

17 Bringing the Technology Revolution Home in Pennsylvania

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The knowledge economy has changed the State of Pennsylvania in many significant ways. While there are many levels upon which to discuss these complex changes, one simple example stands out as being very powerful. It is not a high-tech industry or even a science-intensive activity, but it clearly illustrates what is at stake in this debate. It involves a Pittsburgh business that provides nighttime security to downtown office buildings—a fairly routine function in the post-industrial economy. This particular business was competing to provide security in a large complex, and they lost out on the bid. The company that won the contract is not a Pittsburgh company, nor is it located across the border in Ohio or West Virginia—it is in Australia.

That is the essence of the knowledge economy. It involves rapid breakthroughs in very fundamental and applied technology moving into the business world rapidly. They transform markets very rapidly, and they transform job skills equally rapidly. The challenge is to design the policy framework for that second economy.

This article will describe the state of the knowledge economy in Pennsylvania and how it is transforming state and federal science and technology (S&T) initiatives. It will then outline a few promising gubernatorial initiatives and explore where the state is heading. Finally, it will describe the Pennsylvania Department of Community and Economic Development's role in keeping Pennsylvania competitive in the knowledge economy.

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Background

Pennsylvania has a research and technology base built around the major research universities: the University of Pennsylvania, Penn State, Lehigh, Carnegie Mellon, and the University of Pittsburgh. We also have an industrial base of about 225,000 workers in technology fields and a large cluster of biotechnology and pharmaceuticals concerns based in Philadelphia. Increasingly, it is the integration of these two sectors that drive the Pennsylvania economy. For example, we have a major center for tissue engineering in Pittsburgh and increasing interaction of biotechnology and information technology.

We have tried to strengthen the linkage between the universities and the economy through venture capitalism. We have created two venture capital funds with a mixture of public and private sectors investment. These funds are structured so that they target the critical areas of applied development of chip design, biotechnology, and information technology. Since a portion of the public return on the money invested will be returned to basic research, we are trying to use venture capital to focus the direction of university research while continuing to expand its base of resources. It builds off of the success of our research universities, but tries to integrate it into the private sector more aggressively.

We also have a first-generation science program called the Ben Franklin Program. It has been in existence since 1983, providing seed support and equity financing to technology businesses and universities. That program, which has spawned 14,000 jobs, numerous products, and about 5,000 new companies, remains critical to the future—but by itself, it is not necessarily sufficient to get us where we need to go.

The State of Pennsylvania has fared well in the knowledge economy, especially over the last four years and particularly in the technology sector. That sector has become a significant driver of our economic growth: Technology jobs are growing at twice the rate of all other jobs in Pennsylvania, and there are more Pennsylvanians employed at this moment than at any time in our history. More importantly, the wages in Pennsylvania technology companies are generally 50 percent higher than the income and wage levels in other industries. This represents a transformation of the economic base. Most critically, this technology explosion is dispersed—it is reaching parts of the state that are not ordinarily considered technology centers.

There are three major academic centers in the state. In the Philadelphia area alone there is a high concentration of research and develop-

ment and university-based activity. Other centers are Penn State in the central region, and Carnegie Mellon and the University of Pittsburgh in the southeastern part of the state. The state has always enjoyed a rich mix of technology, large companies, and small companies, and there is extensive growth in those centers. For a technology revolution to take place in those areas is not unexpected.

The significant thing, however, about the last five years is where it is growing outside of the major academic centers. In Bethlehem, for example—a large steel and major processing center north of Philadelphia—there is now a large cluster of firms that are designing chips for Cisco and AEC. Up in Scranton—largely a coal and natural resource processing region—there is now a strong cluster of about 25 software companies, most of which serve the large financial service centers and their back-office operations. Across the northern tier, we are producing computers (there are now more Pennsylvania outfits making computers and software than there are manufacturing steel).

In Oil City, the birthplace of the oil industry, there is a huge concentration of Internet applications for community development, which is transforming the nature and the quality of life in that region. This would never have been possible had we relied on traditional investment and infrastructure centered around natural resources. I can envision Oil City becoming a major location for telecommuting and the development of new applications of home based businesses. (In rural Pennsylvania, we already have one of the highest concentrations of home-based businesses that are on eBay). The key to growth was the ability to invest heavily in information technology applications for students and workers, and to link these institutions and strategies together.

New Economy, New Challenges

There are many new challenges to face in terms of restructuring science and technology policy to take advantage of this transformation. Our ultimate test is going to be how rapidly we are able to extend this diffusion. Can we take the knowledge economy to every corner of Pennsylvania?

The principal focus of state policy in the past was on finding entrepreneurs and getting them started. While that has historically been the model of our policies, and the entrepreneur is still the central part of the knowledge economy, the entrepreneur alone is not enough to gener-

ate our economic growth. The challenge is to develop an entire infrastructure of innovation that supports the entrepreneur.

A secondary policy goal was to attract and cultivate a Ph.D.-level workforce. We could quantify our success by looking at the number of Ph.D.s., although clearly in this economy, that focus must change. Hotel clerks can now use global positioning satellite devices to help people enjoy their experience, so they have to have some level of technology capability. We therefore need a total workforce to learn from scratch.

While state policy work on the concept of technology has been linear—moving from basic to applied science in some clear fashion—the new knowledge economy is not linear. New products are going to change the economy and change jobs. It has become clear that businesses will succeed and only succeed to the extent to which they can provide infrastructure. If you can provide a business plan of total science infrastructure that helps companies get products to market fast, you will be a center of the knowledge economy.

Building a State Plan

There are four basic elements in Pennsylvania's plan to facilitate the state's competitiveness in the emerging speed-to-market economy.

1. Change the overall culture of Pennsylvania so that it is more technology focused—not just in the technology centers around the universities but all across the state. The first thing we have done is to encourage state government to use technologies such as online purchasing. We also plan to put our Web address on our state license plates beginning in September 1999.

2. Link community centers of innovation. One initiative involves training what we call the “tech community”; another lies in developing a test bed where new products—particularly in information technology—can be rapidly infused into the community. The latter involves moving a technology from a university into its surrounding community. Outside of Carnegie Mellon, in an old neighborhood called Oakland—which is a mix of old steelworkers and the more traditional ethnic community—we have established a test bed for new technologies that Lucent and software specialists at Carnegie Mellon are developing.

3. Promote the state as a home base for international start-ups. Our goal is to start companies in Pennsylvania and at the same time provide a home for international companies. Toward that end, we are creating locations at all our major universities for start-up companies from the

major national centers of innovation around the world. We now have centers in Israel, Germany, the United Kingdom, and Japan.

4. Establish and a comprehensive technology workforce development strategy. This multiple-component effort (some of which are listed below) represents the anchor of our program.

- Enhance software and computer infrastructure development for the preschool generation. We plan to connect all 4,000 licensed day care centers in Pennsylvania to the Internet. Our goal is to make sure that every child is computer-ready by the time they start school.
- Connect all schools to the Internet. Our \$132 million initiative to achieve this objective has resulted in a 90 percent linkage. We now have high school students all across Pennsylvania designing Web pages for businesses, which will make them better workers and connect them to research and technology.
- Establish and support science and technology scholarships. We now provide three years of college education for any student who maintains a B average, enters a major science and technology field at a public or private university, and is willing to dedicate one year of working in Pennsylvania for each year they receive the scholarship.

Other initiatives revolve around shoring up a finance stream for the new economy. Until recently, if you were not a hard asset-based company, most state financing programs could not help you. To change that, we have created a new financing vehicle called the Pennsylvania Technology Investment Authority, which will provide “knowledge”-based asset financing: phantom stock, off-balance-sheet financing, synthetic leases, and the various forms of equity financing that knowledge-based companies need.

In a few technology areas we try to focus on bringing the entire issue together. For Pittsburgh’s digital network development initiative, for example, we are combining new venture capital resources, a free university program in chip engineering, product test beds, and a business environment that changes our core structure and legal system. We are trying to create an overall platform—not to steer the economy, but to create a platform for innovation and rapid product development.

Conclusion

Despite the considerable work to date, Pennsylvania still faces several challenges for the future. First, there clearly is a need to restructure federal funding mechanisms for research and development, which are still largely based on linear models. Second, we have always had difficulty aligning the wide range of federal programs that support economic development in the state. The critical challenge is to assess every development program we operate. What is its role in contributing to the knowledge economy? What is its role in contributing to the fundamental environment for innovation and the realignment of programs around the knowledge economy?

Finally, we must critically review the mission for national technology policy. It has moved toward a focus on national competitive models, which is not particularly accurate. We need a unified vision—one that comes from listening to the technology itself. The essence of this technology revolution is how rapidly these technologies can transform lives. Technology today is transforming the state's ability to participate in the economy and the community's ability to see itself with a vibrant economic future. Therein lies the essence of the new mission for technology policy in the United States and federal investments.