

**PCAST Workshop on Innovation
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Good morning and welcome to PCAST's Workshop on Innovation. I would like to thank our Ohio hosts for their hospitality, and the PCAST staff and support personnel for their contributions to what should prove to be an excellent program.

This audience understands better than most that America's economic vitality comes from our ability to introduce a steady stream of high value added products into the marketplace. Where do these products come from? How do we make sure they keep coming? These are the kinds of questions PCAST tries to answer so we can advise the President on federal policies that can help the nation stay on top in an increasingly competitive global economy. They are difficult questions because the preconditions for success stretch back to basic aspects of American society including our conviction that men and women have a right to pursue their dreams. Their success depends on basic infrastructure for transportation and communication, on more abstract systems of laws and justice, on quality education, on adequate housing and other quality of life issues. Moreover, success in conceiving, designing, and producing technologically intensive products requires a vast scientific and technical infrastructure whose scale is well beyond anything a single organization can provide. Consequently, continued economic competitiveness relies on partnerships, which is a main theme of today's workshop.

My own experience with regional technology-based economic development began when I was a graduate student at Stanford. We had object lessons close at hand in Hewlett Packard, nearby Silicon Valley, and what was then called the Stanford Research Institute. My colleagues and I were very much aware that the university had played a central role in getting the region's high technology industry going. After Stanford, I started my own research career at the University of Southern California, and there too I saw first-hand how the Engineering and Business Schools were strongly committed to regional industry, and were leveraging federal funding to build programs that supported regional development. I did my share by helping to start a Center for Laser Studies with federal and industrial co-sponsors.

I took these lessons with me when I went to Long Island in 1980 as president of the State University of New York at Stony Brook. My first task was to open a new 540 bed tertiary care University Hospital, and I saw an opportunity to leverage New York State resources to build up bioscience research, health care, and regional industry all together.

Shortly after I arrived in Long Island, the State of New York retained the Battelle organization to recommend key high technology areas as focal points for economic development. Based on the Battelle report, the state created a program of Centers for Advanced Technology – up to ten centers located at research universities, each to receive \$1 million to be matched by industrial co-sponsors. The state took the remarkable step of asking the National Academies to

oversee the selection process for the CAT competition, which placed the program on a "high road" beyond the inevitable political interest in geographical distribution of development funds. I understand that the State of Ohio has made a similar arrangement with the National Academies.

Long Island had multiple assets for developing biotechnology. Cold Spring Harbor Laboratory – whose director at that time was Nobel Laureate James Watson – was concerned about science staff leaving the region to start up biotech businesses elsewhere. Brookhaven National Laboratory also had important resources for biomedical research. And Stony Brook was about to expand its medical faculty dramatically, in the basic medical sciences as well as the clinical departments.

To make a long story short, Stony Brook established a new degree program in genetics with Cold Spring Harbor and placed one of the new hospital's three linear accelerators for cancer therapy at Brookhaven Lab. Our dean of medicine became a member of the BNL contractor's Board of Directors. We began joint recruiting initiatives to build complementary competencies at the three locations. Meanwhile, Stony Brook succeeded in the competition for a CAT center in medical biotechnology and began to build acceptance within the faculty for industrial cooperative research programs.

These early activities had an important impact on faculty attitudes toward industrial research. The engineering school had been encouraging ties to the regional aerospace and electronics industries, but for physicians and life scientists such interactions were new. There was a national debate then as now about possible negative impacts of industrial participation on research directions and curriculum. It is not necessary to have the entire faculty engaged in this type of work. Usually only a small percentage of faculty are interested in applicable technology and commercialization. It is necessary, however, to have the faculty understand the desirability of such work, and accept its presence on the campus. An academic culture congenial to regional development is an important ingredient for successful technology transfer from university laboratories to industrial partners.

By the mid 1980's, three businesses were growing synchronously at Stony Brook:

- hospital and outpatient medical care in the growing medical school and hospital;
- federally sponsored research in biomedicine and biology;
- industrially co-sponsored work in university laboratories

This activity strengthened our case for low cost financing and grants from the State economic development agency to build a biotechnology incubator facility next to the hospital. It was a huge success. We had received permission from the state to lease university lab space to startup companies, forming a "virtual incubator" that accumulated potential tenants, so occupancy rates were high right from the beginning. This made it possible to maintain an aggressive business plan for the incubator, and led to several rounds of expansion, eventually including the construction of a generic pilot manufacturing facility for biotechnology tenants.

Stony Brook developed a technology transfer office that worked well probably because its director was a former small-businessman who had direct experience with commercialization

of technology. We also had policies typical of research universities allowing for faculty consultation with outside industry and participation in returns on licensing of intellectual property.

All these activities established links between the university, regional business, and the government economic development agencies. Coordination among the major research institutions allowed us to build complementary strengths and present a broader interface to the business community. The creation of critical masses of talent in related fields served to raise mutual awareness of opportunities, and reinforce the directions already established in our long range plans.

Looking back on these experiences, five principles seemed key to our success:

1. *Build competencies with attention to regional strengths.* Prospective new employees should be considered for their compatibility with existing capabilities. When several research institutions occur in the same region, they benefit by cooperating in recruitment and group development. The idea is to build *regional* strength, not just *institutional* strength. Stony Brook, Cold Spring Harbor, and Brookhaven Lab shared information on an informal basis about areas of concentration, and often collaborated on recruitment.
2. *Identify a research strategy.* Our conscious decision to make biomedical research a priority led to allocation of university resources to proposals and projects that worked together to build a foundation for future successes. Stony Brook worked hard to win the initial state-funded CAT center for biomedical technology, and coordinated faculty development and capital improvements to enhance biotechnology capabilities. Other areas needed and deserved attention, but the immediate opportunities for funding lay in the biosciences, and that is where we focused.
3. *Build a regional environment.* In the early 1980's Long Island business organizations were not aware of the rapidly growing opportunities in the biotechnology industry. They did not appreciate the significance of an emerging major tertiary care facility, or the value of federal funding as a source of technology. The Long Island economy was dominated by large aerospace contractors, particularly the Grumman Corporation. We had to take the biotechnology message to business groups, chambers of commerce, and state and local government agencies. Someone always has to take the first step to get others together. Fortunately, Long Island's business community was eager to establish greater economic independence from nearby New York City, and was aware of the dangers of relying on a single industry. Efforts by the leading centers of research to work together and with business were warmly received.
4. *Form regional partnerships.* Institutional rivalries are counterproductive. Cooperation and collaboration are essential for regional-scale development. And regional-scale development is important for a stable pattern of growth. Companies start up, grow, and frequently either die or move elsewhere. That is normal. You just have to keep starting up new ones. Some survive and add permanently to the economy. Others have to be replaced with new businesses similar enough to the old ones to stabilize the workforce. Regional partnerships enhance mobility and multiply opportunities for workers and for businesses.

5. *Fund the machinery.* None of this happens without people who know that their job is to make it happen. The machinery consists of facilities, people, and organizations. You cannot make regional development or technology transfer work with volunteers. Furthermore, high value-added products today require large capital investments. Technology related economic development usually entails investment of state and local government funds in facilities so as to reduce costs for startup tenants. And people are needed to bring entrepreneurs together with financial and technical support. Nearly always such people are more than brokers; they are teachers and counselors too for the entrepreneurs who know the technology but not business practices, and for the investors ignorant of the ways of engineers and scientists.

These principles are not unique to Long Island. They might have been easier to discover there because the scale of our operation was much smaller than, say, the city of Cleveland with its long established universities, huge medical centers, and its extraordinary industrial base. We tried to learn from other regions as we grew, and were grateful for the national organizations that formed during the 1980's to foster good technology management practices. PCAST hopes to learn similar principles from today's workshop, and to help spread the word to other regions about successful strategies for technology intensive development.

I thank the panelists for their willingness to speak today, and look forward to a stimulating and productive workshop.

Thank you.