U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE AND TECHNOLOGY

HEARING CHARTER

The Globalization of R&D and Innovation

Tuesday, June 12, 2007
1:00 p.m. - 3:00 p.m.
2318 Rayburn House Office Building

1. Purpose

On Tuesday, June 12, the Committee on Science and Technology will hold a hearing to consider the implications of innovation offshoring for U.S. workers and the economy. Technological innovation is the key to improving America's standard of living, but science and engineering work—the fundamental building block of innovation—has become increasingly vulnerable to offshoring. This hearing will explore the implications of this trend on the U.S. workforce, the U.S. science and engineering education pipeline, competitiveness, economic growth, and our innovation system.

2. Witnesses

Dr. Alan S. Blinder is professor of economics at Princeton University and director of Princeton's Center for Economic Policy Studies. He served as Vice Chairman of the Board of Governors of the Federal Reserve System from June 1994 until January 1996.

Dr. Ralph E. Gomory is president of the Alfred P. Sloan Foundation. He was Director of Research at IBM Corporation from 1970 to 1986.

Dr. Martin N. Baily is senior fellow at the Peterson Institute for International Economics and senior adviser to McKinsey Global Institute. He was chair of the President's Council of Economic Advisers from 1999 to 2001.

Dr. Thomas J. Duesterberg is the President and CEO of the Manufacturers Alliance/MAPI.

3. Brief Overview

- Some analysts estimate that between 30 to 40 percent of *all* U.S. jobs will be vulnerable to offshoring. This vulnerability means that a large share of previously non-tradable jobs are now tradable, putting downward pressures on wages for U.S. workers in those occupations. Other analysts dispute these estimates, claiming they are too high.
- Science, technology, engineering and mathematics (STEM) jobs are amongst the most vulnerable to offshoring, with computer programming topping the list of all occupations. According to a study conducted by Alan Blinder, nearly all (35 of 39) STEM occupations are offshorable, including 10 of 12 engineering disciplines.
- High-wage jobs, requiring advanced education and skills, are also offshorable, so more education and training will not necessarily immunize workers against offshoring. Instead, some have suggested that we refocus our educational investments towards training for jobs

that will be difficult to offshore.

- There is no consensus on the likely impacts of offshoring. Some argue that it will be as dramatic as the industrial revolution, requiring significant policy changes, while others view it as a minor phenomenon. The ambiguity is aggravated by the very poor quality data we have about offshoring.
- China, India and other developing countries have government policies to actively attract innovation jobs and work. For example, the Chinese government often requires technology transfer as a condition on investments in China by multinational corporations, and India offers tax holidays for any exports from its information technology services industry.

3. Background

Several analysts, using a variety of estimating methods, have separately concluded that that a significant share of U.S. jobs is vulnerable to offshoring. Vulnerability means that jobs that were once safe from being relocated offshore or competition from workers in other countries are no longer so. While the independent estimates by economists such as Alan Blinder, Lori Kletzer, Robert Atkinson, and Ashok Bardhan, cover a wide range, from 20 to 40 percent of U.S. jobs, even the low-end estimates indicate that tens of millions of jobs can be affected by offshoring. Dr. Blinder finds that *nearly all (35 of 39) STEM occupations are offshorable*. Particular occupations are highly vulnerable. For example, seven of the 11 computer-related occupations are considered highly vulnerable, with computer programming topping the list for *all* occupations. Dr. Blinder also finds that 10 of the 12 engineering occupations are offshorable, including biomedical and electronics engineering; fields where the U.S. currently holds technological leadership. The two exceptions are aerospace and health and safety engineering.

Newspaper reports and company announcements seem to confirm that the offshoring of high-skill high-technology work is increasing, with even research moving offshore. For example, Accenture's CEO announced that it will have more workers in India than any other country, including the U.S., by this August. And IBM is projected to have 100,000 workers in India by 2010, more than one-quarter of its workforce, rivaling the U.S. as the leading country for workers. At the same time, firms are investing in plants and R&D facilities in low-cost countries. Companies like General Electric, Eli Lilly, Google, and Microsoft are expanding R&D centers in India and China, which will work on cutting edge research and new product development rivaling their centers in the U.S. A recent University of Texas study found that of the 57 major announcements of locations of global telecom R&D facilities in the past year, more than 60 percent (35) were located in Asia, whereas, a meager nine percent (5) were located in the U.S.

The consequences of these changes are still being sorted out. Some predict that in the long run we will be better off at the new equilibrium, but the road to that new equilibrium will be very bumpy, causing great hardships for many. Others agree that the new equilibrium will be better but also assert that the scale and speed of offshoring has been exaggerated. They emphasize the flexibility of the U.S. economy and labor markets, buffering workers from any significant hardships, and they point to all of the new opportunities and markets that globalization create. Still others disagree with the notion that the new equilibrium for the U.S. will actually be better with offshoring. They say losing our technological leadership in STEM fields could make us worse off as offshoring erodes our comparative advantages.

Nearly everyone agrees about a few things. First, the quality of the data on offshoring is very poor. This makes it difficult to discern the trajectory for offshoring. Second, technologically driven innovation is the key to improving America's standard of living. Third, STEM education will play a key role in our future competitiveness. But according to the Computing Research Association (CRA), enrollment in computer science programs is down an astounding 40 percent over the past four years. One of the reasons that students shy away from these and other STEM majors is the fear and uncertainty surrounding long term career stability. In response to concerns about offshoring, a number of universities have changed course curricula for vulnerable fields. Some are substituting management courses for technical ones or creating interdisciplinary programs; for example, integrating biology into traditional electrical engineering curricula. Both measures are predicated on the hope that they will better inoculate students from offshoring. However, the changes are based on little objective information, leaving open the question of whether students, educators, and workers are making informed decisions.

4. Issues and Concerns

What is the scale and the scope of offshoring in science and engineering jobs and work? What is its potential?
The amount of offshoring will determine the impact on the U.S., but we do not have reliable data and forecasts. Some analysts believe that offshoring's impact will be something akin to the industrial revolution, while others claim it is too small to worry about.

What are offshoring's expected effects on the U.S. economy and workforce?
While many believe that increased international trade guarantees a 'win-win' for both countries, economic theory is more ambiguous. A country that loses its comparative advantages to trading partners can experience lower standards of living. Given that science and engineering is our core competency and drives our comparative advantages, will offshoring R&D and innovation undercut these advantages, resulting in losses for the U.S. as a whole?

How much R&D is being offshored?
A recent University of Texas study found that of the 57 major announcements of locations of global telecom R&D facilities in the past year, more than 60 percent (35) were located in Asia, whereas, a meager nine percent (5) were located in the U.S. Since innovation is key to economic growth, should we be especially concerned by these trends? Do we need policies to keep R&D in the U.S.? For R&D that is being done offshore, do we have the infrastructure to capture and assimilate it?

Does offshoring of science and engineering lead to lesser spillover benefits from R&D?
The primary rationale for government subsidies of R&D is the capture of downstream benefits by companies operating in the U.S. Does offshoring of science and engineering work mean that those benefits are more likely to quickly leak outside the country?

What policies are other countries using to attract innovation work?
China, India and other developing countries have government policies to actively attract innovation jobs and work. For example, the Chinese government often requires technology transfer as a condition on investments in China by multinational corporations, and India offers tax holidays for any exports from its information technology services industry. Do these policies meet the principles of free trade? Should we be adopting similar measures? What criteria do companies use to make decisions about locating their innovation work?

What STEM fields are most vulnerable?
Computer science undergraduate enrollments are down 40 percent in the past four years, but not because our K-12 education system has not adequately prepared students. Instead, the culprit has been fear by students that their future jobs might be offshored. Is this fear well-founded? Students, educators and workers need better data and estimates to make informed career and educational choices. How do we ensure that STEM fields are still attractive?

Should we be investing in all STEM fields or only those where we expect will be rooted in America?
Should a reallocation of resources be made to concentrate efforts on the fields that are most likely to stay in the U.S. Should educators adjust their curricula to teach skills that buffer workers from offshoring? If so, what content should it have?

What happens to STEM workers who are displaced?
One of the expected outcomes of offshoring is displacement of incumbent STEM workers. How many of these workers re-enter the STEM workforce? At what pay level? Are STEM workers hurt even worse than the typical worker by extended periods of unemployment given how quickly technological obsolescence occurs?

Do corporate interests diverge from the country's long-term interest in offshoring?
Companies seek competitive advantages by moving operations offshore, but increasing the competitiveness of a company may not directly translate into increased competitiveness of the country. Where do these interests diverge and how should they be reconciled?