DISCUSSION PAPER SERIES

No. 6242

ENTREPRENEURSHIP, STATE ECONOMIC DEVELOPMENT POLICY, AND THE ENTREPRENEURIAL UNIVERSITY

David B Audretsch and Ronnie Phillips

INDUSTRIAL ORGANIZATION

Centre for Economic Policy Research

www.cepr.org

Available online at: **www.cepr.org/pubs/dps/DP6242.asp**

ISSN 0265-8003

ENTREPRENEURSHIP, STATE ECONOMIC DEVELOPMENT POLICY, AND THE ENTREPRENEURIAL UNIVERSITY

David B Audretsch, Max-Planck-Institut zur Erforschung von Wirtschaftssystemen, Jena and CEPR
Ronnie Phillips, Colorado State University

Discussion Paper No. 6242
April 2007

Centre for Economic Policy Research
90–98 Goswell Rd, London EC1V 7RR, UK
Tel: (44 20) 7878 2900, Fax: (44 20) 7878 2999
Email: cepr@cepr.org, Website: www.cepr.org

CEPR Discussion Paper No. 6242

April 2007

ABSTRACT

Entrepreneurship, State Economic Development Policy, and the Entrepreneurial University*

In this paper, we discuss the nature of the university-industry relationship and recommend specific policies to help achieve the goal of greater economic growth. We argue that state-supported research universities can be used to integrate entrepreneurship into state economic development and incubate entrepreneurial companies. Regional entrepreneurship policy is a new strategy that regards economic development as a process that goes from supporting research and development to creating and growing new businesses. Specifically, we believe that an entrepreneurial higher education system is a key to state-level economic policies. There is an opportunity at research universities to combine the human capital talent available on faculties with the needs and expertise of private industry to accelerate entrepreneurship and economic growth.

JEL Classification: L26
Keywords: economic development, entrepreneurship and universities

David B Audretsch
Institute of Entrepreneurship and Innovation (IEI)
Henry W. Block School of Business and
Public Administration, 5110 Cherry Street
University of Missouri, Kansas City
MO 64119-2499
Email: daudrets@indiana.edu

Ronnie Phillips
Head of Economics Department
Colorado State University
C 312A Clark Building
Fort Collins, Colorado 80523-1771
USA
Email: ronnie.phillips@colostate.edu

* We acknowledge the support of the Ewing Marion Kauffman Foundation in this research. For comments on an earlier draft we thank Bob Litan, Lesa Mitchell, and E.J. Reedy.

Submitted 14 March 2007

Entrepreneurship, State Economic Development Policy, and the Entrepreneurial University

David Audretsch and Ronnie J. Phillips

Introduction

In 2004, the National Governors Association published *A Governor's Guide to Strengthening State Entrepreneurship Policy*. This guide explained how governors could establish and implement policies that would support the growth of entrepreneurial firms in their states.[1] We strongly agree with these views, and those expressed elsewhere, that entrepreneurship is one of the most important factors for future economic growth. The *Governor's Guide* recommended several broad strategies to help states achieve a more entrepreneurial environment. One was for states to use the education system to nurture and encourage future entrepreneurs. The focus of this strategy would be:

- Building entrepreneurial readiness through the state's K-12 schools;
- Offering entrepreneurship education at public universities;
- Supporting faculty entrepreneurship in the university system.

[1] National Governors Association. *A Governor's Guide to Strengthening State Entrepreneurship Policy*. Washington, DC: 2004. The guide complemented other economic policy titles published by the NGA Center for Best Practices, including *A Governor's Guide to Cluster-Based Economic Development, A Governor's Guide to Building State Science and Technology Capacity, A Governor's Guide to Trade and Global Competitiveness* and *A Governor's Guide to Creating a 21st-Century Workforce*.

This strategy, which we believe helps foster greater entrepreneurship in society, has been implemented in a number of states and the Kauffman Foundation has supported this effort.[2]

But more needs to be done, especially with regard to developing an *entrepreneurial university*.[3] We argue that state-supported research universities can be used to integrate this education strategy with two other strategies recommended by the *Governor's Guide*: to integrate entrepreneurship into state economic development and incubate entrepreneurial companies.[4] There is an opportunity at research universities to combine the human capital talent available on faculties with the needs and expertise of private industry to accelerate entrepreneurship and economic growth.

In this paper, we will discuss the nature of the university-industry relationship and recommend specific policies to help achieve the goal of greater economic growth. Though presently university business startups reported by Technology Transfer Offices (TTOs) account for only 2 - 3 percent of new

---

[2] A summary of the Kauffman Campuses initiative can be found at http://www.kauffman.org/items.cfm?itemID=713

[3] The 2000 report by the Council on Competitiveness found shortcomings in the university's role in helping entrepreneurs. See Council on Competitiveness. *Measuring Regional Innovation*. Washington, D.C.: Department of Commerce, 2006. For a review of the literature, see Rothaermel, Frank T., Shanti Dewi Anak Agung Istri, and Lin Jiang. "University Entrepreneurship: A Taxonomy of the Literature." *Industrial and Corporate Change*, forthcoming 2007. In this paper we will not be discussing community colleges, but they also play an important role in economic development and are properly the subject of another paper.

[4] The other two strategies encouraged states to invest in diverse sources of risk capital for the state's entrepreneurs and growth and to "get out of the way" through regulatory reform and streamlining. Though important, these will not be discussed in this paper.

business startups, we believe that number can be increased.[5] To achieve this goal, the following is needed:

- Adequate public funding of state research universities
- The creation of an entrepreneurial culture and skills among faculty and administration at research universities
- Strong private sector support of state research universities

Regional entrepreneurship policy is a new strategy that regards economic development as a process that goes from supporting research and development to creating and growing new businesses. Some have called this "gardening" to stress the cultivation and sustainability in local economic development.[6] However, it may be more appropriate to use the term "entrepreneurial economy," since it emphasizes the need to create and sustain the institutions for an entrepreneurial society. Specifically, we believe that an entrepreneurial higher education system is a key to state-level economic policies.

---

[5] These figures underestimate the number of startups from universities due to a lack of measurement of those startups that occur outside the TTO. The economic opportunity for university startups is much greater when these are included. See Lester, Richard K. "A Framework for Understanding How Higher Education Influences Regional Economic Growth," presented at a conference at the Federal Reserve Bank of Chicago on October 30, 2006 and National Commission on Entrepreneurship. *Building Companies, Building Communities: Entrepreneurs in the New Economy*, July 2000. Lester notes that total licensing revenue to universities is only 4-6 percent of research revenues in the U.S. Consequently, technology licensing is unlikely to transform the finances of the university.

[6] Quello, Steve and Graham Toft. "Economic Gardening: Next Generation Applications for a Balanced Portfolio Approach to Economic Growth," in U.S. Small Business Administration. Office of Advocacy. *The Small Business Economy For Data Year 2005: A Report to the President,* Washington, D.C.: 2006, 157-194.

The Evolution of State Economic Development Policy

A recent report by the Federal Reserve Bank of Kansas City suggests smokestack chasing is dead and that cities and states are moving toward a new "entrepreneurial model"—one that relies on growing new businesses rather than stealing them from other places through tax breaks and zoning rules.[7] This movement toward an entrepreneurial model reflects an evolution in state economic development policy that began after World War II when the U.S. emerged as the dominant economy in the world.

Beginning in the post-war period, many states adopted a regional economic development strategy which involved providing incentives and subsidies to large-scale industry to locate in a specific place. This strategy has been labeled *industrial recruiting*. State government economic development policy meant attracting and retaining manufacturing companies—*smokestack chasing*. Since economic prosperity was tied to the location of a large industrial firm, the policy was to provide incentives and subsidies to get firms to move to one's own particular region. The pressures of emerging global competition in the 1970s and 1980s, however, created problems for this industrial recruiting strategy.

As states competed against one another to retain or attract new firms, the response of many states was to adopt a strategy of *cost competition*. This

[7] Drabenstott, Mark. *A Review of the Federal Role in Regional Economic Development*. Missouri: Federal Reserve Bank of Kansas City, 2005.

resulted in an economic tug-of-war between the states.[8] The strategy to advertise low labor costs and dangle subsidies and incentives in front of firms worked as long as regions maintained the lowest-cost environment. However, the low-cost strategy was doomed to face difficulties when companies such as GM faced restructuring which reflected greater global competition beginning in the 1970s, and other countries began to offer incentives to large industrial firms.

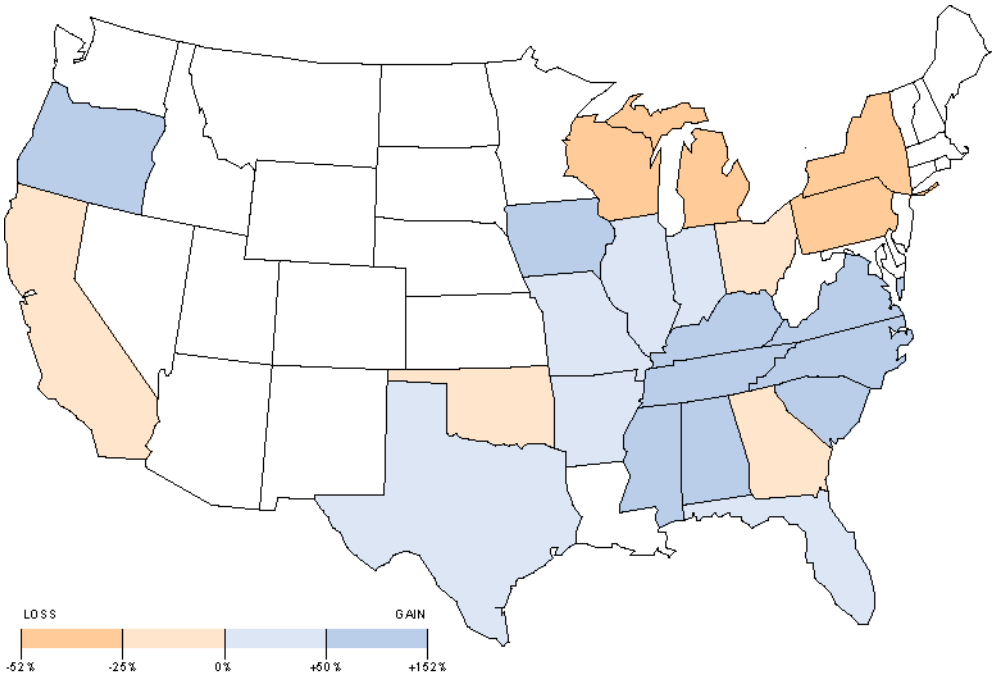
With the shift toward the “New Federalism” in the United States, states were required to assume a greater responsibility for regional economic growth and development. They were expected to depend upon their own resources and responded by not only continuing the program of incentives but also by adding programs intended to foster the growth of small businesses. The policies that resulted in the initial success of the “Massachusetts Miracle” exemplified this wave of economic development strategies. The policies focused on workforce development, venture capital, and infrastructure investment. However, these new policies were ultimately unable to cope with problems associated with regions that had been dependent on manufacturing industries for decades.[9]

Recent studies have concluded that a cost competition policy will ultimately fail. As Terry F. Buss notes in an article in *Economic Development Quarterly*, cost competition policy “is based on poor data, unsound social science

[8] Burstein, Melvin L., and Arthur J. Rolnick. "Congress should end the economic war among the states." *The Region*. Minnesota: Federal Reserve Bank of Minneapolis, 1994.
[9] Pages, Erik R., Doris Freedman, Patrick Von Bargen. "Entrepreneurship as a state and local economic development strategy." In *The Emergence of Entrepreneurship Policy: Governance, Start-ups, and Growth in the U.S. Knowledge Economy*, edited by David M. Hart, 240-259. Cambridge, UK: Cambridge University Press, 2003.

methods, faulty economic reasoning, and is largely a political activity".[10] Another recent study found that economies with rosters of big businesses that changed less over the period from 1975 to 1996 exhibited slower economic growth and slower total factory productivity growth in the 1990s. This effect was most evident in higher income countries, where stable lists of leading businesses correlated with reduced capital accumulation.[11]

Figure 1: Change in Employment in the U.S. Automobile Industry, 1986-2006.



Source: Maynard, Micheline, and Nick Bunkley. "As Auto Prosperity Shifts South, Two Towns Offer a Study in Contrasts." *New York Times,* December 5, 2006.

[10]Buss, Terry F. "The Case against Targeted Industry Strategies." *Economic Development Quarterly*, 13 (1999): 339-56.
[11] Fogel, Kathy, Randall Morck, and Bernard Yeung. "Big Business Stability and Economic Growth: Is What's Good for General Motors Good for America?" National Bureau of Economic Research, Inc., NBER Working Papers: No. 12394, 2006.

Figure 1 illustrates the results of the cost competition policy for the automobile industry in the past two decades. The employment gains in the southeastern parts of the United States were offset by losses in the automobile industry in Michigan, Wisconsin, Pennsylvania, and New York. State government incentives and lower labor costs were the motivators for U.S. firms to move south and for Japanese firms to locate their U.S. plants outside the traditional automobile manufacturing states. The dangers of this policy, which resulted in the movement of the industry from the upper Midwest to the southeastern states, should be apparent when it is recognized that the movement occurring today and in the immediate future in the automobile industry is a shift to southeast Asia.

The Knowledge Revolution

Globalization put a crack in the post-war competitiveness of smokestacks or traditional manufacturing. However, even as traditional manufacturing industries, such as steel, tires, and automobiles, started hemorrhaging jobs through plant downsizing and closures triggered by outsourcing and offshoring, new employment growth was exploding in other industries, such as information technology and life sciences. Just as globalization triggered the loss of competitiveness in the traditional industries, it triggered a new source of competitiveness—innovative activity, which is based on knowledge, creativity, and ideas.[12]

[12] This was formalized in the so-called new growth models where innovative activity is endogenized. See Romer, Paul. "Increasing Returns and Long-run Growth." *Journal of*

There are at least two key reasons why economic activity based on knowledge, creativity, and ideas can succeed in creating state competitiveness:

- *Generating knowledge is so costly that it is unattainable to large parts of the world, especially the developing countries.* Scientific knowledge requires massive investments in university research, corporate R&D, and state-of-the-art education at all levels to generate creative and innovative people. While such investments stretch state and federal budgets in this country, their magnitude effectively preempts participation for most of the world.
- *To access, appreciate, understand, and evaluate such new ideas, geographic proximity is essential.* Face-to-face contact based on non-verbal communication in a nuanced context is essential not only for understanding a new idea but also for understanding why that new idea matters.[13]

Thus, the prohibitive cost of investments in knowledge, combined with their stickiness, or high rate of depreciation as they diffuse across geographic

---

Political Economy, 94 (1994): 1002-1037.; and Lucas, Robert R. "Making a Miracle." *Econometrics*, 61 (1993): 251-272. For empirical confirmation of the importance of human capital for entrepreneurship see Low, Sarah, Jason Henderson, and Stephan Weiler. “Gauging a Region’s Entrepreneurial Potential.” Federal Reserve Bank of Kansas City *Economic Review*, pp. 61-89. Third Quarter (2005).

[13] One of the surprises triggered by globalization is that the cost of transferring smokestacks, or physical capital, across geographic space has proven to be relatively inexpensive and less costly than had originally been thought by many state and local policy makers. Just as the textile industry found it relatively easy to relocate plants from their original New England locations to the South, so too have stalwart manufacturing industries such as automobiles, steel, and rubber found it increasingly simple to shift production out of this country. Indeed, all forms of transportation are now easier. Standardized containers dramatically reduced the cost of shipping goods internationally.

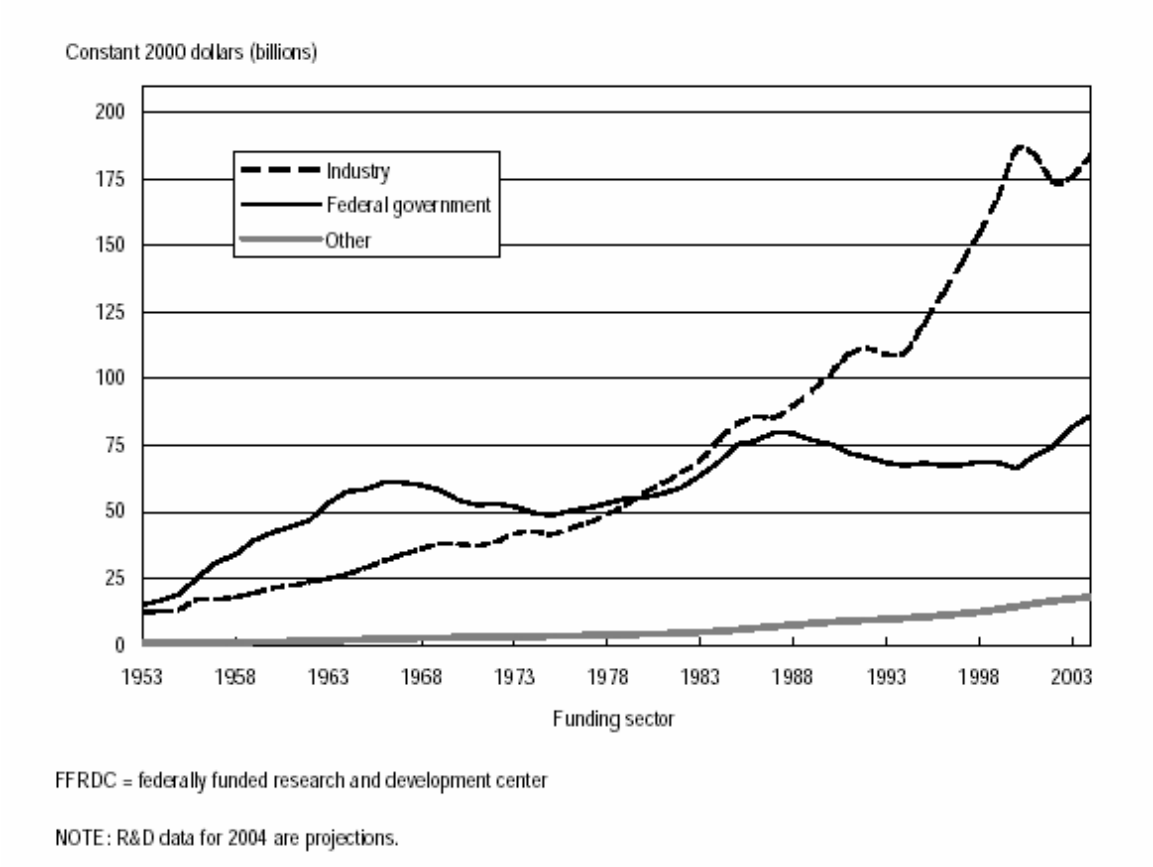
space has resulted in a unique capability of the leading developed countries, and in particular, America, to generate and commercialize knowledge, creativity, and ideas thus resulting in knowledge-based economies. Location is everything and investment in knowledge is crucial. [14]

Investment in Knowledge

Since the mid-1970s, both investments in knowledge as well as the return on those knowledge investments have soared. Figure 2 shows how both private and government investment in research has exploded in recent years. Since 1990, private sector spending has increased by more than 75 percent in real terms reaching almost $200 billion per year.

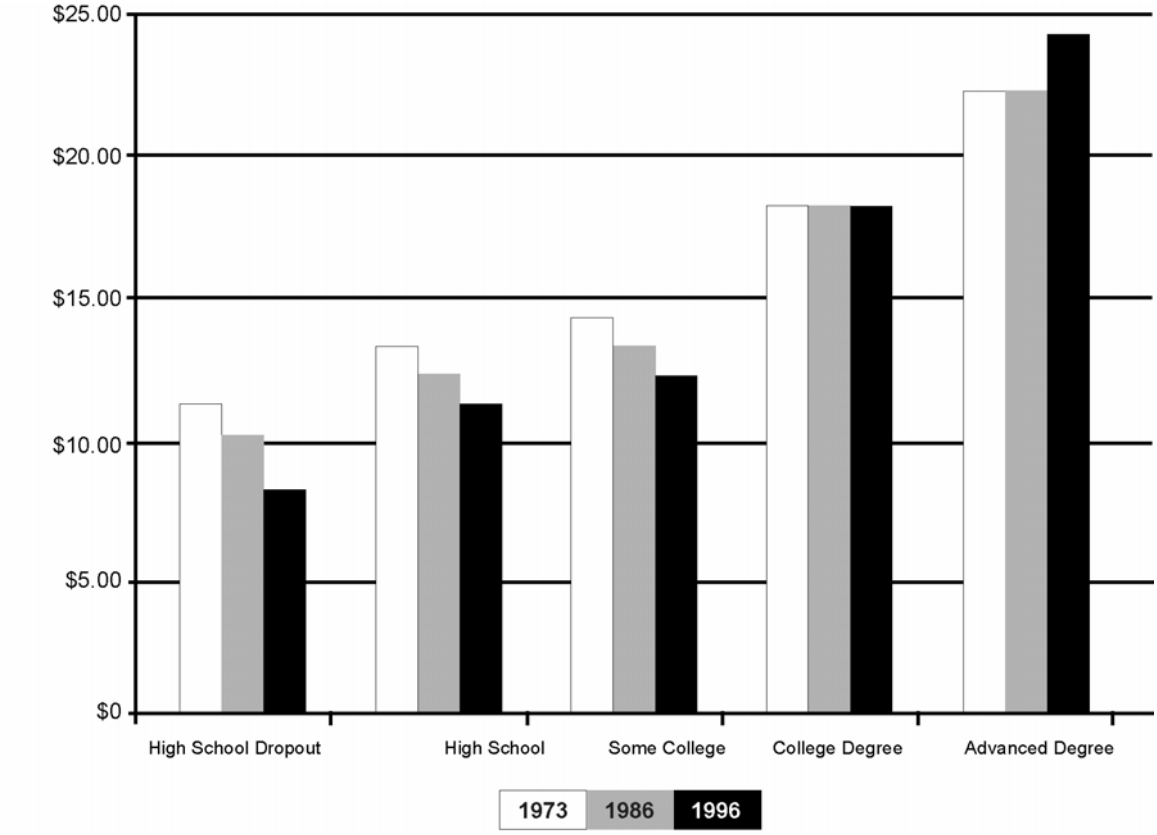
[14] Thomas Friedman may be correct in his discovery of a flat world, but this does not imply that everything transmits instantaneously and costlessly around the globe. In fact, the opposite is the case with knowledge. See Friedman, Thomas. *The World is Flat: A Brief History of the Twenty-first Century*. New York: Farrar, Straus and Giroux, 2005.

Figure 2: Spending on R&D by Industry, Federal Government



Source: National Science Foundation. "U.S. R&D Continues to Rebound in 2004," January 2006, http://www.nsf.gov/statistics/infbrief/nsf06306/ .

Figure 3: Returns to Educational Attainment over Time

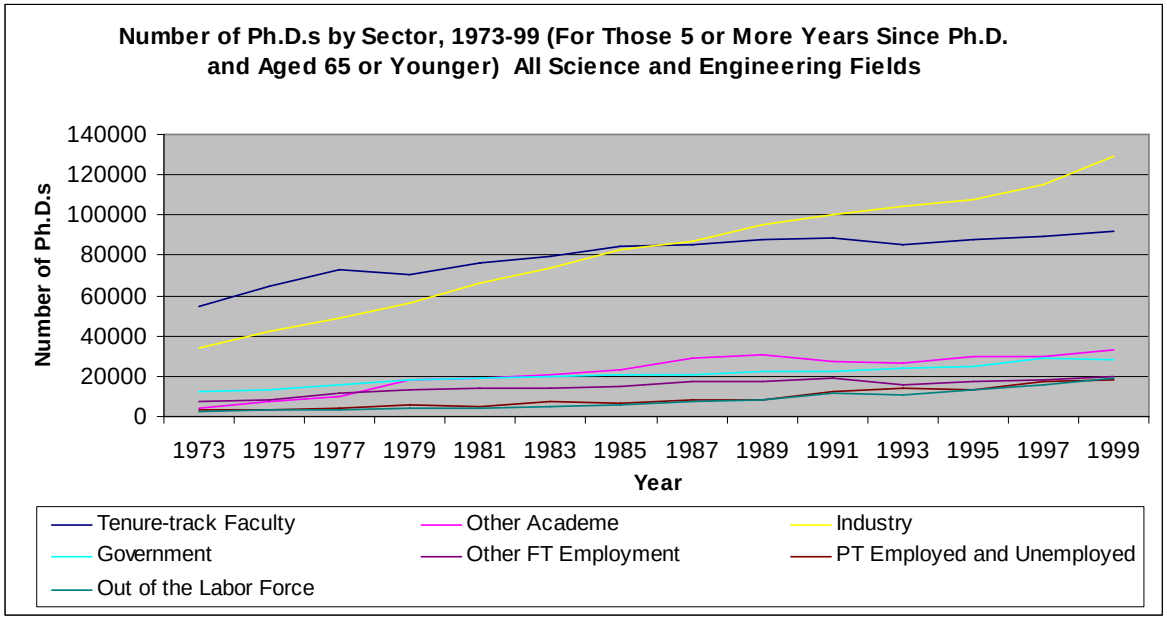


Source: *Economic Report of the President*, various years.
http://www.whitehouse.gov/cea/.

Figure 3 shows how the rate of return to individual investment in human capital, measured in terms of educational attainment, has increased over time. This shows that the payoff to investments in education and human capital have become greater. Those with less than a college degree have seen declines in real income. Figure 3 also indicates that the returns to those with advanced degrees (beyond the bachelor's degree) have seen significant increases in their real income. Figure 4 shows how the number of Ph.D.s hired in the private sector

has exploded in recent years. Thus, there is compelling evidence showing that investments in knowledge have not only increased dramatically in recent years, but that such knowledge investments are paying off richly for individuals making investments in their education.

Figure 4: Number of Ph.D.s by Sector



Source: Figure from Stephan (2006)

The Knowledge Filter

However, even as knowledge emerged as the key factor for state competitiveness in the global economy, it also became clear that investments in knowledge were necessary but not sufficient for generating innovation and growth. Investments in scientific knowledge and research alone will not automatically generate growth and prosperity. Examples abound of regions, states, and entire

economies that abundantly invested in new knowledge yet failed to enjoy a return on that investment in terms of jobs, growth, and international competitiveness.[15]

Knowledge investments must penetrate what has been termed "*the knowledge filter*" in order to contribute to innovation, competitiveness, and ultimately economic growth.[16] In fact, the knowledge filter impeding the commercialization of investments in research and knowledge can be formidable.[17] It is the knowledge filter that stands between an investment in research on the one hand, and its commercialization through innovation, leading ultimately to economic growth on the other.[18]

---

[15] A non-American example may serve the American governors best. Sweden has exhibited the highest rates of knowledge investment in the world. Yet, economic growth and employment generation has remained elusive, resulting in the term *The Swedish Paradox* – the simultaneous existence of high investments in knowledge combined with low innovation rates, sluggish economic growth, and nagging rates of unemployment. The European Union was so impressed with the characterization of Sweden, it was adopted as *The European Paradox*, reflecting the inability of Europe to harvest massive investments in education, human capital, research, and culture in terms of economic growth, jobs, and competitiveness.

[16] Audretsch, David, Erik Lehmann and Max Keilbach. *Innovation and Economic Growth.* New York: Oxford University Press, 2006;Acs, Zolton J., and Catherine Armington. *Entrepreneurship, Geography, and American Economic Growth*. Cambridge: Cambridge University Press. 2006; and Acs, Zoltan J., David B. Audretsch, Pontus Braunerhjelm, and Bo Carlsson**.** "The Missing Link: The Knowledge Filter and Entrepreneurship in Endogenous Growth." Case Western Reserve University, CEPR Discussion Papers: No. 5326, 2005.

[17] In the American context, Senator Birch Bayh warned, "A wealth of scientific talent at American colleges and universities — talent responsible for the development of numerous innovative scientific breakthroughs each year — is going to waste as a result of bureaucratic red tape and illogical government regulations…"Seen through the eyes of Senator Bayh, the magnitude of the knowledge filter is daunting, "What sense does it make to spend billions of dollars each year on government-supported research and then prevent new developments from benefiting the American people because of dumb bureaucratic red tape?" Bayh, Birch. U.S. Senator. Introductory Statement, September 13, 1978, Association of University Technology Managers**,** *Recollections: Celebrating the History of AUTM and the Legacy of Bayh-Dole.* Northbrook, IL: AUTM, 2004, 5.

[18] Bayh, Birch, U.S. Senator. Statement on the approval of S. 414 (Bayh-Dole) by the U.S. Senate on a 91-4 vote, April 13, 1980, cited from Association of University Technology Managers**,** *Recollections: Celebrating the History of AUTUM and the Legacy of Bayh-Dole.* Northbrook, IL: AUTM*, 2004,* 16.

Public policy instruments to promote investment in knowledge, such human capital, R&D, and university research will not automatically generate economic growth if confronted with the knowledge filter—a barrier impeding the spillover of knowledge from the firm or organization where it was originally generated, for commercialization by third-party firms,.[19]

Entrepreneurship Capital

Given the investment in knowledge and the barriers to the commercialization of knowledge, it is imperative that states build what we term their *entrepreneurship capital*. This is crucial to fostering economic growth and development. Sources of knowledge, ideas, and creativity become the focus of policy. According to Richard Florida, the essence of what makes cities attractive is talent, technology, and tolerance. Cities with a high overall level of education, unique characteristics, and tolerance of diversity do the best in terms of economic growth. Ed Glaeser points out that cities which have amenities such as restaurants and live performance venues, aesthetics, public services, and transportation have grown more rapidly than those without these amenities.

Human capital is also important and explains population and productivity growth at the metropolitan area level. Next to environment, skill composition may be the most powerful predictor of urban growth. While human capital predicts productivity growth, it does not predict an increase in amenity levels—real wages

[19] One interpretation of the *European Paradox*, where such investments in new knowledge have certainly been substantial and sustained but vigorous growth and reduction of unemployment have remained elusive, is that the presence of such an imposing knowledge filter chokes off the commercialization of those new knowledge investments, resulting in diminished innovative activity and ultimately stagnant growth.

are rising (wages rise faster than price levels). It is true that skilled cities are more innovative, but the real driver of the skill-productivity connection probably lies in the ability of skilled cities to adapt to new technologies and economic conditions (*the reinvention hypothesis*).[20]

There are a number of things that states can do to help create entrepreneurship capital. The basic items include providing technical assistance to entrepreneurs, mentoring, streamlining business forms (putting everything on line), enforcing short non-compete clauses, and the like. The 2004 National Governors Association (NGA) report[21] provides a convenient list of some of these:

- Make entrepreneurship part of the explicit mission of the state's economic development efforts
- Create support mechanisms for entrepreneurs through appropriate economic development programs
- Use entrepreneurial, capital, and research networks to deliver services
- Deploy workforce development, unemployment insurance, and community development systems to support entrepreneurs and promote entrepreneurship
- Provide business incubation services and create virtual and remote

[20] Florida, Richard. *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Perseus Books Group, 2002; Glaeser, Edward L., Jed Kolko, and Albert Saiz. "Consumer city," *Journal of Economic Geography*, Jan 2001, Vol. 1 Issue 1, 27-50. and Glaeser, Edward L. and Albert Salz. "The Rise of the Skilled City." Washington, DC: *Brookings-Wharton Papers on Urban Affairs*, 2004 (5), 47-105.

[21] National Governors Association, 2004.

incubation options for rural and remote regions

- Support a rich base of early-stage capital options
- Ensure that risk capital is available in underserved rural areas
- Remove legal restrictions on equity ownership by the state, public universities, and other government entities
- Put regulatory and licensing processes on-line
- Use one-stop business and licensing models

One measure of how successful states have been at creating entrepreneurship capital is the Milken Institute's National State Technology & Science Index, which is a composite indicator of investments in science and technology. The top five states according to this index are Massachusetts, California, Colorado, Maryland, Virginia and Washington.[22]

[22] Also see U.S. Department of Commerce. Council on Competitiveness. *Measuring Regional Innovation*. Washington, D.C., 2006.

Table 1: Measures of Innovation by State

State	Rank (2004)	Rank (2002)	Rank Change	Score (2004)	State	Rank (2004)	Rank (2002)	Rank Change	Score (2004)
Massachusetts	1	1	0	84.35	Kansas	26	22	-4	53.12
California	2	3	1	78.86	Wisconsin	27	25	-2	51.76
Colorado	3	2	-1	78.77	Nebraska	28	32	4	50.91
Maryland	4	4	0	78.19	Indiana	29	30	1	50.73
Virginia	5	5	0	72.27	Idaho	30	26	-4	49.03
Washington	6	6	0	69.87	Missouri	31	28	-3	48.11
New Jersey	7	7	0	69.03	Florida	32	29	-3	44.47
Minnesota	8	10	2	67.49	Maine	33	36	3	43.47
Utah	9	9	0	66.49	Tennessee	34	40	6	42.77
Connecticut	10	8	-2	66.26	Oklahoma	35	37	2	42.65
Rhode Island	11	21	10	64.01	Alabama	36	33	-3	42.36
New Hampshire	12	13	1	63.43	Iowa	37	35	-2	41.90
Delaware	13	11	-2	62.51	Montana	38	34	-4	40.65
New Mexico	14	20	6	61.75	Hawaii	39	43	4	40.05
New York	15	12	-3	60.66	Alaska	40	39	-1	39.91
Pennsylvania	16	16	0	60.36	Wyoming	41	38	-3	38.72
Arizona	17	18	1	58.47	Louisiana	42	44	2	36.66
Georgia	18	15	-3	58.10	Nevada	43	42	-1	36.09
Oregon	19	23	4	57.76	South Carolina	44	41	-3	35.94
North Carolina	20	17	-3	57.28	North Dakota	45	45	0	34.55
Illinois	21	19	-2	56.59	West Virginia	46	48	2	33.65
Vermont	22	31	9	56.00	South Dakota	47	47	0	33.31
Texas	23	14	-9	54.91	Kentucky	48	46	-2	32.61
Ohio	24	27	3	54.18	Arkansas	49	50	1	29.53
Michigan	25	24	-1	54.01	Mississippi	50	49	-1	27.48
					State Average				**52.64**

Source: DeVol, Ross, and Rob Koepp. *State Technology and Science Index*: *Enduring Lessons for the Intangible Economy*. Santa Monica, CA: Milken Institute, 2004. http://www.milkeninstitute.org/pdf/state_tech_sci_index04.pdf.

One can look to prominent examples to better understand what is needed to create entrepreneurship capital. As Annalee Saxenian notes, it is more than simply the concentration of skilled labor, suppliers, and information. Saxenian describes the elements present in one region rich in entrepreneurship capital, Silicon Valley in California, where

- A variety of regional institutions exist, including Stanford University, as well as several trade associations, and local business organizations;
- A myriad of specialized consulting, market research, public relations and venture capital firms provide technical, financial, and networking services which the region's enterprises often cannot afford individually;
- Networks exist that defy sectoral barriers and individuals move easily from semiconductor to disk drive firms or from computer to network makers; and
- Individuals move from established firms to start-ups (or vice versa) and even to market research or consulting firms, and from consulting firms back into start-ups;
- People meet at trade shows, industry conferences, seminars, talks, and social activities organized by local business organizations and trade associations (In these forums, relationships are easily formed and maintained, technical and market information is exchanged, business contacts are established, and new enterprises are conceived.); and
- A decentralized and fluid environment promotes the diffusion of intangible technological capabilities and understandings.[23]

[23] Saxenian, Annalee. "Regional Networks and the Resurgence of Silicon Valley." *California Management Review*, 33 (1990): 89 - 111.; see also Saxenian, Annalee. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press, 1994.

Because of its strong propensity to be localized within a geographically bounded region, the creation of entrepreneurship capital is particularly important to state and local economic policy. According to Saxenian, even the language and vocabulary used by individuals can be specific to the entrepreneurship capital associated with that region, "…a distinct language has evolved in the region and certain technical terms used by semiconductor production engineers in Silicon Valley would not even be understood by their counterparts in Boston's Route 128."[24] By creating entrepreneurship capital, state policy helps to penetrate the knowledge filter associated with investments in research and human capital, thereby helping regions to actualize the returns on their investment in research and knowledge.

Research and the Entrepreneurial University

One important source of knowledge is the university. When competitiveness was based on smokestacks, the university made important social, political, and cultural contributions but in the economic realm they played a much more indirect role in economic growth via labor training.[25] However, as competitiveness becomes dependent upon knowledge, ideas, and creativity the university emerges as crucial for economic growth.[26]

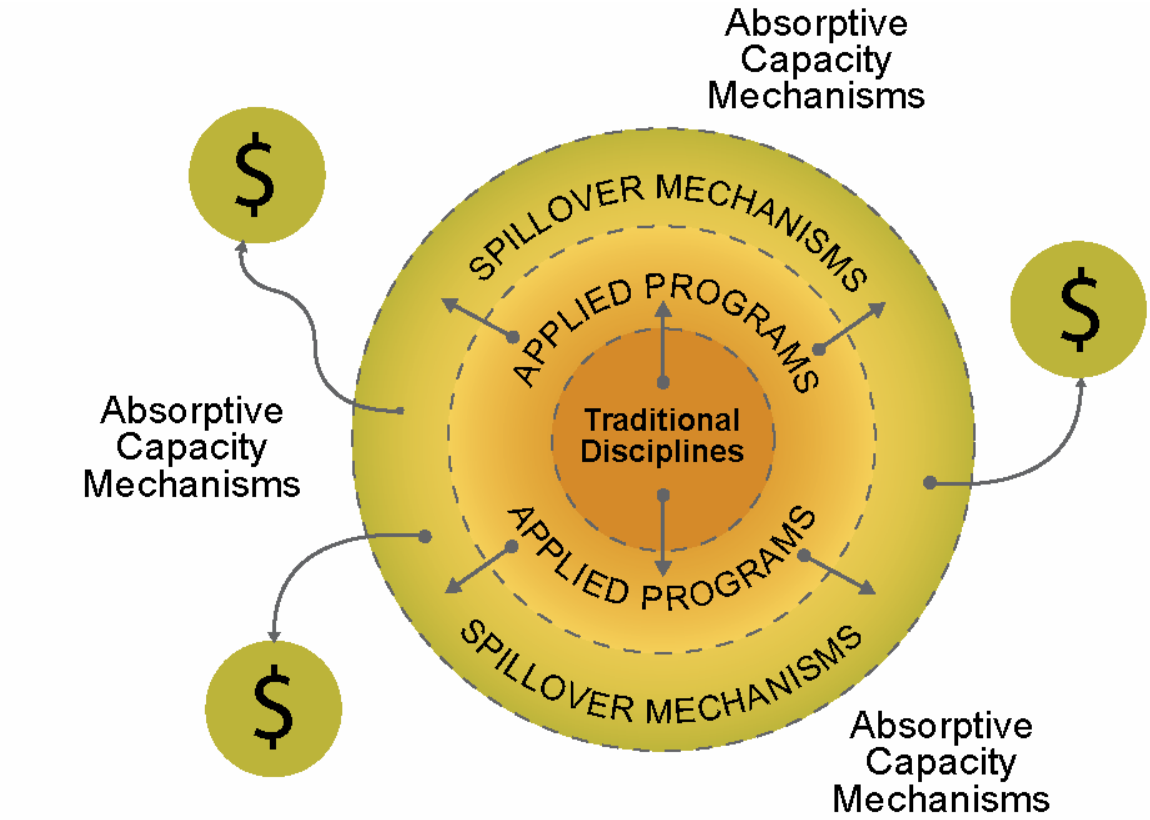
---

[24] Saxenian 1990, and Saxenien 1994.

[25] See Lester 2006. The land grant universities were focused on the agricultural and mechanical arts (A&M) and included industrial and vocational training which did make regions more attractive for industrial location.

[26] See Rothaermel et.al. 2007.

Figure 5: The Entrepreneurial University



The university makes a key contribution by generating new ideas and knowledge in the basic disciplines, which is the traditional core of the university. These disciplines represent the core of the traditional Humboldt model of the university,[27] which was proudly free from both church and government influence. In the Humboldt core of the university, shown in the center of Figure 5, knowledge is valued for its own sake, with little thought or consideration for its applicability in the "real world." As the demand for real world applications of this

[27] Humboldt had been a giant of a scholar and statesman in Berlin during the 1700s. He shaped a new tradition for universities, with freedom of thought, learning, intellectual exchange, research and scholarship as the cornerstone of the university. The Humboldt University of Berlin (German Humboldt-Universität zu Berlin), founded in 1810, is Berlin's oldest university. The structure of Humboldt, with its emphasis on basic research, served as a model for institutions like Harvard, Duke, and Cornell.

knowledge has increased over time, applied and professional programs have been created. Examples of such applied programs, depicted by the second circle in Figure 5, include business schools, informatics, health, education, bioengineering, and public policy.

The land-grant universities in the United States are a deviation from the Humboldt model.[28] The Morrill Act, more commonly known as the Land Grant Act, was signed into law by Abraham Lincoln in 1862. The act granted each state land that was to be used in perpetuity to fund agricultural and mechanical colleges benefiting the state. [29] The idea was to offer the opportunity for higher education to the members of the working class and not just those destined to religious or contemplative professions. Thus, the United States has a long and rich tradition, at least at the land-grant universities, of offering not just basic research and knowledge but also applied programs as well, particularly in agriculture and the mechanical arts.

A crucial distinction between these applied programs/fields and the basic disciplines is the orientation of the former to making a contribution to society beyond the walls surrounding the ivory tower in the inner circle of Figure 5. To be sustained over time, applied programs and fields require demand and interest

[28]The Morrill Act provided for, "*. . . the endowment, support, and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life.*"

[29]Each state was granted 30,000 acres of public land for each Senator and Representative then in office. Thus the minimum amount of land granted is 90,000 acres: two senators and one representative. Most states received much more land for their new universities.

from outside the university. In fact, their development and evolution is typically shaped by societal needs and interests. By contrast, the development and evolution of the basic disciplines tends to be shaped and influenced by the disciplines themselves—that is *knowledge for its own sake*.

Technology Transfer

However, even the addition of applied research and professional education does not generate sufficient spillovers from the knowledge source—the university—to commercialized innovations generating growth in the regional and state economies. Investments in the two inner circles of Figure 5 (traditional disciplines and applied programs) alone do not suffice. In an effort to penetrate the knowledge filter and facilitate the spillover of university-generated knowledge and ideas, a third layer has been developed at universities, which represents mechanisms for transferring university-created technology and knowledge, such as offices of technology, incubators, and university-based research parks. The goal of these university-based offices and mechanisms is to serve as conduits facilitating the spillover of knowledge from the inner two circles representing basic and applied knowledge and the external economy, typically in the region or state.

The ability of a region to absorb university-based knowledge also contributes to the effectiveness of university spillovers. Such absorptive capacity mechanisms exist outside of the university and include the existence of complementary research-oriented large and small firms, non-profit organizations

with a mandate to generate links between the regional economy and the university, and a rich set of entrepreneurial networks forming the basis for vibrant entrepreneurship capital. Such external mechanisms ensure not only that knowledge spillovers will occur, but that they also will tend to be localized within the region that invested in creating that knowledge in the first place. Regional absorptive capacity is the mechanism facilitating the localized appropriation of knowledge spillovers.

Spillover Entrepreneurship and Public Policy

The role that knowledge spillover entrepreneurship plays as a conduit of knowledge spillovers, combined with the strong propensity for those knowledge spillovers to be geographically bounded and remain localized, suggests a special focus of public policy on the impact of local institutions, universities, and policies on the cognitive process of changing career trajectories and making a decision to become an entrepreneur. By filling the gaps created by the inherent market/locational failure, public policy can create a virtuous entrepreneurial circle, where entrepreneurs become networked and linked to each other and provide strong role models of knowledge spillover entrepreneurship for the local scientific community to emulate.

State and regional policy can use the university to create entrepreneurship capital in a number of ways.

- First, investments in the inner two circles of Figure 5 must be at sufficiently high levels to generate basic and applied research.
- Second, effective and creative mechanisms in the third, or outside, circle must be developed to facilitate the spillover and transfer of knowledge for commercialization from the universities to the local and state economies.
- Third, absorptive capacity mechanisms and institutions outside of the university must be developed to quickly and effectively recognize valuable new ideas and implement them commercially must also be developed.

However, an additional key role for policy is to ensure that the boundaries between these different layers of the entrepreneurial university and its external environment are as porous as possible. By creating linkages, interactions, and networks across all of these boundaries, policy can make a vital contribution to creating rich entrepreneurship capital, facilitating the spillover of knowledge that generates growth and employment.

Examples of the Entrepreneurial University

One example of a cross-boundary linkage mechanism is the Indiana Venture Center, which is a public/private non-profit partnership involving Indiana's five research universities and industry. The explicit mandate of the Venture Center is to make the state more innovative and entrepreneurial by

leveraging the knowledge assets of the universities and helping them to transform those knowledge assets into state-based economic growth. By linking university research to private firms, the Indiana Venture Center attempts to make the boundaries between the different knowledge functions depicted in Figure 5 more porous.

Similarly, the Stanford Technology Ventures Program and the Stanford Biodesign Network attempt to link scientists and researchers in the inner two circles with venture capitalists, attorneys, and other professionals outside of the universities. These programs make the boundaries between the inner and second circles depicted in Figure 5 more porous, thereby enhancing the spillover of knowledge from basic research to successful commercial applications and ultimately to economic growth.

Yet another example of a linking mechanism is provided by the Georgia Research Alliance, a research and technology transfer consortium that includes Georgia's research universities. It has a number of creative programs that help create and attract entrepreneurs to the state. Through its Eminent Scholars program, for example, the Georgia Research Alliance brings to the state renowned scientists from all over the world to lead programs at universities that have the potential for significant economic impact for the state. The alliance also invests in numerous research and development labs that eventually become the basis for development of new technologies and businesses. As one of the state's most valuable entrepreneurship resources, the alliance has contributed to the creation of more than 3,000 technology jobs and ninety technology-based firms.

The university as talent magnet is illustrated by a leading scientist in computerized face and object recognition, Hartmut Neven, who left Germany for the University of Southern California to lead a research team to develop a tool for the military and enforcement agencies to identify suspects and enemies.[30] With the encouragement of the technology transfer office at U.S.C., Neven founded a new company that is now called Neven Vision. This example illustrates how basic research in the inner circle of Figure 5 can be applied to spillover to create commercially viable new products.

An example of the way in which a new entrepreneurial university is emerging was featured in a recent publication of the Federal Reserve Bank of Kansas City.[31] The article describes a new company, Optibrand Ltd., which was formed by a collaboration of three professors at Colorado State University in Fort Collins. The idea behind the company—to develop a retinal scanning system for livestock—was originally conceived by a professor of animal genetics and breeding. Through discussions with two other professors at CSU—one in the philosophy department and one in the finance department—the three decided to start the business. Not only were the faculty members in three departments, they were in three different colleges within the university: Natural Sciences, Liberal Arts, and Business.

[30] Flanigan, James "Entrepreneurial Edge: The Route from Research to Start-up," *New York Times*, January 18, 2007.
[31] Steeves, Brye. "Degrees of Innovation: Universities Prompt High Levels of Development Even in Non-Urban Areas," TEN, Fall 2006, 12-17.

Often in universities, faculties know and interact only with colleagues in their own departments, or perhaps on the floor of their building. Each of the colleges typically has their own building and this is an impediment to interaction between colleagues who may have similar interests, but have different disciplinary approaches.

The idea behind Optibrand began by serendipity when a 1997 rainstorm in Fort Collins resulted in the flooding of the basement offices of the building containing the philosophy department. The water level rose to the ceiling of the basement and destroyed most of the materials (computers and paper records) kept by the professors. The philosophy department was forced to relocate and this led to the meeting between Bernie Rollins, the philosophy professor, and Bruce Gordon, the animal genetics professor. Recognizing the need for business expertise, they contracted Professor Ralph Switzer.

This illustrates how innovation can occur in a university environment. It is a combination of the concentration of human capital and knowledge within the university, the interaction between professors from different disciplines, and an entrepreneurial spirit among the faculty. As is often the case with invention and innovation, the combination of these factors was facilitated by chance. In this case, a natural disaster facilitated the interaction.

Optibrand, Inc., is now a multi-billion dollar company and produces the OptiReader, a handheld computer and digital camera that electronically scans an animal’s eye for future identification. When combined with other information about the animal, such as its diet and transport history, there is a database for

tracking and source verifying individual animals. The OptiReader is used around the world and is an important part of the efforts to combat the spread of livestock disease and proof of authenticity in livestock competitions.

Thus, the entrepreneurial university can be leveraged to create state entrepreneurship capital. Universities are talent magnets. The great universities have always attracted an amalgam of creative and innovative minds.[32] One of the things that we have learned is that people will move to places that offer attractive amenities (including parks, mountains, etc.). Transportation infrastructure is also vital to facilitating a concentration of human capital. But now, with porous boundaries, that concentration of creativity and knowledge created in the traditional disciplines at the core of the university can be linked to external applications. Entrepreneurship serves as the conduit for precious investments in knowledge, ideas, and creativity to spillover for commercial application and ultimately state economic growth.

Policy Recommendations to Create an Entrepreneurial University

The economic health of states in the future depends critically on the commercialization of knowledge. Research universities can play a crucial role in this process. However, changes within the university are required to foster an entrepreneurial culture. Though changes in the research universities, which are

[32] However, states can also create impediments to attracting talent to the university. A recent example is the passage of Amendment 41 in Colorado which would prohibit and all state employees from accepting monetary gifts greater than $50 from outside groups as an award for prior work. An employee of a Colorado university would not be able to accept the Nobel Prize, for example, under the current interpretation of the amendment.

already occurring, will not alone solve all of the problems, they are vital. In this regard, we recommend the following policy changes:

- The mission of the university should include a strategy to support innovation and entrepreneurship, and a commitment to an entrepreneurial culture and skills within the university, including faculty, students, and administrators. For example, rather than relying on specific offices or programs to provide the entrepreneurial link to society, the research, teaching, and service/outreach contributions of the faculty should be infused with an entrepreneurial attitude and orientation.
- A decentralization of management or a business-like style in the process of technology transfer needs to occur.[33] As the Kauffman Foundation's "Roadmap for an Entrepreneurial Economy" suggests, universities can allow their faculties to become the equivalent of "free agents," using any third party of their choice (or themselves) to negotiate license arrangements to participate in entrepreneurial activities, provided they return some portion of their profits to the university.[34]
- The university Technology Transfer Office can be retained, but needs to be allowed to compete with third-party agents. This will give faculty members alternative paths to commercialize their research.

[33] Rothaermel et al 2007 and National Commission on Entrepreneurship 2000, p. 24.
[34] Kauffman Foundation. *A Roadmap for an Entrepreneurial Economy 2006.*

- The distribution of intellectual property rights between the university and faculty should be assigned in such a manner to promote entrepreneurship among faculty and students. The emphasis should be to facilitate the spillover and commercialization of university-generated knowledge rather than appropriating the transfer of technology.
- Faculty members should be allowed to use sabbatical leaves to pursue an entrepreneurial venture.[35] In addition to sabbatical leaves focusing solely on scholarly research or teaching, interaction with society through service and outreach activities should be encouraged.
- Universities should expand entrepreneurship training and assist students who seek to start a new business while in school.[36] Such programs should not be limited to business students, but should span a broad spectrum of programs, disciplines, and schools.
- State support for higher education should be sufficient to enable it to achieve its goals in promoting economic development. Higher education is a building block of state economic development. Investments in higher education must be commensurate with the state's economic development profile and goals.

[35] *A Governor's Guide to Strengthening State Entrepreneurship Policy 2004.*
[36] National Commission on Entrepreneurship 2000, p. 24.

Conclusion

Globalization has blown away the traditional model of state economic development. As the smokestacks of yesteryear are being outsourced and offshored to less costly locations around the globe, states are left scrambling for a viable and sustainable economic development strategy. How can states compete in a flat world?

The foundation of the new state economic development strategy is innovation. Factories can be transported across geographical space more easily and at less cost than can the capacity to generate valuable new ideas. Innovation comes from knowledge, creativity, and ideas. Those states, and indeed entire countries, that will prosper in our increasingly global economy are those investing in and able to attract investments in knowledge, ideas, and creativity.

However, investments in knowledge, both public and private, alone will not suffice. Rather, those knowledge investments must be harvested for commercial application resulting in jobs, growth, and competitiveness. Thus, state policy must ensure that costly and precious investments in knowledge, such as K-12 education, university research and teaching, and R&D by private corporations, not only find their way to fruition for innovation and growth, but also that such knowledge spillovers are localized and occur within the state and region.

Entrepreneurship is a key mechanism that facilitates not only the spillover of knowledge investments but also localizes such knowledge spillovers so that they occur locally rather than in some other location in the world. Empirical evidence is already mounting that, just as American states lost their post-war

virtual monopoly on the smokestacks of the world, they are now losing their monopoly in knowledge investments.[37] Knowledge investments are increasingly located outside of the United States, and as. As recent empirical evidence indicates, even in a country such as India, which were written off as developing only a few short years ago, have developed leading technology schools.

As other countries and regions gain equal footing in harnessing physical capital and knowledge capital, global competitiveness will be increasingly determined by the ability to quickly transform such investments into innovation and growth. Entrepreneurship capital is proving to be the unique American advantage that remains elusive to countries with different institutions, traditions, and cultures. In a flat world, it is the capacity to recognize new opportunities and act quickly upon them, or entrepreneurship capital, which increasingly bestows the regional competitive advantage.

However, even while America's unique brand of institutions, traditions, and culture propelled a unique entrepreneurship capital that propelled the economy to unprecedented growth during the last decade of the previous century, (while most of the developed world stagnated) the importance of entrepreneurship capital has not eluded public policymakers in other countries. For example, Romano Prodi, who at the time served as president of the European Commission, proclaimed that the promotion of entrepreneurship was a central

[37] A corporate survey of around 17,000 foreign direct investment projects undertaken by Ernst & Young International revealed that European companies expected to locate over a third of their R&D investments in Central Europe. "Research and Development: Looking for Innovation in the East, where the Engineering Pool is Deep." *Business Week European Edition*, December 12-19, 2005, 58.

cornerstone of European economic growth policy: "Our lacunae in the field of entrepreneurship needs to be taken seriously because there is mounting evidence that the key to economic growth and productivity improvements lies in the entrepreneurial capacity of an economy."[38] With the 2000 Lisbon Proclamation, the European Council made a commitment to becoming not just the leader in knowledge but also the entrepreneurship leader in the world by 2020 in order to ensure prosperity and a high standard of living throughout the continent.

A previous generation saw American economic competitiveness fuelled by an unrivalled investment in smokestacks, or physical capital, ascend to global leadership only to be eclipsed by admiring rivals who learned what mattered to successfully compete. The rest of the world is now determined to implement the most compelling lesson from the American economic leadership that took off in the 1990s—creating entrepreneurship capital is the key to competitiveness and growth in a global economy. As the rest of the world starts to catch up with the American entrepreneurial advantage, will governors and other state policymakers passively stand by and witness an erosion of the American entrepreneurial advantage, echoing the erosion of manufacturing just a few decades earlier? Will it be déjà vu all over again? Or will state policy leaders instead lead their states into a new era of sustained economic growth ensured by developing vital and robust state entrepreneurial economies? The latter will depend heavily on a shift in policy to create state entrepreneurial economies.

[38] Pradi, Romano. *For a New European Entrepreneurship*. Madrid: Instituto de Empresa, 2002 page 1.

References:

Acs, Zolton J., and Catherine Armington. *Entrepreneurship, Geography, and American Economic Growth*. Cambridge: Cambridge University Press. 2006.

Acs, Zoltan J., David B. Audretsch, Pontus Braunerhjelm, and Bo Carlsson. “The Missing Link: The Knowledge Filter and Entrepreneurship in Endogenous Growth." Case Western Reserve University, CEPR Discussion Papers: No. 5326, 2005.

Audretsch, David B. "Entrepreneurship Policy and the Strategic Management of Places." In *The Emergence of Entrepreneurship Policy: Governance, Start-ups, and Growth in the U.S. Knowledge Economy*, edited by David M. Hart, 20 -38. Cambridge, MA: Harvard University Press, 2003.

Audretsch, David, and Max Keilbach. *Innovation and Economic Growth.* New York: Oxford University Press, 2006.

Bayh, Birch. U.S. Senator. Introductory Statement, September 13, 1978*,* Association of University Technology Managers*, Recollections: Celebrating the History of AUTM and the Legacy of Bayh-Dole.* Northbrook, IL: AUTM, 2004, p.5.

Bayh, Birch, U.S. Senator. Statement on the approval of S. 414 (Bayh-Dole) by the U.S. Senate on a 91-4 vote, April 13, 1980, cited from Association of University Technology Managers*, Recollections: Celebrating the History of AUTUM and the Legacy of Bayh-Dole.* Northbrook, IL: AUTM*, 2004,* p. 16.

Burstein, Melvin L., and Arthur J. Rolnick. "Congress should end the economic war among the states." *The Region*. Minnesota: Federal Reserve Bank of Minneapolis, 1994.

Buss, Terry F. "The Case against Targeted Industry Strategies." *Economic Development Quarterly*, 13 (1999): 339-56.

Caves, Richard. “Industrial Organization and New Findings on the Turnover and Mobility of Firms.” *Journal of Economic Literature*, 36 (1998): 1947-82.

Council on Competitiveness. *Measuring Regional Innovation*. Washington, D.C.: Department of Commerce, 2006.

DeVol, Ross, and Rob Koepp. *State Technology and Science Index: Enduring Lessons for the Intangible Economy*. Santa Monica, CA: Milken Institute, 2004. http://www.milkeninstitute.org/pdf/state_tech_sci_index04.pdf .

Drabenstott, Mark. *A Review of the Federal Role in Regional Economic Development*. Missouri: Federal Reserve Bank of Kansas City, 2005.

Economic Report of the President, various years. http://www.whitehouse.gov/cea/.

Federal Reserve Bank of Kansas City. *Regional Asset Indicators – Innovation*. http://www.kansascityfed.org/RuralCenter/Indicators/InnovationMap_706.pdf .

Flanigan, James "Entrepreneurial Edge: The Route from Research to Start-up," *New York Times*, January 18, 2007.

Florida, Richard. *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*. New York: Perseus Books Group, 2002.

Fogel, Kathy, Randall Morck, and Bernard Yeung. "Big Business Stability and Economic Growth: Is What's Good for General Motors Good for America?" National Bureau of Economic Research, Inc., NBER Working Papers: No. 12394, 2006.

Friedman, Thomas. *The World is Flat: A Brief History of the Twenty-first Century*. New York: Farrar, Straus and Giroux, 2005.

Glaeser, Edward L., Jed Kolko, and Albert Saiz. "Consumer city," *Journal of Economic Geography*, Jan 2001, Vol. 1 Issue 1, 27-50.

Glaeser, Edward L. and Albert Salz. "The Rise of the Skilled City." Washington, DC: *Brookings-Wharton Papers on Urban Affairs*, 2004 (5), 47-105.

Kauffman Foundation. *A Roadmap to an Entrepreneurial Economy.* Kansas City, 2006.

Lester, Richard K. "A Framework for Understanding How Higher Education Influences Regional Economic Growth," presented at a conference at the Federal Reserve Bank of Chicago on October 30, 2006.

Low, Sarah, Jason Henderson, and Stephan Weiler. "Gauging a Region's Entrepreneurial Potential." Federal Reserve Bank of Kansas City *Economic Review*, pp. 61-89. Third Quarter (2005).

Lucas, Robert R. "Making a Miracle." *Econometrics*, 61 (1993): 251-272.

Maynard, Micheline, and Nick Bunkley. “As Auto Prosperity Shifts South, Two Towns Offer a Study in Contrasts.” *New York Times,* December 5, 2006.

National Commission on Entrepreneurship. *Building Companies, Building Communities: Entrepreneurs in the New Economy*, July 2000.

National Governors Association. *A Governor’s Guide to Strengthening State Entrepreneurship Policy*. Washington, DC: 2004.

National Science Foundation. “U.S. R&D Continues to Rebound in 2004,” January 2006, http://www.nsf.gov/statistics/infbrief/nsf06306/ .

Pages, Erik R., Doris Freedman, Patrick Von Bargen. "Entrepreneurship as a state and local economic development strategy." In *The Emergence of Entrepreneurship Policy: Governance, Start-ups, and Growth in the U.S. Knowledge Economy*, edited by David M. Hart, 240-259. Cambridge, UK: Cambridge University Press, 2003.

Pradi, Romano. *For a New European Entrepreneurship*. Madrid: Instituto de Empresa , 2002.

Quello, Steve and Graham Toft. “Economic Gardening: Next Generation Applications for a Balanced Portfolio Approach to Economic Growth,” in U.S. Small Business Administration. Office of Advocacy. *The Small Business Economy For Data Year 2005: A Report to the President,* Washington, D.C.: 2006, 157-194.

"Research and Development: Looking for Innovation in the East, where the Engineering Pool is Deep." *Business Week European Edition*, December 12-19, 2005, 58.

Romer, Paul. "Increasing Returns and Long-run Growth." *Journal of Political Economy*, 94 (1994): 1002-1037.

Rothaermel, Frank T., Shanti Dewi Anak Agung Istri, and Lin Jiang. “University Entrepreneurship: A Taxonomy of the Literature.” *Industrial and Corporate Change*, forthcoming 2007.

Saxenian, Annalee. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*. Cambridge, MA: Harvard University Press, 1994.

Saxenian, Annalee. "Regional Networks and the Resurgence of Silicon Valley." *California Management Review*, 33 (1990): 89 - 111.

Stephan, Paula. "Wrapping It Up in a Package: The Location Decision of New PhDs Going to Industry." in *Innovation Policy and the Economy*, MIT Press, edited by Adam Jaffe, Josh Lerner and Scott Stern.. Cambridge: MIT Press, 2006.

U.S. Small Business Administration. Office of Advocacy. *The Small Business Economy for Data Year 2005: A Report to the President,* Washington, D.C.: 2006.

U.S. Small Business Administration. Office of Advocacy. *The Third Millennium: Small Business and Entrepreneurship in the 21st Century*. Washington, D.C.: 2000. 37 http://www.sba.gov/advo/stats/thirdmill.pdf .

World Trade Organization. *Statistics: International Trade Statistics 2004: World Trade Developments in 2003 and Prospects for 2004* Washington, D.C. http://www.wto.org/english/res_e/statis_e/its2004_e/its04_general_overview_e.htm