

**Industrial Research Institute 1998 Symposium
On Changing Paradigms in Science and Technology Policy**

“Emerging Trends at Research Universities that Will Impact Industry”

by

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Good afternoon. It is a pleasure to speak to the members of the Industrial Research Institute and share with you my views regarding trends at research universities that will impact industry. It is a useful opportunity for me to also hear from you and your other speakers since we in the university community are certainly interested in the other side of this coin, “trends in industry that will impact universities.”

The subject of this symposium is timely. Although change can be tantalizingly slow at universities, circumstances today are challenging long accepted conventions. New trends are emerging. Consider the following quotes from well-known authorities:

Peter Drucker, management consultant – “30 years from now the big university campuses will be relics. Universities won’t survive. It’s as large a change as when we first got the printed book.”

James Duderstadt, President Emeritus of the University of Michigan – “Let me suggest that the real forces of change at work here are changes in the roles of the university, in our relationships with society....and in the nature of the higher education enterprise more broadly.”

Philip Condit, CEO of Boeing, and Byron Pipes, President of Rensselaer Polytechnic Institute – “The model of the global university is a logical response to these changes. In this vision, the university reshapes itself structurally to resemble its primary client, industry.”

These visionaries see a different world ahead for the university and the way it interacts with its clientele – the students, the public, industry and elected officials. According to Condit and Pipes, “As the demand by industry for this new dimension of educational support grows, those universities that adapt to meet the demand will thrive; those that do not will become less and less relevant.”

While I agree with much of what is being said about the need to respond to new circumstances, we cannot forget that the education market is not only changing, but also expanding. For example, while it is a given that adult and continuing education needs are growing rapidly and leading to the creation of new entities like Phoenix University, in the sunbelt states there will be dramatic increase in traditional student enrollments as well. Under such conditions, it will be hard for even the more inefficient institutions to go out of business, and Drucker’s predictions are not likely to come to pass. The issue then, is how to maintain and improve quality in the face of an environment that is steadily increasing in complexity.

Before we consider emerging trends, let's examine some of the principal factors driving change:

1. Remarkable advances in educational and communications technology and in access to information
2. Fundamental shifts in federal and industrial support for research
3. Development of the global marketplace and its impact on industry and its related educational needs
4. Growing impetus for collaboration between educational institutions, industry and government agencies
5. Increasing calls for interdisciplinary approaches to teaching and research over traditional disciplinary approaches
6. Rapid growth in needs for post-university education and training
7. Growth in traditional student population in the sunbelt states
8. Changes in student learning patterns

Any one of these factors is important enough to cause a university to rethink its mission and goals, but the late 1990's do not allow for a piecemeal approach. These forces are all on our doorstep today at once, and the effects of the impending changes are going to be lasting and profound.

Universities are struggling with the strategy to address the forces that are upon us, and I would suggest that no one approach will be right for all universities. Those who choose their markets and develop a strategy for it will be the winners. Now, let me provide some of my thoughts about the trends that lie ahead, with an emphasis on those that apply to the research university.

1. Educational Technology and Information Access- Creating Learning Communities

For more than a decade now computer and telecommunications developments have been proclaimed as change agents, but often with little to show for it. However, in the past several years the proclamations have begun to live up to their billings and real and profound change is occurring. We can even expect an acceleration of pace given that there is every reason to believe that there will be exponential increases in capacity not only of the semiconductor chip, but also of fiber and wireless networks to carry information. Around the nation, many campuses are now fully networked, information sources, including libraries, can be accessed at will, most courses are using creative computing software for the learning process, and the majority of students have personal computers. At Georgia Tech we require every student to have a computer, and our high-speed campus network services every classroom, and every campus resident, including those in our Greek system.

On many fronts, traditional and nontraditional universities as well as groups of universities are developing on-line interactive learning networks that can be accessed by both on and off campus learners for credit or noncredit courses. Courses will continue to be delivered live, but if students cannot attend the live session, the class is going to be saved on the server and it can be accessed when needed. The Western Governors University, Phoenix University, and collaborations of universities in Michigan, California, Wisconsin and Georgia have efforts underway. This will change learning styles and the way our graduates will approach the workplace. It also will create a new venue for off-campus continuing and degree education,

something that will offer significant opportunities for industry. It is not difficult to foresee a time when universities that have made appropriate changes, will become hubs of new learning communities consisting of a mixture of traditional and nontraditional students. Traditional universities will not fill all of the needs, but rather will expand their mission-dependent roles to address what is perceived as important to their future.

2. Blurring of the Lines between Science, Engineering and Policy

Universities have a long and proud history of organization along the lines of disciplines. However, this is not the way the problems are defined, and industry recognized this issue well before universities. To become competitive on the global level industry has rid itself of the vertical organization structure, with a commensurate gain in productivity.

For any number of reasons, traditional universities cannot follow industry in simply throwing out the old and bringing in the new, but they have to find the means to accomplish the needed ends. This means configuring effort in ways that blurs the lines between engineering, science and policy, while still utilizing the strengths in the disciplinary system.

Some of the ways in which this is being done at Georgia Tech include:

- Defining institutional level interdisciplinary themes which are used to channel disciplinary efforts.
- Constructing buildings and facilities in such a way to bring disparate groups together.
- Reorganizing promotion and tenure processes to allow full consideration of interdisciplinary efforts.

By blurring of the lines between disciplines, universities will be able to better work with industry in research and create curricula that meet the needs of industrial partners.

3. Effects of a Changing Research Landscape

The innovation deriving from several decades of robust university research is one of the key elements driving the present economic success of the nation. Yet, the future of this enterprise is threatened by the lack of a motivating factor such as the Cold War, the need to address other national needs with federal dollars, and the shift of industry research interests towards production-oriented goals in the face of intense global competition.

Universities are unique in that they largely rely on others for support of their research programs and their graduate students in engineering and science. The infrastructure that was developed over the past thirty years is under threat.

For example, although the federal government has traditionally provided well over 50% of the support for university research, this commitment is waning and the targets of interest moving from defense to health issues. And, finding alternative “patrons” is not easy. Although industry

might be one such patron, it would be difficult for industry to fill the gap by itself, since nationally only 7% of university research is sponsored by industry.

Universities are working through organizations like the Council on Competitiveness, NSF, and AAAS and ASEE, to change the research paradigm. Also, Congress and the Administration are being responsive recognizing that only the federal government can fill certain research sponsorship roles. Trends that are emerging include:

1. Building networks that promote collaboration, within the university community, and with industry, federal and state government, and private support agencies like foundations.
2. Creating "industry-friendly" research contracting procedures within the university and reducing conflicts over intellectual properties.
3. Developing the right mix in the university research portfolio for its research vis a vis other entities such as industry or government laboratories.
4. Looking to states to step up to a larger role in supporting research.
5. Overcoming disciplinary barriers to interdisciplinary research.

All of these are easily said, but remarkably difficult to do. Let me provide some experience that is relevant.

Changing the Ground Rules for Intellectual Properties – One of the major hindrances to sponsorship of university research by industry is the issue of ownership of intellectual property. Solving this dilemma requires universities to become more flexible about intellectual properties, but also requires a new attitude on the part of industry as well. At Georgia Tech we have learned by studying best practices at sister institutions and working with our major corporate partners, that a "menu" approach can be used to offer alternatives to fit the circumstances. In some cases, the parties might agree that one or the other will have all of the rights to the intellectual property. In others, they could agree to negotiate the rights at such time that it is clear something worth negotiating is forthcoming. Still others can fall under a more traditional rubric. Following this approach, we have been able to double our industry sponsored research level in three years. Even so, this area remains one that calls for attention. Industry needs to work with universities to help solve the remaining issues.

Designing Strategic Collaborations with State Support – It is all too easy for universities located within a state and even near to each other to find themselves in a spirited competition for the same research sponsors, offering nearly identical sets of services. Consider the alternative of a well-designed collaborative network that takes advantage of the respective strengths of the neighboring institutions. Clearly the latter is preferable since partners do usually manage to prove wrong the old adage that two heads are better than one. Consider the following story. Daniel Webster told a story from his childhood about the day he and his older brother, Ezekiel, were sitting in the shade. His father asked, "Ezekiel, what are you doing?" Ezekiel said, "Nothing." The father then said, "Well, Daniel, what are you doing?" Daniel replied, "Helping Zeke." This wonderful example of collaboration leads us to a more positive one being set in Georgia through the Georgia Research Alliance. The Alliance has five unique characteristics:

- Funding for research is provided to the state's six research universities, provided that each project involves at least two of the institutions in a partnering approach. The four public research universities as well as two private universities are included, thus adding the strengths of both the public and private sectors.
- It focuses on only three targeted areas, telecommunications, biotechnology and environmental technology, that were defined as important to the future of the state in a strategic study performed by McKenzie Associates.
- A principal element of the strategy is to provide funding to hire eminent scholars who bring with them the contacts with industry and government agencies, and the ability to attract top graduate students.
- It has access to mechanisms to promote job growth in the form of venture capital and a business incubator that support the research done by the universities. This means that all of the pressure to create jobs is not entirely on the researchers, a flaw that exists in many other state research entities.
- The research projects and directions are guided through a board consisting of the state's major business executives.

To date, the GRA has received \$150 million in state funding, but it has leveraged this by \$500 million in industry and federal funding. Importantly, jobs are being created both through start-up companies and corporate re-locations and expansions.

4. Creation of University Incubators

Universities have long recognized the value of encouraging spin-off companies from their research activities. Traditionally this has been done through the creation of technology parks. More recently, it is understood that simply having land or a building is not enough to promote business development, and that a more aggressive approach is needed. This has led to development of university-related business incubators that help move research from the laboratory to commercial use. Rensselaer Polytechnic Institute is one institution with an incubator and it is reported to be responsible for helping incubate companies with total sales of \$100 million. Georgia Tech was fortunate to receive a push in this direction in the mid-1980's when then Governor Busbee supported legislation that created and funded an incubator at Georgia Tech, called the Advanced Technology Development Center (ATDC). This incubator was tasked not only with providing support for start-ups from Georgia Tech research, but also for start-ups from the general business community and other universities. Today it is the largest incubator in the southeast, and last year it was cited as one of the nation's top incubators by a national publication. That ATDC's mission goes beyond Georgia Tech allows it to support efforts at other research universities and those of the GRA. Forty-six companies have graduated from ATDC with total sales over \$500 million.

5. Globalization of the University

U.S. universities have long had programs to encourage study-abroad, and many have mini-campuses overseas. But, the pace and diversity of such efforts are increasing, following the trail blazed by U.S. corporations in expanding their global links. The paper by Condit and Pipes referred to earlier addressed this trend, and noted it would lead to increased convergence of the

objectives of the research university and multi-national corporations. Globalization of higher education is inevitable given the growth of the world economy, the expanding role of the Internet, and the potential of virtual education initiatives.

An example of an initiative involving an international education/research effort is found in Georgia Tech's campus in Metz, France. This campus was built for Georgia Tech by the Province of Lorraine and the City of Metz and is located in a technology park that also houses campuses of two of France's Grand Ecoles, Suprelec and Ensam. This technology park also is home to an increasing number of major corporate entities in France, some of who are multinationals, with whom we are developing research efforts. Our formal relationships with Suprelec and Ensam are designed so that both French and U.S. students can complete double degrees with us and the French universities at either the M.S. and Ph.D. level. The Metz location is also close to Germany and Switzerland, and we have interaction with students and faculty there.

Another trend in the globalization of U.S. universities can be found in the expansion of their co-op programs to include work overseas, and this is encouraged by companies with international operations. While the numbers in such programs is still small, it is growing and likely to continue to multiply.

Globalization of U.S. universities is important since the Internet and virtual educational initiatives will cross international boundaries whether we want them to or not. Also, it parallels the growth of the international reach of U.S. and non-U.S. multinationals with which U.S. research universities have strong research linkages.

SUMMARY

Higher education and research universities in particular face a period with numerous challenges that call for change in the way we do business. Any one of these would cause a university to modify its behavior, but a piecemeal approach is not acceptable. The resulting changes that are made will affect the way these institutions interact with industry. The good news is that much of what is likely to come will result in a more "industry friendly" university.

Trends that are emerging include:

1. Use of information and telecommunications technology leading to creation of learning communities, both on and off-campus. Tailored educational opportunities will become more pervasive and available upon demand using the Internet. Universities and industry will work together to address specific manpower, curricula and training issues.
2. Blurring of the lines between engineering, science, business and policy to better match the interdisciplinary problems faced by industry.
3. Adjusting to the changing research landscape, including: improvement of intellectual properties processes; and creation of functional collaborations between industry, universities and state and federal governments.
4. Development of university business incubators.

5. Expansion of globalization efforts by universities to include collaborative research between universities of several nations and multinational industries.

While all universities face a set of challenges that have common characteristics, each institution brings a different set of strengths, culture and organizational characteristics to the table. Thus, there will be no one optimal approach to the challenges we face, and each university will need to work with its corporate and state stakeholders to develop the solution that works best.