



POLICY MATTERS

Tapping State College Research and Development Capacity in Support of State Economic Development

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Applied research and development activities at regional state colleges and universities bolster their primary mission of undergraduate education as well as contribute to local and statewide economic growth. As states boost efforts to fund and stimulate research as part of an integrated economic development strategy, they should seek to fully harness the research and innovation capacity of all four-year public colleges and universities.

Context

Research, entrepreneurial and technology transfer activities at universities serve as major conduits for strengthening business creation, recruitment and retention within and across states' borders. As part of a coordinated effort to best utilize academic institutions' capacity to foster innovation and economic activity, states increasingly complement federal research and development (R&D) efforts with investments in applied research and business development activities focused on new and promising fields. Although public and private universities with research-intensive missions are the core recipients of federal and state investments in research and development initiatives, regional state colleges play a meaningful, albeit less extensive, role

in research and commercialization efforts. Broader economic trends are influenced by globalization and regionalization—which often transcend traditional political, geographic and cultural boundaries. Given their propensity to serve as regional economic hubs, state colleges offer great opportunities for integrating state economic interests to broader regional economic development strategies.

According to National Science Foundation (NSF) data, academic institutions in the U.S. expended \$47 billion for R&D activities in FY 2006. Funding sources include those from federal, state and local governments, industry, and institutions themselves. This includes \$32 billion spent at public institutions and \$15 billion spent at private institutions. Member institutions of the American Association of State Colleges and Universities (AASCU) expended an impressive \$2.5 billion, although this represents just 5.2 percent of total R&D spending, or 7.6 percent of such spending at public institutions.

This R&D spending translates directly into job growth. According to methodologies developed by Bureau of Economic Analysis of the U.S. Department of Commerce and reported by the Wisconsin

Technology Council, every \$1 million in R&D spending generates 36 jobs. For AASCU institutions alone, this equates to the addition of 90,000 well-paying, high skill jobs spread across the U.S.

Maximizing the market potential and societal contributions of R&D activity at academic institutions are some 1,800 technology transfer professionals, according to the latest (FY 2006) annual Licensing Activity Survey conducted by the Association of University Technology Managers (AUTM). The AUTM survey indicates that in the latest 12-month reporting period, 697 new products were introduced from active licenses stemming from academic research, and 553 new start-up companies were formed. In the nine years from FY 1998 to FY 2008, 4,350 new products were introduced into the marketplace. Since 1980, university research has led to the creation of 5,724 new companies—more than one company every two days.

Nearly all R&D spending nationwide occurs in engineering and the sciences, with the largest proportion (60.4 percent) being spent on the life sciences. Given that AASCU institutions, by and large, do not possess medical schools or extensive biomedical research facilities, they

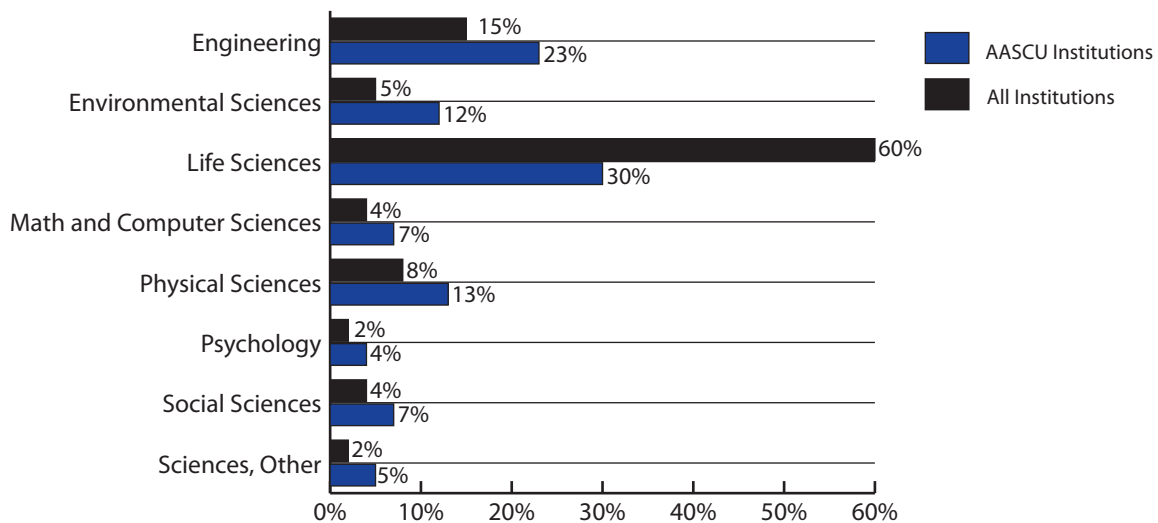
spend disproportionately less on the life sciences, but disproportionately more in areas such as engineering and environmental sciences (see Figure 1).

State college research activities are often born out of longstanding expertise held by scientists, researchers and professors in subject areas that often relate to regional industry and marketplace activities. With a focus on applied research (as opposed to basic research), state colleges possess an orientation that facilitates the transfer of research to the marketplace. An increased proclivity toward research entrepreneurialism and growth in academic programming in entrepreneurship—in addition to the flexibility and nimbleness that often accompany smaller institutions—accentuates state colleges’ inclination to play an important role in both applied research and product commercialization-driven economic development.

Observations

State colleges and universities are well positioned to contribute to a progressive state economic development strategy due to their geographical diversity, regional orientation and capacity for innovation. The U.S. finds itself in the midst of a

Figure 1. R&D Expenditures at Universities and Colleges by Field: Comparison of AASCU Institutions to All Institutions (FY 2006)



Source: National Science Foundation, Survey of Research and Development Expenditures at Universities and Colleges, FY 2006, Table 26, November 2007

swift transition to a technology-based economy, one in which new knowledge is leading to both the wholesale creation of new industries and the application of technologies to traditional industries. Much of the transition from the Industrial Age to the Knowledge Age is taking place in regional, metropolitan areas, where a confluence of resources are assembled to stimulate innovation (i.e., Route 128 in Massachusetts, Research Triangle in North Carolina and Silicon Valley in California).

A report prepared by the State Science and Technology Institute (SSTI) for the Economic Development Administration of the U.S. Department of Commerce, entitled *A Resource Guide for Technology-based Economic Development*, cites seven elements required to foster regional technology-based economies:

- An intellectual infrastructure (universities and public or private research laboratories that generate new knowledge and discoveries)
- Mechanisms for transferring knowledge from one individual or company to another
- Physical infrastructure that includes high-quality computing and telecommunications capabilities
- Highly skilled technical workforce
- Sources of risk (financial) capital
- Quality of life, and
- Entrepreneurial culture

The abundance of these elements in locations anchored by regional state colleges varies greatly and is dependent on the mission of the given academic institutions and the presence of other market forces. However, all public colleges offer at least some of these critical components.

The capacity for postsecondary institutions to strengthen states' standing in both regional and global economic competitiveness contexts is not lost on state political leaders. As illustration, in 2006 the National Governors Association (NGA) launched its Innovation America initiative, an effort aimed at increasing domestic economic competitiveness by improving the country's innovation capacity. Under the leadership of Arizona governor and then-NGA chairwoman Janet Napolitano and

Minnesota governor Tim Pawlenty, NGA vice chair and chair of the NGA Center for Best Practices, the initiative produced a set of recommendations that included the sharing of strategies on how states can harness the full innovation potential of colleges and universities. Increasing postsecondary institutions' research capacity and assisting them in accelerating the commercialization of new technologies were espoused, as was a call to states to reduce regulatory barriers and create tax policies that nurture the growth of budding high technology industries.¹

According to the Brookings Institution's Metropolitan Policy Program, metropolitan areas are home to 83 percent of the U.S. population, 85 percent of the nation's jobs, and 92 percent of all college graduates. Given state colleges' geographical proximity to major transportation hubs, regional metropolitan areas that may cross state borders, and other economic assets within states, these institutions are well equipped to serve as vital components in the development of regional "clusters"—high-tech businesses and entire industries that flourish in a given geographic setting rich in intellectual, scientific and financial capital.

It is perhaps in rural America, however, that regional state colleges have the greatest potential impact. Here, they have the unique capacity to serve as hubs for generating economic activity by providing consulting services to businesses and delivering workforce training programs tailored to local industry. These institutions also serve as conveners of widely dispersed entities representing government, business, educational and other non-profit and civic organizations. These stakeholders, when brought together as a collective, can develop solutions to pressing social, health, environmental and economic issues.

Critical to the role of state colleges is the building of "regional competence," according to John Bardo, chancellor of Western Carolina University, who has

¹*Innovation America: A Partnership* (2007). National Governors Association and the Council on Competitiveness. *Innovation America: A Compact for Postsecondary Education* (2007). National Governors Association.

strategically positioned that institution to contribute to economic development efforts overlapping several states in the Piedmont region. Regional competence, says Bardo, refers to a region's ability to respond to economic opportunities and rapidly changing global conditions. It also refers to the range of abilities, characteristics and resources available in the region and the effective linkages of that region with the resources from the systems of which that region is a part.

The role state colleges fulfill on a regional basis has been a focus of discussion and application through the work of AASCU in its regional stewardship initiative. Member institutions of the association are demonstrating mission-driven commitments to their regions, harnessing institutional capacity to cultivate innovative local economies where livable communities and collaborative government are fostered.²

Regional state colleges and universities are essential to advancing applied research and commercialization efforts that contribute to state and regional economic development agendas – even though they account for a comparatively modest amount of R&D expenditures within the higher education sector. Domestically, large public and private research-intensive universities account for the vast majority of R&D activity and technology transfer output. However, regional, mid-sized state colleges and universities make an impressive array of research-to-marketplace contributions as well. The focused regional orientation of state colleges' R&D activity is illustrated by the fact that these institutions receive twice as much R&D support from states and municipalities as they do from the federal government (9 percent of their average total R&D budgets, compared to 4.7 percent), according to the NSF.

²*Stepping Forward as Stewards of Place: A Guide for Leading Public Engagement at Public Colleges and Universities* (2002). American Association of State College and Universities; Washington, D.C. *Tools and Insights for Universities Called to Regional Stewardship* (2006). American Association of State College and Universities; Washington, D.C.

Another example of the contribution of regional state colleges and universities to research and commercialization efforts is evidenced in the AUTM annual Licensing Activity Survey previously cited. The research and commercialization pursuits of the 14 AASCU institutions (less than 5 percent of the total AASCU membership) participating in the latest survey demonstrate that technology transfer can complement regional state colleges' primary missions of undergraduate teaching while simultaneously lending a competitive edge to their states' economic expansion agendas (see Figure 2).

State colleges also stimulate innovation and economic activity at the regional level through university research parks. Typically located on or near campus, these public-private partnerships provide facilities and support services that foster industry alliances that contribute to technology-led economic development in communities and regions. There are approximately 175 university research parks in North America, which collectively employ some 300,000 workers, according to a report prepared by Battelle and the Association of University Research Parks, *Characteristics and Trends in North American Research Parks: 21st Century Directions*. The report suggests that every job in a research park generates an average 2.57 jobs in the economy, resulting in an impressive employment impact. Further, the report cites evidence that university research parks are

Figure 2. One-Year Snapshot: Research and Technology Transfer Activities at AASCU Institutions* (FY 2006)

\$670 million	Research and Development Expenditures
16	Startup Companies
445	Invention Disclosures
92	U.S. Patents Issued
251	New U.S. Patent Applications Filed
\$7.2 million	Income Yielded from Licenses and Options

Source: U.S. Licensing Activity Survey: FY 2006, Association of University Technology Managers. *Survey is limited to AUTM members only, and therefore does not reflect data of all AASCU members.

moving away from their traditional recruiting of R&D and technology companies to locate near universities. Instead, research parks increasingly employ a contemporary model that stimulates local homegrown business start-ups, focuses on business retention and expansion, and offers commercialization and business development support services.

States are investing significant sums of taxpayer dollars to spur research and generate commercial applications. In so doing, policy makers and citizens acknowledge the public purpose of such investments. In a quest to become leaders in new and emerging fields, several states in recent years have invested significant funds in scientific, infrastructure and risk capital to advance research efforts that will lead to business incubation and full-fledged cluster development. California led the way with an enormous \$3 billion voter-approved bond measure in 2004 with the hopes of making the state a world leader in stem cell research. In 2005, Ohio voters approved a legislative referendum aimed at expanding the state's research capabilities to promote product innovation, development and commercialization, and preparing economic sites and facilities in the state. Similarly, in 2007 voters in Maine approved a referendum that will provide \$50 million in capital expenditures for research, development and commercialization projects in targeted technology sectors in the state. Also in 2007, New York's governor and legislature created the Empire State Stem Cell Trust, which will distribute \$600 million over the next decade to advance biomedical research.

In June 2008, Massachusetts Governor Deval Patrick signed legislation that will allocate \$1 billion in biotechnology investments in order to capitalize on the tremendous growth potential of the life sciences industry. A full one-half of the monies will be spent on infrastructure, much of which will be directed to the state's public university system. The balance will be spent on tax incentives for companies and on research grant programs. Among the first beneficiaries of the state's new infusion of life sciences monies was the University of Massachusetts Lowell, which received funding

from a New Faculty Startup Grant program, an initiative that targets investments to attract and retain nationally recognized faculty at the state's colleges and universities. The university will use the monies to enhance its research capacity in biomufacturing science and engineering.

Not to be outpaced in the race to preeminence in the biotech industry, Maryland Governor Martin O'Malley proposed a 10-year, \$1.1 billion investment plan on the very same day that the Massachusetts legislation was signed into law. In laying out his proposal—which included building incubators to assist small companies, bringing commercial applications to market, and spending money on stem cell research—Gov. O'Malley said the investment is key to unlocking the future economic potential of the state. A vital element in such state investments is the opportunity to leverage additional grant dollars. The O'Malley administration has estimated that over the course of the proposed decade-long biotech investment program, an additional \$6.3 billion in private and federal investment could be realized.

Governors and legislators may initiate these hefty investments of public tax dollars, but as cited in the above examples, voters themselves often must give final approval. Such citizen consent is an affirmation that states' investments in applied research and commercialization endeavors are seen as fitting within the public purpose that guides taxpayer spending.

Public higher education institutions—often research-intensive universities and those with medical centers alongside private ventures—are typically the beneficiaries of these state-funded research dollars. But so too are smaller and mid-sized state colleges and universities, which often are well positioned to exploit state-backed research and commercialization efforts.

The applied research and technology commercialization activities conducted at regional state colleges and universities are increasingly recognized through the formal inclusion in state economic development programs. The

aforementioned SSTI resource guide provides insight into how states position colleges and universities to drive innovation and economic growth. These strategies include the support of academic institutions in their efforts to build research excellence in key areas, attracting and retaining highly talented faculty and scientists, helping link academic researchers with industry, and assisting these institutions in their ability to fully account for and capitalize on intellectual property in order to create new companies, products and processes. Common approaches states use to foster these strategies include:

- The creation of university-industry research centers,
- “Eminent scholars” programs that recruit top research talent into endowed chair positions,
- Industry-university matching grant programs aimed at stimulating research and commercialization partnerships between businesses and academic institutions, and
- University technology commercialization programs

For each of these approaches, the SSTI resource guide provides key features, success factors, required resources, and potential sources of funding and considerations in choosing each of these approaches.

Provided here are a few examples of how states are formally including regional state colleges in programs that seek to increase research, technology transfer and market development activities.

Ohio Third Frontier. Initiated in 2002, the Ohio Third Frontier was designed to expand Ohio’s research capacity, company formation and product development. An original \$1.6 billion commitment, when compounded by additional federal and private support, is expected to result in a total investment exceeding \$6 billion. The Third Frontier is focused on targeted technology sectors, the establishment of regional and statewide industry clusters, and the commercial viability of R&D investments made through the initiative. Regional public colleges and

universities in the state are eligible to apply for grants and participate in all of the Third Frontier programs that are open to academic institutions. Ohio’s regional state colleges have demonstrated a notable role in the state’s technology transfer and innovation efforts, according to Norm Chagnon, executive director of the Third Frontier Commission, which directs the project. He comments: “These schools are very much in step with regional economic development needs and have strong relationships with local industry. Therefore, a significant component of their R&D effort is applied and driven by these local needs.” Chagnon notes that a number of state colleges—Cleveland State University, Wright State University and the University of Toledo among them—have won awards from the Wright Centers of Innovation program, the flagship of the Third Frontier’s R&D programs which provides grants to support large-scale world-class research and technology development platforms designed to accelerate the pace of Ohio commercialization.

The Kentucky Challenge Fund. Kentucky is a good example of how all of its state universities are included as part of a strategy to tap its postsecondary institutions’ full potential as economic engines. In 1997 the Kentucky legislature passed the Kentucky Postsecondary Education Improvement Act (HB 1) that created the Strategic Investment and Incentive Funding Program. Passage of the Act led to the creation of an endowment match program known as the “Bucks for Brains” initiative, which has been funded with \$350 million in state appropriated monies. The program requires that universities match state funds with donations from philanthropists, foundations, non-profit agencies and corporations; thus, when fully funded with private donations, \$700 million will be added to the endowments of Kentucky’s public universities. Earnings from the combined invested public and private monies fund faculty positions, programs and scholarships—all of which have spurred research and economic development activities in the state.

A unique feature of the program is that all of the state’s public universities are leveraged, with the state’s two large research universities receiving

matching grant funding from a Research Challenge Trust and the state's regional public institutions receiving monies from a Regional University Excellence Fund. The leveraged state monies have produced impressive returns generated through a broad set of activities that reflect the institutions' missions and unique capacities. While the state's research universities have significantly elevated their applied research and technology transfer activities, Kentucky's regional state universities have fueled economic development in myriad ways, including through increased research activity at the undergraduate level, increased scholarship, and product commercialization activities led by top-flight researchers who bring expertise in specific high-tech fields. From the program's inception in 1997 through June 2006, over \$45 million in private gifts have been leveraged through the Bucks for Brains matching grant program by Kentucky's six regional state universities.

North Dakota Centers of Excellence. The North Dakota Centers of Excellence program was created with the goal of investing in the infrastructure and research capacity of the state's colleges and universities, and thus more fully capitalizing on students' and scientists' ability to commercialize new ideas into products and services. Originally proposed by North Dakota Governor John Hoeven and passed by that state's legislature in 2005, the Centers of Excellence program has led to the approval of 11 centers, with each leading public-private partnership initiatives focusing on areas such as renewable energy development, energy workforce training and technology, aerospace, electronics, and advanced manufacturing. A state investment of \$23 million has been leveraged by nearly \$100 million in matching funds from the private sector and other sources. The same legislation also created the Centers of Excellence Commission comprised of members from the State Board of Higher Education and the state's Economic Development Foundation.

Two examples illustrate the way in which regional state institutions participate in North Dakota's innovation agenda. Dickinson State University's Strom Center for Entrepreneurship and Innovation-

Institute for Technology and Business serves as a source for entrepreneurial strategies to help technology-based businesses start or expand in the state's rural communities. The Institute for Customized Business Solutions at Valley City State University focuses on preparing industry-ready enterprise software consultants for jobs in North Dakota. The Center is a critical resource for budding technology start-ups as they seek to utilize sophisticated technology applications at reasonable costs. It is anticipated that these two regional state universities will receive nearly \$10 million in matching grant monies through the Centers of Excellence program to fully launch their respective centers.

Michigan Smartzones Program and Pre-Seed Capital Fund. Another example of how a state can more fully utilize the research and technology transfer capacity of its regional public universities is in Michigan, where the quasi-governmental Michigan Economic Development Corporation, utilizes its SmartZonessm program. The state's 12 SmartZones are distinct geographic locations near public college campuses, where technology-based firms, entrepreneurs and researchers locate in close proximity to other community resources in order to facilitate their research, product commercialization and business start-up activities. The SmartZones include technology business "accelerators"—entities focused on the quick incubation of new businesses—that provide services such as business feasibility studies, business planning, consultation on product development, start-up financing, and even offer 16 incubation facilities that include access to wet lab space. Since the program's inception, 845 businesses have located or expanded in these SmartZones, resulting in the creation of 16,360 new jobs and over \$1 billion in public and private investment. A number of regional public universities throughout the state, including those located in rural areas, serve as host institutions for the various SmartZones, thus enabling them to serve as business incubators in all corners of the state.

While the SmartZones program provides the entrepreneurial environment and services needed to marry the innovation capacities of its universities

and private research entities, the Michigan Pre-Seed Capital Fund supports high-tech start-up companies as they near commercial viability by providing access to early-stage capital to accelerate company development. These funds seek to extend the personal investment of entrepreneurs during the critical stage when they are developing their businesses to the point of readiness for outside investment. The fund targets companies throughout the state that are creating the newest technologies in the areas of advanced automotive, manufacturing, and materials; alternative energy; homeland security, and the life sciences.

These aforementioned program illustrations are just a small sampling of how states invest and leverage public monies to support regional economic development. Common to all is a focused effort on nurturing the growth of high technology industry clusters, and in so doing, including the applied research and product commercialization capabilities of state colleges and universities.

Conclusion

Among the direct benefits of state investment in university research and development activities are new business start-ups, job creation, the attraction and retention of highly skilled, highly paid workers, increased tax revenues, and an elevated standing on the national innovation scene. The return on investment of these public tax dollars is accompanied by additional positive impacts derived from this research and technology transfer activity that benefit society as a whole, such as improvements in health care, the environment, transportation, and public safety.

In their efforts to implement a broad economic development strategy that includes applied research and product commercialization activities, state policymakers, in partnership with the private sector, should seek to tap the full potential of all four-year state colleges and universities. The extent to

which individual regional state colleges are involved in applied research and entrepreneurial support activities varies greatly. Collectively, however, these institutions make a meaningful contribution to states' overall economic development agendas. Granting all public postsecondary institutions the opportunity to participate in state-funded research and development grant programs, lending legislative and public policy support to facilitate state colleges' efforts to attract, retain and expand businesses and industry clusters, and tapping the full slate of intellectual resources offered by university scientists will enhance states' capacity to increase their competitiveness in the knowledge-age economy.

Resources

Alliance for Regional Stewardship. regionalstewardship.org

Association of University Research Parks. aurp.net

Association of University Technology Managers. autm.net

Brookings Institution Metropolitan Policy Program.
brookings.edu/metro

Council on Undergraduate Research. cur.org

Innovation Associates. innovationassociates.us

National Business Incubation Association. nbia.org

National Governors Association–Center for Best Practices.
nga.org

Ohio Third Frontier Project. thirdfrontier.com

State Science & Technology Institute. ssti.org

The Information Technology and Innovation Foundation.
itif.org

University Economic Development Association.
universityeda.org

Reports

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