratieff Waves: 35-50 Years in Duration**
 - **Electric Power**
 - **Electronic Communications and Internet**
 - **Automobile**
 - **Semiconductor Devices**
 - **Software**
- **Very Rapid Incremental Advancements in Existing Technology: Months to Few Years in Duration**
 - **Integration of Product Design and Manufacturing**
 - **Making Products Smart by Embedding Microelectronics**

TAKE AWAY: WE NEED BIG BREAKTHROUGHS AND INCREMENTAL IMPROVEMENTS; HISTORY SUGGESTS EE AND CE WILL BE MAJOR DRIVERS OF BOTH

EE, CE & CS Have Earned Special Consideration as Economic Drivers



- Educate More of Population on Fundamentals of EE, CE & CS
- Need More EE, CE & CS Courses Crossing Other Disciplines
- Need More EE, CE & CS University Presidents and Provosts
- Promote EE, CE & CS to Prospective Students

TAKE AWAY: WE NEED LEADERS WHO RECOGNIZE THE IMPORTANCE OF EE AND CE

Economic Sinks: Three Sectors with Negative Productivity Growth

1

- **Healthcare @ 18% of GDP – Larger Than Federal Budget Less Healthcare**

2

- **Federal and State Governments @39 % of GDP**

3

- **Public Education @ 5% of GDP Funded by Taxes**

TAKE AWAY: WE AREN'T LIKELY TO GET GDP GROWTH RATE ABOVE 3.5 PERCENT UNTIL HEALTHCARE, PUBLIC EDUCATION AND GOVERNMENT SPENDING ARE UNDER CONTROL

Proposed 2013 Federal R&D Budget

**\$40 Billion
Spent at
Universities**

**\$45 Billion
Spent at
Government-
Owned
Laboratories**

**\$55 Billion
Spent at
Companies**

Agency	2013 Proposed	Agency	2013 Proposed
Defense	\$71.204 billion	H&HS	\$31.400 billion
NASA	\$9.620 billion	Energy	\$11.903 billion
NSF	\$5.904 billion	Agriculture	\$2.297 billion
Commerce	\$2.573 billion	Transportation	\$ 1.076 billion
EPA	\$0.580 billion	Veterans Affairs	\$1.166 billion
Education	\$0.398 billion	Homeland Security	\$0.729 billion
Others	\$1.852 billion	Total	\$140.82 billion

TAKE AWAY: WE NEED OUR FEDERAL R&D INVESTMENT TO PRODUCE MORE ECONOMIC GROWTH

Comparison of Labs and Universities

Quality Needed	Lab	University
Diversity of Staff or Faculty	weak	strong
Non-Hierarchical Structure	weak	strong
Ease of Establishing Teams	strong	weak Individual Investigator
Innovation Culture & Vision	weak mission focus	weak publish focus
Innovation Incentives	weak	weak
Partnership Incentives	weak	weak
Risk-Taking	weak	weak
Big Problem Focus	weak	weak
Trust	moderate	weak

TAKE AWAY: TURNING UNIVERSITIES AND GOVERNMENT-OWNED LABS INTO INNOVATION MACHINES IS MAJOR TASK AND WILL REQUIRE PRESSURE

Federal R&D Accountability

- **Hold Agencies Accountable for Turning R&D into Innovation**
- **Hold Performers of Federal R&D Accountable for Turning R&D into Innovation**
 - **Companies**
 - **Universities**
 - **Government-Owned Laboratories**

TAKE AWAY: ACCOUNTABILITY WILL HELP FEDERAL R&D PRODUCE MORE ECONOMIC GROWTH



RECOMMENDATION #1

We propose that NIH spend 10 percent of its R&D budget on healthcare services productivity growth, healthcare cost reduction and disease prevention and that Department of Education spend its R&D budget on increasing the productivity and quality of education.



RECOMMENDATION #2

We propose that any educational institution receiving federal R&D funds be required to offer education options that can be pursued for no more than \$10,000 for a four-year education.



RECOMMENDATION #3

We propose that companies employing an electrical or computer engineering or computer science student in a co-op or intern position be permitted to pay one term of that student's tuition for each term of work and take that tuition payment as a tax credit.



RECOMMENDATION #4

We propose that government-owned laboratories be required to (1) employ 1 percent of their total workforce as electrical or computer engineering students in co-op or intern positions and (2) pay one term of each student's college tuition for each term of work.



RECOMMENDATION #5

We propose that each university receiving federal R&D funds be required to use 10 percent of its federal R&D funds to promote innovation by establishing and nurturing an economic ecosystem that spins off entrepreneurs and small companies. We recommend that states match the federal innovation investment at each of its public universities. We also recommend that the innovation history of a university be a consideration in selection of university projects to fund by any federal agency.



RECOMMENDATION #6

We propose that each government-owned laboratory be required to use 10 percent of its federal R&D funds to promote innovation by establishing and nurturing an economic ecosystem that spins off entrepreneurs and small companies. We also recommend that the innovation history of a government-owned laboratory be a consideration in selection of which government-owned laboratory to fund by any federal agency.



RECOMMENDATION #7

We recommend that the Federal Government task a panel of distinguished scientists and engineers from universities to identify the top 20 most important research inventions and resulting innovations in the past 25 years from each government-owned laboratory. This effort should be updated every five years.



RECOMMENDATION #8

We propose that the H1B Visa Program establish a special category for immigrant entrepreneurs called H1BE and that this program be open to any foreign-born scientist, businessperson or engineer who meets H1B requirements and wishes to come to the US to start a new company. However, if after 5 years an H1BE immigrant has not started a new company that employs 20 or more people, they will not be eligible for receipt of a green card.

Summary Of Take-Aways

- *WE NEED A 3.5 PERCENT GDP GROWTH RATE AND A BALANCED FEDERAL BUDGET*
- *INNOVATION IS ABOUT JOB CREATION IN THE PRIVATE SECTOR*
- *SHIFT EMPHASIS FROM R&D INPUTS AND OUTPUTS TO INNOVATION OUTCOMES*
- *USE FEDERAL R&D TO GROW MULTIPLE, SELF-SUSTAINING ECONOMIC ECOSYSTEMS AND EMPHASIZE HIGH RISK, HIGH-PAYOFF, MULTI-DISCIPLINARY PROJECTS*
- *WE NEED BIG BREAKTHROUGHS AND INCREMENTAL IMPROVEMENTS; HISTORY SUGGESTS EE AND CE WILL BE MAJOR DRIVERS OF BOTH*
- *WE NEED LEADERS WHO RECOGNIZE THE IMPORTANCE OF EE AND CE*
- *WE AREN'T LIKELY TO GET GDP GROWTH RATE ABOVE 3.5 PERCENT UNTIL HEALTHCARE, PUBLIC EDUCATION AND GOVERNMENT SPENDING ARE UNDER CONTROL*
- *WE NEED OUR FEDERAL R&D INVESTMENT TO PRODUCE MORE ECONOMIC GROWTH; ACCOUNTABILITY WILL HELP*
- *WE NEED UNIVERSITIES AND GOVERNMENT-OWNED LABORATORIES TO BECOME NUCLEI FOR ECONOMIC ECOSYSTEMS*



QUESTIONS?
SUGGESTIONS?