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A New Paradigm for Economic Development

How Higher Education Institutions Are Working to Revitalize Their Regional and State Economies

March 2010

By David F. Shaffer and David J. Wright

HIGHLIGHTS

In states across America, higher education institutions and systems are working to become key drivers of economic development and community revitalization. They are:

- Putting their research power to work by developing new ideas that will strengthen the country's competitive edge in the new economy — and then by helping to deploy those innovations into commercial use.
- Providing a wide range of knowledge-focused services to businesses and other employers, including customized job-training programs, hands-on counseling, technical help, and management assistance.
- Embracing a role in the cultural, social, and educational revitalization of their home communities.
- And, most fundamentally, educating people to succeed in the innovation age.

Together, these trends suggest a new paradigm for economic development programs — one that puts higher education at the center of states' efforts to succeed in the knowledge economy.

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HIGHER EDUCATION

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I. Introduction

As long ago as the Golden Age of Athens, when Socrates and Sophocles flourished in a city that rose to become the first great commercial power of the Mediterranean world, people knew there was a connection between higher learning and prosperity. "Athens is the school of all Greece," declared Pericles. "The fruits of the whole earth flow in upon us."

At two turning points in its history, the United States has ambitiously applied that insight.

In the second half of the 1800s, the Morrill Act spurred the creation of a network of land-grant colleges that educated the people and developed the ideas needed to take the nation to leadership in the early Industrial Age. Then, in the second half of the 1900s, the GI Bill sent over a million veterans to college, giving the nation the world's best educated and most productive workforce, and supercharging the growth of research universities that spawned the technologies with which we live today.

Now, with the United States facing global economic competition on an unprecedented scale, a third wave may well be under way.

In states across America, higher education systems, universities, and community colleges are working to help their regions and states advance in the new knowledge economy. They are marshalling each of their core responsibilities — education, innovation, knowledge transfer, and community engagement — in ways designed to spur economic development.

From Springfield, Massachusetts, where a technical college has converted an abandoned factory into an urban tech park, to Raleigh-Durham, North Carolina, where research universities worked to turn a sleepy backwater into a global powerhouse of innovation and manufacturing, to Sidney, Nebraska, where a community college operates a training academy that has helped keep the headquarters of a growing national company in its rural hometown, communities today recognize that their hopes for the future are tied to higher education.

Will this third wave yield results on the scale of the first two? Across the country, there is promising evidence of new investment, new companies, new jobs being created through higher education's efforts. But many of these efforts are just beginning, and the ultimate results are not yet known. Many institutions are going through a learning experience, as they test out what seems to work best.

Some of the characteristics shared by the most active institutions in the field can be identified now, however. They have the leadership to make economic revitalization a priority, the culture to mesh that objective with their academic mission, the legal flexibility to mix and match assets and brainpower with the private sector, and the resources to make it all work.

Moreover, this drive for university-spawned economic revitalization is now widespread enough that individual institutions and systems have much to learn from one another.

To that end, the Rockefeller Institute of Government, which has specialized in comparative analyses of state and local governments' implementation of major policy directions in the United States, surveyed these efforts at institutions and systems. We undertook this work at the request of Nancy L. Zimpher, chancellor of the State University of New York, who declared on her first day on the job — June 1, 2009 — that she wanted to make SUNY "the engine of New York's economic revitalization."

New York and its State University have a long record of bringing higher education resources to bear on economic development.

SUNY and New York have a long record of bringing higher education resources to bear on economic development — ranging from hands-on assistance delivered to entrepreneurs by SUNY's Small Business Development Centers, to training for the new Global Foundries facility in Saratoga County, to leading-edge research in nanotechnology at the University at Albany, in energy at Stony Brook, in bioinformatics at the University of Buffalo, in systems integration at Binghamton University.

But rather than assessing these home-grown initiatives, the Institute and the State University agreed that we would aim at finding additional ideas from other states. After assembling some data on all 50 states, we reviewed the literature in the field, and then took a closer look at programs and projects in about a dozen of the states. We found a diverse range of efforts — everything from researching genomics for insights into new drug therapies, to training janitors. Beyond simply learning about the range and scope of efforts in different states and systems, we were interested in knowing how they got started, how they have worked, and where they are going.

Our findings can be catalogued in four broad areas of endeavor, which we detail in the subsequent sections of this report:

- First, institutions and systems are advancing **innovation** — new technologies, new processes, new products, new ideas — in their local and regional economies. This focus on innovation sees university faculty and leaders thinking creatively about how to leverage their strengths in *knowledge creation* to yield tangible economic benefits.

- Second, higher education institutions and systems are pursuing strategies to **help employers prosper and grow**. They do this by deploying their strengths in *knowledge transfer* — through worker training, management counseling, help for startups, and other initiatives.
- Third, higher education institutions are playing a more vigorous role in **community revitalization**. Many are a significant factor in the life of their home communities, and take that responsibility seriously.
- Finally, higher education's most fundamental contribution to economic development lies in its traditional role: creating an **educated population**. The new economy is making the traditional academic mission ever more important.

Taken as a whole, these developments suggest that a new paradigm may be emerging for the efforts that state governments have traditionally made to attract and keep industry, create jobs, and grow their economies.

For much of the twentieth century, states' economic development efforts centered on incentives, financial packages, cost comparisons, labor policy, permitting requirements, roads and water systems, and so on — things that state governments are comfortable working with, but that do not suffice to meet key challenges for the new economy.

The twenty-first century paradigm, in contrast, is shifting toward putting *knowledge* first. For states, increasingly, that means connecting their higher education systems more closely to their economic development strategies.

The thinking that first pointed to this new path came from the academy itself. Since 1990, when Paul Romer published a landmark article, "Endogenous Technological Change," in the *Journal of Political Economy,* economists at universities across the country have collaborated in developing a new theory of growth that puts knowledge — and not the traditional measurements of land or capital or labor or natural resources — at the center of our understanding of the wellspring of economic change and progress.

David Warsh, the chronicler of this new movement in the academic study of economics, puts it directly:

> Take a look at any map. The places with universities are the ones that have remained on top or renewed themselves around the world. That knowledge is a powerful factor of production requires no more subtle proof than that.[1]

II. Innovation: Building the Economy of the Future

One sunny afternoon in January, three huge earthmoving machines were racing noisily across a sloping red-clay field in Raleigh, North Carolina. Within earshot of the ruckus, about 200 people were working on network server software. Others nearby were focused on new textile designs, or environmental controls for papermaking, or wildlife conservation, or immunology, or solar energy, or plant health, or maybe some other things they don't want to share just yet.

To them the noise in that field was perfectly normal. The machines were preparing the ground for a big new library at North Carolina State University, on a rapidly growing campus expansion that is an unusual combination of academic center and technology park. It's just the latest chapter of a half-century saga in which North Carolina's higher education institutions have created a new-economy powerhouse out of a region once known mostly for tobacco fields and cotton mills.

This site, which NC State calls its Centennial Campus, is a bustling example of a phenomenon on display all over the country, in ways large and small, as universities and university systems work to apply themselves to the daunting job of helping this country stay on top in a global economy marked by rapid development of new ideas, new technologies, new products, new processes. Marked, that is, by **innovation**.

The connection between idea and practice doesn't happen automatically.

Innovation is an old and, to a degree, an obvious concept. Mankind has known since the invention of, say, the wheel that new ideas can be shaped and deployed in ways that advance human happiness and prosperity.

But innovation has become a focus of intense analysis in public policy circles in recent decades — as we've grown in our understanding of the critical mass of intellectual and research power needed to come up with truly new ideas in an advanced society, and as we've watched the fruits of those ideas span the globe (and create and destroy businesses and jobs) with accelerating speed.

"America must never compete in the battle to pay workers least — and it will take sustained innovation to ensure that we don't have to," said Bruce Mehlman of the U.S. Commerce Department in 2003.[2]

The leaders of states across America, like their counterparts in other countries, increasingly see in higher education their best hope of capturing an advantage in this new innovation economy.

Michigan looks to university-led innovation as the way out of an economic meltdown caused by the collapse of its traditional industrial base. Georgia has wrapped together a tight and coherent program that combines new research infrastructure, assistance to entrepreneurs, and customized training programs to help employers upgrade their productivity. New York is talking about releasing its university system from the restrictions that have kept it from changing as fast as the world around it. Private and public colleges in St. Louis, Missouri, have collaborated on a series of

research parks and startup clusters focused on biotech. Maryland has made headway in science education at the urban university. Iowa deploys its university resources to help its businesses get on top of everything from technology to business plans to human resources management.

This change in higher education is moving so fast that nobody can yet document exactly what works best. On the other hand, so much is being tried, in so many places and in so many different ways, that there is ample opportunity for states to learn from one another.

Beginning — But Not Stopping — With Research

Let's take a step back. How does innovation work? And how does it fit with research universities?

The word "innovation" is sometimes used interchangeably with "research," or with "research and development." But there's a distinction. Dr. Geoffrey Nicholson, inventor of the Post-It™ note, once gave a humorous twist to the difference:

> Research is the transformation of money into knowledge. Innovation is the transformation of knowledge into money.

We don't get innovation without research — but unless at least some of our research leads to innovation, a society doesn't develop the wealth that's needed to support more research.

The connection between idea and practice doesn't happen automatically. The ancient Olmecs of Mexico made wheels, too — but unlike the Mesopotamians, they never put them to use. Great researchers might not think first, or ever, about commercializing their idea; often someone else has to suggest it. "It's a lot of knocking on doors," says Margaret Dahl, an associate provost at the University of Georgia who does just that, as head of the Georgia BioBusiness Center.

Real, productive innovation goes from start, to finish. There's the germ of an idea. As the idea is proven and developed, people think of ways it might be put to practical use in the world. Some kind of enterprise is set up to commercialize the idea. The enterprise gets a little startup financing. It finds a place to operate, gets some advice, raises some capital. The idea goes to market. And then somebody goes back to the people who created it all and says: How about doing that again?

Every one of those things is being done today at universities.

In this Section we examine university research, and some of the efforts to put it to work in the economy. In Section III we examine some of the efforts higher education makes to help businesses become more efficient and innovative — in cases where the underlying knowledge did not necessarily come straight from the research lab.

Top 10 Public Universities in Research Funding

1. University of Wisconsin – Madison
2. University of California – Los Angeles
3. University of Michigan – Ann Arbor
4. University of California – San Francisco
5. University of Washington – Seattle
6. University of California – San Diego
7. Ohio State University – Columbus
8. University of Minnesota – Twin Cities
9. University of California – Davis
10. Pennsylvania State University – University Park

For details, see Table 1.

Research Prowess at the University Level

Because innovation begins with research, we can start by looking at the successes different states have had in building the basic prowess of their research universities.

By one authoritative count, the United States has about 200 top research universities, of which over 140 are public.[3] The amount of research funding attracted by public universities (mostly, but not entirely, from the federal government) varies widely. At a few individual campuses — the University of Wisconsin at Madison, the University of California at Los Angeles, the University of Michigan at Ann Arbor — it is close to $1 billion a year. But most are in the range of $50 million to $300 million.

Table 1, on pages 55-59, provides numbers and rankings both by individual public institution, and by statewide public systems.[4]

In general, the ranking of states' public institutions by research dollars tends to track the relative size of the state systems as measured by baccalaureate and graduate enrollment. Big universities and systems bring in big research dollars.

For example, as illustrated in Table 2, on page 60, California ranks 1st, and Texas 2nd, both in research dollars attracted to the state's major public institutions, and in total four-year and graduate enrollment in the state's public institutions. Michigan is 5th in enrollment and 3rd in research; Colorado is 14th in enrollment and 15th in research; Pennsylvania is 7th in enrollment and 4th in research; Connecticut is 35th in enrollment and 36th in research. But it is worth noting that certain states appear to punch above their weight, so to speak, in terms of research. For example, Iowa is 36th in enrollment but 20th in research; Washington is 25th in enrollment but 7th in research.

The Impact of the Research Enterprise

What do we know about the economic impact of research universities?

A widely cited 1999 study by the Milken Institute found that high-tech industry "is becoming a more important determinant of the relative economic success of metros." High-tech output growth correlated statistically with 35 percent of the 1975-to-1989 economic growth of the U.S. metropolitan areas Milken studied — but that figure had risen to **65 percent** for the period from 1990 to 1998. The Milken study said that the key to fostering high-tech industry, in turn, was ***fostering robust research universities and institutions*** — "undisputedly the most important factor in incubating high-tech industries."[5]

In a 2008 study for the Brookings Institution, Timothy J. Bartik and George Erickcek found that in addition to direct technology transfer, local businesses also benefit from "a wide variety of formal and informal interactions in which professors, researchers and students at the university interact with nearby businesses,

either through formal contracts or more information interaction to help local businesses solve a wide variety of problems."[6]

There is also the simple impact of research universities' spending. Any higher education institution provides jobs and buys goods and services, to the benefit of its local economy, and produces what economists call a "multiplier effect" — meaning, for example, that if 1,000 people are employed at the institution, they buy enough groceries, shoes, gasoline, and so on to support some additional number of other local jobs. In many smaller communities around the country, the local college is a much valued, very high-profile part of the local economy. But for public institutions, the spending multiplier effect may be blunted to some degree because much of the money they spend was already in the state and the effect is potentially transferrable — for example, a state government could decide to spend the money on hospitals instead, and the immediate economic impact might be about the same.

A research university, however, has economic impact of another order. It attracts money, mostly federal, that was not already in the state — or that, to the extent it came from federal taxes collected in-state, would have left the state but for the university's ability to capture it. Various studies of research and development (R&D) spending undertaken by the National Academies of the Sciences, the Bureau of Economic Analysis, and others, suggest the research spending local multiplier may be in the range of 2.0 — meaning, for example, that the $878 million spent on research activities alone at SUNY's major research centers in 2006 likely resulted in at least $800 million of additional economic activity that year in their regions.[7]

In many smaller communities around the country, the local college is a much valued, very high-profile part of the local economy.

A recent research report from the Federal Reserve Bank of New York argues that research universities also have a significant impact on a region's human capital.

Jaison R. Abel and Richard Deitz found that while higher education levels in the populace are important to state and regional economies, there is a more powerful impact if the local schools are research universities. Because "college graduates are highly mobile," they write, "we find only a small positive relationship between a metropolitan area's production [meaning, the number of college students it educates] and stock of human capital." However, "R&D activity tends to be much more geographically concentrated," and because these activities "influence the demand for human capital in a region …we find evidence that spillovers from academic R&D play an important role" in attracting highly educated workers to a region.[8]

Toward Practical Application

Beyond the economic impact that research universities create simply by virtue of their presence in a community, how can their research activities be leveraged in practical applications that will help their communities and states develop a competitive advantage?

A 2006 study done for the U.S. Department of Commerce by the State Science and Technology Institute found that universities

that had been successful in "launching and supporting knowledge economies" shared most or all of the following characteristics:

- Research leadership in areas of inquiry relevant to their particular regional economies.
- A "cadre" of nationally prominent faculty.
- Leadership that sees economic growth as a priority, and that links effectively with business leadership in pursuit of that objective.
- The physical infrastructure needed to support research and technology development — labs, equipment, classrooms, research parks, conference facilities.
- And the policies and legal flexibility needed to facilitate the commercialization of research outcomes.[9]

In some cases, the key is "to identify and support areas of university expertise that align with clusters of opportunity for the region."

The need for a proper "fit" between what the university is good at researching, and the structure of the local economy, was also emphasized in a study done by Carnegie Mellon's Center for Economic Development. "The task for the university (and for regional stakeholders) is to identify and support areas of university expertise that align with clusters of opportunity for the region," the authors wrote.[10]

A "cluster" is an agglomeration of similar businesses in an area, together with other businesses that serve such businesses — the wineries in New York's Finger Lakes, for example, plus all the suppliers, lawyers, accounting firms, marketing specialists, and so on who specialize in working with wineries. There is considerable research showing that firms located in a dynamic local cluster perform better over the long haul than do firms working in isolation. And a cluster, in turn, gives a university's business support activities an opportunity to have an impact beyond what it might be able to do working with a single firm. Some economic development agencies and activities have tried to create institutions that can facilitate development and use of new technologies, procedures, workforce training, marketing and the like for specific clusters that individual firms are not always able to do for themselves at all, or as well. The networking function built up among participating firms has a synergistic value, and one that ties firms together and to their location. Universities are especially well-positioned to provide settings and mechanisms to provide multi-firm economic development assistance.[11]

Top 10 States in Academic Patents

1. California
2. Massachusetts
3. Florida
4. Maryland
5. Wisconsin
6. Michigan
7. Minnesota
8. North Carolina
9. Arkansas
10. Wyoming

Rankings are relative to the number of science and engineering doctorate holders in academia. For details see Table 3.

Applied Research

Where do individual states come out in terms of the degree to which they are creating applied university research that might have economic or commercial value in the near term?

The Association of University Technology Managers says that in 2008, colleges and universities in the U.S.

created 542 companies and issued 2,821 patents. Among public universities and systems, the top-ranked in creating new companies was the University of California system (55 companies), followed by the University of Utah (20), the University of Florida (14), and the University of Michigan (13). The University of Illinois, the University of Colorado, and Purdue were tied for fifth with eleven startups each; the State University of New York, the University of Texas, and the University of Alabama were tied for sixth with ten startups each.[12]

The National Science Foundation has published data that offer other indicators. Compiled in Table 3, on page 61, these figures include the amount of academic research and development spending in each state (at its public and private universities, combined), relative to the size of its economy — and, on the other hand, the number of academic patents awarded to academic researchers in each state, relative to the number of science and engineering doctorate holders in academia.

California, Massachusetts, Florida, Maryland, and Wisconsin are the top five in academic production of patents, relative to the size of their research force. But of them, only Massachusetts and Maryland are also in the top five in terms of academic R&D spending (relative to their size of the economy). This pattern persists for others as well — wide variations between how a state ranks in R&D spending and how it ranks in patents.

One inference might be that states ranking higher in spending than in patents have a stronger overall focus on basic than on applied research — and vice versa. It is also possible, however, that some simply happen to emphasize research in areas that are more, or less, prone to patenting. The comparisons are thought-provoking, but they suggest that policy lessons for each individual state would require careful study of the particulars.

North Carolina: Working for a Second Success

In sum, the literature and data clearly place research universities at the center of the drive for success in the innovation economy. But we need to go into the field to see what universities and higher education systems can do — what they *are* doing — to lend their knowledge and expertise to that purpose.

State Support for Research — Weakening?

Overall, it appears that support for research at public universities in the U.S. may be slipping.

A report done for the National Bureau of Economic Research in 2009 found that the growth in research output (as measured by published papers) from U.S. universities slowed significantly, starting in the 1990s. Author James D. Adams, an economist at Rensselaer Polytechnic Institute, held that because this slowdown in output was concentrated in public universities, it is attributable to "slower growth in tuition and state appropriations for public universities compared to revenue growth, including from endowment, in private institutions." Federal support for research grew significantly, and more rapidly for public universities than for private ones — but this was "canceled out by the slower growth of state dollars in public universities."*

* James D. Adams, "Is the U.S. Losing Its Preeminence in Higher Education?" (Working Paper no. 15233, National Bureau of Economic Research, August 2009).

Bring up the topic of university-driven research and growth, and often as not, the first thing people think of is the Research Triangle Park. It's the crown jewel of North Carolina's economy. Opened 50 years ago, the "park" is a still largely wooded landscape of 7,000 acres with some 170 research- and tech-oriented companies employing more than 42,000 people on site.

But the interesting thing is that North Carolina isn't stopping there. North Carolina State University is currently developing a second, entirely new research park on its Raleigh campus — a 1,334-acre development for education, research, and industry collaboration, known as the Centennial Campus. Legislation has been adopted giving other universities in the state the legal flexibility to develop similar research parks on their own.

The original Research Triangle Park was founded not by one but by three universities — NC State, Duke, and the University of North Carolina at Chapel Hill — and is roughly equidistant between them (hence the use of the word "triangle" in the names of both the park and the region). Today the Research Triangle Park (RTP) is the largest research park in the United States; by some measures, such as employment, it is now a larger enterprise than the three universities combined. By many accounts it has transformed the region's economy — just as its creators had hoped it would. But that didn't happen overnight.

North Carolina State University is currently developing a second, entirely new research park on its Raleigh campus

Background on the Research Triangle Park

The idea for a research park in the Raleigh-Durham-Chapel Hill area began in the 1950s, spawned by a disparate cast of characters that included bankers, professors, real estate operators, and government officials.

They were grappling with a dilemma. North Carolina was a relative backwater with a low-wage economy that was starting to attract some industry from elsewhere — but that wasn't producing enough good jobs even for the existing stream of graduates coming out of the state's colleges. The state's leaders didn't want a permanent identity as a low-wage location. They knew manufacturers that had research facilities liked to locate those facilities near their manufacturing plants. They theorized that North Carolina might be able to attract more higher-tech, higher-wage industry if it encouraged the siting of research facilities, not just factories. And they felt that the state's universities could help make that possible.

In 1955 the chancellor of NC State, Carey Bostian, together with a small group of business and government leaders, went to Governor Luther Hodges with the idea of a "research park." The governor, in turn, elicited the support of Duke and of the University of North Carolina. Faculty members from the three universities wrote brochures documenting the research strengths of their institutions, and made more than 200 field visits to prospective companies to try to sell the idea.

To ensure maximum flexibility in developing the park and connecting it to all three founding universities, a separate

nonprofit foundation was created to operate it. Early efforts to attract investors to buy land fell flat, but in December of 1958 Archibald Davis of Wachovia Bank managed to raise $1.4 million in private contributions to secure the land. The first company in the park, Chemstrand, opened its doors in 1960. Five years later IBM announced that it would locate a research facility in RTP, and the federal government sited its National Environmental Health Center in the park as well. That set off a long period of steady growth; employment in the park was around 5,000 by 1970, 10,000 by 1980, and over 30,000 by 1990.[13]

The growth of Research Triangle Park has accompanied — and, the state's leaders believe, has helped create — an impressive economic boom in the Raleigh-Durham-Chapel Hill area. Total employment in the region more than tripled between 1970 and 2007, from 286,000 to 1.03 million. Per capita personal income rose from 11.4 percent below the national average in 1970 to 1.5 percent above it in 2007.[14]

There's no inarguable method for proving how much of the region's job growth is attributable to the Research Triangle Park, versus the other way around (that is, how much of the park's success might be attributable to the region's overall growth attributes). But researchers at the Park itself note that 51 percent of businesses in the entire region are now in what they define as "new-line" industries (such as chemicals, electronics, communications, business services, educational services, and engineering and management services), versus fewer than 15 percent when the park was created. The share of the region's jobs that are technology-related is now 25 percent higher than the national average, they find.[15]

In any case, North Carolina's leaders clearly feel that the Research Triangle Park was a huge success. That's why North Carolina is, in effect, trying to do it again, with the Centennial Campus.

With the Centennial Campus, North Carolina is pursuing a different strategy from the one used in its renowned Research Triangle Park.

Centennial Campus

"People do confuse Centennial and RTP," said Amy Lubas, director of partnership development at Centennial, in an interview on January 12, 2010. "This is a somewhat different approach — more closely integrated with the university itself."

The Research Triangle Park is 10 miles away from each of its founding universities; Centennial, by contrast, is actually part of the NC State campus. This new research park already has nearly $1 billion invested in facilities, with 2.7 million square feet occupied, with more under construction now, and with plans to grow to 9 million square feet when fully built out in 20 to 40 years.

And with Centennial, NC State is pursuing a different strategy than guided the original Research Triangle Park.

In 1984, North Carolina Gov. James B. Hunt, Jr., was looking for a way to expand NC State's campus to deal with enrollment and research growth, while at the same time further leveraging the university's capacity to undergird the region's economic development. He spotted a plot of underutilized state land adjacent

to the campus, and set the university, state officials, and business leaders to work on something he envisioned as campus and research park combined. He won the enactment of legislation that gave the university the legal flexibility to lease real estate to its partners and to direct income from its property to paying off the bonds that were needed to build facilities.

A master plan was developed for a "mixed-use community" that would combine academic classrooms, labs, and libraries with corporate and governmental tenants, residential and food-service facilities, a lake, a golf course, even a public middle school.

Already three of NC State's colleges (engineering, textiles, and veterinary medicine) are largely or entirely located on the Centennial Campus, as are 59 tenants (including private companies, nonprofits, and government agencies such as the North Carolina Wildlife Resources Commission and a federal Center for Plant Health, Science and Technology).

Thanks to the legal flexibility North Carolina has permitted for Centennial, construction on the campus has been financed by a variety of sources.

One large building is devoted to the world headquarters of Red Hat, a global leader in enterprise and server software based on the Linux operating system. Another is occupied by a research center for MeadWestvaco. Other tenants (with names like Advanced Energy Corporation, d-Wise Technologies, Juniper Networks, Pathfinder Pharmaceuticals, Star Nanotech, and Venganza) rent portions of buildings. A number of small startup companies rent "incubator" space on the campus; the university counts about 20 current tenants and 26 "graduate" companies that grew out of the incubator. The overall occupancy rate was listed as 94 percent at the end of 2009. There is also a 60-unit residential condominium project by the lake. The new library under construction will serve as the centerpiece of the campus.

Thanks to the legal flexibility North Carolina has permitted for Centennial, construction on the campus has been financed by a variety of sources: state appropriations for the actual classroom buildings, state bonds being repaid by rents from some of the buildings used by tenants, and private financing by developers who take 60-year leases on other parts of the property.

"We really see ourselves as the research park of the future," said James Zuiches, NC State's vice chancellor for extension, engagement, and economic development, in a January 12, 2010, interview. The objective, he said, is to use the proximity of real-world and commercial work to enrich the student and faculty experience, while at the same time leveraging the university's research strengths to help build and grow successful companies.

Zuiches has written that an "open innovation model" is needed to "accelerate the technology and knowledge transfer process from idea to execution, from laboratories to businesses and consumer use."

"The open innovation model assumes high levels of communication, careful listening, reciprocity among the parties, mutual commitment, and serious engagement to achieve the goals. It also requires proximity."[16]

NC State's Partners

Proximity, says Amy Lubas, is at the heart of Centennial's approach; employers who locate on the campus "tend to work very heavily with faculty." As the primary liaison with the campus tenants, which NC State refers to as "partners," she believes that most would not have come to the Raleigh-Durham area at all, without the availability of the on-campus location. "They believe that they get value being here that they could not get elsewhere," she said.

"A company can access a relationship with NC State regardless of where it is in North Carolina — it doesn't need to be on this campus," Lubas said. "But people who come here have a deeper relationship with the university. They are embedded on the campus, treated as part of it in a sense. They have more interaction, are more likely to deal with students and faculty, more likely to have collaborative projects."

"North Carolina State has a strong cultural opinion that academic-industry relations are good. Centennial is our most visible economic development activity — our front door."

Companies on Centennial Campus have full access to NC State's libraries and its online collection of research journals — potentially a huge savings for smaller companies, because subscriptions to some research journals can run into five figures. And their employees have faculty-like access to other NC State facilities, including gyms and the pool.

"North Carolina State has a strong cultural opinion that academic-industry relations are good."

James Gwatkin, a software engineer who worked for Lucent Technologies at Centennial Campus (in the building subsequently occupied by Red Hat), said in a January 14, 2010, interview that it is "an ideal place to work. I could walk over to the engineering school and sit in on a class. At lunch time I could take a shuttle bus to the gym, swim in the pool, run on the track, take a shower, catch a bus right back to my office. It was great."

Lubas agreed, saying "being on the campus makes it easier for companies to attract the high-quality employees they want."

But it's very definitely a two-way relationship. The university has final approval over all tenants, including those in buildings and laboratories built by private developers, and each tenant must have a "partnership agreement" spelling out how it will relate to the university. The specifics vary, but Lubas said they include things like informal consulting and discussions with faculty; using students as part-time workers; hiring graduates; some basic sharing of labs and equipment; contractual consulting with faculty; joint development and sponsorship of seminars and lecture series; sponsoring senior design projects for students; serving as adjunct faculty, members of advisory teams, or guest lecturers; equipment donations; collaboration on new standards, test protocols, etc.; joint research projects and grant applications; licensing technology; and allowing the university to acquire royalty positions with certain technology.

NC State operates a long list of programs intended to help transfer its research into commercial application. A Textile

Protection and Comfort Center on the Centennial Campus works on things like fire-resistant clothing for fire, police, and the military, for example. There's a Digital Games Research Center working on advanced software that emergency response agencies can use to "game out" and plan for potential natural or man-made disasters. An Industrial Extension Service offers expertise from NC State's College of Engineering to help companies adopt "lean manufacturing" techniques; it has set a goal of $1 billion in economic impact by the end of 2010, and calculated an impact of $854 million as of September 2009, with 1,249 jobs created.

All told, NC State counts 2,200 employees working for partners on the Centennial Campus — in addition to 1,350 university faculty, staff, and postdoctoral students who work at least part of the time on the campus.

Georgia and the Mind

Sometimes victories grow out of defeats — not just in sports, but also in innovation-oriented economic development. A case in point can be found in Georgia.

In 1983, Atlanta was one of several metros in the competition to win the headquarters of the Microelectronics Computer and Technology Corporation, a consortium that was being formed to develop a new generation of semiconductors. It lost out to Austin, Texas, which then became a booming high-tech center.

Georgia set out to significantly upgrade the research capacity of its major universities.

Governmental and business leaders in Georgia took the loss to heart. They closely examined the reasons Austin had won out over Atlanta, and developed an action plan focused on what they considered would be the key advantages needed for such a competition in the future.

The strategy they settled on was twofold: Develop a collaborative effort involving business, state government, and both the public and private sectors in higher education; and focus that collaboration on, first, significantly upgrading the research capacity of the state's major universities and, then, pushing research into commercialization.

So in 1990 they founded the Georgia Research Alliance (GRA), a private, nonprofit corporation run by a Board of Trustees that Gov. Sonny Perdue has called "the most powerful board in the state." The board includes nineteen major business leaders, and the presidents of the six participating research universities — Clark Atlanta University, Emory University, the Georgia Institute of Technology, Georgia State University, the Medical College of Georgia, and the University of Georgia. What they came up with is perhaps the most comprehensive research-to-implementation strategy in any state.

Scholars Were the Key

The linchpin of the plan was an Eminent Scholars program, through which GRA set out to lure major, renowned, and entrepreneurial researchers to the state.

Georgia says the Alliance has attracted $2.6 billion in grants, created 5,500 new science and research jobs, and established more than 150 new companies.

With the early support of then Gov. Zell Miller and the state legislature, GRA secured a state commitment of $750,000 to match $750,000 put up by one of the universities to sponsor each "eminent scholar" recruited. The $1.5 million total endowment is used as the scholar sees fit to support the research. The university in question is responsible for the salaries of the scholar and others involved in the particular project. Because one of the critical recruitment incentives for such scholars is the availability of laboratory equipment, GRA helps fund that, too. It helps match grants, primarily federal, that fund laboratory equipment needed for specific funded projects. It also helps plan, finance, and incubate high-tech startup firms derived from university research.

To date GRA has attracted some 60 top-shelf researchers and invested some $510 million, which it calculates has leveraged another $2.6 billion in federal and private research grants, creating more than 5,500 new science and research jobs, establishing more than 150 new companies, and helping a long list of existing Georgia companies grow.[17]

Little wonder that Jerry B. Adams, the president of the nascent Arkansas Research Alliance, is trying to build his program on the model of the Georgia Research Alliance. "GRA simply falls into the best-of-breed category," he said in a February 4, 2010, interview. Arkansas hopes to name its first two eminent scholars this year.

Georgia's first eminent scholar was Dr. John Copeland, a computer scientist who focuses on the development of software to fight cybercrime. GRA says his software is now the most widely used of its kind, serving hundreds of companies and government agencies, and gave rise to a company called Lancope, in Alpharetta, Georgia, which currently employs 60 people. Without GRA, says Copeland, he probably would have gone to work "somewhere on the West Coast," where he had two job offers.

GRA helped Emory University recruit Dr. Rafi Ahmed *from* the West Coast — the University of California at Los Angeles, specifically. Since then his work on an HIV/AIDS vaccine has brought in more than $200 million in funding. Other GRA eminent scholars are working on topics ranging from water conservation in irrigation projects, to biofuels, Alzheimer's disease, telecommunications, climate studies, and spectroscopy.

A Focus on Collaboration

Given the involvement of both public and private universities in its governance and sponsorship, GRA is especially interested in projects that promote collaboration across sectors. For example, four eminent scholars at Emory University (private) and Georgia Tech (public) were instrumental in creating an academic department that the two institutions share, its Department of Biomedical Engineering. Eminent scholars Ralph Tripp at the University of Georgia and Rafi Ahmed at Emory collaborated to attract $33 million in federal research funding to a center of excellence for influenza research and surveillance.

Initially GRA's programs explicitly required collaboration between two or more institutions. "But after a few years of that, the power of the collaborative model was so great that it no longer had to be required — it was automatic," said Kathleen Robichaud, an executive with the program, in a January 25, 2010, interview.

"GRA's basic strategy is to build the research capacity of the state's universities, public and private," Robichaud stressed.

"We've gotten much more savvy over time about commercialization. We realized there is a lot of intellectual property that has commercial potential — but some that doesn't."

VentureLab

To move research into the marketplace, GRA's principal tool is its VentureLab program, created in 2002. The objective, the alliance says, is to "build high-growth companies around laboratory discoveries at GRA's partner universities," whether or not those particular discoveries originated in the lab of a GRA-funded eminent scholar.

VentureLab seeks out research with commercial potential; offers incubator space for startups at one of the six universities; provides assistance with planning, marketing, and technology; and — significantly — provides actual seed money for startup costs, in small and staged doses as a company proves out its potential. An approved VentureLab startup is eligible for $50,000 in state funds to be used demonstrating the potential of the idea. If, on the basis of that, the nascent company can raise $50,000 in private capital, it's eligible for another $50,000 state grant to develop a business plan. Upon actual launch, it is then eligible for up to $250,000 in low-interest loans from GRA, which in effect operates a state-backed, rotating venture capital fund.

Since 2002 the VentureLab program has evaluated more than 300 discoveries or inventions for commercial potential. It has proceeded to startup with 107 companies, 68 of which are still going concerns; these employ about 450 people and have attracted some $300 million in private equity investment. Lancope, the cybersecurity software firm, was one; others are in businesses ranging from new technologies for manufacturing lenses, to advanced burr-free drilling for aerospace materials, to regenerative medicine.[18]

Georgia BioBusiness Center

A significant VentureLab program and incubator facility is the Georgia BioBusiness Center, at the University of Georgia. Margaret Dahl, who directs it, said in a January 26, 2010, interview that a major challenge is identifying faculty members who have produced commercially viable research, and then convincing them to try out the process of incubating the company. "We're less worried about getting the one big home run, and most interested in starting lots and lots of little success stories," she said. And that approach is more credible with faculty: "They may not see their idea leading to some huge new company, but they can see it being

Essential reading at the University of Georgia: "Start-Ups for Smarties."

viable on a smaller scale." UGA was working on startups even before VentureLab; it has originated over 100 small startups since 1974.

The BioBusiness Center has produced a brisk little handbook, *Start-Ups for Smarties*, explaining the process step-by-step. Applicants start by sending a simple one-page summary to the center, and continue with a process of peer review (that is, review by others who have taken university research into commercialization) to hash out the viability of the concept. Dahl said the system of providing funding in stages "serves as a risk mitigation program, in effect. There's money, but with each tier there are milestones."

Currently there are eight small startups resident in the center, pursuing business ideas in things like monoclonal antibodies, bioinformatics software, optical applications of biochemical processes, and protein therapeutics. "Graduates" of the center include Prolinia Viagen, P3Labs, Apgen, and Bacterial Barcodes.

Collaboration in St. Louis

Another example of public and private universities collaborating with each other — and with the private sector — is to be found in St. Louis.

Over a decade ago civic and university leaders began working together to find ways to move beyond the city's manufacturing economy. The St. Louis Regional Chamber & Growth Association commissioned a series of studies of the region's prospects, and identified plant and life sciences as a promising growth sector. Not only was the city home to Monsanto; it had a concentration of universities and research institutions in the life sciences as well.

Three universities (Washington University in St. Louis, the University of Missouri-St. Louis, and Saint Louis University) and two other research institutions (Barnes-Jewish Hospital Foundation and the Missouri Botanical Garden) are collaborating on a project called CORTEX to establish a biotechnology district in a 246-acre area of midtown St. Louis. More formally known as the Center of Research, Technology and Entrepreneurial Exchange, CORTEX has completed a $36 million, 170,000-square foot laboratory and office building as the first major development of the project.

Nearby is a 92,000-square-foot Center for Emerging Technologies developed by a separate not-for-profit to provide space to startup companies in biotechnology and biomedical engineering — as well as advanced materials and electronics.

The neighborhood for this nascent "biobelt" was selected both to be close to key institutions — medical centers are on two sides, and the botanical research center on a third side — and to be attractive to research recruits, with a park on another side, and a restored urban district around it.

"It was a big thing for us to set aside one place," said Susan Sauder, a vice president of the St. Louis Chamber & Regional Growth Association, in a December 18, 2009, interview. "But we have so much potential in this arena. There is power in focusing on one whole district, bringing together all these collaborators."

Western Michigan University worked to turn a crisis for its hometown, Kalamazoo, into an opportunity.

Madison's University Research Park

In 1984, the same year Governor Hunt of North Carolina started work on expanding NC State, the University of Wisconsin at Madison established its own University Research Park three miles west of its main campus. In addition to the connection to the university, the park offers tenants wet lab and office space, unlimited library access, conference facilities, and career services.

Madison's park currently has 1.8 million square feet of office and laboratory space in 37 different buildings, housing more than 110 companies; the university currently counts some 3,500 people employed there. Startups are housed in the park's technology incubator, the Madison Gas & Electric Innovation Center. Companies that have outgrown that (as well as going concerns that moved to the park to take advantage of its university access) have constructed their own facilities, scattered around 263 acres of what once was agricultural research land. (The university had the legal flexibility to transfer the land to a nonprofit that then leases sites to the tenants.)

Wisconsin is now working on a Phase 2 expansion of the park that is expected to more than double its size — adding 270 additional acres with an additional 54 building sites. That, it says, will enable it to increase the tenant count to well over 200 companies, potentially with as many as 10,000 to 15,000 additional employees.[19]

Biotech in Richmond

In what once was a blighted area of downtown Richmond, Virginia Commonwealth University (VCU) took the lead in the establishment in 1995 of the Virginia BioTechnology Research Park. Today the park houses nearly 60 public and private life science organizations, including, it reports, "research institutes of VCU, state and federal laboratories, more than a dozen early and mid-stage ventures, and multinational companies including a number of international bioscience companies from the U.K., France, Germany, Scandinavia and Israel."

The park itself has 1.1 million square feet of dedicated research and office space in nine buildings. It is adjacent to the VCU College of Medicine and to the VCU Medical Center, the fourth-largest university-affiliated teaching hospital in the U.S. Altogether, that means that in and around the park there are some 12,000 company employees, researchers, educators and hospital staff, "making the area in and around the Park one of the largest, most comprehensive and vibrant life science clusters on the East Coast," the organization says.[20]

Western Michigan University

Civic leaders in aging industrial states in the Northeast are so accustomed to losing the really big economic development prospects to places like North Carolina and Georgia that they may tend to think: There's no point in getting in this game. We won't win anyway.

But big companies don't create most new jobs. It's small businesses — specifically, small new businesses — that do it.[21] Which is why the small businesses being created at universities are no small matter.

Consider, for example, the case of Western Michigan University, which is working hard to turn a crisis for its hometown, Kalamazoo, into an opportunity.

In 2003 Pfizer Inc. announced that it would close a research facility that employed 1,500 in Kalamazoo. The lab had been an anchor of the local economy, valued especially because of the intellectual capital it represented and the high wages it provided.

The goal of Western Michigan's efforts since then has been to mitigate the loss not with another big employer, but with a bunch of small ones. It quickly focused on its Business Technology and Research Park, adjacent to its new engineering campus, hoping to lure some of the Pfizer scientists to stay in town and become entrepreneurs. The park's incubator facility, the Southwest Michigan Innovation Center, "began to fill up with one- and two-person operations, many of them started by former … Pfizer employees," as one local civic leader has written.[22] The state's legislature appropriated $10 million for a new Biosciences Research & Commercialization Center to house university tech-transfer efforts and new ventures. Pfizer ended up donating some of the lab equipment it was leaving behind. A local venture capital fund sprang up, encouraged by the university and by Southwest Michigan First, the local economic development organization.

The research park now has 22 startups in the biosciences center. Eight other firms have built their own facilities in the research park — and 16 have laboratory and office space in the Southwest Michigan Innovation Center in the park. The park as a whole is now more than 80 percent full, with about 650 people working there, the university says.

In fact, the university is working on getting zoning approval to expand into a second research park, on nearby land that is now used as an orchard. "We may not need the space today," said Robert Miller, an associate vice president of the university, in a December 17, 2009, interview. "But we don't want to be caught short when we do need it. And we will."

III. Strengthening Employers for Success and Growth

State university systems around the country help local firms with everything from business plans to personnel policy to keeping the books. Community and technical colleges in every state work with employers to provide job-training programs for their workers, on topics ranging from working in a warehouse to packing pills.

But if advanced knowledge, advanced skills, advanced technology, and leading-edge commercialization are the key to our economic future, then why are higher education institutions involved with seemingly small-bore stuff like accounting and forklifts?

Because how well businesses *operate* is critical to a local economy's ability actually to absorb and benefit from innovation. Innovation is of no value if not implemented successfully.

"Generating new technologies locally does not seem as important as having the capacity to adapt them."

As Edward Glaeser of Harvard and Albert Saize of the University of Pennsylvania have concluded, "generating new technologies locally does not seem as important as having the capacity to adapt them."[23]

This points to an important distinction in the taxonomy of the economic development efforts of higher education. As the Organization for Economic Cooperation and Development pointed out in 2007, universities and systems really have two separate, though related, roles: "*knowledge creation* through research and technology transfer; [and] *knowledge transfer* through education and human resources development."[24] Using the results of university research to drive innovation and new companies, as stressed in Section II, leverages knowledge *creation*. Business assistance, such as management counseling and workforce training, leverages the broader educational strengths of the institution for knowledge *transfer* — and can occur both for companies based on research and ideas created at the university, and for firms with no such connection. In this Section, we consider higher education's role in assisting businesses that are not based on a university's own research, but that can benefit from higher education's expertise.

Key research in this area is being done by Richard K. Lester and colleagues at the Industrial Performance Center at the Massachusetts Institute of Technology. The Center notes that many universities are focused on developing and transferring new technologies — "but often," it says, "this is not the most important contribution" they can make to local economies.

"The vigor and dynamism of local economies depends on the ability of local firms to adapt to changing markets and technologies by continually introducing commercially viable products, services and production processes — that is, by innovating successfully," Lester has written. Higher education institutions can play a vital role in "strengthening local capabilities for innovation … the ability to conceive, develop, and/or produce new technologies and services, to deploy new production processes, and to improve on those that already exist."[25]

Based on more than 700 interviews with business and university executives in 23 metropolitan areas in the U.S., the U.K., Norway, Finland, and Japan, the MIT researchers found that "upgrading existing industries" was the most common, most successful form of higher education's intervention in the local economy — with "diversification" (helping an existing firm expand into a new line of business) second. The kinds of programs that more often make the news — such as successfully helping a new firm start from scratch, or helping to attract an existing industry from elsewhere — were in fact less often cited as having had an impact.[26]

This mission — helping local and regional firms become more efficient, more competitive, ultimately more *innovative* — is one that higher education in the U.S. has been performing for more than a century, going back to the agricultural extension work fostered at land grant universities. But it seems to become broader and more complex every year.

Competing Creatively

States that work hard to attract and grow industry through their higher education systems are getting increasingly creative in how their assistance is packaged, promoted, and managed.

Georgia's economic development offices are literally on the campus of Georgia Tech —sending a powerful message to business prospects.

A good candidate for "best of breed" can be found at Technology Square, on the campus of the Georgia Institute of Technology in Atlanta. This new campus extension is a mixed-use area that includes university facilities, a conference center with hotel attached, and commercial offices allied with the university. (As with North Carolina, Georgia law gives the university the legal flexibility to lease land and facilities to its partners in the private sector.)

On 5th Street at the heart of the campus' Technology Square is a 12-story building that houses the headquarters of the state Department of Economic Development, the Enterprise Innovation Institute through which Georgia Tech offers technology and other assistance to businesses, the economic development offices of the state's utilities, the headquarters of the Quick Start program through which Georgia offers free job training programs to qualified employers, a smaller program for providing training from baccalaureate-level colleges in the state, and a major bank.

Let's home in on an important point. When the state of Georgia is working on a prospect for new or expanded business investment in the state, the place it meets with them is literally ***on the campus of Georgia Tech***. And everybody else the potential business most needs to talk to is right there, in that same on-campus building, as well.

"When the state brings business prospects to that building," says George Israel, the president of the Georgia Chamber of Commerce, "the message they get is that technology is a priority in Georgia."

Workforce Training

The most widespread, and arguably the most important, way in which higher education institutions help support the competitiveness and growth of employers in their communities is through worker training programs.

Workforce development may seem such a mundane activity that it couldn't really have that much to do with the new economy. Lessons in how to control an automated forklift? Classes in how to wash the floor in a biotech plant?

But new skills are just that — new. Workers being trained are learning something that will enable their employer to adopt new processes, or to produce new products or services, in ways that will improve the efficiency, competitiveness, and staying power of the firm. Newly hired or promoted workers at a firm might be trained in a new skill that will enable them to hold a better job, or get a promotion, or move to a new position that will make them more productive and enable them to add more value to the employer's business. All of that supports innovation.

Community colleges offer much of their workforce training through noncredit courses — a "hidden college," in effect.

Using Community Colleges — Or Not

Across the country, states almost always deliver job-specific training of this kind to employers through their two-year community or technical colleges. But some states pursue this purpose more aggressively than others.

As noted in Section V, below, community and technical colleges offer credit-bearing courses that lead to certificates and two-year degrees, as well as enabling their students to transfer to four-year colleges.

But much of the job-specific training they provide is in the form of *non*credit courses that are developed outside of normal academic guidelines. Often these are put together to meet the needs of a specific employer for workers with a specific set of skills; in other cases they train not for a specific employer, but instead for a type of job that multiple employers in a community are having trouble filling (training people to install solar panels, for example, or operate machine tools).

Noncredit courses are often the option of choice for job-specific learning at community colleges because they can be set up quickly, and because colleges have the flexibility to design courses for particular needs without the lengthy reviews typically needed for changes in the academic, for-credit side of a curriculum. For example, Massachusetts' Springfield Technical Community College (which has hit upon the idea of calling these courses "credit-free," rather than "noncredit") offers customized contract training for employers in 50 different subject matters, ranging from sales skills to medical back-office management to information technology.

But only 19 states have designated community colleges as their primary vehicle for providing workforce training, and only about half provide any general fund support for these programs at community colleges.[27] A report prepared by the Community

College Research Center at Columbia University argues that "funding for noncredit workforce education from state general funds provides an important signal about the state's vision for community college noncredit workforce education."[28]

In part because they are outside the normal academic process, say researchers Richard A. Voorhees and John H. Milam, "noncredit programs traditionally have been the orphans of higher education," even though "today's noncredit programming is just as likely to be on the cutting edge of employment markets." Noncredit enrollment numbers do not even appear in comprehensive federal and state databases on higher education — meaning that this sector is in effect a "hidden college," as Voorhees and Milam point out.[29]

Hidden or not, a number of them are pioneering new ways of delivering on this mission.

Individual community colleges across the country offer thousands of workforce-related programs, designed and packaged in a myriad of ways. But when economic developers talk about states with effective, easily navigable programs to meet the training needs of new or expanding businesses, two seem to come to the top of the list — North Carolina and Georgia.

North Carolina Community Colleges and the Workforce

As long ago as 1958, North Carolina began providing free, employer-specific workforce training at its community colleges.

"Early on, the state recognized that the availability of training is a very direct incentive for business to locate and grow here," said Maureen T. Little, assistant vice president for economic development at the North Carolina Community College System, in a January 12, 2010, interview. "Our state government is very pro-business and is determined that companies do well here."

North Carolina's community college-based training program is "joined at the hip" with the state's Department of Commerce.

North Carolina's legislature currently provides $12.4 million a year for its Customized Training Program. Each of North Carolina's 58 community colleges can access the funds to design and deliver training tailored to the specific need of a new or existing company — without charge to the company. The training program is developed at the local college, in concert with the employer. "The system office is available as a helping hand, but the local colleges design their programs — and then share their experiences," said Little.

The main point of entry into the program for new businesses, or those newly locating to North Carolina, is the state's Department of Commerce, Little said. "We really feel that we're joined at the hip with Commerce," she added. "And they feel that their No. 1 incentive is the training we can offer to employers."

Existing employers are more likely to go directly to their local community college to ask for help, she said. Each community college has an employee assigned to "reach out to local business and industry, identify their training needs, and find ways to meet them." The cost of this position is shared by the state and the local college.

For example, Talecris Biotherapeutics, which uses blood plasma to produce a number of critical care treatments at its plant in Clayton, has a longstanding training relationship with Johnston Community College. "We work together very closely and they provide training that fits exactly with our needs," said Donna Steele, Talecris' Performance Development Manager, in a February 1, 2010, interview.

Each year the facility's production is put on hold for three weeks, during which time plant maintenance and upgrades are performed, while the entire 550-person manufacturing workforce goes to training classes operated by the college. Planning for each year's training sessions begins six to nine months in advance, with officials from the college and specialists from the company working together to identify the kinds of training and courses that will be provided to each individual staff member during the training period. These can range from training in new production processes, to "soft skills" like human resources management. The two sides identify existing courses that can be used, and, if necessary, develop new ones — as well as recruiting instructors from the college and elsewhere to teach them.

"We make the courses as hands-on as possible; that's what our people are used to, and what they respond to," said Steele. The college offers much of the instruction in a new training center about a mile from the plant.

Georgia Quick Start seeks to live up to its name — getting companies up and running quickly.

Not just any business can qualify; North Carolina is looking to help businesses that will grow its economy. So the statute specifies that state-paid training is available for manufacturing, technology intensive industries, regional or national warehousing and distribution centers, customer support centers, air courier services, and national headquarters of companies with operations outside the state. "We would never consider retail, for example," Little said. In addition, to be eligible a company must demonstrate that it is making an appreciable capital investment, deploying new technology, creating new jobs, or expanding an existing workforce, and/or enhancing productivity or profitability. Companies themselves pay for training that doesn't necessarily meet all the criteria, as is the case with some of the programs Johnston Community College runs for Talecris. Employees must be paid full salary while in training.

The cost to the state is relatively modest — averaging about $500 per employee — and Little said the available appropriation has always been enough to cover all eligible applicants. For the five years leading up to the current recession, North Carolina community colleges averaged training 26,277 employees a year at an average of 774 companies a year; the recession cut that to 19,861 employees at 671 eligible companies in 2008-09.

To Get a Quick Start in Georgia

Suppose you're a small biopharm company that needs somebody with access to miniaturized video equipment to make a training video that can show your employees what a process that

they're learning how to operate looks like from *inside* the sealed laboratory equipment.

Or suppose you're a global manufacturer that's decided to move to Georgia and wants a workforce selected and trained while you're building the plant — so you can start production the day the doors open.

In both cases the companies went to Georgia's Quick Start program, which offers a number of innovations in the process by which community colleges help employers with job-specific needs. An arm of the 33-campus Technical College System of Georgia (Georgia doesn't use the term "community college"), it works just downstairs from the state Department of Economic Development. Georgia officials place it at the heart of their economic development efforts.

Like North Carolina's community college program, it's free — for new employers, but also for existing companies that are increasing employment and/or making substantial upgrades in plant and equipment. The difference is that Quick Start has the centralized staff, resources, and experience to quickly develop and deploy customized training anywhere in the state, rather than relying heavily on individual colleges to develop the programs.

"Your incentives traditionally are the site prep, tax considerations, labor costs and so on," said Rodger Brown, executive director of Quick Start, in a January 26, 2010, interview. "But today, more and more companies find that the workforce is what determines long-term success."

The basic program, carrying Georgia's commitment to provide free training for new and growing businesses, dates back to 1967. But the state ramped it up significantly in the 1990s, after finding that offshore competitors were undermining the state's traditional cost competitiveness. Officials say that by now it has conducted almost 6,000 projects involving some 780,000 trainees.

Quick Start has the centralized staff, resources, and experience to quickly develop and deploy customized training anywhere in the state.

Today when qualifying employers want training or retraining for their workers, Quick Start assigns teams of analysts to dig into the process or workflow in question. Then it develops a customized training program, complete with handbooks, presentations, videos, online lessons, or other training materials produced by its own specialists. For all new projects, Quick Start will even prescreen potential hirees for the company, using the knowledge it has acquired of the production system to match candidates with the skills required. The training is then deployed at the company's location, at one or more of the technical colleges, or at one of five Quick Start facilities located around the state.

"Quick Start has invented a new technology of training that is superior to anything I have seen in Europe," the agency quotes Hans Wilden, CEO of Wilden AG, as saying.[30]

The basic budget is currently $22 million a year, though at times that is supplemented with extra funds allocated as part of the incentive package for a major new plant.

NCR's first Georgia-produced ATM rolled off the production line only eight weeks after the plant was announced.

One such instance occurred in June 2009, when NCR announced that it would move its headquarters from Dayton, Ohio, to Georgia, while also building a new plant to manufacture ATMs — eventually to bring 3,000 jobs to the state.

Quick Start had been working closely all along with the team of Georgia economic developers who were negotiating with NCR. So even before the announcement it had done a first draft of a training program, had built a simulated NCR production line using the company's own equipment, and had begun prescreening job applicants. Within a week of the official announcement Quick Start sent a team to study an existing NCR plant in Hungary to make sure the training plan would work properly. A revised training program was then delivered to hirees even as the plant was under construction. It paid off; the first ATM for delivery rolled off the production line in Georgia only eight weeks after the announcement.

"When you're investing in a modern facility, if you don't start production quickly, you are losing huge amounts of money every day it sits there," explained Brown. The very name Quick Start is intended to convey that Georgia gets it.

In 2008, Quick Start was tasked with setting up prehiring screening and training programs for a new Kia Motors plant in West Point, Georgia, with a projected eventual workforce of 2,500 — and for another 6,500 workers at suppliers to that plant, as well. It oversaw the design and construction of a whole new Kia Georgia Training Center with robotics, welding and electronics labs, classrooms, and equipment for training on state-of-the-art programmable logic controllers (PLCs). As the production in the plant ramps up, the facility is being used both for pre-employment screening and for training those hired.

All told, Quick Start reports delivering 223 customized workforce training projects in 2009, associated with 15,916 jobs retained or created.

Western Nebraska Community College

One community college that's been notably innovative in meeting the needs of its local economy is located in a particularly challenging area — a 12-county, 17,000-square-mile region with only about 100,000 people. It may indeed be the challenges of that location that pushed Western Nebraska Community College out onto the leading edge.

Headquartered on the high plains in Scottsbluff, in the shadow of a monolith that was a landmark on the Oregon Trail, Western Nebraska Community College (WNCC) has traditionally had a strong emphasis on the conventional academic courses and associate's degrees that help local students get started on their four-year degrees. That's a vital service, in a community that's 100 miles from the nearest Nebraska public four-year college (and 400 miles from the University of Nebraska). But Western Nebraska's reach is even farther than

that; in fact, it has students as far away as Hartford, Connecticut.

With the exception of health care, the Western Nebraska region has few large employers, or even large industry clusters, of the sort that undergird the demand for job-specific, often noncredit courses in larger communities. Over the years WNCC has steadily grown its occupation-oriented programs; its 1993 mission from the state legislature lists "applied technology education" as its first priority. But even in such fields its emphasis is on for-credit programs — in part because Nebraska provides less state funding for noncredit than for-credit courses, but also because the local leadership cherishes the college's role as a reliable stepping-stone to a four-year college education.

This for-credit orientation, in turn, happened to fit well with the needs and aspirations of what became the college's single most important training "customer" — Cabela's.

Western Nebraska Community College developed a customized, credit-bearing education program for a key local employer.

Cabela's, headquartered in Sidney, Nebraska (population 6,500), is a mail-order marketer and specialty retailer of hunting, fishing, camping, and other outdoor gear; it describes itself as "the largest mail-order, retail and Internet outdoor outfitter in the world." The company began in 1961, when Dick Cabela and his brother Jim began selling fishing flies out of Dick's garage. Forty-seven years later, in 2008, Cabela's reported revenues of $2.55 billion. It publishes about 100 different catalogs a year, with total distribution of over 130 million copies, and gets over 80 million visitors a year to its shopping Web site; it ships merchandise direct to customers in over 100 countries every year. It also operates 30 retail stores in the U.S. and Canada — each a "destination" store with large inventory, a common décor, a two-story taxidermy diorama, outdoors education programs, and a carefully nurtured, distinctive style of running the store and dealing with customers.

WNCC had a longstanding relationship with Cabela's, through various course offerings at its satellite campus in Sidney (75 miles from Scottsbluff). But as Cabela's grew in scale, it wanted a way of delivering a more uniform training program to its employees everywhere — not just at headquarters in Sidney. And as the family-owned company began taking initial steps toward going public, Nebraska leaders began to worry that a new corporate structure might result in moving the headquarters. Cabela's and the community college worked intensively to develop a program that would address the company's educational needs, while giving it an even stronger link to Nebraska.

The result, announced in 2002, was Cabela's University, a customized program of for-credit, college-level courses provided by WNCC, leading eligible Cabela's employees up a five-stage "achievement ladder" that culminates in an Associate of Occupational Studies degree. Steps up the ladder are also steps toward promotion. Not only that, Cabela's executives say, the fact that the

program yields real college credits is an extra incentive for employees to work for, and stay at, the company.

The curriculum includes subjects that are found in any community college degree program, such as math and writing, as well as topics that would be found in any business curriculum, such as finance, inventory analysis, and human resources. But the courses were not all off-the-shelf from WNCC; Cabela's had a fair amount of say in getting courses tailored to its needs. "We would say things like, 'the project management course you have now is not exactly the kind of project management we need,' and they would find ways to match what we wanted," said Sarah Kaiser, a senior human resources manager for Cabela's, in an October 2008 interview.

"It says a lot for the college that they really see the company as a client."

Most of the courses are available online, accessible to Cabela's employees from Hartford to Reno. Cabela's paid for the development of the courses and pays the students' tuition.

Kathy Shirley, WNCC's vice president of outreach education, who oversees the program, said it has been good for both sides. "We learn so much from working with employers — and especially Cabela's."

"It says a lot for the college that they really see the company as a client," said Kaiser. Cabela's went public in 2004, and it's still in Sidney.

Biomanufacturing and North Carolina

One Tuesday in January, Winnell Newman was having a very good afternoon. As a researcher and manager at North Carolina State University's Golden LEAF Biomanufacturing Training & Education Center (BTEC), she leads a public tour of the facility one afternoon a week. And on this particular day the turnout included just the kind of prospects she hopes for — three executives from a nearby pharmaceutical plant, making an unannounced visit to check out whether the center could help them with the training programs needed for a possible expansion.

"We operate just like in industry," Newman said, pausing periodically to point out expensive-looking equipment and clean rooms, as well as more mundane things like foot-traffic patterns, floor markings, air flow, and even floor finishes — all intended to give trainees and students an experience as close as possible to what they might encounter in the high-tech working world. "Here's a clean room designed specifically to hold stuff, and traffic goes only in one direction," she said, then repeated, "It's set up just like in industry. I know; I came from industry."

For the one ordinary tourist on the visit, Newman explained how BTEC serves life science, chemistry, and engineering students at North Carolina State University, hosts a community college program training entry-level and transitional workers in the basic protocols of working in a biomanufacturing environment, and provides a combination of lab and class work for higher-skill jobs in North Carolina companies. The pharmaceutical executives

in the tour group, meanwhile, kept pointing out to each other equipment and features that they recognized from their own work. When the tour wound down, the three began asking Newman for details on how they could bring a larger group from their company for a closer look.

BTEC is a state-of-the-art, 82,500-square-foot, $45 million facility that NC State opened in 2007, with the construction financed by the Golden LEAF Foundation that North Carolina created to use a portion of its tobacco settlement monies in ways that would help the state's economy. It was built from the ground up to fully replicate a biomanufacturing operation capable of producing biopharmaceutical products and packaging them in an aseptic environment. There are classrooms as well, and labs in which faculty and students work on new processes. The facility is located on NC State's Centennial Campus (see Section II, above).

BTEC is unusual in that it serves both the university's education program, and direct job training programs for multiple employers that are based in North Carolina but not on Centennial itself. Also unusual is that it serves both university-level and community college-level training purposes.

North Carolina used some of its tobacco settlement monies to build a biomanufacturing training facility.

Rick Lawless, an associate director of BTEC, said in a January 12, 2010, interview that the idea for the center arose from the biotech and pharmaceutical manufacturing industry itself. Over the years North Carolina had attracted more and more biotech and pharmaceutical companies, many of them to the Research Triangle Park — but the industry gradually came to feel that its growth in the state was outstripping the supply of workers with appropriate training.

Operating with a $6 million annual appropriation from the state, the Biomanufacturing Training & Education Center offers learning in three categories. First, it serves NC State students who want a class, or a minor, in biomanufacturing; in the spring semester of 2009, its second year of operation, 215 students took classes and about 125 are pursuing enough courses to qualify for a minor. Second, it operates a professional development program that combines lab and classroom work to teach professional and supervisory-level employees in the North Carolina biomanufacturing sector the latest developments in fields like fermentation engineering, purification processes, and bioreactors for cell culture. And third, it hosts courses offered by nearby Wake Technical Community College to teach entry-level biomanufacturing workers (often those transitioning from a downsizing industry in another field) how to operate in the super-clean conditions required in biomanufacturing.

In addition to this course work, BTEC offers consulting and lab time to manufacturers who, for example, want to test a new process on a small scale before deploying it in the factory, or need short-term access to specialized equipment and/or advice.

"When a university gets involved in economic development, it has to touch home."

Help for Employers in Maryland

Workforce training is the most common way in which higher education systems help businesses around the country — but far from the only one.

Take, for example, Towson University, located in the northern Baltimore suburbs — a public institution that began life as a teachers' college in 1866 and gradually developed into a broad-spectrum institution. About six years ago the state of Maryland designated Towson as a "growth university;" its fall 2009 enrollment was 21,177, with plans to hit 25,000 by 2016.

Faced with that mandate for growth, Towson adopted a strategic plan in 2004 that, among other things, consolidated various programs and engagement activities in a new Division of Economic and Community Outreach. With some 120 employees today, the division is largely self-funded, through a combination of government and foundation grants, and fees for its services.

Dyan Brasington, who was a prominent economic development professional in Maryland and in the Washington, DC, area before she became Towson's vice president for economic and community outreach, said in a January 11, 2010, interview that "when a university gets involved in economic development, it has to touch home." Towson's key efforts aren't focused on high-level basic research. Its approach has been to develop both educational and assistance programs that leverage the university's resources to help meet the operational needs of employers and government officials in Baltimore County, the surrounding region, and the state.

So there's a Center for Applied Information Technology and an information solutions group that provides master's and doctoral level education in current IT skills and practices, as well as providing consulting services in information technology to both private- and public-sector employers in the region. It's found particularly good opportunities in the growing demand for training and consulting in IT security and information assurance, Brasington said.

This Towson division also operates a Small Business Development Center that offers, among other things, a two-year multidisciplinary executive assessment, training, mentoring, and coaching program for owners and operators of small businesses. The center operates four satellite facilities located in local economic development offices, where it runs training workshops and provides technical assistance and counseling on issues ranging from accounting and tax compliance to advertising. (The centers are based on a program operated in all 50 states with funding from the federal Small Business Administration; Maryland, like a number of other states, also chips in funds from its Department of Business & Economic Development.)

Each of these programs relies upon the skills of Towson faculty, Brasington said; younger faculty, in particular, have an "engagement orientation." In programs ranging from Towson's

economic analysis and business consulting services to its development of job-specific training programs, "what we do is access and advocate the skills of our faculty,"she added. Faculty members find that the outreach programs enable them to supplement their research with field work, provide internships for their students, and sometimes earn extra income.

Small Business Development in North Carolina

In North Carolina, the federally funded small business assistance program is a University of North Carolina systemwide program managed by NC State. Its network of 17 Small Business Development and Technology Centers is based mostly at business schools in other public colleges across the state, providing training courses and counseling for small business owners.

Scott Daugherty, assistant vice chancellor and executive director, said in a January 12, 2010, interview that North Carolina's small business centers have carved out special expertise in technology assistance; in helping small businesses find local sources of capital; and in providing comparatively lengthy and intensive one-on-one counseling programs for small business owners.

"We are deeply committed to maintaining the capacity to provide truly meaningful, in-depth consulting" about business strategies, marketing, management, and technology, Daugherty emphasized. "A lot of counseling is brief — helping you fill out a tax form, for example. But providing more like 20 to 30 hours of consulting is where you see all the difference in the world, in terms of results." The program is able to offer intensive consulting services, he said, because it relies both on faculty, and on business students — about 650 in an average year. "They provide a valuable service, and the experience adds value to their education, as well," said Daugherty. The program counts 110,000 counseling clients and 85,000 attendees at training programs since 1984, with the clients creating 25,000 jobs and growing sales and jobs at more than three times the state average.

Business students working on North Carolina's small business consulting program "provide a valuable service, and the experience adds value to their education, as well."

In an era in which small businesses across the country say that a critical problem is the difficulties they face in getting bank loans or other capital, NC State's small business program has developed specific, separate training programs to help small investors in the state understand how to set up, operate, and succeed with local "angel capital" networks and, on the other hand, to train small business owners how to find investors, understand their expectations, and meet their needs. "Financing is a problem everyone talks about, and it turns out that like a lot of other problems, learning is one key to solving it," said Daugherty.

Georgia Tech's Enterprise Innovation Institute

The Georgia Institute of Technology operates a broad spectrum of programs that Stephen Fleming, the vice provost in charge of them, calls "the largest and most comprehensive university-based program of business and economic development assistance in the United States."[31] The objective of this Enterprise

Innovation Institute is to assist outside enterprises (a term it uses to include for-profit companies, government agencies, and not-for-profits) improve their competitiveness through the application of science, technology, and innovation. The Institute was created three years ago out of the consolidation of previously separate programs. It is endowed with the legal flexibility to enter into technology partnerships and offer service agreements in various fields relating to the Georgia Tech's core interests in innovation.

Carl Rust, director of the Institute's Strategic Partners Office, said in an interview on January 27, 2010, that the university sees a seamless connection between its education and research, and its assistance to outside enterprises.

One of the Institute's units works to commercialize ideas growing out of Georgia Tech's research labs — helping faculty become entrepreneurs. "Very few faculty are able, on their own, to take a company to its potential," said Rust. "We try to do match-making — getting them someone they feel they can have some trust in to work with. Ideally we want serial entrepreneurs. And we have quite a few." In 2009 alone, the Institute reports, it helped form 20 new companies based on Georgia Tech research — companies that attracted almost $100 million in new capital.

Georgia Tech's Enterprise Innovation Institute helps established businesses that want to adopt innovative new processes and strategies.

A second unit offers similar services to other small startups around Georgia, in concert with Georgia Tech's incubator, the Advanced Technology Development Center.

But almost half the Enterprise Innovation Institute's staff of 133 work in an "industry services" unit that focuses on the needs of companies that are well established but want Georgia Tech's help in adopting innovative new processes and strategies. Its services include business consulting for competitiveness, quality, lean manufacturing, environmental compliance, and energy efficiency.

One recent project, for example, involved working with Thermal Ceramics, an insulation manufacturer in Augusta that wanted to achieve International Organization for Standardization (ISO) certification for its quality management systems. Staff from the Enterprise Innovation Institute conducted a "gap" audit to learn what the company had to accomplish to get there, assisted in reworking some of the factory's systems, and identified training needs, among other things. The company reported that its sales had increased $6 million after getting the certification, while it had reduced its costs by $2 million.

"There's a cycle of renewal at work," said Rust. "We want to help companies in Georgia that will hire our students — and use our facilities, equipment, and knowhow to develop new products and innovative services. Maybe even sponsor research. We see successful companies and their key employees contributing to the local economy and the university. They pursue new lines of business, become angel investors, make philanthropic contributions, mentor students, spin off new companies. And we want those new companies to grow and hire and support Georgia Tech again and again."

Iowa State's Center for Industrial Research and Service operates field offices around the state to put businesses in touch with university resources and assistance.

Iowa State's "System for Innovation"

Iowa State University, a land grant institution in Ames, operates what it calls its "System for Innovation" to coordinate and promote seven programs that deliver assistance to Iowa businesses, as well as transfer some of the university's own research into commercialization.

The Pappajohn Center for Entrepreneurship, for example, provides a wide variety of business-related guidance and assistance, including market research, business plan development, financing, licensing, inventions, and networking, both for startups and for existing businesses. The center also serves as a gateway to help businesses gain access to technologies, expertise, and equipment and facilities from the university.

Iowa State's Center for Industrial Research and Service operates field offices around the state to put businesses in touch with university resources and assistance. It reports serving some 667 companies in 2008 alone. There is also an Iowa State Research Park, home to 50 small companies, and an Institute for Physical Research and Technology Company Assistance, which provides no-cost assistance to companies that want to prove out concepts and compete for federal grants in materials-related areas.[32]

A Tech Park at a Community College?

Incubators and tech parks are commonly thought of as being attached to research universities. But when the purpose isn't so much the transfer of some advanced technology, as providing space and help for a growing cluster of companies in a single industry, a community college might fill the bill.

At least that's the evidence from Springfield Technical Community College, in Massachusetts, which has helped sustain its city as something of a telecommunications switching hub for the Northeast.

In 1996, after Digital Equipment Corporation closed its Springfield factory across the street, Massachusetts bought the property and turned it over to the community college. Building on the communications infrastructure already in place, the college gradually developed it as Technology Park, a 15.3-acre site that now houses 26 tenants, 14 of which work on telecommunications and related technologies.

Companies at the site have access to college faculty and they employ students; the college says their presence has in turn enabled it to expand its course offerings in information technology. Tenants at the park have invested some $300 million and employ more than 850 workers.[33]

IV. Community Revitalization

While today's university leaders think globally more than ever before, they are also looking closely at conditions right next door. Partnering with community organizations to revitalize surrounding neighborhoods is an established and growing trend. Successful university/community partnerships have been underway at Ohio State University, Georgia Tech, the University of Cincinnati, Arizona State University, and the University of Pennsylvania, among others.

Two main forces drive the increased attention to universities' community development role.

On the one hand, government officials and community activists have long pursued investments in community development from private industry. As the corporate sector has become increasingly global and mobile, more hope for such investments has fallen to universities and other public institutions with durable, sustaining presence in the community. Globalization may lead universities to forge alliances and even establish campuses overseas, but institutions of higher education are anchored in their communities, and increasingly in a knowledge economy can serve as anchors for community development.

Globalization may lead universities to forge alliances and even establish campuses overseas, but institutions of higher education are anchored in their communities.

University leaders, meanwhile, increasingly see that the community environment has a direct impact on the marketability of their institutions as places to study, work, and invest.

One way to think about university-community relationships in the twenty-first century is to envision four separate streams: Revitalizing the surrounding environment, *engaging* with community stakeholders, partnering to improve the K-20 *educational pipeline*, and being intentional about *targeting institutional activities for broad community impact*.

The Surrounding Environment

Growth and change on university campuses can mean the spread of new educational facilities and the displacement of others in the community. But when institutions take into account the interests of the local community as they expand their real estate holdings, the result — as Harvard business professor Michael Porter has pointed out — can be win-win strategies that transform communities and benefit institutions.[34]

Memphis

Finding the way to cooperative growth was a key goal for university developers in Memphis, where prior college expansions and concerns over neighborhood degradation were fraught with conflict. The solution was a network for public/private community development partnerships formed by executives of the University of Memphis, neighborhood leaders, and business owners. Their intent: Maximizing the university's economic and community revitalization impact on its core surrounding neighborhoods. The university helped pay for and staff a master planning effort

The University of Memphis helped with a master plan for property uses where the university and neighborhood connect.

that set a design, and a process leading to community buy-in, for property uses where the university and neighborhood connect. A private, nonprofit, neighborhood-based organization — institutionally distinct from but closely coordinated with the University of Memphis — was created to move the community development strategy forward, with distinct, linked organizations giving voice to area businesses and residents.

Under the University District project, the university built an expanded student residence hall and joined forces with a private developer on a $63 million mixed-use development. This includes more than 230 residential units and 100,000 square feet of retail and restaurant space funded through tax increment financing, where publicly issued bonds pay for infrastructure improvements (additional streetlights, sidewalk improvements, and a new parking garage) meant to increase property values and hence generate additional property-tax revenue, which then pays off the bonds. The success of this venture attracted additional private development, including a $13.9 million, 85-unit luxury student housing project, complete with fitness facilities, a "cyber café" and entertainment room with a parking garage, and 2,510 square feet of retail, as well as a 40-unit condominium project built by a local developer. The University of Memphis law school, meanwhile, was moved into the old Customs House as part of an effort to create a more vibrant waterfront promenade area in downtown Memphis. The law school represents a $45 million reuse of the building, and will bring 500 students and faculty downtown on a daily basis, as consumers and possible residents.

Downtown Pomona

Downtown development is a recurring theme for university revitalization. In the early 1990s, a major aerospace contractor departed Pomona, California. Thousands of high-end jobs disappeared. Many downtown businesses closed, leaving their buildings abandoned. Leaders of California State Polytechnic University proposed to help stabilize the city by creating a Downtown Center, in a building previously occupied by a bank. Their initial goal was to start arts-related after-school activities to counteract gang influence and provide alternative activities in the community. But the Downtown Center has since become the nexus of a spreading web of activities and services to benefit all of Pomona.

Beyond the events hosted at the facility, the center has helped lead a resurrection of Pomona's core. An arts colony has emerged, and many of the formerly abandoned buildings now house residents, art galleries, antique shops, and restaurants. The Academy for Literacy through the Arts provides free arts-based activities at the Center that are in great demand, primarily serving low income families with children who are underachieving academically. Civic and community groups such as Weed and Seed, Pomona Unified School District Community Arts Team, Pomona Youth Commission, Citizen's Police Academy, and others use community meeting space at the Center.

The Downtown Center provides a laboratory for Cal Poly Pomona students to test their skills while helping others. Student teachers show their aptitude for working with children. Accounting students offer free tax preparation. Theater students hone their craft while teaching high school students the elements of theater. The Center also hosts annual concerts and community workshops by the Los Angeles Philharmonic Orchestra and the Los Angeles Opera.

Phoenix

One of the largest and most aggressive examples of university-based economic revitalization can be found in Phoenix. Though a thriving metropolitan area, Phoenix had a moribund downtown a decade ago. Arizona State University (ASU), meanwhile, found itself landlocked in the older inner suburb of Tempe, with nowhere to grow. ASU President Michael Crow proposed creation of a new downtown campus populated by entire colleges and departments of particular import to downtown interest groups, such as nursing, public affairs, communications, social work, community development, and criminal justice — with the promise of more to come. Operational expenses would come from the ASU budget. Phoenix Mayor Phil Gordon committed to developing capital funding to build the new campus. A new light rail line would give students, faculty, and staff an 18-minute commute between the Tempe and downtown campuses.

Arizona State is developing a new campus in downtown Phoenix, populated by colleges and departments of particular import to downtown interest groups.

The initiative began in 2006 with a $223-million city referendum on a general obligation bond issue to build the first phase of the new "ASU Downtown Phoenix Campus." In March 2006, Phoenix voters decisively approved the bond program. Just five months later, the first buildings were ready and classes opened downtown for three colleges previously housed at the Tempe campus.

The new downtown campus now serves over 6,000 students on its way to a build-out enrollment of 15,000. At completion, it will comprise nine buildings, covering 20 acres, with 1,800 faculty and staff. Projections are that the campus will create 1,300 jobs and have an initial economic output approaching $167 million. When fully built, the campus's annual operations will inject an estimated $570 million into the local economy.

To the city of Phoenix, the university represented the foundation for a "24-7 downtown." ASU leadership saw the effort as revitalizing the university as well as its city environs; as an opportunity to become a "New American University" emphasizing university wide, interactive, and mutually supportive partnerships among the city, the university, and the broader community. "The idea," in ASU professor John Hall's words, "is that a campus should become a vital part of the city and its downtown, sharing its challenges and helping it build a sustainable future through useful research and teaching."[35]

Ohio

Public universities in Ohio have been particularly active in community revitalization. Ohio State University's Campus Partners for Community Urban Redevelopment project has encouraged neighborhood planning and consensus-building, and has leveraged significant investment by the public, private, and nonprofit sectors to fight crime and disinvestment and improve life in the neighborhood around the university's campus. OSU's Communities Properties Initiative provides $100 million for housing preservation and neighborhood revitalization, and other improvements include a $152-million mixed-use project with retail, entertainment, residential, and commercial space. The University of Cincinnati is an active partner in over $325 million in neighborhood revitalization in the six neighborhoods surrounding its campus. Case Western Reserve University's Arts and Retail District involves a mixed-use development of more than $100 million that includes retail stores, condominiums, apartments, as well as cultural arts.

The University of Akron is located south of downtown in University Park, a working-class neighborhood with a significant population of students and young professionals. Through its University Park Alliance (UPA), the university has invested $334.1 million to revitalizing 40 blocks of diverse neighborhoods surrounding the university in central Akron. As a partnership with the city, Summa Health System, and other community leaders, the University Park Alliance is a multifaceted effort to inject new life into the neighborhood. Beyond real estate and business investments, UPA's community outreach arm serves the community with free health screenings, classes, tutoring, and more.

Expanding on cooperative extension, University engagement increases community access to the expertise of faculty and students who, in turn, gain real-world experience.

Engagement

Engagement is the watchword for creating a "new kind of university,"[36] but it is also an animating mission with deep historical threads for public universities. These include the traditions of "cooperative extension" arising from applied knowledge delivered by land grant colleges to the agricultural sector, as well as more recent emphases on service learning to round out and ground the educational experiences of college students, and civic service efforts to produce an effective citizenry.

Outreach in Minnesota

The University of Minnesota, for instance, is one of the original land grant institutions created by Congress and President Lincoln in 1862. For many years, the university coordinated outreach to rural communities through an organized system of locally based Extension offices and Research and Outreach Centers that conduct both basic and applied research to address problems and issues affecting the lives of rural Minnesotans. But recognizing it is located in the heart of a major metropolis, the university in 2005 decided to make institutional changes to ensure its urban

engagement activities matched its historical efforts on behalf of rural parts of the state.

Its Urban Research and Outreach/Engagement Center weaves together research and public engagement, and is based on an interdisciplinary approach dedicated to developing long-term sustainable partnerships. To create a visible symbol and vehicle for stimulating economic development, the university purchased a 21,000-square-foot Northside shopping plaza to be used as the operating facility for the center, with many community partners housed in the renovated space.

The University of Minnesota has an array of community linkages involving youth and education, economic and community development, as well as agriculture and the environment. Within each area, the university provides academic, community, and program resource information, so that area groups or individuals can quickly find the programs or linkages they seek. A Council on Public Engagement brings together faculty, staff, students, community members, politicians, and administrators to encourage and develop public engagement at all levels. The Office for Business and Community Economic Development contributes to the economic growth of the region by promoting business opportunities, providing technical support, and implementing programs in areas such as small business development, executive leadership, and management assistance for small business. The Children, Youth, and Family Consortium networks among university, community, government organizations, and nonprofits to address early childhood development, continued student development, family relationships, and intergenerational issues.

The University of Minnesota provides academic, community, and program resource information, so that area groups or individuals can quickly find the programs or linkages they seek.

Michigan State

Michigan State University (MSU), like Minnesota, has a land grant, community extension tradition of applied scholarship, meant to encourage the generation and direct transfer of knowledge to solve problems. Since 2003 MSU has embraced community engagement as a signature initiative of the institution. University-Community Partnerships link faculty teams with community groups to work on issues of mutual interest, develop networks of faculty and staff around key issues and in specific geographic areas, disseminate research and evaluation findings to the scholarly community and provide community services including program evaluation, training, and organizational development. MSU's Center for Service-Learning and Civic Engagement provides over 9,000 student volunteers for tutoring, market research, communication planning, adult literacy and other forms of community service.

MSU is also home to scholars who conduct research on university engagement. For example, its National Center for the Study of University Engagement offers consulting services about models and methods to other institutions of higher learning, to inform promotion/tenure and other policies.

The University of Georgia's Archway Partnership process begins by having community leaders and citizens meet with representatives from the university to identify local needs.

Archway in Georgia

The University of Georgia (UGA) is another institution where community engagement comes from the roots of cooperative extension. In January 2005, the university's Cooperative Extension Service hosted a two-day retreat facilitated by Public Service and Outreach faculty to talk about how the university could improve its capacity to respond to the state's community and economic development needs. What emerged was "The Archway Partnership," intended as a new way to help communities solve problems by increasing access to expertise among faculty and students — who, in turn, would gain practical experience outside of the classroom.

The Archway Partnership process begins by having community leaders and citizens meet with UGA representatives and other partners to identify local needs and see where UGA can help. Local communities contribute funding, space, and organizational support to establish and operate the coordinating effort. The Archway Professional, a UGA Public Service faculty member knowledgeable in community and economic development, staffs the office, helps each community identify high priority needs, and is available to facilitate student and faculty interaction with the community. While tailored, Archway Partnership projects typically involve UGA's Public Service & Outreach units, Cooperative Extension, schools, colleges, institutes, other entities; community organizations, school districts, and city/county government; and state agencies and departments that play a key role in community and economic development activities.

Archway partners often tackle issues such as land-use planning, housing, and community services. In Washington County, partners are working to create a master plan for a downtown area, to offer workforce development training and opportunities to attract physicians and health professionals to the area. In Glynn County, a key activity is the newly formed Golden Isles Career Academy, a charter technical school opened in late 2009. The Clayton Archway Partnership assembled faculty and students from UGA's College of Public Health to assist in researching and preparing an application to establish additional Federally Qualified Healthcare Centers to improve care and reduce indigent care costs for existing service providers in the region. Students from UGA's Grady School of Journalism are joining with community leaders in creating a community-wide "brand" to serve on gateway signage and marketing campaigns and as a focal point for building a shared identity among businesses, governments, organizations, and citizens.

In the Atlanta area, Georgia State University's Neighborhood Collaborative builds community capacity by partnering with neighborhood residents and organizations through three resource offices. The collaborative seeks to improve low income residents' access to human services through collaboration and partnerships between service providers and communities. Programs match

System Initiative in California

The California State University (CSU) system offers an example of how efforts to encourage university engagement can be structured in a multicampus setting. An administrative infrastructure was established at all 23 campuses and at the system-wide level in 1997, when the Board of Trustees passed a resolution calling for the creation of service opportunities for all students. Since 2008, a new Center for Community Engagement in the Chancellor's Office leads a network of campus-based offices that support and train community engagement champions, foster partnerships, and promote faculty participation.

Outside the university, more community organizations seek out CSU to partner, especially with respect to hosting events, and campus Community Engagement offices play an important convening/collaborative role. A CSU Community Engagement Student Fellowship initiative is in place. Three campus offices have been endowed with matching funds, and greater acceptance of multicampus grants has been noticeable among more campuses. Two collaborative Chancellor's Office grant proposals have been written and more campuses report stronger partnerships with advancement.

volunteers to service needs in the community involving foster grandparents, truancy reduction, support for parents, health care for the uninsured, and neighborhood gentrification. Georgia State student volunteers work with local nonprofits on food service outreach, tutoring low-income children, and other projects around Atlanta.

Educational Pipeline

The pipeline from kindergarten through college has sprung severe leaks, with millions of students leaving high school each year ill-prepared for the rigors of higher education or the requirements of future jobs. As a result, forward-thinking university leaders increasingly say that improvements to the K-20 pipeline are a matter of institutional, civic and economic survival. Several university-community projects have sprung up with a particular focus on developing new and lasting partnerships to improve education.

Striving in Cincinnati

In 2006, the University of Cincinnati (UC) launched a first-of-its kind educational partnership. Called "Strive," the partnership brings fluidity to Cincinnati and Northern Kentucky's entire educational system by connecting institutions from preschool through college. The program brings together nonprofit, business, and governmental education and provides a roadmap that seeks to lead every student in the region to education beyond high school — certification in a valuable skill, a two- or four-year degree, or more.

Cincinnati's Strive supports young people all the way from birth to career and involves dozens of partner entities in the region, including educational, business, nonprofit, and civic organizations.

Strive supports young people all the way from birth to career and involves dozens of partner entities in the region, including educational, business, nonprofit, and civic organizations. At key transition points in a student's lifetime, the program brings together networks of professionals — from teachers and principals to health-care workers and psychologists — in hopes of ensuring that every child successfully manages the transition. To improve readiness for kindergarten, for example, the program put together a Strive team made up of 22 organizations, including hospitals and community medical programs, early-childhood programs,

public schools, and universities. Over four years, UC's efforts have increased enrollment of Cincinnati Public School students at the University of Cincinnati by 28 percent.

An Educator Corps

The Urban Serving Universities' Urban Educator Corps, another multistate effort, has brought together educators from different schools, states, and regions to serve as a stimulus and a clearinghouse for a variety of education reforms through meetings, publications, and grants. The Corps' influence can be seen in initiatives across the country, including urban teacher preparation programs at Georgia State University and the University of Colorado Denver; a program for training urban principals at Wichita State University, and a Tennessee State University-led program that focuses on improved training for mathematics teachers at historically black colleges and universities.

Universities have taken on direct responsibility for elementary school operations and performance, under special agreements with local school districts. For instance, Temple University's Office of Partnership Schools was established in 2002 when the School District of Philadelphia asked the university to lead a group of public schools in the neighborhoods surrounding its Main Campus in North Philadelphia. Four elementary schools and approximately 1,800 students in kindergarten through grade eight are involved. The Temple Partnership Schools remain part of the city school district but are under the direct leadership of Temple University — which determines the schools' reform strategy, educational program, professional development activities, principal selection and evaluation, and budgets. The Partnership Schools receive standard Philadelphia school resources, and participate in all required standardized testing. Partnership School staffs are employees of the city school district, which also is responsible for upkeep, safety, and security of the school buildings. Temple provides approximately $500,000 per year in in-kind support for basic administration and seeks philanthropic support for the Partnership Schools from individuals, corporate, state, and federal sources.

Temple Partnership School students made significant improvements in math and literacy.

Temple Partnership School students made significant improvements in math and literacy, according to Pennsylvania System of School Assessment tests data cited by the university. In math, 35.3 percent of tested students scored at or above grade level, an increase of 18.1 percentage points from 2005 and 29.2 percentage points since 2003. In reading, 24.2 percent of tested students scored at or above grade level, representing an 8.2 percentage point increase over the previous year and an increase of 14.2 percentage points since 2003.

Charter Schools in New Orleans

The University of New Orleans (UNO) founded the UNO Charter School Network and became involved in running several public schools after Hurricane Katrina devastated an already troubled city

school system. The university's efforts have led to reform in everything from curriculum to teaching strategies, and providing counseling and professional development, as well as needed resources. And the university has helped to achieve remarkable results in improving grade-level passing rates for fourth and eighth graders.

Several universities have pursued special initiatives in their communities to improve K-12 student interest and performance in science, technology, and math. At the University of St. Louis-Missouri, an innovative program links the study of technology, science, and culture by virtually connecting youth from high-poverty neighborhoods in St. Louis with youth in four African countries. The "Science House" at North Carolina State University works to improve knowledge of and interest in the sciences through innovative programs targeting K-12 students and teachers, part of a $21.3 million initiative that reaches over 20,000 students each year. Florida International University's Center for Diversity in Engineering and Computing prepares Miami youth to begin careers in science and engineering. Recognized by the National Science Foundation as a model, the $1 million STEP (Science and Technology Enhancement Program) program at the University of Cincinnati uses an inquiry-based science curriculum to encourage more than 1,000 local students each year to pursue careers in the sciences. At the University of Akron, programs like Igniting Streams of Learning in Science bring 60 high school students to a summer academy, while the Akron Global Polymer Academy Summer Institute helps grammar school teachers increase their knowledge of science. The newly built National Inventors Hall of Fame Science, Mathematics, and Technology Community Learning Center will function as both a middle school and as a professional development school for University of Akron undergraduates and graduate students.

Targeting Institutional Activities for Broad Impact

Institutions of higher education can influence community development in additional ways beyond program activities to affect their physical setting, to improve K-20 education, and to become fully "engaged" in providing applied research activities that serve the community and further scholarship. Along with their other roles, universities are also employers of a significantly varied and sizeable workforce. They are purchasers of a considerable volume of goods and services. Universities that are able to act intentionally in incentive programs, hiring practices, and purchasing procedures can ensure that these routine institutional activities have a corollary benefit in terms of community development impact.

Universities that are able to act intentionally in incentive programs, hiring practices, and purchasing procedures can ensure that these routine institutional activities have a corollary benefit in terms of community development impact.

Michael Porter has observed that about one-third of the jobs in colleges and universities are faculty; the remaining two-thirds are administrative and support staff positions.[37] Colleges and universities can recruit and train job seekers from local labor pools, thereby improving the lives of local residents and meeting their demand for labor. A centralized, coordinated effort to hire locally, using partnerships with local nonprofits to identify potential

employees, builds stronger economic ties to surrounding communities, and political capital as well.

Employer-based incentive strategies can also influence where staff members chose to live. Subsidized housing, through down-payment incentives, loan guarantees, and the like, can help steer university employees to neighborhoods targeted by the school, providing another tool in the development strategy.

The University of Pennsylvania (U-Penn) was an early leader in this approach. In 1998, U-Penn established two new housing initiatives in Philadelphia, and it significantly expanded an existing program to incent employees choosing to reside in neighborhoods near the school, an area known as University City. The first is a Home Ownership Incentive Program, in which the university gives either $3,000 per year for seven years, or $15,000 upfront to be spent on housing expenses, to Penn faculty and staff who purchase homes in University City and commit to reside in the home for a minimum of seven years. The university also offers a Home Improvement Loan Program, in which faculty and staff who already own homes in University City may obtain up to $7,500 in matching funds toward exterior home improvements. An expanded Guaranteed Mortgage Program, which was initiated in 1965, permits faculty and staff buying homes in West Philadelphia to finance 120 percent of the initial purchase price for a property that needs rehabilitation.

Ohio State's homeownership incentive program encourages faculty and staff to buy homes and live in the University District neighborhoods.

Launched on January 1, 2009, the University of Minnesota Home Buyer Incentive Program provides down payment or closing cost assistance for university employees seeking to purchase a home in one of the University District neighborhoods, through a $10,000 2 percent interest loan that requires no monthly payments and is forgivable over five years. Similar programs have been in place at the University of Akron ($10,000 in forgivable loans to purchase newly constructed homes in University Park), and Case Western Reserve University ($15,000 forgivable loan for down payment or closing costs for the purchase of an owner-occupied home in Greater University Circle, and employees currently living in the district may be eligible for up to $4,000 in matching funds for exterior renovations). Ohio State University's homeownership incentive program likewise encourages faculty and staff to buy homes and live in the University District neighborhoods. More than 90 employees have purchased homes with support from this program.

Finally, higher education institutions also purchase a vast amount of commodities. Porter estimates that roughly half their budgets go into the purchase of goods and services. The University of Pennsylvania was famously able to increase its local spending from $2.1 million in 1987 to more than $55 million in 2000 through its "Buy West Philadelphia" program. Tying together the roles universities can play as developer, employer, purchaser, educator, and community engager is what U-Penn's Ira Harkavy and others have summarized as the "anchor institution" role — a fulcrum for comprehensive community transformation.

V. An Educated Population

Innovation, business assistance, community revitalization — all of these represent challenges and opportunities that higher education systems are embracing today. Important as they are, however, they don't undermine the fact that the bedrock purpose of higher education is still … education.

Education is important for a wide range of reasons, starting with the purpose and satisfaction that individuals derive from an intellectually vibrant life. But it has a huge, well-documented impact on the economic competitiveness of a society, as well as on the economic prosperity of education's individual beneficiaries.

"That the twentieth century was both the American Century and the Human Capital Century is no historical accident," wrote Harvard economists Claudia Golden and Lawrence F. Katz in their 2008 book, *The Race Between Education and Technology*. "Economic growth in the more modern period requires educated workers, managers, entrepreneurs and citizens. Modern technologies must be invented, innovated, put in place, and maintained. They must have capable workers at the helm."[38]

"In a rapidly changing world," wrote Lee Harvey, a British scholar in higher education research, "graduates need to be lifelong learners. The primary role of higher education is increasingly to transform students by enhancing their knowledge, skills, attitudes and abilities while simultaneously empowering them as lifelong critical, reflective learners."[39]

There is extensive literature demonstrating both that individuals with more education have higher earning potential, and that societal incomes overall are higher in populations with higher education levels.

As Table 4 on page 62 shows, states vary in the percentage of their current workforce with a bachelor's degree — from a high of 43.2 percent in Massachusetts, to a low of 22.5 percent in Arkansas. What is striking is that the portion of the state's workforce holding a bachelor's degree correlates closely with its overall prosperity — as measured by personal income per capita. The top ten states in terms of personal income per capita are 18 percent above the national average in the share of their workforce with a bachelor's degree or higher — while the bottom ten states in terms of personal income are 17 percent below the national average in the share of their workforce with a bachelor's. (The R^2 correlation across 50 states is 63.7.)

Top 10 States in College Attainment

1. Massachusetts
2. Connecticut
3. New Jersey
4. Maryland
5. New York
6. Colorado
7. Virginia
8. New Hampshire
9. Illinois
10. Vermont

Based on holders of bachelor's degree or higher, as a percentage of the workforce. For more, see Table 4.

Current Trends in Enrollment, Graduation

As Table 5 on page 63 shows, enrollment in public and private colleges in 2006 equaled about 60 percent of the nation's population ages 18 to 24 — up 16 percent since 2002.[40] The enrollment figures for both years include people who are older than 24 (meaning the percentage of 18-to-24s who are enrolled would be a bit

Top 10 States in College Enrollment

1. Arizona
2. Iowa
3. Minnesota
4. Massachusetts
5. Rhode Island
6. Colorado
7. Missouri
8. Vermont
9. Kansas
10. Nebraska

Based on college enrollment, from both within and outside the state, as a percentage of its age 18-24 population. For more, see Table 5.

lower than 60 percent). Still, achieving 16 percent overall growth between 2000 and 2006 is better than not.

Table 6 on page 64, in turn, compares the states in terms of numbers of new degrees produced, not just students enrolled (again, public and private colleges combined). As it indicates, states also differ widely in their production of bachelor's degrees, relative to population.

In 2005 the nation's colleges as a whole awarded 48.4 bachelor's degrees for every 1,000 persons aged 18-24 (again, the caveat applies: some share of the college-going cohort is older than 24, so the share of actual 18-to-24s getting degrees would be somewhat smaller).[41]

The number of blacks enrolled in college, as a share of the black 18-24 age cohort, is beginning to approach the average for all students in a large number of states. However, Hispanics still lag well behind. Table 7 on page 65 displays the college-going rates, by state, of blacks and of Hispanics, compared to the rate overall. Nationwide, in 2006, college enrollments equaled 60.3 percent of the 18-24 population. For blacks, it was 54.7 percent — but for Hispanics, only 39.2 percent.[42]

In recent years analysts have also been concerned about the number of students taking degrees in science and engineering — critical fields in the innovation economy we discussed in Section II. Table 8 on page 66 details the percentage of science and engineering degrees in each state. Nationwide, the share represented by such degrees increased by over 20 percent between 1996 and 2005.

One institution in particular — the University of Maryland, Baltimore County — has achieved wide recognition for success in delivering science educations to minority students. As *Time* magazine noted in naming its president, Freeman Hrabowski, one of the ten best college presidents in the country, "UMBC is one of the nation's leading sources of African-American Ph.D.'s in science and engineering, and almost half of its seniors go immediately to grad school."[43]

The Growing Importance of Community Colleges

Nationwide about 40 percent of all undergraduates are enrolled in public two-year colleges, such as community colleges and technical schools.

As of fall 2006, according to IPEDS data, there were 15,184,302 undergraduates in public and private institutions nationwide, of which 6,224,871 (or 40%) were at public two-years. Enrollments are also growing rapidly; the American Association of Community Colleges calculates from a sampling of its members that enrollment "in credit-bearing courses at U.S. community colleges in fall 2009 was 11.4 percent higher than it was in fall 2008, and 16.9 percent higher than it was in fall 2007."[44]

The Bureau of Labor Statistics projects that about 45 percent of job openings in the years ahead will require more than a high-school education, but less than a four-year degree. Jobs requiring a four-year degree or better are projected to account for about 33 percent of openings.[45]

Table 9 on page 67 shows two-year college enrollment by state, in comparison both to the 18-24 population and (because community colleges attract so many older learners) in comparison to the entire over-18 population.

Credit-bearing courses at two-year colleges play an important role in educating a work-ready population; they can lead to certificates or two-year degrees that qualify recipients for careers in fields ranging from practical nursing to police work. They also can enable students to transfer to four-year colleges to complete their baccalaureate.

Experimenting with New Delivery Models

Another insight that's emerging from policymakers and educators who want to see the population achieve progressively higher levels of education is: Don't stop thinking about college when "the college years" are over. There's a growing demand for college courses from middle-aged and old citizens — people who didn't or couldn't go to college when they were young, or who didn't or couldn't finish, or who did get a degree but feel their career path demands another one, or at least a few more courses.

Don't stop thinking about college when "the college years" are over.

Online Learning

For adult learners, new delivery models can be significant; the hours of regular college classes often don't fit with their working lives. An increasingly important answer is online learning, which is turning out to be not only convenient, but effective.[46]

New York's Excelsior College, now entering its 40th year, is a pioneer in distance learning, for example. The State University of New York's Empire State College caters to adult learners with a combination of online courses, and small learning centers in 35 locations scattered across the state. Western Governors University (www.wgu.edu), created in 1997 as a consortium of 19 Western states, is an entirely online, "virtual" university; it currently enrolls 17,000 students, with an average age of 36.

Georgia: Employers and Continuing Education

At times, employers themselves will need adult, college-educated workers to go back to college for some specific learning that will fine-tune their skill sets to match particular professional requirements.

The University System of Georgia operates a program called the "Intellectual Capital Partnership Program" (ICAPP), which works somewhat like a traditional, community college-based job training program — but with the emphasis on more specialized needs, and on for-credit college-level learning.

ICAPP finds former college students and college graduates who have the basic background for jobs opening up at a new or expanding employer, but who aren't quite a perfect fit. Working with the employer, the program develops and delivers program of study to close whatever gap there is, with the cost split between the employer and the state.

"Say we have an aircraft company that wants to hire avionics engineers, and there aren't enough available," explained Terry S. Durden, assistant vice chancellor of the Office of Economic Development in the University System of Georgia, in a January 25, 2010, interview. "So we ask them, what's the kind of engineer that's closest to an avionics engineer? An electrical engineer, probably. We find electrical engineers, figure out the additional courses they need, find people around the system who can provide those courses, and get that done."

Resources Applied

Higher education is among the primary purposes, and the most expensive functions, of state governments across the country — accounting for about 10 percent of all state government expenditures, a total of $170 billion in Fiscal 2006-07.[47]

States differ, however, in the amount they spend to support higher education. Table 10 on page 68 shows the amount per capita that states and their local governments (which often share in the support of two-year colleges) spend on higher education. The national average was $678 per capita in Fiscal 2006-07.

States that had long-established private institutions before the public sector grew to prominence (Massachusetts, for example) tend to spend less per capita than those that are more dependent upon their public sector institutions (Texas or New Mexico, for example).

Interestingly, a state's per-capita spending on higher education does not correlate closely with its overall tax burden.

The top ten states in per capita state and local taxes rank 42nd, 3rd, 36th, 9th, 45th, 15th, 48th, 12th, 24th, and 21st, respectively, in per capita state and local spending on higher education.[48] It seems to be a matter of priorities, not revenues.

Top 10 States in Public Spending on Higher Education

1. Vermont
2. North Dakota
3. Wyoming
4. Delaware
5. New Mexico
6. Utah
7. Iowa
8. North Carolina
9. Alaska
10. Alabama

Based on state and local spending per capita on higher education. For details see Table 10.

VI. Conclusion

What, then, have we learned about how higher education systems and institutions can strengthen their states' economies and communities?

We have learned that universities and university systems around the country are pursuing multiple economic purposes, often at the same time, including knowledge creation, knowledge transfer, community engagement, as well as traditional education goals. We have also found that academic institutions have generated a great variety of strategies to achieve these goals. And we have learned that no single strategy works for all types of institutions or economic and community conditions. Instead, the best implemented, enduring, and widely valued initiatives have emerged from creative efforts responsive to the particular strengths and needs of the institutions, businesses, economic conditions, and communities involved. Thus, although the examples described in this report offer an extraordinary range of potential models for universities and university systems to draw upon, the process of thinking through the goals and how they can be met in specific circumstances appears to be the key to creating strong and mutually useful relations among states, academic institutions, local economies, and communities.

The process of thinking through the goals and how they can be met in specific circumstances appears to be the key.

Learning from Others

The selection or design of strategies should vary with the circumstances of the state or community served. For each strategy, there are ample opportunities for a state to learn from the example of others.

For example, a state that is competitive when manufacturers or others are looking to site major, new facilities may want to create a **high-quality, fast turnaround workforce training program** in its community college system. A good place to emulate might be Georgia, with its track record of delivering the "Quick Start" it promises new employers.

Alternatively, a state may give top priority to developing its ability to "grow its own" — **to strengthen existing businesses, and spawn new ones**. This strategy is especially relevant for states that are *not* often competitive in the siting of major, new companies from outside the state. In such a state, the enormous economic impact of research universities in California, Texas, North Carolina, Wisconsin, and other states would be instructive.

For a state that wants to get started in upgrading its research strengths, the way in which the Georgia Research Alliance has carefully bolstered the capacities of both public and private universities, and with a strong emphasis on **research with commercial value**, provides a good model. Western Michigan's record in developing an incubator campus and a research park shows how a university can **respond quickly** when its community is challenged. North Carolina State's Centennial Campus is a model for

a technology-focused university seeking a major expansion of its connections with industry.

Iowa State's success in nurturing entrepreneurs and in providing field-based industrial consulting provides a good, twenty-first century update on the **extension services** traditionally provided by land grant universities. Western Nebraska Community College is a model of how even a small, rural institution can listen carefully enough to figure out what a major employer needs, and then **move creatively** enough to provide it.

Quite a number of institutions of higher education are anchored in their communities, and well-positioned as catalysts in state community development efforts. University-led mixed use projects in Ohio, California, and Tennessee have shown they can serve the housing, retail, and cultural needs of university customers and neighbors alike. These and other models are available for institutions that want to significantly improve the surrounding environment and, in return, bolster the desirability of both school and community as places to study, work, and invest.

A state that ranks low in **college enrollment and degree levels** may want to look first for strategies that will remedy that situation. A good place to emulate might be New York, with a robust network of both public and private institutions that produce a highly educated population, at below-average cost to the taxpayers.

Any university that has a school of education but isn't involved in trying to help its own local schools might well ask itself: Why not?

Some of the initiatives we've described may be applicable in nearly all states. Free, community college-based **workforce training**, like that offered in North Carolina, would likely be welcomed by employers in almost any community. The same may be true for greater budget support for **noncredit community college courses**, especially those tied directly to the workplace. Any university that has a school of education but isn't involved in trying **to help its own local schools** might well ask itself: Why not? And finding **seed money** for businesses that start in a state's own university research labs, as Georgia's VentureLab program does, might also make sense in many institutional and economic settings.

This is not to say that we know exactly what works best for every given need, and why.

Our studies suggest that higher education institutions and systems that want to become more active in promoting economic revitalization have some experimenting to do. They will want to proceed thoughtfully, try different approaches, carefully monitor results — and start with a number of smaller tactical moves, rather than betting too much on any one strategy.

It would appear, as well, that the many people working in economic development and community revitalization at campuses and systems across the country could benefit from more cross-pollination and shared research. There is a nascent University Economic Development Association, based at Towson University in Maryland. Perhaps it could serve as a focal point for foundation and governmental support behind a comprehensive effort to catalog these efforts and to quantify and compare results.

Institutions and systems are trying to find sweet spots at the intersection of their institutional strengths, and the structure of their particular communities, economies, and business clusters.

A Diversity of Models

The need for further study and experimentation is borne out by the great diversity of models we have found in the origins, development, implementation, and management of the various initiatives we have reviewed. There isn't one clear-cut operational approach.

For example, the Georgia Research Alliance grew out of an initiative by the state's business leadership, not its university or governmental leaders. It incorporates both public and private institutions. Though it disperses state funds, it is governed by a board drawn from business and the universities, and its internal operating costs are raised privately.

Fifty years ago, North Carolina built the Research Triangle Park at the instigation of business, university, and governmental leaders all working together — and established it as a collaboration between public and private universities, with the park devoted almost entirely to corporate and research facilities. But its new Centennial Campus was instigated directly by the then governor; is controlled and operated solely by one public institution, NC State; and mixes research, corporate, business assistance, and educational facilities together.

Some states provide new or expanding employers with free, basically as-of-right training at community colleges; others negotiate to wrap that into some, but not all, location incentive packages.

Georgia's Quick Start training program is highly centralized, while North Carolina's is basically dispersed among individual community colleges —yet both appear to have excellent reputations among business location specialists.

Differing economic circumstances drive different approaches. North Carolina has established a large biomanufacturing sector, so the emphasis there, as evident in the BTEC facility at NC State, is on helping that industry meet its growing need for qualified workers. Georgia, by contrast, has not yet attracted comparable investments in the field, so it is concentrating on trying to grow its own, through initiatives like the Georgia BioBusiness Center.

Business assistance programs, in turn, must vary with the nature of the business being helped. Industrial extension programs like those at Iowa State and Georgia Tech provide consulting to existing, often long-established local firms. Other programs, such as Georgia's VentureLab program, are built around the needs of startups that stem directly from university research. Iowa's Pappajohn Center helps entrepreneurs who mostly started on their own. Western Michigan's business assistance is tailored to startups and small firms that need lab space and access to engineering faculty and students.

Community engagement efforts of universities and university systems, by definition, are tailored to the contours of their local settings. Specific activities vary, ranging from the rural development strategies of the University of Georgia's Archway

Partnership to industrial area revitalization efforts in Michigan and urban agriculture projects in Minnesota, and everything in between. Growing from the community extension and service-learning traditions, university/community engagement initiatives share a common goal of offering a way to help solve real-world problems by increasing community access to the expertise of faculty and students who, in turn, gain practical experience outside of the classroom, and do so through a collaborative process of identifying local needs.

In summary, institutions and systems are trying to find sweet spots at the intersection of their institutional strengths, and the structure of their particular communities, economies, and business clusters. Those are intersections that each state, each system and each institution must find for itself.

Five Essential Elements

That said, we believe we have identified five essential elements that must be leveraged if universities and systems, and higher education as an industry, are to fulfill their potential as engines of economic revitalization in communities, in the states, and in the nation. These are leadership, flexibility, culture, resources, and a new paradigm.

Leadership

It takes leadership to produce new directions and great results. Higher education itself has had numerous pioneering leaders. It still does, and at multiple levels, not just the top. These are leaders with the vision to find a wider role for their universities, the ability to marshal support for that wider role, and the implementation skills to bring it to fruition. But in a number of states, it has taken gubernatorial leadership, as well, to make the difference. New Yorkers are familiar with the central role that Gov. Nelson A. Rockefeller played in the creation of the modern State University of New York. Governors in other states also provided powerful examples of this kind of impact — Luther Hodges and James B. Hunt in North Carolina, for example, or Zell Miller in Georgia.

Flexibility

Higher education institutions and systems also require some flexibility to work in collaboration with the private sector to create economic growth and revitalize their communities. A university is not just another government agency. The rules on real estate, purchasing, preapprovals and the like that are appropriate for, say, a state park can prove a serious encumbrance when applied to a university that is trying to work with business to produce jobs. Yet the laws in some states make few if any concessions to that reality. For example, joint-use projects like the tech park at Springfield Technical Community College in Massachusetts, or the Centennial Campus at NC State, or the shared economic development center at Georgia Tech, would be very difficult, if not outright impossible, for the State University of New York to emulate

The rules that are appropriate for, say, a state park can prove a serious encumbrance when applied to a university that is trying to work with business to produce jobs.

under current New York law. Local purchasing preferences like those adopted by the (private) University of Pennsylvania in Philadelphia would be illegal under the low-bid laws governing public universities in most states.

Culture

For institutions and higher education systems to embrace their responsibility for their states' economic development also requires the right institutional culture.

In the 1870s, John Bascom, president of the University of Wisconsin, declared that a university's purpose was not only to educate citizens, but also to create and nurture new ideas, and to use its expertise to the direct benefit of society.

Bascom's approach came to be called "the Wisconsin Idea," and ever since it has formed a key strain in the culture of many higher education institutions. But not the only strain, and not at every institution. University leaders who work in this arena will tell you off-the-record that some members of their campus communities think a focus on economic impact will lead their institution to become "a trade school." Some say they want to do good in the wider world, not "merely" in the immediate locality.

"The Wisconsin Idea" has formed a key strain in the culture of many universities.

But to repeat what Dyan Brasington at Towson University said, "when a university gets involved in economic development, it has to touch home."

Joseph Burke, a former provost of the State University of New York system and now a senior fellow at the Rockefeller Institute, argues that "university adoption of the new economic development paradigm could prove as beneficial for faculty and students as for states and business.

"It opens more opportunities for research funding for faculty and can add a practical element to student education in fields such as business, economics, engineering, and technology."

Resources

Led, free and willing to take on an economic revitalization role, higher education still can't do this without the necessary resources.

Particularly given the current recession and the extreme budget difficulties it has created for states across the country, how can universities and systems possibly afford the cost of growing their research enterprise, or expanding job training, business assistance, or community engagement programs?

Part of the answer is that sometimes the costs can be surprisingly modest. The Georgia Research Alliance, for example, has generated some $2.6 billion in research activity with a state budget investment averaging only about $25 million a year. North Carolina's core job-training program at community colleges has a nationwide reputation in the business and economic development communities, but it costs only about $12 million a year.

Another part of the answer is that in many states, large sums are already being spent for economic development purposes, in ways that may not always be optimal. Perhaps there are funds

available that could be transferred to potentially more productive economic growth strategies — strategies that are knowledge-centered and in which, therefore, universities and higher education systems play a central role.

Most states, for example, receive large sums of federal aid for worker training and retraining programs.

If these funds are spent on, say, training at a community college in skills that employers in the area are specifically requesting, there can be some assurance that the training will actually lead to jobs — and higher-skilled, possibly higher-paid, jobs at that. But only 19 states have designated community colleges as the primary providers of this workforce training. In other states, the funding is scattered among myriad agencies and local programs, often focused largely on entry-level (hence low-skill, low-paid) jobs, and with little or no connection to the state's overall economic development priorities.

Similarly, most states operate economic development programs that spend money on tax abatements, and often outright grants, for firms that promise to create, or to "create or retain," jobs.

If these funds are spent on, say, an out-of-state firm that is investing and creating new jobs in the state — or on a firm that will export its products or services to other states and countries, thus bringing new money into the state — then they may well prove a sound investment.

But in many cases money is being provided to existing, in-state retail, service, utility, distribution, or other businesses that simply live on whatever economic activity the state already has, rather than growing it. New York State, for example, has been spending in the range of $500 million a year on its Empire Zones program for tax abatements and other incentives. Yet an analysis of the program done for the sponsoring agency, Empire State Development, found that at least a third of the money — $170 million in 2005 alone — was going to businesses "that follow growth rather than stimulate it."[49] New York is hardly alone in facing this dilemma; a study of 75 enterprise zones around the country, conducted for the Upjohn Institute in 2002, found that they generally tend to have "very little impact on new investment."[50]

States have money to spend on economic development. The issue is where they can best invest it.

So states have money to spend on economic development. The issue is where they can best invest it.

The New Paradigm

This, finally, brings us to the question of whether it is time for states to consider a new paradigm for their overall economic development efforts.

The old paradigm rests largely on the traditional mix of business attraction and retention incentives. Research, technology transfer, management assistance, and/or worker training are often thrown in among the incentives — but sometimes as a kind of afterthought.

Given our growing understanding that innovation is the key to future economic competitiveness and progress, however, a new

approach may fall to hand. Perhaps there is now an opportunity to flip the old model around — adopting a new, "knowledge first" paradigm in which higher education systems explicitly take a leading role.

A model in which *knowledge* is the lead incentive that states offer businesses they want to attract or grow — while it is the other incentives that are the extras.

Without doubt, the traditional packaging of infrastructure, utilities, tax breaks, and so on is sure to play a continuing role. But how will states know which businesses will prove to be the best long-term bets for those incentive programs?

In the economy of the future, the businesses that will have staying power, and growth potential, will be those most dependent on knowledge — on research, new ideas, new technologies, new processes, upgraded skills for their workers.

If a business doesn't need those things, is it the best bet for the long run? And if it does need those things, aren't our higher education systems the key to delivering them?

In *The Uses of the University*, Clark Kerr, the legendary architect of California's university system, wrote: "We are just now perceiving that the university's invisible product, knowledge, may be the most powerful single element in our culture, affecting the rise and fall of professions and even of social classes, or regions, and even of nations." He wrote that in 1963. It appears that it is even more true in 2010.

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Table 1. Research Dollars Attracted by Top Public Universities			
Institution, by state	**Total Research $, 2006 (in thousands)**	**Institutional Rank**	**State Rank***
Alabama			
University of Alabama - Birmingham	331,436	28	
Auburn University	126,522	77	
University of Alabama - Huntsville	59,231	115	
University of Alabama - Tuscaloosa	35,129	139	
State total	552,318		21
University of **Alaska** - Fairbanks	153,470	69	41
Arizona			
University of Arizona	535,847	13	
Arizona State University - Tempe	201,955	55	
State total	737,802		16
Arkansas			
University of Arkansas for the Medical Sciences	107,871	89	
University of Arkansas - Fayetteville	99,271	94	
State total	207,142		37
California			
University of California - Los Angeles	811,493	2	
University of California - San Francisco	796,149	4	
University of California - San Diego	754,766	6	
University of California - Davis	573,002	9	
University of California - Berkeley	546,035	12	
University of California - Irvine	300,229	33	
University of California - Santa Barbara	174,429	66	
University of California - Riverside	124,820	78	
University of California - Santa Cruz	114,126	84	
San Diego State University	73,777	108	
San Jose State University	34,687	140	
State total *	4,432,283		1
Colorado			
University of Colorado - Health Sciences Center	258,030	40	
Colorado State University	253,992	41	
University of Colorado - Boulder	250,255	42	
State total	762,277		15
Connecticut			
University of Connecticut - Health Center	108,707	86	
University of Connecticut - Storrs	106,477	90	
State total	215,184		36
University of **Delaware**	114,985	83	45
Florida			
University of Florida	565,491	11	
University of South Florida	285,941	36	
Florida State University	185,633	60	
University of Central Florida	107,996	88	
Florida International University	65,805	110	
Florida A&M University	34,293	141	
State total	1,245,159		5

Table 1. Research Dollars Attracted by Top Public Universities (continued)			
Institution, by state	**Total Research $, 2006 (in thousands)**	**Institutional Rank**	**State Rank***
Georgia			
Georgia Institute of Technology	440,898	19	
University of Georgia	323,843	31	
Medical College of Georgia	61,174	113	
Georgia State University	52,690	122	
State total	878,605		10
University of **Hawaii** - Manoa	249,635	43	35
University of **Idaho**	86,863	98	48
Illinois			
University of Illinois - Urbanna-Champaign	476,198	16	
University of Illinois - Chicago	332,176	27	
Southern Illinois University - Carbondale	74,520	106	
State total	882,894		9
Indiana			
Purdue University - West Lafayette	372,958	22	
Indiana University / Purdue University - Indianapolis	213,002	54	
Indiana University - Bloomington	142,002	72	
State total	727,962		17
Iowa			
University of Iowa	346,357	25	
Iowa State University	221,998	50	
State total	568,355		20
Kansas			
University of Kansas - Lawrence	131,195	76	
Kansas State University	123,746	79	
University of Kansas Medical Center	64,752	112	
State total	319,693		31
Kentucky			
University of Kentucky	323,958	30	
University of Louisville	135,873	75	
State total	459,831		24
Louisiana			
Louisiana State University - Baton Rouge	246,093	45	
Louisiana State University HSC	79,927	95	
University of Louisiana - Lafayette	47,308	99	
State total	373,328		27
University of **Maine** - Orono	93,153	96	46
Maryland			
University of Maryland - Baltimore	405,260	21	
University of Maryland - College Park	354,244	24	
University of Maryland - Baltimore County	65,718	111	
University of Maryland Biotechnology Institute	59,297	114	
University of Maryland Ctr. For Environ. Science	40,146	131	
State total	924,665		8

Table 1. Research Dollars Attracted by Top Public Universities (continued)			
Institution, by state	**Total Research $, 2006 (in thousands)**	**Institutional Rank**	**State Rank***
Massachusetts			
University of Massachusetts Medical School - Worceste	191,659	57	
University of Massachusetts - Amherst	136,057	74	
State total	327,716		29
Michigan			
University of Michigan - Ann Arbor	800,488	3	
Michigan State University	358,097	23	
Michigan Technological University	43,081	130	
Wayne State University	220,731	51	
State total	1,422,397		3
University of **Minnesota** - Twin Cities	594,877	8	19
Mississippi			
Mississippi State University	189,917	58	
University of Mississippi Medical Center	39,254	132	
University of Southern Mississippi	39,163	133	
Jackson State University	38,273	135	
University of Mississippi - Oxford	54,217	120	
State total	360,824		28
Missouri			
University of Missouri - Columbia	215,240	53	
University of Missouri - Rolla	37,384	137	
State total	252,624		34
Montana			
Montana State University - Bozeman	112,428	85	
University of Montana - Missoula	52,903	124	
State total	165,331		39
Nebraska			
University of Nebraska - Lincoln	215,850	52	
University of Nebraska Medical Center	108,012	87	
State total	323,862		30
Nevada			
University of Nevada - Reno	98,917	95	
University of Nevada - Las Vegas	57,031	118	
Desert Research Institute	38,511	134	
State total	194,459		38
University of **New Hampshire** - Durham	115,117	82	44
New Jersey			
Rutgers - State University of New Jersey - New Brunsw	280,994	37	
University of Medicine & Dentistry of New Jersey	245,771	46	
New Jersey Institute of Technology	77,583	102	
State total	604,348		18
New Mexico			
University of New Mexico - Albuquerque	181,223	61	
New Mexico State University - Las Cruces	169,029	67	
New Mexico Institute of Mining and Technology	73,792	107	
State total	424,044		25

Table 1. Research Dollars Attracted by Top Public Universities (continued)			
Institution, by state	**Total Research $, 2006 (in thousands)**	**Institutional Rank**	**State Rank***
New York			
University at Buffalo - SUNY	297,909	34	
University at Albany - SUNY	274,354	38	
Stony Brook University - SUNY	234,635	49	
Upstate Medical University - SUNY	37,181	138	
Binghamton University - SUNY	33,973	143	
State total	878,052		11
North Carolina			
University of North Carolina - Chapel Hill	443,790	18	
North Carolina State University	330,936	29	
State total	774,726		14
North Dakota			
North Dakota State University	103,778	91	
University of North Dakota	56,074	119	
State total	159,852		40
Ohio			
Ohio State University - Columbus	652,329	7	
University of Cincinnati	294,150	35	
Wright State University - Dayton	47,711	126	
Ohio University - Athens	38,000	136	
State total	1,032,190		6
Oklahoma			
University of Oklahoma - Norman	101,015	92	
Oklahoma State University - Stillwater	100,323	93	
University of Oklahoma Health Sciences Center	77,704	101	
State total	279,042		33
Oregon			
Oregon Health & Science University	272,174	38	
Oregon State University	189,606	59	
University of Oregon	57,153	117	
State total	518,933		22
Pennsylvania			
Pennsylvania State University - University Park	567,549	10	
University of Pittsburgh	530,162	14	
Temple University	79,736	100	
Pennsylvania State University - Hershey Medical Cente	76,663	103	
State total	1,254,110		4
University of **Rhode Island**	70,696	109	49
South Carolina			
Clemson University	179,840	63	
Medical University of South Carolina	176,055	64	
University of South Carolina - Columbia	153,737	68	
State total	509,632		23
Tennessee			
University of Tennessee - Knoxville	240,379	47	
University of Memphis	43,715	129	
State total	284,094		32

Table 1. Research Dollars Attracted by Top Public Universities (concluding)			
Institution, by state	**Total Research $, 2006 (in thousands)**	**Institutional Rank**	**State Rank***
Texas			
Texas A&M University	492,955	15	
University of Texas MD Anderson Cancer Center	457,696	17	
University of Texas - Austin	431,398	20	
University of Texas Southwest Medical Center - Dallas	333,237	26	
University of Texas Medical Branch - Galveston	179,915	62	
University of Texas Health Sciences Center - Houston	175,154	65	
University of Texas Health Sciences Center - San Antonio	150,040	70	
Texas A&M Health Sciences Center	76,109	104	
University of Houston - University Park	75,662	105	
Texas Tech University	58,591	116	
University of Texas - Dallas	44,198	128	
State total	2,474,955		2
Utah			
University of Utah	248,168	44	
Utah State University	138,670	73	
State total	386,838		26
University of **Vermont**	121,841	81	43
Virginia			
Virginia Polytechnic Institute and State University	321,722	32	
University of Virginia	238,754	48	
Virginia Commonwealth University	149,256	71	
College of William & Mary	52,025	123	
George Mason University	50,381	124	
Old Dominion University	49,966	125	
State total	862,104		13
Washington			
University of Washington - Seattle	778,148	5	
Washington State University - Pullman	196,391	56	
State total	974,539		7
West Virginia University	122,134	80	42
Wisconsin			
University of Wisconsin - Madison	831,895	1	
University of Wisconsin - Milwaukee	34,033	142	
State total	865,928		12
University of **Wyoming**	89,414	97	47

Source: The Top American Research Universities: 2008 Annual Report. University of Arizona, Center for Measuring University Performance, 2008.

Individual institutions have since published numbers for more recent years, but the Arizona center provides a consistent national compilation that reports research dollars from all sources.

*State totals and rankings include only the research dollars raised by these major institutions or the central administration. In most states additional, smaller amounts are also raised by other institutions.

Table 2. Enrollment vs. Research Rankings of Public Higher Education Systems					
State	Four-Year Enrollment	Graduate Enrollment	Total, Fall 2006	Enrollment Ranking *	Research Rank
Alabama	119,822	31,263	151,085	15	21
Alaska	25,347	2,167	27,514	45	41
Arizona	102,391	25,324	127,715	20	16
Arkansas	69,794	10,759	80,553	32	37
California	510,404	107,573	617,977	1	1
Colorado	120,525	30,731	151,256	14	15
Connecticut	50,998	13,633	64,631	35	36
Delaware	20,237	3,833	24,070	47	45
Florida	340,975	50,590	391,565	3	5
Georgia	173,714	31,817	205,531	8	10
Hawaii	21,020	5,910	26,930	46	35
Idaho	40,201	5,865	46,066	39	48
Illinois	152,095	46,065	198,160	11	9
Indiana	172,050	30,587	202,637	9	17
Iowa	51,905	12,234	64,139	36	20
Kansas	76,296	17,859	94,155	28	31
Kentucky	95,008	19,593	114,601	23	24
Louisiana	120,940	19,315	140,255	18	27
Maine	30,566	4,238	34,804	40	46
Maryland	105,785	34,567	140,352	17	8
Massachusetts	82,553	23,631	106,184	27	29
Michigan	222,795	59,597	282,392	5	3
Minnesota	104,196	21,091	125,287	22	19
Mississippi	55,856	12,131	67,987	33	28
Missouri	108,436	20,925	129,361	19	34
Montana	29,771	3,783	33,554	41	39
Nebraska	41,326	11,008	52,334	38	30
Nevada	75,732	8,570	84,302	30	38
New Hampshire	23,430	4,821	28,251	44	44
New Jersey	119,660	30,532	150,192	16	18
New Mexico	42,999	12,858	55,857	37	25
New York	295,133	62,992	358,125	4	11
North Carolina	160,192	38,724	198,916	10	14
North Dakota	28,712	3,981	32,693	42	40
Ohio	224,519	46,775	271,294	6	6
Oklahoma	93,204	16,242	109,446	24	33
Oregon	66,182	15,306	81,488	31	22
Pennsylvania	217,591	38,389	255,980	7	4
Rhode Island	19,457	3,988	23,445	48	49
South Carolina	76,132	17,854	93,986	29	23
South Dakota	27,706	4,280	31,986	43	50
Tennessee	104,457	21,145	125,602	21	32
Texas	433,654	101,007	534,661	2	2
Utah	98,110	10,322	108,432	26	26
Vermont	16,434	1,952	18,386	49	43
Virginia	147,070	45,178	192,248	12	13
Washington	91,582	17,232	108,814	25	7
West Virginia	55,615	9,714	65,329	34	42
Wisconsin	133,019	21,502	154,521	13	12
Wyoming	9,468	3,284	12,752	50	47

Sources: National Digest of Education Statistics - 2008, Table 217. Arizona Center data on research.
* Note that enrollment figures are for all public institutions, whether those are included in the research figures or not.

Table 3. Indicators of Academic Research & Development, by State				
State	**Academic R&D Spending per $1,000 of GDP, 2005**	**Rank**	**Academic Patents Awarded per 1,000 S&E Doctorate Holders in Academia, 2005**	**Rank**
Alabama	3.90	19	8.0	19
Alaska	3.90	20	-	-
Arizona	3.39	29	5.4	30
Arkansas	2.41	43	9.7	9
California	3.88	21	20.2	1
Colorado	3.85	22	2.4	43
Connecticut	3.46	28	8.6	16
Delaware	2.04	47	7.4	20
Florida	2.17	46	13.3	3
Georgia	3.56	25	8.8	14
Hawaii	4.39	16	3.6	41
Idaho	2.61	40	-	-
Illinois	3.19	36	7.0	24
Indiana	3.21	34	6.3	27
Iowa	4.66	11	8.3	17
Kansas	3.31	31	2.3	44
Kentucky	3.26	32	6.3	26
Louisiana	3.21	35	5.2	32
Maine	1.82	49	0.8	46
Maryland	6.87	1	12.8	4
Massachusetts	6.50	2	13.8	2
Michigan	3.91	18	11.5	6
Minnesota	2.42	42	10.8	7
Mississippi	4.43	15	8.9	12
Missouri	4.15	17	4.9	33
Montana	5.71	4	4.1	39
Nebraska	4.99	7	7.3	21
Nevada	1.62	50	1.2	45
New Hampshire	5.31	5	8.1	18
New Jersey	2.03	48	8.9	13
New Mexico	4.96	8	5.4	29
New York	3.75	24	8.6	15
North Carolina	4.71	10	10.3	8
North Dakota	6.02	3	3.1	42
Ohio	3.46	27	6.7	25
Oklahoma	2.40	44	4.8	35
Oregon	3.78	23	4.4	37
Pennsylvania	4.84	9	7.2	22
Rhode Island	4.58	13	5.3	31
South Carolina	3.47	26	4.8	34
South Dakota	2.19	45	-	-
Tennessee	3.23	33	4.2	38
Texas	3.11	37	9.1	11
Utah	4.53	14	7.2	23
Vermont	5.09	6	3.8	40
Virginia	2.61	41	4.6	36
Washington	3.32	30	5.5	28
West Virginia	2.73	39	-	-
Wisconsin	4.60	12	12.8	5
Wyoming	3.06	38	9.6	10
United States	**3.63**		**9.2**	

Source: National Science Foundation: Science and Engineering Indicators 2008 - Tables 8-35, 8-39. Includes both public and private institutions.

Table 4. College Attainment, and Per Capita Personal Income, by State					
State	Bachelor's Degree Holders 25-64 years old, 2005	Degree Holders as % of workforce, 2005	Rank	Personal income per capita, 2006	Rank
Alabama	549,086	26.7	38	31,484	43
Alaska	96,854	30.4	21	38,898	16
Arizona	781,932	28.7	27	33,498	35
Arkansas	287,058	22.5	50	29,573	48
California	5,732,017	34.2	12	41,404	7
Colorado	936,007	38.4	6	40,912	10
Connecticut	707,700	40.8	2	52,702	1
Delaware	131,287	31.6	18	39,168	15
Florida	2,398,022	28.6	29	38,308	19
Georgia	1,394,550	31.8	17	33,473	36
Hawaii	200,132	32.6	14	38,520	17
Idaho	178,690	25.6	41	31,668	42
Illinois	2,113,824	34.6	9	39,549	13
Indiana	745,940	24.4	46	32,881	40
Iowa	404,729	25.8	40	33,853	29
Kansas	425,214	30.6	20	35,756	22
Kentucky	467,998	24.9	45	30,129	47
Louisiana	496,071	25.6	42	33,750	31
Maine	193,647	28.9	26	33,735	32
Maryland	1,095,665	38.8	4	45,121	4
Massachusetts	1,387,065	43.2	1	47,330	3
Michigan	1,407,669	29.8	24	33,198	38
Minnesota	906,335	32.4	15	40,015	11
Mississippi	293,533	23.9	48	28,010	50
Missouri	792,737	27.8	33	34,062	28
Montana	139,593	30.1	22	32,204	41
Nebraska	267,867	28.5	30	35,726	23
Nevada	272,492	23.1	49	39,376	14
New Hampshire	243,698	34.7	8	40,999	9
New Jersey	1,734,942	40.8	3	47,655	2
New Mexico	252,804	29.1	25	30,587	45
New York	3,460,430	38.6	5	43,973	6
North Carolina	1,229,917	29.9	23	33,640	33
North Dakota	95,520	27.9	32	33,602	34
Ohio	1,521,816	27.4	35	34,093	27
Oklahoma	431,778	26.5	39	33,280	37
Oregon	564,786	32.2	16	34,623	26
Pennsylvania	1,842,351	30.9	19	37,326	20
Rhode Island	181,553	33.6	13	38,392	18
South Carolina	534,821	27.6	34	31,031	44
South Dakota	104,555	25.4	44	33,767	30
Tennessee	750,100	27.2	37	32,986	39
Texas	3,062,665	28.7	28	35,275	25
Utah	339,337	28.0	31	30,320	46
Vermont	118,184	34.6	10	36,021	21
Virginia	1,438,181	38.0	7	41,367	8
Washington	1,069,031	34.6	11	39,623	12
West Virginia	181,476	24.1	47	28,722	49
Wisconsin	791,966	27.4	36	35,665	24
Wyoming	68,128	25.5	43	44,700	5
United States	**44,972,214**	**31.7**		**37,728**	

Sources: National Science Foundation: Science and Engineering Indicators 2008 Arlington, VA (NSB 08-01; NSB 08-01A) | January 2008; U.S. Bureau of Economic Analysis, Regional Economic Accounts, http://www.bea.gov/regional/spi

Table 5. Enrollment Growth, and Enrollment in College, as % of Population Ages 18-24					
State	Fall Enrollment in Degree-Granting Institutions, 2006	Growth in State's Fall Enrollment, 2000-2006	Rank in % Growth	Enrollment as a % of 2006 Population, 18-24	Rank in % Enrolled
Alabama	258,408	10.4	39	57.7	31
Alaska	29,853	6.8	49	41.6	50
Arizona	567,192	65.6	1	96.4	1
Arkansas	147,391	28.0	4	55.2	38
California	2,434,774	7.9	46	64.3	14
Colorado	308,383	16.9	18	67.1	6
Connecticut	176,716	9.6	42	55.3	37
Delaware	51,238	16.7	19	61.6	18
Florida	885,651	25.1	8	55.5	36
Georgia	435,403	25.8	7	47.6	49
Hawaii	66,893	11.2	36	53.5	39
Idaho	77,872	18.7	15	52.2	42
Illinois	830,676	11.7	34	64.8	11
Indiana	368,013	17.1	17	59.8	25
Iowa	238,634	26.3	6	76.5	2
Kansas	193,146	7.3	47	66.0	9
Kentucky	248,914	32.2	2	64.8	12
Louisiana	224,147	0.2	50	49.2	48
Maine	66,149	13.1	30	57.2	33
Maryland	319,460	16.7	20	59.9	23
Massachusetts	451,526	7.2	48	71.3	4
Michigan	634,489	11.8	33	64.6	13
Minnesota	375,899	28.1	3	72.3	3
Mississippi	151,137	10.0	41	49.8	47
Missouri	377,098	17.3	16	66.3	7
Montana	47,501	12.5	32	50.0	46
Nebraska	124,500	11.0	37	65.9	10
Nevada	112,270	27.7	5	52.6	41
New Hampshire	70,669	14.5	26	58.9	28
New Jersey	385,656	14.8	25	50.5	44
New Mexico	131,828	19.0	14	64.3	15
New York	1,160,364	11.2	35	59.8	24
North Carolina	495,633	22.5	11	59.4	26
North Dakota	49,519	23.0	10	60.6	22
Ohio	619,942	12.8	31	56.5	34
Oklahoma	206,236	15.9	22	55.9	35
Oregon	197,594	7.9	45	58.1	30
Pennsylvania	707,132	16.0	21	59.0	27
Rhode Island	81,734	8.3	44	70.4	5
South Carolina	212,422	14.2	28	50.2	45
South Dakota	48,931	13.2	29	58.9	29
Tennessee	290,530	10.1	40	52.9	40
Texas	1,252,709	21.2	12	51.2	43
Utah	202,151	23.4	9	63.4	17
Vermont	41,095	15.8	23	66.1	8
Virginia	456,172	19.5	13	61.1	20
Washington	348,154	8.5	43	57.3	32
West Virginia	100,519	14.4	27	61.5	19
Wisconsin	340,158	10.7	38	60.6	21
Wyoming	34,693	15.6	24	63.9	16
United States	**17,758,870**	**16.0**		**60.3**	

Sources: U.S. Census Bureau; National Digest of Education Statistics - 2008, Table 208. Data count any degree-granting institution - four-year or two-year, public or private. Note that enrollment figures include both students who originally came from outside as well as within the state.

Table 6. Bachelor's Degrees Conferred, by State				
State	Bachelor's Degrees Conferred, 2005	Population Aged 18-24, 2005	New Degrees Per 1,000 People Ages 18-24	Rank
Alabama	21,388	448,894	47.6	32
Alaska	1,427	70,429	20.3	50
Arizona	34,915	576,725	60.5	10
Arkansas	11,186	270,471	41.4	41
California	139,417	3,726,736	37.4	45
Colorado	24,936	459,040	54.3	21
Connecticut	16,835	313,202	53.8	23
Delaware	5,220	83,016	62.9	9
Florida	60,434	1,572,959	38.4	43
Georgia	35,086	903,396	38.8	42
Hawaii	5,127	123,584	41.5	40
Idaho	7,235	149,739	48.3	28
Illinois	59,611	1,274,718	46.8	33
Indiana	36,579	623,312	58.7	14
Iowa	20,418	311,451	65.6	5
Kansas	16,565	292,984	56.5	17
Kentucky	17,905	395,618	45.3	37
Louisiana	21,199	490,354	43.2	38
Maine	6,485	117,048	55.4	18
Maryland	25,685	526,277	48.8	27
Massachusetts	45,623	625,908	72.9	3
Michigan	50,565	986,126	51.3	24
Minnesota	27,869	516,133	54.0	22
Mississippi	11,681	311,137	37.5	44
Missouri	33,838	572,472	59.1	12
Montana	5,177	94,488	54.8	19
Nebraska	11,993	188,583	63.6	8
Nevada	5,029	207,871	24.2	49
New Hampshire	8,111	121,124	67.0	4
New Jersey	31,987	747,332	42.8	39
New Mexico	6,580	205,017	32.1	47
New York	112,475	1,919,224	58.6	15
North Carolina	39,289	822,150	47.8	29
North Dakota	5,161	80,276	64.3	7
Ohio	56,993	1,112,156	51.2	25
Oklahoma	17,922	375,095	47.8	30
Oregon	16,296	341,623	47.7	31
Pennsylvania	78,044	1,191,907	65.5	6
Rhode Island	9,811	116,201	84.4	1
South Carolina	19,256	420,351	45.8	35
South Dakota	4,921	83,635	58.8	13
Tennessee	25,770	557,703	46.2	34
Texas	88,000	2,421,692	36.3	46
Utah	19,565	326,302	60.0	11
Vermont	4,841	62,424	77.6	2
Virginia	36,747	737,118	49.9	26
Washington	27,571	605,063	45.6	36
West Virginia	9,572	167,236	57.2	16
Wisconsin	30,839	562,611	54.8	20
Wyoming	1,695	54,090	31.3	48
United States	**1,420,043**	**29,333,266**	**48.4**	

Source: National Science Foundation: Science and Engineering Indicators 2008 Arlington, VA (NSB 08-01; NSB 08-01A) | January 2008. Data include degrees conferred by both public and private institutions in the state.

Table 7. College Enrollment, Blacks and Hispanics Compared To All Students, by State							
State	Black Enrollment, Fall 2006	% of Blacks, 18-24	Rank	Hispanic Enrollment, Fall 2006	% of Hispanics, 18-24	Rank	All Students, Share of All 18-24s
Alabama	74,706	51.6	34	4,050	34.8	24	57.7
Alaska	1,034	28.0	49	1,117	22.3	44	41.6
Arizona	55,215	243.3	1	90,784	45.5	8	96.4
Arkansas	27,615	51.1	35	3,270	21.9	45	55.2
California	187,898	73.6	12	654,999	42.6	12	64.3
Colorado	17,782	90.7	7	36,023	35.3	23	67.1
Connecticut	18,867	50.6	36	14,902	32.9	31	55.3
Delaware	10,173	53.0	28	1,918	33.6	26	61.6
Florida	158,812	49.6	40	166,973	45.7	7	55.5
Georgia	133,082	43.3	45	11,804	16.6	49	47.6
Hawaii	1,372	23.9	50	2,022	13.7	50	53.5
Idaho	662	56.2	25	3,812	24.2	43	52.2
Illinois	118,401	56.8	24	97,790	45.0	10	64.8
Indiana	31,669	53.3	27	11,059	33.3	28	59.8
Iowa	13,280	142.9	2	7,605	60.0	3	76.5
Kansas	11,733	57.6	22	9,153	33.8	25	66.0
Kentucky	22,312	60.2	18	3,041	32.0	34	64.8
Louisiana	65,386	39.7	48	5,786	37.2	17	49.2
Maine	1,322	81.5	8	842	45.1	9	57.2
Maryland	88,870	52.8	29	13,096	35.7	22	59.9
Massachusetts	36,392	77.1	10	28,745	43.1	11	71.3
Michigan	87,311	59.6	20	17,971	38.8	15	64.6
Minnesota	29,338	116.3	4	8,161	38.3	16	72.3
Mississippi	59,252	45.1	44	1,310	21.0	46	49.8
Missouri	47,311	63.9	16	11,080	57.2	4	66.3
Montana	290	43.0	46	826	26.9	37	50.0
Nebraska	5,635	61.2	17	4,539	33.3	29	65.9
Nevada	8,884	52.3	33	17,025	28.7	36	52.6
New Hampshire	1,459	109.9	5	1,781	50.8	6	58.9
New Jersey	54,650	45.4	43	53,089	36.8	19	50.5
New Mexico	3,861	75.5	11	54,690	55.2	5	64.3
New York	160,707	48.9	41	133,361	36.9	18	59.8
North Carolina	121,528	57.0	23	13,675	21.0	47	59.4
North Dakota	798	57.8	21	522	26.2	40	60.6
Ohio	75,639	52.4	32	12,845	40.9	13	56.5
Oklahoma	18,542	53.4	26	7,526	24.9	42	55.9
Oregon	4,832	69.7	15	10,860	26.7	39	58.1
Pennsylvania	74,113	52.6	30	22,835	36.8	20	59.0
Rhode Island	5,041	71.2	14	5,573	39.9	14	70.4
South Carolina	58,560	41.4	47	3,651	20.4	48	50.2
South Dakota	728	79.7	9	487	25.0	41	58.9
Tennessee	57,065	50.0	38	5,464	26.9	38	52.9
Texas	156,044	50.0	39	339,190	35.9	21	51.2
Utah	2,747	91.3	6	10,185	32.1	33	63.4
Vermont	793	122.0	3	921	78.1	1	66.1
Virginia	89,979	52.4	31	18,298	32.7	32	61.1
Washington	15,015	59.7	19	20,748	31.0	35	57.3
West Virginia	5,430	72.5	13	1,252	61.5	2	61.5
Wisconsin	17,597	45.7	42	10,087	33.5	27	60.6
Wyoming	391	50.3	37	1,487	33.2	30	63.9
United States	**2,279,605**	**54.7**		**1,964,319**	**39.2**		**60.3**

Sources: U.S. Census Bureau; National Digest of Education Statistics - 2008, Table 229. Data count any degree-granting institution - four-year or two-year, public or private - as well as students who originally came from outside as well as within the state.

Table 8. Science and Engineering Degrees Conferred, by State					
State	Science & Engineering Degrees, 2005	S&E Degrees as a Percentage of All Degrees	Rank	Growth in S&E Degrees Conferred Since 1996	Rank in Growth
Alabama	7,951	24.9	42	14.0	35
Alaska	676	32.1	15	0.9	48
Arizona	10,968	18.2	50	64.8	1
Arkansas	3,306	23.1	48	19.2	22
California	75,803	38.3	2	29.5	7
Colorado	13,189	37.3	4	19.1	23
Connecticut	8,154	30.9	18	16.9	28
Delaware	2,158	28.9	26	13.9	36
Florida	23,974	28.3	29	38.7	3
Georgia	14,394	29.6	22	36.2	5
Hawaii	2,349	33.4	10	21.0	18
Idaho	2,360	26.3	38	37.0	4
Illinois	25,927	27.1	36	20.3	20
Indiana	13,317	27.2	34	12.1	41
Iowa	7,328	28.9	27	12.6	39
Kansas	6,139	26.9	37	15.1	30
Kentucky	6,085	24.2	44	23.4	15
Louisiana	7,773	27.4	33	14.6	32
Maine	2,550	31.2	17	17.6	26
Maryland	15,608	39.1	1	36.0	6
Massachusetts	25,232	33.4	11	13.5	37
Michigan	21,249	28.4	28	13.1	38
Minnesota	11,199	27.4	32	20.6	19
Mississippi	3,577	22.5	49	3.0	46
Missouri	12,852	24.6	43	24.5	13
Montana	2,254	35.1	5	19.2	21
Nebraska	3,836	23.4	47	23.0	16
Nevada	1,826	27.2	35	55.0	2
New Hampshire	3,316	30.8	19	14.6	33
New Jersey	15,667	34.4	7	24.7	12
New Mexico	2,860	29.4	24	(0.1)	49
New York	51,555	29.2	25	18.8	24
North Carolina	16,664	32.0	16	14.8	31
North Dakota	1,539	23.8	45	5.3	45
Ohio	20,687	25.8	40	7.0	43
Oklahoma	6,286	26.3	39	26.2	10
Oregon	7,691	33.8	9	25.0	11
Pennsylvania	31,632	29.5	23	22.8	17
Rhode Island	3,646	29.7	21	12.4	40
South Carolina	6,857	27.6	31	16.4	29
South Dakota	2,017	32.4	14	1.4	47
Tennessee	8,706	24.9	41	11.4	42
Texas	34,716	28.1	30	27.4	8
Utah	7,840	33.3	12	24.3	14
Vermont	2,493	38.1	3	17.2	27
Virginia	17,549	34.6	6	14.1	34
Washington	12,020	32.9	13	26.2	9
West Virginia	2,945	23.5	46	6.7	44
Wisconsin	12,160	30.2	20	18.6	25
Wyoming	757	34.4	8	(15.9)	50
United States	**609,114**	**29.9**		**21.3**	

Source: National Science Foundation: Science and Engineering Indicators 2008, table 8-17. Data include degrees conferred by both public and private institutions in the state, regardless of whether the recipient originally came from within or outside the state.

Table 9. Enrollment in Public Two-Year Colleges, by State					
State	Enrollment in Public Two-Year Institutions, Fall 2006	As Percentage of 18-24 Population	Rank in 18-24 Enrollment	As Percentage of Population Over 18	Rank in Over-18 Enrollment
Alabama	76,811	17.2	25	2.2	26
Alaska	1,081	1.5	50	0.2	50
Arizona	201,862	34.3	3	4.4	4
Arkansas	48,972	18.4	22	2.3	23
California	1,421,282	37.6	1	5.3	1
Colorado	77,956	17.0	26	2.2	27
Connecticut	46,489	14.5	32	1.7	36
Delaware	14,048	16.9	27	2.2	28
Florida	253,457	15.9	28	1.8	35
Georgia	137,354	15.0	31	2.0	30
Hawaii	22,419	17.9	23	2.3	24
Idaho	12,570	8.4	47	1.2	46
Illinois	349,924	27.3	6	3.6	7
Indiana	64,595	10.5	44	1.4	40
Iowa	84,447	27.1	7	3.7	6
Kansas	74,007	25.3	8	3.6	8
Kentucky	86,237	22.4	12	2.7	19
Louisiana	49,057	10.8	42	1.5	39
Maine	12,702	11.0	41	1.2	44
Maryland	116,940	21.9	16	2.7	16
Massachusetts	85,557	13.5	36	1.7	37
Michigan	222,519	22.6	10	2.9	14
Minnesota	114,821	22.1	15	2.9	13
Mississippi	67,178	22.1	14	3.1	10
Missouri	86,330	15.2	30	2.0	32
Montana	8,846	9.3	45	1.2	45
Nebraska	40,831	21.6	17	3.1	11
Nevada	16,559	7.8	48	0.9	49
New Hampshire	13,279	11.1	40	1.3	43
New Jersey	154,085	20.2	20	2.3	22
New Mexico	64,802	31.6	4	4.5	3
New York	272,950	14.1	34	1.8	34
North Carolina	203,687	24.4	9	3.0	12
North Dakota	9,419	11.5	39	1.9	33
Ohio	173,438	15.8	29	2.0	29
Oklahoma	65,601	17.8	24	2.4	20
Oregon	76,738	22.6	11	2.7	18
Pennsylvania	126,143	10.5	43	1.3	42
Rhode Island	16,373	14.1	33	2.0	31
South Carolina	79,838	18.9	21	2.4	21
South Dakota	5,418	6.5	49	0.9	48
Tennessee	76,551	13.9	35	1.7	38
Texas	547,190	22.3	13	3.2	9
Utah	38,823	12.2	37	2.2	25
Vermont	5,593	9.0	46	1.1	47
Virginia	160,576	21.5	18	2.8	15
Washington	185,651	30.6	5	3.8	5
West Virginia	19,029	11.6	38	1.3	41
Wisconsin	115,179	20.5	19	2.7	17
Wyoming	19,657	36.2	2	5.0	2
United States	**6,224,871**	**16.0**		**2.8**	

Sources: U.S. Census Bureau; National Digest of Education Statistics - 2008, Table 217.

Table 10. Per Capita State and Local Spending on Higher Education, by State		
State	**Spending Per Capita, 2006-07**	**Rank**
Alabama	865	10
Alaska	915	9
Arizona	619	34
Arkansas	728	26
California	733	24
Colorado	731	25
Connecticut	602	36
Delaware	997	4
Florida	446	50
Georgia	502	48
Hawaii	803	15
Idaho	618	35
Illinois	597	37
Indiana	725	27
Iowa	947	7
Kansas	863	11
Kentucky	707	28
Louisiana	627	33
Maine	571	41
Maryland	770	22
Massachusetts	574	40
Michigan	838	14
Minnesota	705	29
Mississippi	790	18
Missouri	565	43
Montana	787	19
Nebraska	842	13
Nevada	540	46
New Hampshire	581	39
New Jersey	548	45
New Mexico	995	5
New York	566	42
North Carolina	921	8
North Dakota	1,116	2
Ohio	653	32
Oklahoma	783	20
Oregon	795	16
Pennsylvania	550	44
Rhode Island	534	47
South Carolina	675	31
South Dakota	585	38
Tennessee	490	49
Texas	684	30
Utah	978	6
Vermont	1,145	1
Virginia	774	21
Washington	792	17
West Virginia	758	23
Wisconsin	861	12
Wyoming	1,029	3
U.S. average	**678**	

Source: Calulations based on data from the U.S. Bureau of the Census - Census of Government Finances, 2007; current population estimates.

Endnotes

1 David Warsh, *Knowledge and the Wealth of Nations: A Story of Economic Discovery* (New York: W.W. Norton Co., 2006), 400.

2 Testimony of Bruce Mehlman, Assistant Secretary of Commerce for Technology Policy, House Committee on Small Business, *The Globalization of White-Collar Jobs: Can America Lose These Jobs and Still Prosper: Hearing before the Committee on Small Business, 108th Congress*, 18, 2003, 59-68.

3 Elizabeth Capaldi, John V. Lombardi, Craig W. Abbey, and Diane D. Craig, *The Top American Research Universities: 2008 Annual Report* (Tempe, AZ: University of Arizona, Center for Measuring University Performance, 2008).

4 Ibid. The Center notes that the numbers found in its tables "may not always match the figures published by the original source. The Center makes adjustments, when necessary, to ensure that the data reflect the activity at a single campus rather than that of a multiple campus institution or state university system." The Rockefeller Institute computed the ranking of individual institutions and of states from the Center's numbers on institutions. Smaller institutions in each state also raise smaller amounts of research dollars, so the total research dollars raised by all public institutions in each state (not just the larger ones we list here) would be somewhat higher than the totals shown. Comprehensive, comparable data for the smaller institutions are not available. From a sampling of reports from smaller institutions, however, we believe that including them would result in few, if any, changes in state rankings.

5 Ross C. Devol, *America's High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas* (Santa Monica, CA: Milken Institute, 1999), 97, 53. The study conceded that a cause-and-effect relationship is difficult to quantify precisely, because "many of the traditional location factors (cost-of-doing-business measures) that are especially attractive to high-tech manufacturing industries also are important to non-high-tech manufacturing industries…. Nonetheless, we can conclude that high-tech output growth is closely associated with total output growth of metros and that the relationship is robust."

6 Timothy J. Bartik and George Erickcek, *The Local Economic Impact of "Eds & Meds": How Policies to Expand Universities and Hospitals Affect Metropolitan Economies* (Washington, DC: Brookings Institution Metropolitan Policy Program, December 2008), 15.

7 Calculated multipliers vary widely, depending upon such variables as the degree to which an entity's spending is local, and the size of the geographic area for which the multiplier is being calculated. (There is a kind of "ripple effect" in that the estimated multiplier for a given amount and kind of spending becomes greater, though at a progressively slower rate, the farther out from the center of spending the calculations account for.) Two widely cited studies suggest regional impact multipliers for overall university spending, including but not limited to research, in the range of 1.7 to 1.8. See Larry L. Leslie and Sheila A. Slaughter, "Higher Education and Regional Development," in William E. Becker and Darrell R. Lewis, eds., *The Economics of American Higher Education* (New York: Kluwer Academic Publishers, 1992). And John J. Siegfried, Allen R. Sanders, and Peter McHenry, "The Economic Impact of Colleges and Universities"(Working Paper no. 06-W12, Vanderbilt University Department of Economics, 2006).

8 Jason R. Abel and Richard Deitz, *Do Colleges and Universities Increase Their Region's Human Capital?* (New York: Federal Reserve Bank of New York, Staff Report no. 401, October 2009), 4

9 State Science and Technology Institute, *A Resource Guide for Technology-Based Economic Development: Positioning Universities as Drivers Fostering Entrapreneurship Increasing Access to Capital*, prepared for the Economic Development Administration, U.S. Department of Commerce (August 2006), 12-13.

10 Jerry Paytas, Robert Gradeck, and Lena Andrews, "Universities and the Development of Industry Clusters," prepared for the Economic Development Administration, U.S. Department of Commerce (Pittsburgh, PA: Center for Economic Development, Carnegie Mellon University, 2004), 44.

11 There is a substantial literature on the role of universities in working with local industry clusters. See, for example, Jerry Paytas et al., "Universities and the Development of Industry Clusters." Also, Council on Competitiveness, *Cooperate: A Practitioner's Guide for Effective Alignment of Regional Development and Higher Education,* prepared for the U.S. Department of Labor Employment and Training Administration (March 2008). And Lauren Millier, "Economic Clusters: Universities as a Catalyst for Development," *EcDevJournal.com (2002)*, http://www.ecdevjournal.com/index.php?Itemid=28&id=279&option=com_content&task=view.

12 The Association of University Technology Managers, *AUTM U.S. Licensing Activity Survey: FY2008,* www.autm.net.

13 Albert Link and John T. Scott, "The Growth of Research Triangle Park." *Small Business Economics, 20*, 2003, 167-175.

14 All data from the Regional Economic Accounts, Bureau of Economic Analysis, U.S. Department of Commerce: http://www.bea.gov/regional/.

15 Rick L. Weddle, Elizabeth Rooks, and Tina Valdecanas, "Research Triangle Park: Evolution and Renaissance," (presentation to the IASP World Conference, June 2006), 6-7.

16 James J. Zuiches, "Bringing New Ideas to Market," *Science Progress* (2009), http://www.scienceprogress.org/2009/12/bringing-new-ideas-to-market.

17 Georgia Research Alliance, "About GRA," www.gra.org/AboutGRA/Origins.aspx. State funds pay for the alliance's grants and loans to universities and startups, but its internal operating budget is raised privately, from foundations and corporations.

18 More details are available at www.gra.org.

19 See University Research Park, University of Wisconsin Madison, http://universityresearchpark.org/.

20 See Virginia Bio-Technology Research Park, http://vabiotech.com/.

21 It should be noted, however, that for many new and small businesses, their most important customers are big businesses. Over the last 50 years the share of employment in large corporations has declined while smaller companies have grown their share — often because of outsourcing by the larger companies to the smaller ones.

22 Ron Kitchens, with Daniel Gross and Heather Smith, *Community Capitalism: Lessons from Kalamazoo and Beyond* (Bloomington, IN: AuthorHouse, 2008), 56. Kitchens is president of Southwest Michigan First, the economic development organization in Kalamazoo.

23 Edward L. Glaeser and Albert Saiz, "The Rise of the Skilled City" (Discussion Paper No 2025, Harvard Institute of Economic Research), 44.

24 "Higher Education and Regions," *OECD Observer*, September 2007.

25 Richard K. Lester, "Universities, Innovation, and the Competitiveness of Local Economies" (Working Paper 05-010, Industrial Performance Center , Massachusetts Institute of Technology, December 2005), 3, 6.

26 Ibid., 16-22.

27 Michelle Van Noy et al., *Noncredit Enrollment in Workforce Education: State Policies and Community College Practices* (Washington, DC: Community College Research Center at Columbia University, for the American Association of Community Colleges, 2008), 41-42. The states that provide general fund support are Arkansas, Arizona, California, Florida, Idaho, Illinois, Iowa, Kentucky, Maryland, Michigan, Minnesota, Mississippi, Montana, Nebraska, New Jersey, New Mexico, North Carolina, North Dakota, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Texas, Utah, Virginia, West Virginia, and Wisconsin. Other states may provide support on a discretionary basis for specific training programs developed for a particular company they are trying to attract or keep.

28 Ibid., 11. This report offers extensive insights on how community college systems do, or don't, address the barriers between their noncredit offerings on the one hand, and their for-credit faculty and courses on the other. It also notes that some colleges successfully use noncredit courses as a "marketing tool" that helps them attract students to for-credit offerings as well.

29 Richard A. Voorhees and John H. Milam, "The Hidden College: Noncredit Education in the United States" (Paper prepared for Highered.org, Voorhees Group, 2005), 1, 3, http://www.voorheesgroup.org/Hidden%20College.pdf. Based on Census data, the American Association of Community Colleges calculates that enrollment in noncredit courses each year is equal, or nearly so, to the 6 million enrolled in for-credit courses.

30 Quick Start Technical College System of Georgia, "Inside the Quick Start Process " (Atlanta, GA: Technical College System of Georgia, 2009), 6.

31 Georgia Tech Enterprise Innovation Institute, *Annual Report 2009* (Atlanta, GA: Georgia Tech Enterprise Innovation Institute), 3.

32 For more, see Iowa State University, "Industry Relations," http://www.industry.iastate.edu/.

33 See Springfield Technical Community College, Division of Economic and Business Development, Technology Park, http://techpark.stcc.edu/.

34 Michael Porter, *Colleges and Universities and Regional Economic Development: A Strategic Perspective* (Cambridge, MA: Forum for the Future of Higher Education, Forum Futures 2007), 43.

35 John Stuart Hall, "Universities and Downtowns: Phoenix's Big Breakthrough," http://citiwire.net/post/434/, November 2008

36 Stephen L. Percy, Nancy L. Zimpher, and Mary Jane Brukardt, eds. *Creating a New Kind of University: Institutionalizing Community-University Engagement* (Bolton, MA: Anker Publishing Co., 2006).

37 Porter, *Colleges and Universities.*

38 Claudia Goldin and Lawrence F. Katz, *The Race Between Education and Technology.* Cambridge, MA: The Belknap Press of Harvard University Press, 2008, 1-2.

39 Lee Harvey, "New Realities: The Relationship Between Higher Education and Employment," *Tertiary Education and Management 6*. Amsterdam: Kluwer Academic Publishers, 2000, 3.

40 Fall 2006, the most recent year for which comprehensive statistics are available from the federal Integrated Post Secondary Educational Data System, or IPEDS. Enrollment figures in Table 5, for all degree-granting institutions, should be read with figures for enrollment in two-year colleges only, which appear in Table 9 on page 67.

41 As the table shows, states vary widely on this measure. But the figures should be read carefully. Rhode Island, Massachusetts, and some other high-ranking states attract significant numbers of college students from out-of-state, which makes their numbers look higher; lower-ranking states like Nevada and Wyoming are significant net exporters of students. Comparisons among states whose circumstances are more nearly similar — New Jersey, Pennsylvania, Ohio, and New York, for example — might be worth further study.

42 Again the caveat is that these data do not precisely reflect the share of the 18-24 population, alone, going to college, because the enrollment figures include some undetermined numbers of students older than 24.

43 The University of Maryland, "Freeman Hrabowski" in "The 10 Best College Presidents," *Time Magazine,* November 11, 2009, http://www.time.com/time/specials/packages/article/0,28804,1937938_1937933_1937920,00.html.

44 American Association of Community Colleges. "Community College Enrollment Surge: An Analysis of Estimated Fall 2009 Headcount Enrollments at Community Colleges." Washington, DC: AACC Policy Brief 2009-01PBL, December 2009, p. 5. Note that both the IPEDS data and the AACC estimates are limited to students in credit-bearing courses at two-year colleges; those colleges are estimated to enroll another 5 million students each year in noncredit courses, ranging from remedial education to job-specific training course.

45 Harry J. Holzer and Robert I. Lerman, *The Future of Middle-Skill Jobs* (Washington, DC: The Brookings Institution, February 2009), 4-5.

46 The U.S. Department of Education published a 2009 "meta-analysis" of 51 independent, controlled studies of online learning and concluded that students who took online courses performed better, on average, than those who took the same course in a classroom: Barbara Means, Yukie Toyama, Robert Murphy, Marianne Bakia, and Karla Jones, "Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies." Washington, DC: U.S. Department of Education, Office of Planning, Evaluation and Policy Development, 2009.

47 U.S. Bureau of the Census, "Census of Government Finance," State and Local Finances, 2006-2007, Table 1, http://www.census.gov/govs/estimate/.

48 For data on tax burdens by state, see the Public Policy Institute of New York State, Inc., www.ppinys.org/reports/jtf.

49 A.T. Kearney Management Consultants, *Delivering on the Promise of New York State: A Strategy for Economic Growth & Revitalization* (New York, 2007), 28-29.

50 Alan H. Peters and Peter S. Fisher, *State Enterprise Zone Programs: Have They Worked?* (Kalamazoo, MI: W.E. Upjohn Institute for Employment Research, 2002).

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