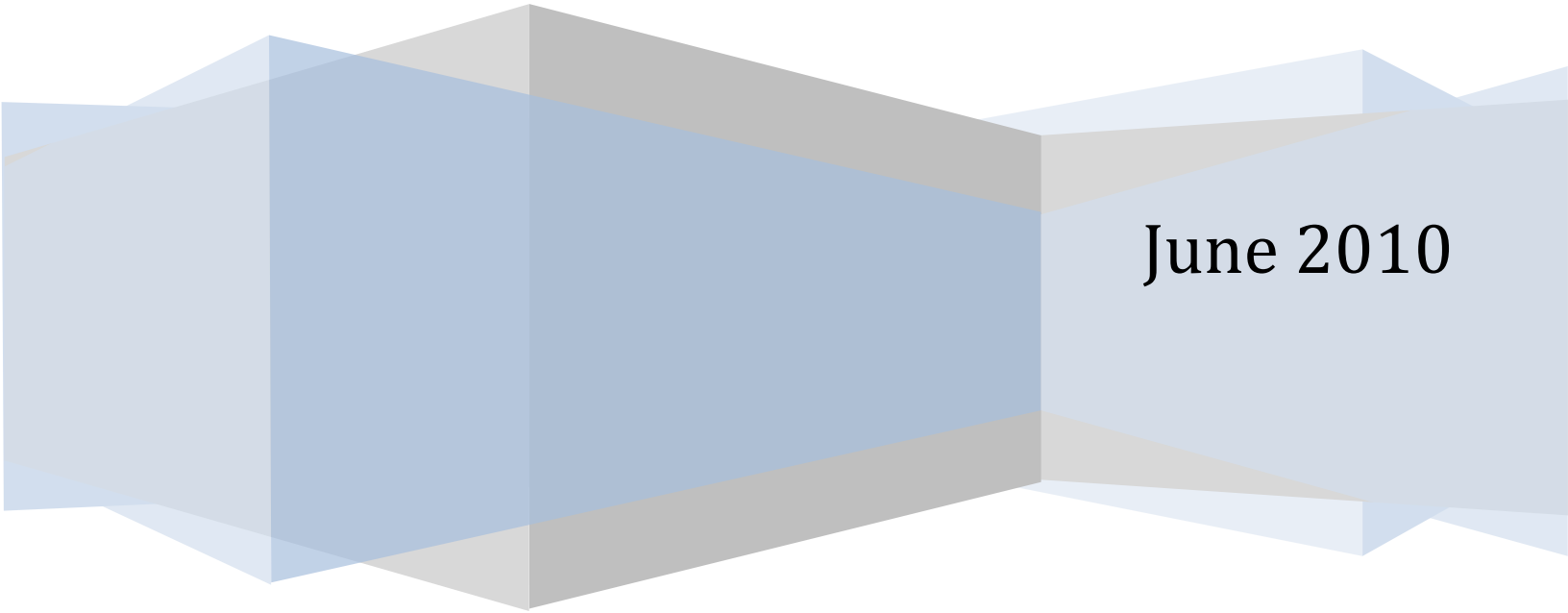
Center for Public Policy
Innovation

The Decline in Semiconductor Manufacturing in the United States



June 2010

Project Description

The Center for Public Policy Innovation (CPPI) has developed an abstract exploring the status of the global semiconductor industry, the decline in U.S. competitiveness in the industry and the repercussions for the United States if this trend continues. The abstract also includes an overview of public policy that is relevant to the semiconductor industry and how these policies affect the innovative climate required to keep U.S. firms competitive.

Introduction

Semiconductors are the United States' second largest export and the industry is a crucial part of the U.S economy. It is a major source of high-wage employment and a stimulus to development in a number of U.S. regions. It also "provides critical enabling technology for the rest of the U.S. and global economy, for national defense, for lowering the cost and improving the delivery of health care services and for advancing overall quality of life."[i]

Over the past decade, the manufacturing of semiconductors in the US has declined as more and more companies move production overseas. Research and Development takes place in close proximity to manufacturing. The U.S. stands to lose its innovative edge if this trend continues, effecting not only the American economy, but national security as well.

The Decline of Semiconductor Manufacturing In the U.S.

In 2009, the percentage of global semiconductor production capacity in the U.S. was 14%, down 11% from 2005.

Shares of Global Capacity
Japan 25%
Taiwan 18%
Korea 17%
U.S. 14%
Europe 11%
Middle East 11 %
China 9%
Southeast Asia 6%

Sixteen semiconductor wafer (fab) plants began construction in 2009, only one of them in the U.S. Seven of those fabs will produce light-emitting diodes (the most promising energy-saving technology developed in 50 years), none of which will be built on U.S. soil. China led the world, constructing six fab plants, Taiwan began construction of five, while Korea, Japan, the E.U. and Southeast Asia each began construction of one plant.[ii]

Semiconductor Industry Association, the leading voice for the U.S. semiconductor industry, reports that:

- "Approximately 65 percent of U.S. industry global capital spending for wafer fabrication is today directed to the United States, down 14.6 percentage points between 1997-1999 and 2005-2007.
- Three-quarters of U.S. industry global R&D spending today is still in the United

States, down 8.4 percentage points between 1997-1999 and 2005- 2007.
- The offshore R&D spending shift in the last decade has not been to Korea, Taiwan and China but to Europe and ROW (India, Israel, Singapore, Malaysia, etc.).
- U.S. industry spending on R&D in China is very small but growing."[iii]

"The semiconductor industry is undergoing a fundamental change in structure that will leave only a few companies producing devices at the leading edge, as more of them utilize common shared foundry processes due to the exorbitant cost of maintaining or building new state-of-the-art fabrication facilities, which require multi-billion dollar investments. Bob Johnson, VP of research at the Gartner analyst firm, predicts that by 2014 there will be only 10 companies operating at the leading edge."[iv]

Reasons for the Decline

The U.S. does not provide a hospitable environment for the manufacturing of semiconductors. While other countries offer incentives to attract multi-billion dollar capital investments in semiconductor manufacturing and R&D capacity, the U.S. has one of the highest corporate tax rates in the world. Furthermore, the R&D tax credit is one of the least competitive of developed economies.

Other countries also make it cheaper to build. It costs $1 billion dollars more to build and operate a semiconductor manufacturing facility in the U.S. over a ten-year period than it would in more tax friendly countries because of tax and incentive policies.

Other countries also invest in research and education to increase the number of highly qualified scientists and engineers trained in semiconductor-related fields. Meanwhile, the U.S. is experiencing a shortage of such highly skilled workers.[v]

Consequences for Research and Development

Research and Development takes place in close proximity to manufacturing. When U.S. companies set up manufacturing overseas, R&D follows. "The U.S. leadership in high technology is at risk if the manufacturing 'anchor' is damaged, said a study by the President's Council of Advisors on Science and Technology (PCAST). The United States economy cannot be dependent on 'knowledge' if its Research and Development is 'de-coupled' from manufacturing. According to a report released during the George W Bush Administration entitled, Sustaining the Nations Innovation Ecosystems, Information Technology Manufacturing and Competitiveness,[vi] "Design, product development and process evolution all benefit from proximity to manufacturing, so that new ideas can be tested and discussed with those working on the ground." As a result, the U.S. might not be able to maintain its place as a leader in cutting-edge industries.

Fewer students might pursue degrees in science and engineering fields for fear of fewer employment opportunities. Today over 50 percent of students graduating from U.S.

universities with master's degrees and over 70 percent of those graduating with PhD degrees in science and engineering fields applicable to the semiconductor industry are foreign nationals. Since U.S. immigration's quotas result in long waits for permanent residence, many of these graduates put their skills to use elsewhere. This could lead to the stagnation of innovation, weakening the country's ability to compete in the global economy.[vii]

Immediate Economic Impact

There are also immediate impacts of moving manufacturing outside the U.S. The Bureau of Labor Statistics (BLS) published a report in December 2009 predicting the U.S. job market will suffer the loss of 146,000 jobs between 2008 and 2018. The same report states the chip industry's job losses will be the second highest, only behind department stores. From 1998 to 2008, 217,000 semiconductor jobs were eliminated in the U.S.

Specifically the semiconductor subcategory job totals fell from 292,000 jobs in 2001 to185,000 in 2009, close to a 40 percent reduction. "Moreover, the BLS figures project that U.S. semiconductor manufacturing employment will have dropped from an annual high of 676,000 in 2000 to 287,000 by 2018, equivalent to approximately two-thirds the workforce."[viii]

National Security at Risk

If the current trend continues, and the U.S. loses its ability to produce innovative technology, national security will be at risk. "From the 'smart bombs' that allow the U.S. military to minimize civilian and allied casualties today, to the 'super suits' that will protect and enhance the effectiveness of our soldiers in the field of tomorrow, the important role chips play in many weapon and communications systems makes maintaining a strong domestic industry of strategic value."[ix]

Public Policy

Currently, the U.S. corporate tax rate is the second highest among major industrialized countries, averaging 39 percent. This makes it inequitable for U.S. firms to repatriate profits back into the U.S. that could be used to increase R&D and build new facilities. "The vast majority of countries have adopted a territorial tax system to help their global companies better compete and to help repatriation of cash to invest in the home country…Taxes on repatriated funds make it more likely that these funds will be reinvested overseas."[x]

In 2004 Congress passed the American Jobs Creation Act (AJCA) Repatriation Provision. It provided firms with a repatriation tax holiday that allowed them to access foreign earnings. However, the new legislation did not lead to more investment in the U.S. For example, in 2005 IBM added less than 400 jobs and "shed 5 million square feet of space

in the United States, making it highly unlikely that any of those jobs were added in the U.S."[xi] Because of the shortcomings of AJCA, Congress is weary of passing similar legislation now. Future legislation may need requirements that direct repatriated earnings to specific areas for economic development such as R&D investment, building new manufacturing facilities, and the like.

The U.S. lacks a permanent R&D tax credit. It has been extended over a dozen times since created in 1981. This tax credit promotes job growth and an innovative climate that is vital for the U.S. to remain competitive in the global market.

U.S. innovation and competitiveness is also threatened by an immigration policy that has remained unchanged for two decades. In 1990 Congress capped the annual number of H-1B visas set aside for high-skilled immigrant workers at 65,000. 10 percent of the U.S. population is composed of immigrants, yet they make up 30 percent of R&D scientists and engineers with Ph.D.s.[xii]

The Semiconductor Industry Association (SIA), the leading voice of the industry in the U.S., recommends the following:

- Doubling funding for basic research at national laboratories and U.S. universities by 2016.

- Enacting tax policies that will retain and attract investment in R&D and manufacturing facilities in America.

- Reforming U.S. export controls and streamlining the licensing process.

- Providing incentives to promote energy efficiency and development of renewable energy sources.

- Avoiding climate change policies that add costs, limit flexibility, and otherwise make U.S. companies less competitive.

- Enhancing the U.S. workforce through education reform, expanding research programs at U.S. universities and immigration reform to make it easier for foreign students graduating from U.S. universities with masters and PhD degrees to obtain green cards.[xiii]

Fiscal Year 2011 Budget Implications for Semiconductor Industry

President Obama's FY2011 budget proposes making the R&D tax credit permanent. The budget also calls for the doubling of federal investment in science with $13.3 billion total for the National Science Foundation, Department of Energy, Office of Science and Technology Policy, and the National Institute of Standards and Technology labs.

The budget calls for the extension of the clean energy Manufacturing Tax Credit (passed as part of the American Recovery and Reinvestment Act). The new budget would add $5 billion to the current cap.

More than $500 million in private-public partnerships for STEM (Science, Technology, Engineering, Math) education as a part of President Obama's "Educate to Innovate" campaign has also been proposed.[xiv]

Certain proposals in the budget could harm the bottom line for many in the semiconductor industry. These worrisome proposals include:

-Deferring Deduction of Interest Expense Related to Deferred Income ($25.6B)
-Determining Foreign Tax Credits on a Pooling Basis ($32.0B)
-Preventing Splitting of Foreign Income and Foreign Taxes ($27.4B)
-Taxing Currently Excess Returns Associated with Transfers of Intangibles Offshore ($27.4B)
-Limiting Shifting of Income Through Intangible Property Transfers ($1.2B)[13]

Major Players in the Semiconductor Industry

China is playing an increasingly more significant role in the semiconductor industry. The Chinese government has invested roughly $7 billion in new fabs over the last five years and plans to invest $20-$25 billion in the next five. China has a 17 percent value added tax (VAT) on imported semiconductors, giving Chinese manufacturers an enormous advantage. Furthermore, no new fab will pay taxes in China for the next ten years.[xv]

South Korean companies are among the most competitive in the memory market. Their success is a reflection of government policies that provide an economic environment that encourages innovation. The Korean government promotes high-tech growth with low-interest rates, tax incentives, duty-free import of selected capital goods. The government also invests directly in educational institutions and R&D to ensure the continuance of innovation.[xvi]

Taiwan offers a five-year income tax holiday to companies in the manufacturing and technology industries to encourage expansion in strategic industries. Firms manufacturing in Taiwan are exempt from paying import duties and commodity taxes on machinery, equipment and raw materials required for production. Taiwan Semiconductor Manufacturing Co. Ltd (TSMC), as of 2007, "posted $900 million in investment tax

credits in four categories of exemption."[xvii] Singapore, Malaysia and Israel offer similar tax holidays to encourage in-house production of semiconductors.

India offers a "ten-year tax deduction for 100 percent of profits derived from the export of certain products by new qualifying industrial businesses that locate in a Free Trade Zone."[xvii]

The E.U. is increasing the number of regional and national programs to strengthen Research and Development. For example, the Interuniversity Microelectronics Centre (IMEC), a micro and nano electronics research center in Belgium, "draws annual funding from the Flanders regional government of $45 million. Conducting research under contract for European governments and for companies both inside and outside the EU, IMEC has become an international center for semiconductor manufacturing research."[xviii]

Conclusion

A host of public policy issues make it increasingly inequitable for manufacturing to take place on American soil. The incentives and tax breaks offered by other countries continue to attract investment, which leads to new facilities and advancing innovation. With Research and Development migrating overseas, the U.S. stands to get left behind as one of the leaders in this vital industry. To maintain its competitive edge, more investment in R&D is necessary. In addition, outdated immigration policies should be addressed in order to prevent further loss of highly skilled workers.

"The semiconductor industry is arguably the greatest example of American innovation and the strategic importance of leadership in technology," said Brian Toohey, newly named president of the SIA. "No other product or industry exerts such an outsized positive influence on the success of other industries and economic sectors."[xix] In order to prevent the demise of this industry, both the private and public sector must work together to protect the U.S.' ability to compete in a globalized economy.

Questions for Further Study

What are some of the most successful models employed by countries excelling in the production of semiconductors and how might such a model be implemented in the U.S.?

How might the AJCA be restructured to ensure that similar legislation would lead to repatriation of U.S. cash flow?

How might the U.S. begin to encourage greater enrollment into science and engineering programs applicable to the semiconductor industry?

Is the World Trade Organization doing enough to ensure a level playing field by closely examining such practices as China's 17 percent VAT?

In what ways will national security be weakened by the decline of the semiconductor industry in the U.S.?

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