



Offshore Outsourcing of Engineering: Implications for Innovation Policy

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Ron Hira, Ph.D., P.E.
Center for Science, Policy, and Outcomes
Columbia University
rh2107@columbia.edu, 202-776-0370
www.cspo.org

Center for Science, Policy, and Outcomes

- Organizationally under Columbia University's Earth Institute
- Organizing question for the Center for Science, Policy, and Outcomes (CSPO).
 - Science is the most powerful transforming force in today's world. How can science most effectively contribute to an improved quality of life for the greatest number of people?

Center for Science, Policy, and Outcomes

“Scientists have made many great discoveries during the past 100 years, but those discoveries have affected society in complex and sometimes paradoxical ways. ... How can we design a science policy that will distribute the benefits of scientific discoveries more equitably, and will foster research that addresses our most critical social needs? ...

Science and its power continue to advance, yet our ability to harness that power for maximum social benefit remains stagnant. That mismatch means that the societal costs of our current approach to science policy are likely to grow in the future. Policies that focus on social outcomes are a key part of the solution.”

- *Michael M. Crow, Chronicle of Higher Education, March 9, 2001*

CSPO People & Projects

- Michael Crow, Chair, Now President of Arizona State U
- Daniel Sarewitz, Managing Director
 - Frontiers of Illusion
 - Prediction: Science, Decision Making, and the Future of Nature
 - Living With the Genie
 - Social Implications of Nanotechnology
- Barry Bozeman, GA Tech
 - Public Value Mapping
 - Equitable Distribution of S&T
- Paul Wilson, AAAS Diplomacy Fellow
 - UN AIDS Task Force

CSPO People & Projects

- Noela Invernizzi
 - Science & Technology & Social Welfare – Public Participation
- Guillermo Foladori
 - World Public Health Issues – Conflicts in Public Private Partnerships
- Ron Hira
 - India's IT Industry
 - Breast Cancer Research – Public Value Mapping Project
- Affiliated Faculty
 - Richard Nelson, Columbia
 - Bhaven Sampat, GA Tech
 - David Guston, Rutgers

Outline

- Objective and definitions
- What is claimed
 - Large move offshore – Likened to manufacturing
- Potential impacts
- Conflicting goals and contradictory theories
- Current political milieu
- Potential policy responses
- Policy analysis can inform policy responses

The McGraw-Hill Companies

BusinessWeek

FEBRUARY 5, 2003

www.businessweek.com

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SILICON VALLEY
TALE OF A HIGH-TECH ZOMBIE

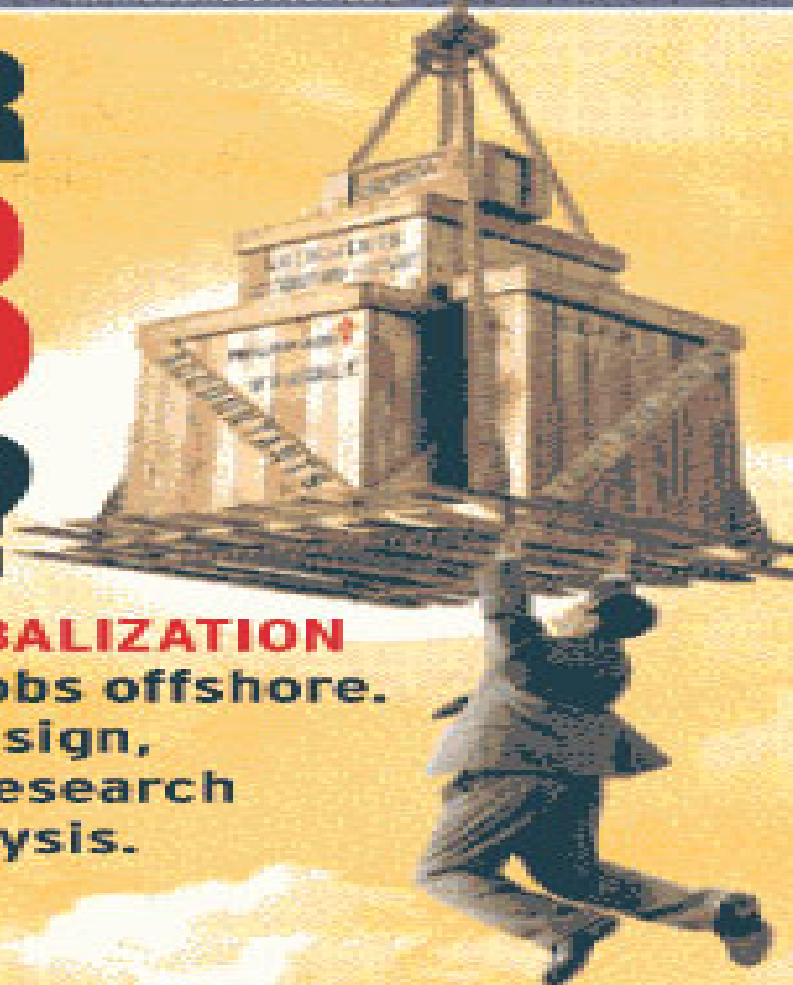
AIRLINES
HOW SOUTHWEST WEATHERS THE STORM

STOCK OPTIONS
COMPANIES ARE GROPING FOR A BETTER WAY

IS YOUR JOB NEXT?

A new round of **GLOBALIZATION** is sending upscale jobs offshore. They include chip design, engineering, basic research—even financial analysis. Can America lose these jobs and still prosper?

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Objective of Talk

- Raise offshore engineering as an important issue.
- Introduce some of the claims and argue that few are subject to academic scrutiny.
- Offshore engineering will happen. How does the U.S. design good policy?
 - Argue that policy research and policy analysis can help lead to better policy responses.

Some Definitions

- Outsourcing
 - Procter & Gamble contracts with HP for IT services – estimated \$3bn over 10 years.
 - Not new – classic make or buy issue in supply chain management – Freemarkets
- Offshore Outsourcing
 - Northrup Grumman contracts with Satyam to provide IT services
 - Nearly all work is completed offshore
- Near Shore, Best Shore, etc.

Some Definitions

- Offshore Sourcing (MNC)
 - Daimler Chrysler has an R&D center in Bangalore
- Onsite Outsourcing by Domestic Multinationals (same as Outsourcing?)
 - IBM, EDS, IGATE
- Onsite Outsourcing by Foreign Multinational
 - Tata Consultancy Services, Infosys, Wipro, Satyam
 - Primarily Foreign Workers on Temporary Visas (Hira 2003)
- Blended Sourcing

Claim:

3.3 Million US Services Jobs To Go Offshore

- “The IT industry will lead the initial overseas exodus.”
- John McCarthy, Forrester Research, November 2002
- “Lethal Outsourcing”
 - Similar to Manufacturing exodus
- Paul Craig Roberts, Washington Times, Feb. 27, 2003
- **“Can America lose these jobs and still prosper?”**
- BusinessWeek, Cover, Feb. 3, 2003

My Focus is on Impact on Supply and Demand of Engineers

- How much engineering work will move offshore?
- How does this affect the domestic engineering workforce & pipeline?
- How does the U.S. benefit from the increased global talent base?

Why do Companies Utilize Offshore Engineering Talent?

- Cost
- Exceptional talent?
 - Shortage of U.S. workers? Ph.D.'s?
- Politics & Access to the local market
 - Trade, e.g., China & Russia – Boeing Engineers
- Developing countries' strategy?
- 24/7 Capabilities
- Collaborative engineering technology
- **Managers are now aware of it!**

Why do Companies Utilize Offshore Engineering Talent?

<u>Country</u>	<u>PPP</u>	<u>Salary</u>
U.S.	1.0 * \$70k	\$70,000
Hungary	0.367 * \$70k	\$25,690
China	0.216 * \$70k	\$15,120
Russia	0.206 * \$70k	\$14,420
India	0.194 * \$70k	\$13,580

Policy Implications: Why should you care?

- U.S.
 - National Innovation System
 - Economic Growth and National Security and Social Equity (?)
 - Engineering Workforce
- Developing Countries
 - Strategy for development
 - Many countries are betting on it
- Other Developed Countries
 - Reserved for another time

U.S. Impacts

- Lift economic development at home
 - Improve productivity
 - Distributional benefits and costs?
- Open new markets
- Lift economic development abroad
 - Improve international relations and cooperation

U.S. Impacts

- U.S. engineering workforce
 - Will it decrease domestic demand or will mundane work move abroad?
- Military capacity
 - Access to and assimilation of technology
- Homeland defense
 - Critical data and information housed abroad
- Best and brightest go home or never come
 - Brain circulation vs. brain drain
- U.S. innovation system
 - Will the U.S. be able to create new products and industries and exploit them?

Developing Country Impacts

- Best path to growth?
 - Most obvious comparative advantage is low cost skilled labor
- Movement up the ladder of innovation
 - Spillover benefits
- Learning western business practices
- Macroeconomic advantages
 - Foreign debt and currency strength
- Utilize idle labor force

Developing Country Impacts

- Best and brightest are suppliers for external markets instead of addressing domestic problems
- Loss of sovereignty to MNC's?
- Proper use of scarce resources
 - Tax holidays for IT companies
 - Working on male pattern baldness rather than on malaria
 - Traditional engineering graduates moving towards IT

Developing Country Impacts

- Industrial Policy
 - Opening domestic markets to MNC's – quid pro quo?
 - Import Substitution versus Export Led
 - Should countries pick winners through subsidies?
- Race to the bottom?
 - Margins on the decline
 - Infosys – Prices Down 5%, Volumes Up 13%
 - “The economic situation, competition and the type of business we are, strategic global outsourcing, which is price competitive, has had an impact on the margins,”
– Reuters, April 10, 2003

U.S. Politics of Offshore Engineering

Difficult Time for Reflective Discussion: Jobs, Jobs, Jobs

- Interest Groups
 - Industry, ITAA
 - Workers, Management, Shareholders
 - Universities
 - Professional Groups
 - Programmers and Engineering Activists
 - Labor
 - Foreign Companies
 - NASSCOM and Confederation of Indian Industry

Conflicting Goals

- U.S. Industry:
 - Access to a large pool of high skilled and low cost labor
 - Government is responsible for training of technology workers
 - Access to foreign markets
 - Intellectual property protection
 - Ability to move labor where it sees fit – labor is one more input

Conflicting Goals

- U.S. Engineers
 - Protection from “unfair” competition
 - H-1B & L-1
 - Government procurement – “Buy American”
 - Keep jobs at home
 - Protection from becoming “disposable commodity”

Conflicting Goals

- U.S. Government
 - Lift Economic development at home
 - National Innovation System
 - Military strength
 - Strong domestic technology talent
 - Access to foreign technology
 - Employment

Conflicting Goals

- U.S. Government
 - Equitable distribution of costs and benefits
 - Competitiveness
 - Open new markets abroad & develop good relations
 - Homeland security versus open borders
 - Continue to attract best and brightest – reverse brain drain

Conflicting Goals

- Developing Countries' Industry
 - Ability to move labor in and out of the U.S. with no restrictions
 - Indian IT industry's competitive advantage is highly dependent on its use of H-1B and L-1 (Hira, 2003)
 - Movement up the ladder of innovation
 - Infosys wants to directly compete with Accenture
 - Tata eyeing ASIC design
 - R&D Centers and Technology Incubators in China, India
 - Access to U.S. market
 - Largest and most sophisticated
 - Learning business practices

Conflicting Goals

- Developing Countries' Governments
 - Improve the economy
 - Avoid race to the bottom
 - Avoid being white collar sweatshop for West
 - Promote domestic companies over foreign MNCs
 - Macroeconomic benefits
 - Address domestic problems with best & brightest
 - Utilize an idle labor force

Contradictory Theories

- U.S. Industry claims that the shortage of U.S. engineers accelerates the magnitude of offshore outsourcing
- Government should subsidize engineering education to increase supply
 - Paul Romer's "prospecting" thesis - Tech Talent Bill
- U.S. Engineering activists believe in a zero-sum-game
 - Work moved offshore is lost completely
 - Too many engineers depresses wages
 - Age discrimination

Contradictory Theories

- Downward Spiral?
 - Shortages cause increased offshore engineering
 - Increased offshore engineering lowers domestic demand
 - Lower domestic demand discourages those entering engineering and lowers supply
- How do we make sense of this?
 - Magnitude and timing are important
- Can we measure supply and demand?

Contradictory Theories

- U.S. Industry used the argument that looser H-1B regulations saved U.S. jobs by preventing movement offshore
 - Hira argues that H-1B policy accelerated the movement offshore for IT work
- Training is the responsibility of the worker but engineering half-lives are short
- Short term vs. medium term vs. long-term impacts may be very different
 - Technology cycles shorter
 - Electrical Engineering careers more volatile

Three Views in 2003

- Engineering Activists
- University President
- Professional Group

The H-1B is a visa for highly skilled foreigners to come to work in America. It is destroying America's technical leadership and stealing our jobs. Nearly 40% of applicants have falsified their credentials. Most weren't highly skilled at all.

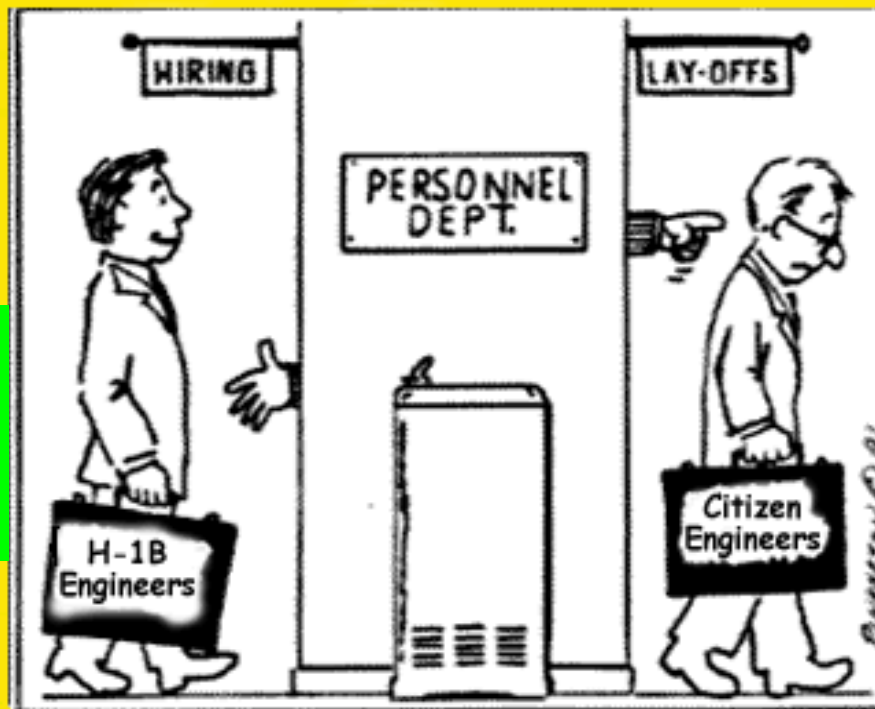
Many H1B and L1 workers pay little or no taxes. They certainly pay less than the American workers they replace. This is the REAL reason for California's 40 BILLION dollar budget deficit

Hundreds of H-1B workers have been caught stealing American technology for Chinese, Taiwan, and Indian companies. The next Pentium might not come from Intel if this keeps up. (Intel employs over 8,000 H-1Bs)

The H-1B was supposed to be a temporary worker program but over half use it as a way to gain U.S. citizenship. Congress passed a law last year allowing H-1Bs to stay in the US and look for work even if their job is terminated

In 2002, 9 out of 10 new technology jobs in America went to foreign workers

It is not illegal for a company to fire an American and replace them with a foreign worker. Companies don't have to try to hire American first either



STOP THE H-1B!

During this recession, England and Germany eliminated their foreign technology worker programs, while America INCREASED it!

Last year over a million foreign technology visas were granted while nearly a million american technology workers lost their jobs

Imagine the humiliation of being forced to train your foreign replacement and finding out they don't know the first thing about how to do the job, that all their experience was faked, and they haven't even graduated from college while you hold a masters.

Millions of H-1B workers are here in America, but the US government refuses to keep statistics and reports numbers in terms of petitions not visas making it impossible to prove that the official limits have been exceeded every single year

In 2000, Indian lobbyists and the ITAA donated millions of dollars and mislead congress with falsified reports of a shortage. Congress passed the increase of visas from 65,000 to 195,000 in the middle of the night

<http://www.Zazona.com/ShameH1B/Horror.htm>
<http://groups.yahoo.com/group/AmericanWorkersCoalition>
<http://www.HireAmericanCitizens.org>
<http://www.H1BProtest.com>

<http://www.hannatroup.com:81>

<http://www.TechsUnite.org>

<http://www.NoMoreH1B.com>
<http://groups.yahoo.com/group/H1BFraud>
<http://heather.cs.ucdavis.edu/itaa.real.html>
<http://www.Toraw.org>

Write your Congressman!

h1bprotest@yahoo.com

Write your Senator!

“Washington Consensus”

Industry and Academic and Gov't (?) View: U.S. Suffers from Shortage of Engineers

- ... both national security and economic status in a global economy has relied primarily on technological superiority.
 - **Not enough U.S. students are choosing majors in science, mathematics, engineering, and technology to maintain this status quo, much less sustain global leadership.**
 - **The United States has relied on importing talent on H1B [sic] visas** when it has been unable to find the science and technological professionals at home. This practice has **shielded the United States from experiencing a growing domestic shortage.**

Envisioning A 21st Century Science and Engineering Workforce for the United States: Tasks for University, Industry, and Government, NAP (2003)

- *Dr. Shirley Ann Jackson, President RPI, President-Elect AAAS*



Contact: Chris McManes
Marketing Communications/Public Relations Coordinator
Phone: +1 202 785 0017, x8356
E-mail: c.mcmanes@ieee.org

Unemployment Rate for Electrical Engineers Skyrockets to Record Level

WASHINGTON (28 April 2003) — The unemployment rate for electrical engineers (EEs) rose to an unprecedented 7.0 percent in the first quarter of 2003, according to the U.S. Department of Labor. The rate stood at 3.9 percent in the previous quarter, and is a full percentage point above the quarterly figure for all workers.

The previous high quarterly EE jobless rate was 4.8 percent (second quarter, 2002). It's difficult to compare the figures, however, because the Bureau of Labor Statistics (BLS) has revamped its occupational

Trade Politics of Offshore Engineering

- General Agreement on Trade in Services (GATS)
 - Mode 4, Mobility of Natural Persons
- Government Procurement
- Trade Related Aspects of Intellectual Property Rights (TRIPS)
- Who determines the USTR position?
 - Secret negotiations



Policy Responses – Protectionist

NJ Bill S1349

eWeek March 10, 2003

Offshore Outsourcing Battle Heats Up *By [Lisa Vaas](#)*

The New Jersey State Legislature has reportedly tabled a closely watched **bill that would have prevented the overseas outsourcing of N.J. state government IT projects.** ...

The bill was passed unanimously by the New Jersey State Senate ...

The bill may be doomed to failure or to being watered down, but it will have left a legacy: **At least three other states are now considering similar legislation, including Connecticut, Missouri and Wisconsin.** ...

Indian news accounts credit lobbying efforts by the ITAA and by Nasscom...

Potential Policy Responses – 1980's Manufacturing and Competitiveness

- Subsidize work that helps create new industries (e.g., nanotechnology) and improve the productivity of existing industries
 - NBS becomes NIST – ATP, MEP and Baldrige
- Subsidize commercialization of key/critical technologies
 - Flat panel display
- Industrial policy masked as defense policy
 - Sematech
- States engaged in industrial policy
- Retraining workers
 - Did this happen well for steel workers?

Analogies to 1980's Manufacturing and Competitiveness

- Voluntary quotas – Japan
 - Restrict H-1B & L-1
- Anti-Dumping enforcement – U.S. Int'l Trade Commission
 - Anti-Dumping of engineering services?
- Working standards for employees
 - Regulations or use of shame to work against sweatshops

Potential Policy Responses – 1980's Manufacturing

- Competition leads to:
 - Lean manufacturing and quality
 - Removing some of the fat in IT services
 - Greater globalization
 - Movement to other industries
 - Nanotechnology

Shouldn't Policy Responses be Guided by Analysis?

- Base data is poor
 - Number of engineering graduates and stock abroad
 - R&D performed – domestic and abroad
 - Not just amount, but characteristics
 - Timely data
 - Why companies use offshore engineering?
 - Shortages in U.S.?
 - Quantity of engineering work performed overseas
 - Services trade data is notoriously bad

Shouldn't Policy Responses be Guided by Analysis?

- Categorizing the types of work that have gone overseas and those that will easily move there
 - IT services, Accounting
 - R&D – Types, scale and scope
- Evaluating the effectiveness of re-training and life-long learning for displaced workers
 - H-1B retraining does not help high-skill workers
 - Pilot programs

Shouldn't Policy Responses be Guided by Analysis?

- Estimating supply and demand
 - How will automation affect future engineering demand?
- Engineering price index
- Distributional impacts of various policies
- Estimating impact on innovation capability of U.S.
 - Does it matter whether the offshore engineering employers are U.S. based or foreign based?



Shouldn't Policy Responses be Guided by Analysis?

- Impact on military capability
 - Institutional models for international absorptive capacity - Spin-on capabilities
 - Technical workforce
 - Security
 - Espionage
 - Export Control and ITAR
- Engineering tools
 - How will engineering tools shape the ability to work across borders?

Shouldn't Policy Responses be Guided by Analysis?

- How to encourage U.S. best and brightest to continue to pursue engineering?
- How does it affect standards setting?
 - Standards are often a comparative advantage
 - Collaborative engineering productivity may require greater investments

Bad Data Abounds

- “Equally worried was Ray Bingham, CEO of Cadence Design Systems in San Jose, ...’ **China produces 600,000 engineers a year, and 200,000 of them are electrical engineers,**’ he said in his presentation at the conference.”
 - “The Reverse Brain Drain”, *FORTUNE*, Tuesday, October 29, 2002
 - China had 195,354 engineers graduates in 1999 (NSF, 2002)
 - No breakdown by discipline.
 - India graduates 29,000 in 1990?
 - ABET Equivalence?
- International R&D data is also suspect.

Good Policy?

- Offshore outsourcing will happen.
- How does the U.S. design good policy
 - Accelerate progress towards goals and at the same time compensate the losers?
 - Will policy analysis help this effort?