Milken Institute

Arkansas' Position in the Knowledge-based Economy

Prospects and Policy Options

Prepared for Accelerate Arkansas

September 2004

Acknowledgements

Acknowledgements

This report was made possible by a grant from the Winthrop Rockefeller Foundation to the Capital Resource Corporation, sponsor of Accelerate Arkansas. The authors of the study would like to thank the entire membership of Accelerate Arkansas for its insight and comments on the original draft that greatly improved the final report. The authors extend a special thanks to Accelerate Arkansas chairman, Tim McFarland, for his numerous contributions and oversight of the entire project.

About the Participating Organizations

The *Winthrop Rockefeller Foundation* is a private, nonprofit foundation dedicated to improving the lives of Arkansans by funding programs and projects that improve education, economic development and economic, racial and social justice. In 1974, the Trustees of Governor Winthrop Rockefeller's Estate endowed the Winthrop Rockefeller Foundation to continue the work of the Rockwin Fund. Governor Rockefeller set up The Rockwin Fund in 1954 and, on an annual basis from 1956 until his death in 1973, funded projects and programs he believed were important to improving the quality of life in Arkansas.

The *Capital Resource Corporation* sponsors *Accelerate Arkansas* and is a nonprofit organization that helps educate, promote and foster the development of innovation, entrepreneurship and venture capital formation within the state of Arkansas. It was set up by the Arkansas Capital Corporation. Arkansas Capital Corporation is a private nonprofit business development corporation formed in 1957.

Accelerate Arkansas is a statewide group of volunteers working under the Capital Resource Corporation. Its mission is to foster economic growth in Arkansas by using the essential building blocks of the knowledge-based economy—knowledge creation through research and development, intellectual property development, commercialization of new technologies, growth of entrepreneurial knowledge-based firms, knowledge workforce and the evolution of knowledge-workforce clusters—to create an environment supporting entrepreneurship and continuous innovation.

Milken Institute is an independent economic think tank whose mission is to improve the lives and economic conditions of diverse populations in the U.S. and around the world by helping business and public policy leaders identify and implement innovative ideas for creating broad-based prosperity. We put research to work with the goal of revitalizing regions and finding new ways to generate capital for people with original ideas.

The *University of Arkansas' Center for Business and Economic Research* serves the Arkansas business, governmental and academic communities, through research and analysis, supporting statewide economic development. Through analysis of proposed investments, policy changes and programs, its helps businesses and communities make sound financial and public policy decisions for tomorrow. The Center also serves as a catalyst for change by encouraging the growth of knowledge-based businesses throughout the state.

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Executive Summary

A fundamental transformation is occurring in the world: a shift toward knowledge-based economic activity as the foundation of sustained comparative advantage. This alters the relative importance of assets that can be harnessed for regional economic development purposes. The assets propelling states and regional economies in the past were physical in nature—proximity to waterways, railways, raw materials—and the manufacturing infrastructure that developed around them such as cheap labor, and low business costs, that determined economic success.

Today, regional economic prosperity is largely based upon how successful a location is in attracting and expanding knowledge-based assets and leveraging them for economic development. Essentially, this is the movement from a tangible asset-based economy to an intangible asset-based economy. Most of the value of an intangible or knowledge-based economy is anchored in its stock of human capital and the places where they reside. States succeeding in knowledge-based and technology-based growth will push income per capita higher, especially relative to those states that falter.

The structure of the world economy is very different today than it was even a generation ago. The liberalization of international trade and investment regimes, and technological gains in communications, transportation and management skills over the past quarter-century, have created the opportunity for a greater degree of interpenetration of markets and production leading to a world economy that is becoming increasingly deeply integrated or globalized.

Economic regions are now more susceptible to an exodus of industries (and jobs) attracted elsewhere—to other states within the U.S. or countries offshore—by the perception of greener pastures. Firms seeking to invest in an area for the first time have no "roots" and their investments are, therefore, highly locationally sensitive. Those already established in a geographic location are able, albeit not without some difficulty and cost, to relocate to competing areas. For these reasons, it is important to constantly innovate, and start and grow indigenous firms to diversify the economic ecosystem of a region. This lessens the chances of the entire ecosystem collapsing when existing firms expand elsewhere, move or become extinct.

Our review of the data reveals that Arkansas has been operating at the periphery of the knowledge-based economy. Arkansas has been making progress, but most states are focused on investing heavily and nurturing key institutions to improve their position in the knowledge-based economy. Given that Arkansas is starting far behind other states in the knowledge-based economy race, it is necessary to implement both incremental improvements and invest in transformational change to lift its position and begin to close the gap in per capita income with the U.S. average.

Technology and Science Assets

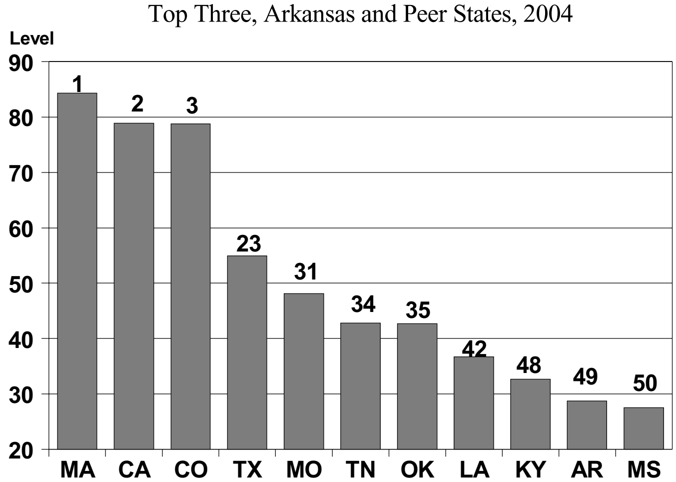
In order to provide a benchmark assessment for Arkansas, and provide a means to monitor progress, we have utilized our national **State Technology and Science Index**. It provides a set of interrelated but distinct measures and indicators that encompass a comprehensive inventory of the technology and science assets that are a hallmark of knowledge-based economies.

Among these assets are research and development capabilities that can be commercialized for future regional and state technology growth; entrepreneurial capacity and risk capital infrastructure that fuels the success of converting research into commercially viable technology services and products, and human capital, the most important intangible asset of a regional or state economy.

The intensity of the technology and science workforce indicates whether sufficient depth of high-end technical talent is resident within a state. Technology concentration and dynamism can be viewed as a measure of how Arkansas puts its technology and assets to use.

The bar chart below shows Arkansas' position of 49th in the United States on the overall 2004 State Technology and Science Index. Massachusetts, California and Colorado are the top three ranking states in the nation. With the exception of Mississippi, all of the states comparable to Arkansas ranked higher on the 2004 index.

State Technology & Science Index
Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

Arkansas' poorest showing on the compound subindexes that make up the technology and science index was in the category of research and development assets. Individual categories within R&D assets suggest the areas in which Arkansas might focus attention for improvement. Each relates to funding. The challenge is for Arkansas to channel its limited resources into areas identified as promising. Arkansas scored poorly (49th) on both of the human capital subindex and the technology and science workforce subindex. Arkansas also came in 49th for percent of the adult population with a bachelor's degree or greater. If Arkansas is to participate in the knowledge-based economy, it must improve the quality of its workforce.

Policy makers and stakeholders interested in improving the competitiveness of Arkansas' technology and science capabilities would do well to work toward achieving gains in the state's R&D assets. Especially noteworthy is Arkansas' lack of success in securing funding from outside sources. For example, Arkansas scored low in the following external R&D areas:

- Competitive National Science Foundation (NSF) Funding—Arkansas ranked 50th in the nation for this measure on both the 2002 and 2004 indexes;
- NSF Research Support Funding—Arkansas ranked 47th on the 2002 index slipping to 49th in 2004;
- Overall Phase I and Phase II Small Business Innovation Research (SBIR) Awards—On the 2004 index, it received limited Phase I SBIR awards, but no Phase II awards; and
- Federal R&D—Arkansas ranked 49th in 2002 then slipped to 50th in 2004.

It would be glib to suggest that Arkansas merely go out and secure additional funds from these sources. States, metros, municipalities and individuals aggressively pursue these limited resources. A number of practical suggestions, in the recommendations and concluding sections of this report are presented for public policy makers and stakeholders to consider, so that Arkansas may improve the state's R&D inputs and thereby, its overall technology and science performance.

Arkansas' best showing on the compound indexes was in the area of risk capital and entrepreneurial infrastructure. The state's improved performance on this index is seen in its rise from 47th-place on the 2002 index up to 42nd in 2004, rising above each of the comparable states in its region.

Arkansas also performed marginally better in the area of technology concentration and dynamism. From an analysis of each of the components included in this measure, it is clear that Arkansas' greatest strength, albeit limited, lies in its ability to both create and sustain the formation of new high-technology businesses in the state. This is reflected in the high scores and rankings of the state in the following components:

- Number of high-tech industries growing faster than in the U.S.—Arkansas ranked above the national average for this measure, at 16th in the nation on the 2002 index and 20th in 2004;
- High-tech industries average yearly growth—Arkansas ranked 18th in 2002 improving its performance to 12th in 2004; and
- Net formation of high-tech establishments per 10,000 business establishments—Arkansas substantially increased its rank to 36th in the nation on the 2004 index from 49th in 2002.

Arkansas' strong performance in the area of net formation of high-tech establishments is very good news for the state's economy. The state's strengths here, however, can hardly be taken for granted. If negative factors such as business costs are not kept in check and inputs such as the quality of primary education are not improved, Arkansas' competitiveness in the attraction and retention of high-tech firms will quickly erode. Competitiveness can be fleeting, especially in dynamic, sometimes fickle, high-tech industries.

Just as a high ranking should not be interpreted to mean that a state be complacent about the security of its competitive position, a lower ranking should similarly not be taken to mean that a state is consigned to a fate of underperformance. Virginia's rise to high-tech economic dynamism over recent years can offer lessons for states that aspire to a more prosperous future in an intangible economy. California had an economy dominated by natural resources and agriculture. Moreover, new state policies that may come from recently launched initiatives hold out the potential for substantive improvement in Arkansas.

Business and Environmental Competitiveness Factor Analysis

The issue of the competitiveness of the state of Arkansas revolves around the proposition that what one state in the U.S. does, affects or is affected by, what is going on in other states in the country. Different states have different factor endowments. Location advantages specific to the state of Arkansas are factors that favor production within Arkansas. No single measure can capture the issue of competitiveness totally. For this reason, we analyze a diverse set of indicators.

A review of the Small Business Survival Index created by the Small Business Survival Committee in Washington, D.C. is a helpful evaluation tool. Its purpose is to rate varying states on how friendly their business climate is to the establishment and survival of smaller businesses. In performing this evaluation, it is important to understand that 90 percent of smaller businesses file as individuals, and thus are affected by personal income tax levels according to the U.S. Small Business Administration.

Arkansas is in the middle of the pack (25th) on this index. Among peer states, only Oklahoma and Kentucky trail in 27th and 28th place, respectively. Arkansas ranks much higher on this index than in some other comparisons due to the fact that the state's business climate provides numerous cost advantages to small businesses, while its limited resources in technology, workforce training and infrastructure are more likely to hamper businesses looking to expand or relocate.

Arkansas' main advantages in providing a strong climate for small businesses are in lower workers' compensation costs, lower property taxes, affordable health care and moderate electricity costs. The state is hampered by higher than average personal income tax, sales tax and unemployment tax rates. Although the state's tax burden is lighter than most for mid-to-large–sized corporations, the tax burden more strongly affects small businesses in the state due to the higher relative costs for them of the larger sales tax and personal income tax rates. The overall ranking of Arkansas in this index does provide some positive indicators. Once businesses are established in the state, they have a fairly high rate of survival.

The Beacon Hill State Competitiveness Index provides a reference for measuring the long-term competitiveness of a state in direct comparison to the rest of the country. The Beacon Hill index is broken down into ten subindices that compare states on everything from state fiscal policy and finances to human capital and the local climate for business. Arkansas performs rather poorly in this comparison, ranking 47th overall. Deficit scores in infrastructure (48th), human resources (48th), technology (50th) and domestic competition (50th) harm its position.

The Corporation for Economic Development issues an annual "Development Report Card for the States" that issues a grade for each state in terms of performance, development capacity and business vitality. The last of these three is the one that is directly relevant to this study. Arkansas has an overall business vitality ranking of B for 2003. This grade is generated based upon nine different rankings that are divided into two categories—competitiveness of existing business and entrepreneurial energy.

Due to increased international economic integration, it is important to analyze measures such as foreign direct investment (FDI) and exports to gauge competitiveness. By examining multiple calculation measures we see that foreign activity has a significant and increasingly positive impact on the competitiveness of the state of Arkansas. Arkansas has witnessed a dramatic increase in the FDI share of gross state product, but it is still substantially below the ratio for the U.S. average (6.9 percent versus 11.9 percent for the U.S.).

Arkansas' total exports increased from $2,304.8 million in 1997 to $2,816.6 million in 2003. Exports from Arkansas account for only a small but growing portion of the value of shipments of exports from the entire country (approximately 0.4 percent). Exports of goods and services, particularly manufactured products, and foreign direct investment have the potential to further contribute to Arkansas' economic development.

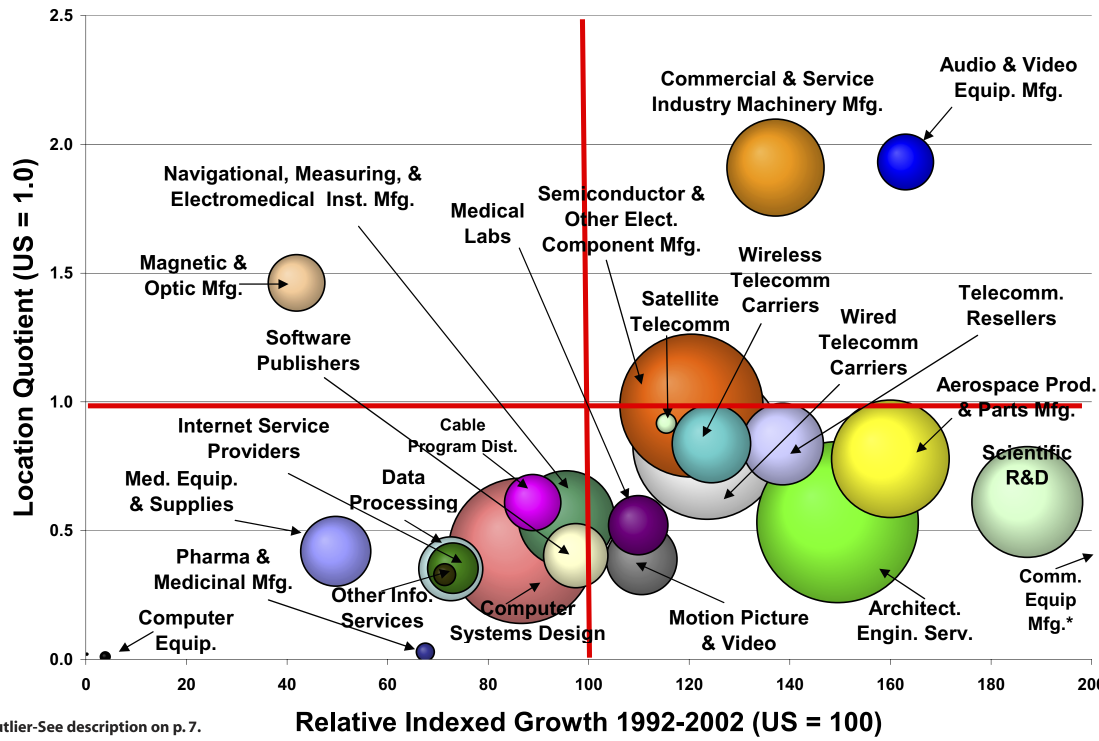
However, it is important for state policy makers to recognize that, relative to other states, Arkansas' share of the total foreign direct investment coming into the nation has declined. More specifically, in the manufacturing sector, Arkansas is capturing a larger share of the country's domestic and overall manufacturing employment but a smaller share of the country's foreign manufacturing employment such that from 1977 to 1999, foreign affiliate manufacturing employment was less significant in the state than in the country as a whole. In effect, this data shows Arkansas slowly losing ground in the competition for FDI in the United States.

Industry Group Analysis

In addition to assessing the assets that promote knowledge-based growth and other business competitiveness factors, it is necessary to analyze the industry composition and performance of Arkansas' economy. For the purposes of this report, we investigated 282 individual industries operating in the state of Arkansas from 1992 to 2002. The industries were separated into three groupings: Tier 1, high-tech industries; Tier 2, other knowledge-based industries; and Tier 3, all other industries. We conducted this analysis for the state overall, each of the metropolitan areas and for nonmetro or rural areas of the state.

Employment in Arkansas' **high-tech sector** (Tier 1) as a share of total employment in the state increased from 1.7 percent in 1992 to 1.9 percent (10,739 employees) in 2002 (the U.S. average figure was 6.4 percent). Our analysis reveals that few of these high-tech industries contribute to Arkansas' economic growth in a meaningful way. A pictorial representation of Arkansas's high-technology industrial composition is presented below. Please refer to the detailed industry group analysis section for a complete description.

Arkansas' High-Tech Industries
Employment by Size, Growth & Concentration



* Outlier-See description on p. 7.

From the above chart we see that the commercial and service industry machinery manufacturing sector is the most export-intensive high-tech industry in Arkansas. It ranked 7th for employment in the state's high-tech sector. Its significance to Arkansas is reflected in that it is twice as important to the Arkansas economy as to the nation as a whole and it grew substantially faster than the national average.

Audio and video equipment manufacturing is also significant to Arkansas. The size of that sector in Arkansas is relatively small however, employing only 722 people in 2002 up from 554 in 1992.

Audio and video equipment manufacturing is a high-growth industry relative to that of the U.S. as a whole.

The high-tech industry segments that employed the most people in Arkansas in 2002 were:
- Architectural engineering and related services (6,026 employees);
- Wired telecommunications carriers (5,138 employees); and
- Computer systems design and related services (4,909 employees).

Each of these three high-tech industries had strong positive rates of employment growth in the state with 96 percent, 54 percent and 113 percent employment growth respectively, from 1992 to 2002. In addition, each experienced above-average or about-average rates of employment growth relative to that in the U.S. overall.

Of the total high-technology industries examined in Arkansas, the sectors that ranked highest for employment growth change over this decade were:
- Communications equipment manufacturing (a huge 1,893 percent); and
- Software publishers (139 percent).

Communications equipment manufacturing warrants special mention. No bubble appears on the above chart for this industry segment. Its circle falls way off the chart—relatively low and very far to the right—making it, in statistical terms, an “outlier.” It experienced high growth, but from a low base.

Employment in Arkansas’ **other knowledge-based sector** (Tier 2) as a share of total employment in the state decreased from 8.4 percent in 1992 to 8.0 percent in 2002 (the U.S. average was 16.0 percent). Therefore, although the actual number of employees in this sector increased from 163,362 in 1992 to 186,092 in 2002, the contribution that knowledge-based industries made to Arkansas’ economic growth, declined.

Employment in Arkansas’ knowledge-based industries in 2002 is greatest in the management of companies and enterprises industry with 22,318 employees, and in the depository credit intermediation industry with 18,378 employees. Both of these segments employed a significant number of people in the state in 1992 and 2002, experienced double-digit employment growth and increased wage rates. In both 1992 and 2002, management of companies and enterprises and depository credit intermediation contributed substantial and increasing amounts to Arkansas’ GSP. The concentration of these knowledge-based industry segments in the state increased to significant levels with location quotients (a measure of the concentration of an industry in a state or region relative to its importance to the nation) for each, rising above 1.0 (the national average) in 2002.

The following 10 knowledge-based industry segments exhibited high and increasing location quotient, wages, employment and GSP from 1992–2002:

- Iron and steel mills and ferroalloy manufacturing
- Steel product manufacturing from purchased steel
- Hardware manufacturing
- Management of companies and enterprises
- Insurance and employee benefit funds
- Forging and stamping
- Depository credit intermediation
- Motor vehicle parts manufacturing
- Activities related to credit intermediation
- Motor vehicle body and trailer manufacturing

Arkansas' above average knowledge-based industry performers in terms of employment concentration are electrical equipment manufacturing, and pulp, paper and paperboard mills The electrical equipment manufacturing industry experienced the highest GSP growth overall for knowledge-based industries operating in the state from 1992 to 2002.

Arkansas Institutions and Policy Tools Serving the Knowledge-based Economy

If Arkansas is to be successful in building an economy that includes knowledge-based industries as more than an anomaly, it must be based on the development and nurturing of critical public and private institutions whose express missions include the goal of supporting Arkansas knowledge-based companies. Failure to support existing institutions tasked with providing critical functions to the knowledge-based economy (KBE), or failure to create those institutions that are necessary but missing from the state, dooms any effort, no matter how well conceived.

The list includes pre-school, K-12, two-year colleges and technical institutes, four-year universities and workforce development institutions, institutions that nurture an entrepreneurial culture (programs at colleges and universities, small business development centers, Chambers of Commerce and entrepreneur networking organizations), institutions providing access to financial capital (venture capital programs and angel investor networks), institutions creating and facilitating knowledge spillovers and institutions supporting quality of life.

The legislative response to the Lake View decision by the Arkansas Supreme Court has provided an unequaled opportunity for improvement in Arkansas preschool, primary and secondary education. Several key pieces of legislation have a direct impact on the educational goals directly linked to the ability of the state's preK-12 system to provide the foundation for development of a sufficient and continual supply of talent upon which to build knowledge-based companies in Arkansas. It is unclear, however, whether these steps will lead to improved educational outcomes directly linked to promoting the KBE in Arkansas. It is critical for the state to succeed in this effort in order to have sufficient numbers of college-eligible students.

Two-year colleges and technical institutes have grown rapidly over the last decade, both in terms of students and number of institutions. The obvious potential benefit of growth in the system is improved access to higher education. Improved access is evidenced by the state's rank of 10th nationally in number of postsecondary schools per capita. Students attending Arkansas' two-year colleges and technical institutes, however, are far less likely than their national counterparts to earn a four-year degree. Nationally, 13 percent of students entering two-year public institutions graduate with a bachelor's degree within six years. In Arkansas, only 3 percent eventually graduate from a four-year institution.

Immense efforts and substantial commitments have been made to the state's four-year universities to improve quality. The effect of these efforts is obvious. Newspapers are replete with announcements by state institutions of generous gifts, national research awards won through competitive peer review processes, and faculty and student accomplishments. In short, students seeking educational opportunities that provide them with the ability to compete with peers from any other state don't need to look to another state for a four-year university education.

Business incentives and legislation tailored to improving economic development efforts are important to the overall competitiveness of the state of Arkansas in attracting and retaining knowledge-based companies. By and large, the incentives available to firms from the state of Arkansas are adequate to compete with other states. However, Arkansas' financial incentives are disproportionately aimed at mature companies with steady profit streams. The incentives do little to encourage early stage high-risk, high-return companies to consider relocating in Arkansas.

Arkansas has been creating more institutional support mechanisms, but they must be nurtured further and the proper resources devoted to them. A thorough review of these institutions is contained in the report.

Economic Impact of Successful Creation of Knowledge-Based Industries

In order to identify the potential benefits of Arkansas developing a more knowledge-based economy, it is illustrative to compare two alternative futures: a baseline forecast and an alternative forecast. The model's baseline forecast is described as the scenario by which the state is projected to grow assuming the current industry mix and workforce within the state. The purpose of composing an alternative forecast is to determine the types of jobs, both in terms of quality and quantity, necessary to keep up with the growing per capita income in the nation. In so doing, we have assumed that the state must closely mimic the national industry mix and in some cases grow faster than the national average in terms of both employment and output.

Although public policy decision making will ultimately influence the future growth of a region's industry structure, the alternative scenario can serve as a basis for determining those industries that are essential to the overall health and prosperity of the state economy. While we are aware that knowledge-based or high-tech industries is where the state should focus most of its resources, they should act as a supporting cast towards those key industries in which the state already has a considerable employment base, such as food processing, freight, etc.

In short, the alternative forecast scenario explains the economic impact of adding approximately 27,000 additional jobs above the baseline forecast in high-tech and knowledge-based industries by the year 2020. This direct impact would generate an additional 19,000 jobs in other sectors such as wholesale, retail trade and manufacturing, ultimately accounting for 46,000 newly added jobs above the baseline in the state. Relative to the baseline forecast (the scenario in which Arkansas adds jobs in high-tech/knowledge-based industries at its recent historical rate), total personal income and gross state product would increase by $12.7 billion, and $11.6 billion, respectively by 2020. The alternative scenario also captures a higher share of national income per capita. Finally, the change in employment would also generate an additional $2.4 billion in tax revenues.

Conclusions and Recommendations

Many of the suggested policies and solutions offered here are intended to provide improvements to the state's economy quickly, even within a few years. In order to make the distinction between what is readily achievable and what is achievable only through extended efforts, the recommendations are listed by timeframe of implementation.

Leadership

In order to alter the economic development paradigm towards greater focus on knowledge-based economy initiatives, it will be critical for Arkansas to have a leadership group that acts as a catalyst and provides strategic vision. Accelerate Arkansas can position itself as the key leadership and catalyst group in promoting knowledge-based economic development among all stakeholders. It has the broad-based membership and individuals of stature to provide credible leadership. Accelerate Arkansas should consider some additional actions.

- Establish a communication outreach plan to target audiences
- Bring CEOs or senior executives of major Arkansas corporations aboard
- Identify other key stakeholder groups and individuals for membership
- Solicit personal involvement and support of Governor
- Initiate Legislative education and outreach effort

Recommendations

The following 10 recommended actions are those considered most essential to the transformation of the state's economy and structure:

1. Coordination of Existing Agencies and Initiatives

In order to instigate productive change within the state's economy, it is important that the various resources within the state, both within the state government and in the private sector, are encouraged to focus their efforts in a complementary fashion. In order to implement each of the recommendations in this section successfully, interagency cooperation and commitment, rather than rivalry, is highly important. Many programs and partnerships designed to encourage innovation and new enterprises have either been underutilized or handicapped by budgetary limitations.

2. Development of Coordinated Risk Capital Policy

To promote venture capital and angel investing, and to link those investors with promising new businesses, it is strongly recommended that the state government play a leadership role in developing a coordinated system for encouraging such activities. The state of Arkansas can assist this effort by continuing to institute policies to reduce or share the risk of early-stage investing in new technologies and startups as well as providing a central resource to match angel investors with interested companies. Coordinated risk capital policies in Arkansas should not only involve investors from other states, but also key players already established locally such as Stephens Inc., and integrate them into the process of establishing the risk capital infrastructure.

3. Providing Assistance for Funding and Grant Opportunities

Numerous private organizations such as the Kellogg Foundation and the Kauffman Foundation exist to offer grants to starting businesses. The federal government's Small Business Administration also has numerous resources on offer. Given the existing constraints on state spending, providing resources and assistance to those who would be eligible for grants and awards is a cost-effective solution that aids local businesses in need of funding.

4. Industry Focus Initiatives and Strategy

The following is a set of recommendations to further industrial development, particularly in terms of building up the knowledge-based and technology-related employment base in the state of Arkansas. The objective of these recommendations is to establish four levels of development approaches and goals:

- Promote and link the state's well-established regional industry base to technology, focusing on technology adaptation
- Promote the extension of flagship enterprising firms to develop new product and service areas
- Promote new technology initiatives that will help existing small, but rapidly growing enterprises
- Regional cooperation and resource sharing

Policy, legislative and governing recommendations

Arkansas should form a state commission on advising and overseeing the state's industrial development. The commission, comprised of public and private stakeholders, would formulate priorities and have the stated goal of improvement in industry growth and enterprising formation.

Industry-specific recommendations

A. Food Processing/Refrigeration Industry Core Group: crossing industry boundaries and exploring possibilities.

B. Wholesale/Retail: packaging and product designs—beyond low cost enterprising, a creativity and design center on the horizon.

C. Transportation/Information System: Building a high-tech transportation and distribution hub that provide the best logistics service to track goods and yield benefits for citizens statewide.

D. Helping other key fast–growing industries and less developed regions: "Today's gazelles, tomorrow's lion."

5. Identify Comparative Advantages in the State and Develop Them

In order to attract new businesses to Arkansas as well as keep the ones that are considering relocation, it is strongly recommended that the state make efforts to identify the key advantages it holds over potential rivals and to make the business sector aware of how important those advantages are. Arkansas must ensure that its quality-of-life standards improve even as it tries to limit its cost of doing business so as to still attract companies who wish to remain in the country and in a place that they feel comfortable.

6. Improve the Image of the State to Lure Investment

Arkansas can benefit greatly from encouraging investment from other states, and particularly from other countries. In order to promote a positive image of Arkansas as well as encourage inquiries, the state government should strongly consider reconstructing the state's website to improve access to information for those curious about the state, and to better serve the goal of promoting Arkansas as a good place to live and work. A marketing campaign based on a new image is needed to promote a new view of the state in people's minds and erase any preconceptions they might have which would keep them from doing business in the state.

7. Upgrade Arkansas' Infrastructure

In order for Arkansas to continue to develop, the state should develop an organized strategy for spending its money on infrastructure where it can most effectively facilitate existing growth, rather than spending the money on projects intended to create growth on their own. Northwest Arkansas is already beginning to move towards a crisis point, as the continual job growth in the region is fueled by companies such as Wal-Mart and Tyson Foods. Although the two corporations have strong historical ties to the area, a failure to increase the capacity of the local infrastructure at the pace of the corporate rate of expansion runs the risk of their future economic development moving to a location that can handle their growing demands.

8. Reform the Tax Code and Improve Incentives for Business

The state's tax structure on the whole is fairly competitive, but the reliance of the state on revenues derived primarily from personal income tax and sales tax has impeded the development of new knowledge-based and high-technology companies. In order to promote the growth of small companies and new knowledge-based industries, it is recommended that the tax code be restructured or at least modified to be friendlier to new businesses. The state should simplify the tax structure, particularly for small businesses, to make it easier to understand.

9. Improvements in Education

In the wake of the Arkansas Supreme Court's decision in the Lake View case, it has become apparent to most observers that the state's system for funding and organizing public K-12 education must undergo significant changes. Arkansas has made significant efforts to increase the state's capacity in higher education and to create the potential for students to earn more advanced degrees. In order to actually utilize this capacity to improve the education of the populace, it will be necessary to focus the state's educational resources on specific goals, many of which will only be achievable in the long term.

State leaders should consider the Texas model, in which a statewide incentive-based advanced-placement program in science and math has been established in every Texas high school to help improve the students' chances to compete for jobs not only with their fellow Americans, but also with overseas workers as well. In addition to preparing students to matriculate to four-year institutions, two-year schools and the students might be better served by linking the two-year schools more effectively to local businesses, which can utilize the schools for funded worker training and retraining.

10. Utilize Key Resources to Boost Research and Science

To firmly establish Arkansas as a developing center of knowledge-based industry and research, it is essential that the state harness the resources of both its existing research institutions and the industries in which it holds the highest comparative advantage. Leadership and coordination must occur over the long term to allow time for connections to be established between the state, its research institutions, and the companies that can most contribute to and benefit from that research.

To develop centers of research and innovation, the leaders of this strategy have to work with key industries that can fund and benefit from this research, and establish connections to already existing research institutions. Attempting to develop a research cluster from the ground up is both risky and expensive, which means that the three most viable candidates are the University of Arkansas in Fayetteville, the University of Arkansas Medical School in Little Rock, and the University of Arkansas-Little Rock, even if other candidates such as Arkansas State University in Jonesboro might establish itself as such further in the future.

Goals

In order to be able to evaluate the success of implementing these recommendations, it is important to have measurable goals which can be utilized to observe improvements within Arkansas. These goals should receive wide dissemination and stakeholder groups should develop an implementation plan to achieve them with responsibility and accountability assigned. Intermediate and long-range goals should be established with annual or bi-annual performance reviews to monitor progress. Frequent monitoring allows adjustments or interventions to be made on a timely basis and improves the probability of achieving stated goals. Once the state has improved to near or above the national average in these specific fields, the goals can reasonably be considered to have been met. New goals should be established as progress is made or the initial goals fulfilled. As these various recommendations are implemented over the course of the next several years, improvement should appear in the following five categories:

1) The number of SBIR Phase II awards received per year
2) Number of business starts per 100,000 population
3) People holding bachelor's degrees or greater as a percentage of the adult population
4) Percentage of jobs in high–tech and in other knowledge-based industries
5) Per capita income relative to the national average

Conclusion

The state of Arkansas currently stands at the threshold of a knowledge-based economy. The question that faces the state's leaders should not be one of whether or not Arkansas wants to be part of this new economy, but of how its leaders can ensure that the state actively participates in it and can use this participation to benefit its citizens. The state can simply not afford to be left behind as the rest of the country continues to move forward. Arkansas does not have to abandon its economic legacy of manufacturing, food processing and retail to embrace knowledge-based industries. Instead, the state can build upon its historical strengths as it prepares itself for the economic challenges of the next 20 years.

Arkansas and the State Technology and Science Index

In the Milken Institute's first *State Technology and Science Index* released in 2002, we stressed the need for states to recognize new realities of an intangible economy. This mandate remains unchanged. In the intervening time, however, the nuances of those realities have themselves taken on new meanings.

Across the nation, states are facing radically altered conditions for their funding sources and spending priorities. In Alabama, for example, after only four months in office, Governor Bob Riley, a conservative renown for his anti-tax principles felt compelled to propose raising taxes by $1.2 billion a year. Not only was this the first time in Governor Riley's political career that he had ever supported a tax increase, he was, moreover, proposing the single biggest tax increase in Alabama's history—a drastic measure aimed at relieving the state's most dire fiscal situation since the Great Depression. Dubbed "Laying the Foundation for Greatness," the governor's proposal was designed to solve more than the state's fiscal deficit. It was, rather, designed to help eradicate a deficit in human capital as well by using tax dollars to boost the state's number of skilled workers and consequentially its economic performance. With a rationale grounded in the sort of comparative rankings on which the Institute's Index is based, the governor appealed to voters with the question: "Do you still want to be 49th and 50th in everything we do?"[1] In the end the Alabama electorate rejected the governor's plan, but that hardly diminishes (and in fact underscores) the boldness of his proposal.

Today's globalizing economy requires new, often unprecedented, thinking about state policy. Economically leading states are no more protected than those that are poor performers. All corners of the nation's economic landscape are facing heightened demands to go beyond the status quo. However, states with strong technological, knowledge-based economies do weather global challenges better than states still anchored in a traditional tangible economy. The Institute believes that this Index provides a valuable framework of measures to guide policy makers and the public on the realities of state performance in the knowledge-based economy of today.

As pointed out in the 2002 Index, the notion of a new economy has often been mischaracterized and even more often misunderstood. What economists really have described with growing frequency in recent years is the movement from a tangible asset-based to an intangible asset-based economy. The economy is not itself new, but the relative importance of economic assets has been fundamentally transformed. In an intangible economy, concepts such as patents, copyrights, customer relationships, brand value, unique institutional designs, the value of future products and services, and their structural capital (corporate culture, systems and processes) become ever more important to firms. Most of the value of an intangible economy is anchored in its stock of human capital and the locations where they reside.

The intangible economy is based upon more than high-technology industries alone, although they are essential for sustained economic success. The advent of the technology and science-based economy, and the growing importance of innovation as a competitive-enhancing attribute, is having very significant spatial implications. The role of locational choice is becoming a more important component of firm strategy. Governments and collaborative agencies should give more attention to how best organize and utilize the physical assets within their jurisdiction in order to attract and retain the mobile assets necessary to upgrade productivity, and better promote the dynamic competitive advantages of their indigenous resources and capabilities. Places that can attract, grow and retain firms and industries proficient at deploying technology, in addition to producing it, will be at a competitive advantage.[2]

This notion underpins the purpose of the State Technology and Science Index. It provides a benchmark for states to monitor progress, offering a set of interrelated but distinct measures and indicators that encompass a comprehensive inventory of the technology and science assets that are a hallmark of intangible economies.

Specifically, the State Technology and Science Index is composed of five equally-weighted major composites (subindexes). They are:

- Research & Development Inputs,
- Risk Capital and Entrepreneurial Infrastructure,
- Human Capital Investment,
- Technology and Science Workforce, and
- Technology Concentration and Dynamism.

These five composite indexes are comprised of 75 individual components. Each of the components is measured on a relative basis to a relevant indicator (e.g., population, Gross State Product, number of establishments, etc.) The data was collected from a number of governmental agencies, foundations and private sources and then compiled, calibrated and analyzed by the Milken Institute.

Intangible economies are driven by a place's ability to attract and expand technology and science assets, and leverage them for economic development. State and regional economic performance is determined by how effectively its comparative advantages are used to create and expand knowledge assets and convert them into economic value. If you can use recreational amenities such as a beach, snow-capped mountains or an innovative culture to retain or draw these assets, you are ahead in the technology-based economic-development game. And states succeeding in technology-based growth will push income per capita higher, especially relative to those states that falter.

Technology, science and knowledge-driven innovation are critical to job and wealth creation in this new economic reality. The degree to which a state's knowledge assets are harnessed and converted into successful innovations, products and services will determine its economic future. Research, development and innovation assets, risk-capital and entrepreneurial infrastructure, human capital capacity, the technology and science workforce, and ultimately, technology concentration and dynamism, are the yardsticks for states and regions in an intangible economy.

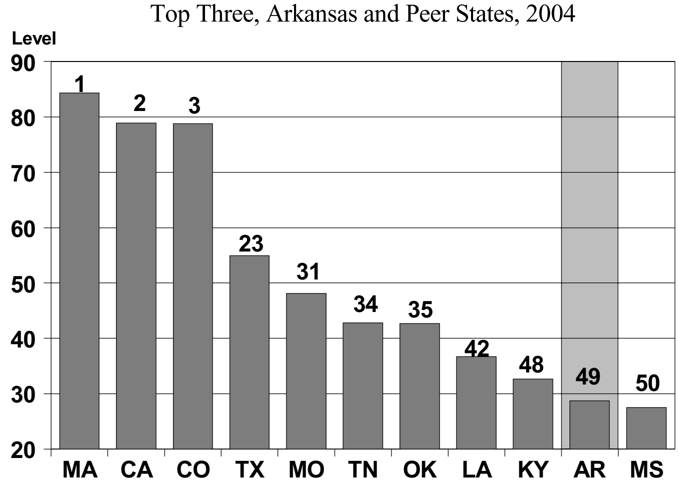
State Technology and Science Index and Arkansas

The State Technology and Science Index encompasses a comprehensive inventory of technology and science assets of states that can be leveraged to promote economic development. Among these assets are research and development capabilities that can be commercialized for future regional and state technology growth; entrepreneurial capacity and risk capital infrastructure that fuels the success of converting research into commercially viable technology services and products; and human capital, the most important intangible asset of a regional or state economy.

The intensity of the technology and science workforce indicates whether a sufficient depth of high-end technical talent is resident within a state. Technology concentration and dynamism can be viewed as a measure of how Arkansas puts its technology and assets to use. Measuring technology growth points is essential to the effectiveness of policy makers and other stakeholders in transforming regional assets into regional prosperity.

The bar chart below shows Arkansas' unenviable position of 49th in the United States on the overall 2004 State Technology and Science Index. Massachusetts, California and Colorado are the top three ranking states in the nation. With the exception of Mississippi, all of the states comparable to Arkansas ranked higher on the 2004 index.

State Technology & Science Index
Top Three, Arkansas and Peer States, 2004



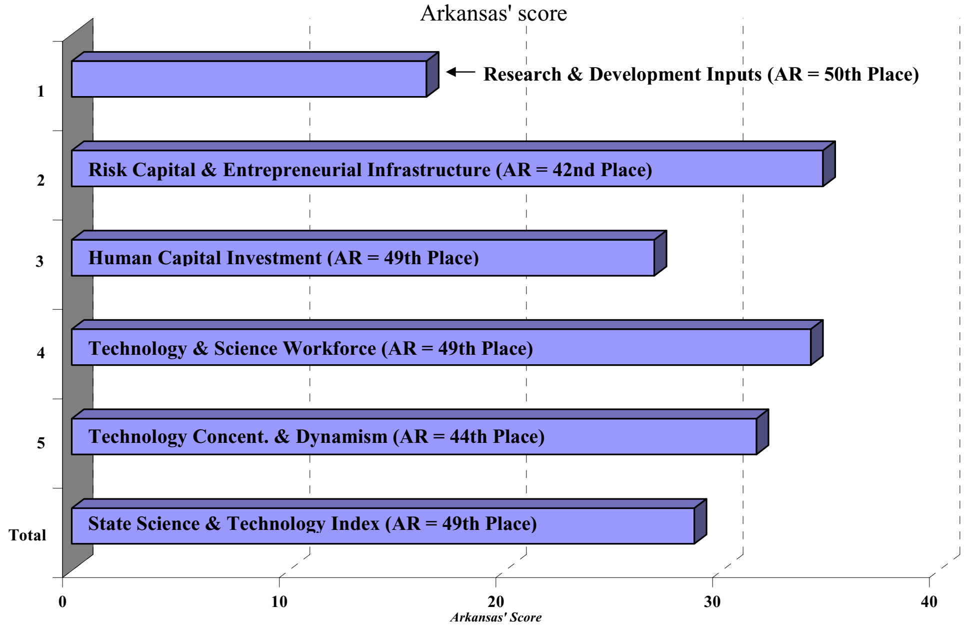
Source: Milken Institute

Arkansas' overall score on the 2004 Index is 29. This ranked the state 49th in the nation, about 1 index point above last-place Mississippi and more than a full 23 index points below the national average of 52.6. Arkansas' ranking represents an improvement over the 2002 Index when it placed 50th overall with a score of 22.8.

Something of Arkansas' general overall condition in science and technology competitiveness is reflected in its poor performance in each of the five components of the overall State Technology and Science Index displayed in the accompanying horizontal bar chart. As previously mentioned, this compound indicator essentially measures outcomes. In other words, it shows how well a state does with the science and technology assets of its intangible economy. Arkansas' difficulties are apparent in each.

State Technology & Science Index

Arkansas' score



	1	2	3	4	5	Total
Arkansas	16.37	34.67	26.89	34.11	31.60	28.73
State Avg.	51.51	51.53	51.25	55.25	53.66	52.64

Arkansas' poorest showing on the compound indexes was in research and development assets. Individual categories within R&D assets suggest the areas on which Arkansas might focus attention for improvement. Each relates to funding.

The term funding is often quickly translated into budget issues, which given the present emphasis on fiscal restraint, is not only difficult, but may be quite unrealistic. Gains can always be made with additional resources. The challenge is for Arkansas to channel the limited resources into the areas identified by the index research.

Policy makers and stakeholders interested in improving the competitiveness of Arkansas' technology and science capabilities would do well to work towards achieving gains in the state's R&D assets. Especially noteworthy is Arkansas' lack of success in securing funding from outside sources. For example, Arkansas scored low in the following external R&D areas:

- Competitive National Science Foundation (NSF) Funding—Arkansas ranked 50th in the nation for this measure on both the 2002 and 2004 indexes;
- NSF Research Support Funding—Arkansas ranked 47th on the 2002 index slipping to 49th in 2004;

- Overall Phase I and Phase II SBIR Awards—In the 2004 Index (based on 2001 data), it received limited Phase I SBIR Awards, but no Phase II Awards; and
- Federal R&D—Arkansas ranked 49th in 2002 then slipped to 50th in 2004.

It would be glib to suggest that Arkansas merely go out and secure additional funds from these sources. Indeed, the competitiveness section of this report has a compelling discussion regarding the lack of availability of external funding sources. States, metros, municipalities and individuals aggressively pursue these limited resources. A number of practical suggestions, in the recommendations and concluding sections of this report are presented for public policy makers and stakeholders to consider, so that Arkansas may improve the state's R&D inputs and thereby, its overall technology and science performance.

The listing below helps identify Arkansas' relative position on each of the component indexes, with respect to all states in the U.S.

Technology & Science Index Components

Arkansas rankings, 2004

	Science & Technology Index Components	Rank
1	Research & Development Inputs	50
2	Risk Capital & Entrepreneurial Infrastructure	42
3	Human Capital Investment	49
4	Technology & Science Workforce	49
5	Technology Concentration & Dynamism	44

Arkansas' best showing on the compound indexes is in the area of risk capital and entrepreneurial infrastructure. The state's improved performance on this index is seen in its rise from 47th place on the 2002 index up to 42nd in 2004, rising above each of the comparable states in its region.

Arkansas also performed relatively well in the area of technology concentration and dynamism. From an analysis of each of the components included in this measure, it is clear that Arkansas' greatest strength, albeit limited, lies in its ability to both create and sustain the formation of new high-technology businesses in the state. This is reflected in the high scores and rankings of the state in the following components:

- Number of high-tech industries growing faster than in the U.S.—Arkansas ranked above the national average for this measure, at 16th in the nation on the 2002 index and 20th in 2004;
- High-tech industries average yearly growth—Arkansas ranked 18th in 2002 improving its performance to 12th in 2004; and
- Net formation of high-tech establishments per 10,000 business establishments—Arkansas substantially increased its rank to 36th in the nation on the 2004 index from 49th in 2002. While it trails (but not by a lot) the rankings of Texas, Kentucky and Missouri, it is well above the rankings of Oklahoma, Tennessee, Mississippi and Louisiana.

Arkansas' strong performance in the area of net formation of high-tech establishments is very good news for the state's economy—employment, wage-rates, gross-state product contributions, tax base, etc. The state's strengths here can hardly be taken for granted. If negative factors such as business costs are not kept in check and inputs such as the quality of primary education are not improved, Arkansas' competitiveness in the attraction and retention of high-tech firms will quickly erode. Competitiveness can be fleeting, especially in dynamic, sometimes fickle, high-tech industries.

Just as a high ranking should not be interpreted to mean that a state be complacent about the security of its competitive position, a lower ranking should similarly not be taken to mean that a state is consigned to a fate of underperformance. Virginia's rise to high-tech economic dynamism over recent years can offer lessons for states that aspire to a more prosperous future in an intangible economy. California had an economy dominated by natural resources and agriculture as recently as the middle of the 20th century; its high-tech industrial base is, compared to the more mature high-tech economies of East Coast, a relatively recent phenomenon. Moreover, new state policies that may come from recently launched initiatives such as Accelerate Arkansas hold out the potential for substantive improvement among underperforming states and regions.

Research and Development Assets

Background and Relevance

The new raw materials of technology-based economic development are research, development and innovation. Arkansas' research and development infrastructure is critical to building new industry clusters from breakthrough technologies as well as sustaining the vibrancy of existing industry clusters. A new cluster can be formed by importing firms that have commercialized technology elsewhere, but those regions in which basic R&D activities take place have distinct advantages in building a cluster that "sticks."[3]

Creating "sticky places in slippery spaces"[4] is the ultimate challenge for Arkansas' high-tech economic development. A lesson that emerges from the success of Silicon Valley is the need to cultivate local capabilities and resources. Unlike others, Silicon Valley's core leadership recognized that policies aimed simply at drawing in modern industry would not work. Instead, they identified the greatest need to be the fostering of home-grown industries that used local talent and resources.[5]

Private research laboratories, federal research laboratories and university-based R&D are important drivers of economic development if properly channeled and harnessed. R&D investments and policies are an integral component of economic development in successful regions and states. All economic development activities benefit from well-designed and executed programs to expand the R&D assets.[6] Investments in R&D strengthen the research competencies in a region and attract further investment by the private and public sectors in a process of dynamic feedback loops.

The biggest category of R&D expenditures is industry-performed research and development. Industry funds and conducts more R&D than all other sectors combined. Industry R&D expenditures rose briskly in the second half of the 1990s and rose above 70 percent of total R&D performance in 2002.[7] In the manufacturing sector, funding growth was attributable to large increases in electronic and communications equipment, pharmaceuticals and biotechnology. Other key developments were the rapid gains in nonmanufacturing R&D. In 1982, the nonmanufacturing sector accounted for less than 5 percent of industry R&D, but reached 36 percent by 2000. The largest shares were in professional, scientific and technical services and the broad information category.

Universities and colleges, excluding academically administered federally funded research and development centers, accounted for 13.0 percent of national R&D performance in 2002, followed by the federal government (8.6 percent) and nonprofit institutions (4.2 percent). Private industry provided 65.5 percent ($180.8 billion) of total R&D funding in 2002. Most of these funds (98.1 percent) flowed to industrial performers of R&D. The federal government provided the second largest share of R&D funding, 28.3 percent ($78.2 billion), with only 43.6 percent of these funds financing federal labs and federally funded research and development centers. The other sectors of the economy (i.e., state governments, universities and colleges, and nonprofit institutions) contributed the remaining 6.2 percent ($17.2 billion).[8]

Places with firms reinvesting their profits into their innovation pipeline will likely have long lives and be an engine of development. The value of industry R&D can be hidden in the incremental innovation of its products and services, but entirely new technologies can be spawned as well. Returns to industry R&D activities are more short-term focused. Despite the critically acclaimed success of university-based R&D centers such as Silicon Valley and Raleigh-Durham, our research shows that location-based industry R&D deserves more credit than it is afforded for sustained job and wealth creation, although the two are clearly interrelated.

Technology firms are continually monitoring the globe for attractive locations for their R&D activities. Corporate R&D is a global endeavor. Missing an important emerging R&D region, may mean sacrificing market opportunity or losing competitive advantage to a global rival.[9] For example, the fastest growing segment of U.S. industrial R&D expenditures is foreign-based multinational corporations (foreign direct investment). Foreign multinationals have also gained quick access to U.S.-based R&D through mergers and acquisitions with innovative firms. The direction of global outsourcing trends in recent years demonstrates that regardless of U.S. strength in R&D, strategic-asset-seeking companies located here (both domestic and foreign firms) will not hesitate to place crucial research functions in other nations that offer sufficiently attractive attributes.

Another key development in private-sector innovation is the shift to aspiring new firms as a source for R&D.[10] Corporate research laboratories are accounting for a smaller share of industry R&D. Federal programs such as the Small Business Innovation Program (SBIR) attempt to support private-sector R&D through a set-aside program earmarked for promising technology at small firms that has not yet been demonstrated to be commercially viable. These new firms have difficulty accessing the capital that they need to demonstrate commercial potential. SBIR is the federal government's effort to fill this void. For a firm to qualify for an award it must meet four criteria: it must be a for-profit entity; American-owned and independently operated; employ the principal researcher; and have no more than 500 employees.

Federally funded R&D can be an important economic development asset. Through its seemingly unintended regional development policies over the past 50 years, the federal government has reinforced and enhanced the position of well-known technology clusters. These regions were often sited for strategic, national security and political reasons. By placing defense-related federal research facilities in such places as Silicon Valley where advanced semiconductors were designed and produced, the federal government helped them prosper.[11] The regions that helped these labs spin out technology have benefited directly.

Federal support of R&D has diminished as a share of total R&D funding. Federal R&D funding was heavily defense-related during the cold war years. The federal share of total R&D peaked at 66.7 percent of all U.S. R&D in 1964 and began a gradual descent, falling below 50 percent for the first time in 1979. After 1987, it fell steadily, dropping from 46.3 percent in 1987 to 25.1 percent in

2000 (the lowest it has been since 1953). This sharp decline in the federal government share must not be misinterpreted as a drastic decline in the actual amount of R&D funding. Federal support grew from $58.5 billion to $66.4 billion during that period. In 2002, the federal share of R&D funding is estimated to have grown to 28.3 percent. R&D financing from nonfederal sources grew by 7.6 percent per year from 1980 to 1985. This growth rate slowed to 3.3 percent between 1985 and 1994, but rose to 8.6 percent during the 1994–2000 period. More recently, between 2000 and 2002, nonfederal sources of R&D funding declined by 1.8 percent per year in real terms.[12]

There have been some significant changes in the distribution of federal R&D funds across research areas over the past decade. Federal funds have been shifted toward life sciences and away from the physical sciences and engineering. Basic and applied federal funding of life sciences rose from 40 to 45 percent of the total in the 1990s, while physical sciences and engineering fell from 38 to 32 percent.[13] These shifts have important implications for states and regions attempting to attract more federal R&D funding.

Key factors behind increases in industrial R&D include a growing concern with international competition, especially in high-technology industries; the increasing technological sophistication of products, processes and services, and general growth in defense-related industries such as electronics, aircraft and missiles. Between 1985 and 1994, growth in R&D funding from industry was slower, averaging just 3.1 percent per year. From 1994 to 2000 industrial R&D support grew by 8.9 percent per year. This rapid growth rate came to a halt following the downturn in both the market valuation and economic demand for technology in the first years of this new century. Between 2000 and 2002, industrial R&D support declined by 2.5 percent per year.[14]

R&D funding from other nonfederal sectors (i.e., academic, nonprofit institutions, state and local governments) has been more consistent over time, growing at an average annual rate of 6.3 percent between 1980 and 2002. Most of these funds went to research performed within the academic sector. Universities receive more than 60 percent of their total R&D funding from the federal government. The bulk of the funding is going into life sciences as evidenced by the dramatic increase in university patenting in this promising field.

The economic value of university research accrues over many years. However, university facilities, research staff and knowledge contribute to the research base and have a short-term payoff, too: they attract new business.[15] States with successful research universities have played an important role in attracting research-oriented companies. Increasingly, universities are conducting more applied research for the benefit of specific corporate sponsors. Joint industry/academic research collaboration supports industry research objectives by granting them access to cutting-edge innovation and establishes a network for hiring top graduates.

A region's R&D assets are important, but the degree of interaction with other elements of the economic environment determines whether commercially viable outcomes result. Location-based technological change depends upon user-producer relationships (inter-firm, inter-industry and consumer-producer); science-production relations; inter-firm relations in dynamic clusters; and firm-government-university relations. It is increasingly important that these relationships are nonhierarchical, and based on substance-dependent communication and action processes.[16]

Collaboration in research and development among corporate labs, corporate supplier networks, universities and government labs is evolving into a new distributed, external platform system for innovation.[17] Relationships between industry and universities have grown more extensive over the past two decades as federal sources of R&D funding are increasingly tied to attracting private sector investments.

As an example, The Small Business Technology Transfer program seeks to increase the participation of small businesses in federal R&D and to increase private sector commercialization of technology from federal sources. Many newly chartered firms play an increasingly instrumental role in today's rapid commercialization of technology innovations. Unencumbered by other core technology assets, small firms can bring new products and services to market quickly. The unique feature of this program is its requirement for collaboration in the early stages of research.

Technology transfer policies must be part of research facility charters. To fully leverage new technologies for commercial success, applied research programs need to be established between the government and university labs with the private sector. The culture at many university and government research facilities must also emphasize commercial applications beyond research for the sake of scientific discovery.[18] States in which scientists and other researchers are encouraged and given support to license their research to the private sector, become part-time consultants to private firms, and move to the private sector themselves to develop commercial applications, will reap the economic rewards.

The Research and Development Composite Index and Arkansas

Arkansas scored last on a relative size basis on the 2004 research and development composite index. The state's average score increased from 9.04 in 2002 to 16.37 in 2004 —an 81 percent increase—but its ranking remained unchanged from its 50th-place ranking on the 2002 index. While its percent increase is a significant step for the state in the right direction, Arkansas arguably has a ways to go to reach its potential.

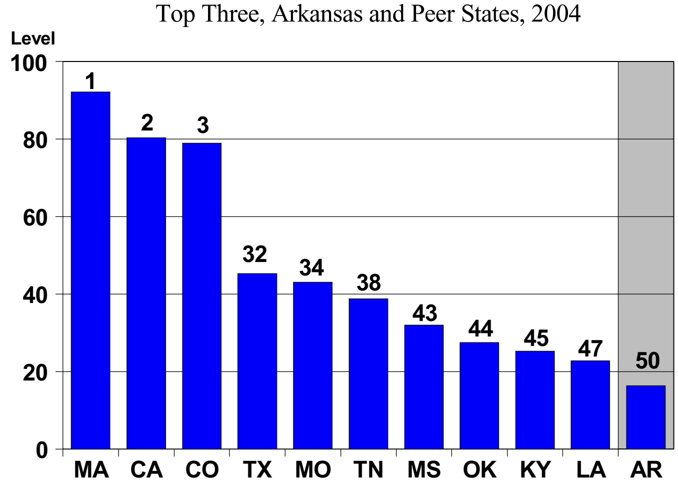
A useful way to analyze Arkansas is by comparison with other states in the nation. Geography matters. Arkansas borders adjoin Texas, Louisiana, Mississippi, Tennessee, Missouri and Oklahoma. In this research, we compare Arkansas to each of these states as well as to Kentucky, which is in close proximity to Arkansas, and has, along with Mississippi and Oklahoma, gross state product (GSP) values relatively close to that of Arkansas.

To earn a perfect index score of 100, a state would have to place first in each of the 18 research and development components. Massachusetts' score of 92.2 thus approximates a perfect competitive ranking. The bar chart below depicts Arkansas' position on the Research and Development Inputs Composite Index in relation to its comparable states.

Massachusetts' ascension to the cutting edge of technological innovation was fueled by an unprecedented combination of scientific excellence, R&D assets, human capital and financial resources. Fueling this expansion is a vast reallocation of resources away from traditional manufacturing and agriculture to science- and technology-oriented industries such as biotechnology, medical instruments and computer science. Louisiana improved its score from 17.29 on the 2002 index to 22.81 in 2004, moving it from 48th to 47th place. Kentucky's 49th-place score of 16.83 on the 2002 index rose to 25.24, so that state now ranks 45th.

Research & Development Inputs Component

Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

The following horizontal bar chart depicts Arkansas' performance in each of the individual indicators that make up the Research & Development Inputs Composite Index. The bottom bar, R&D Inputs Component, represents the state's composite score for all of the 18 indicators above it. The 2004 index added two indicators that were not part of the index in 2002: per capita R&D expenditures on agricultural sciences; and per capita R&D expenditures on biomedical sciences. The additions reflect the growing importance of life science research to Arkansas' economy, specifically and to the economy of the United States as a whole.

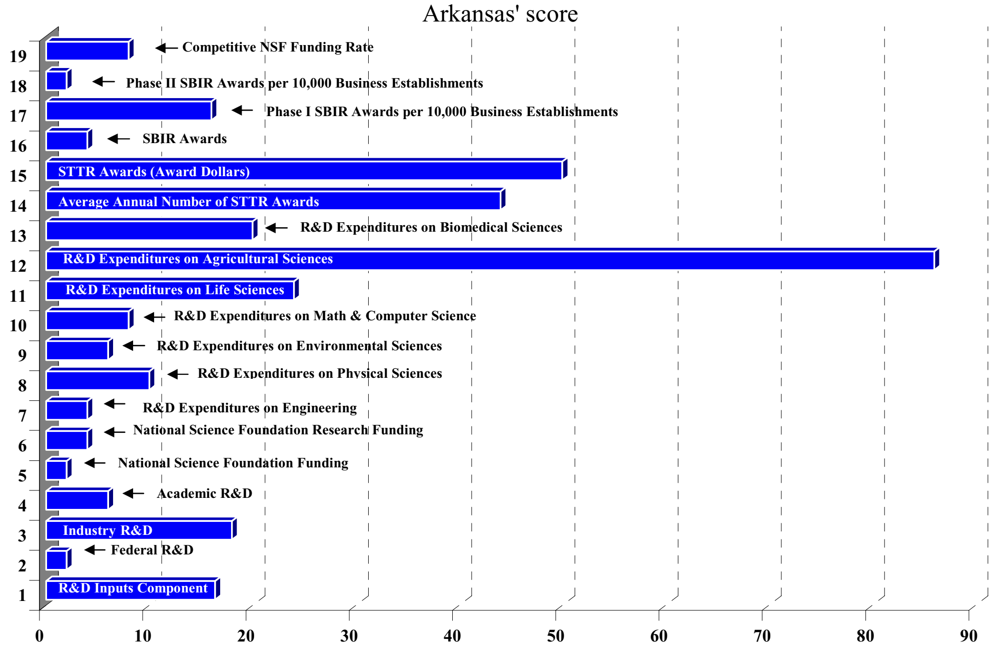
R&D spending is classified as coming from three general sources: the federal government, private industry and academia. The index's federal R&D expenditure measure captures the sum of all basic and applied research in projects that are federally supported and includes work pertaining to national defense, health, space research and technology, energy and general science. The industry

R&D measure sums all the money spent by corporations on basic and applied research, including those amounts spent by corporations on federally funded R&D centers. Industry R&D receives great weight in the composite index because of its large share of overall R&D. All research, basic and applied, performed by colleges and universities is funded by a combination of federal, industry and academic sources.

The National Science Foundation (NSF) is an independent agency of the United States government that funds research and education in science and engineering through grants, contracts and cooperative agreements. R&D expenditures on engineering dollars per capita equals the statewide amount of funds spent at doctorate-granting institutions on various basic and applied engineering programs. Other important funding categories include physical sciences, environmental sciences, math and computer sciences and life sciences. The Small Business Technology Transfer (STTR) awards are federally funded research awards granted to small businesses and nonprofit research institutes. Small Business Innovation Program (SBIR) awards fund the often costly startup and development stages as well as encourage the commercialization of the research findings. The funding rate of competitive NSF project proposals for basic research are crucial for generating momentum at the formative stages of R&D in universities.

Research & Development Inputs

Arkansas' score



Arkansas' Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Arkansas	16.37	43.51	102.12	52.23	12.84	9.05	4.95	2.73	0.88	0.77	38.83	18.26	20.23	0.20	3.00	0.90	1.43	0.00	21.00%
State Avg.	51.51	244.47	675.08	113.87	43.49	34.86	17.16	9.45	6.21	4.37	66.18	7.93	56.17	0.50	7.00	4.84	4.41	2.08	28.20%

The listing below helps identify Arkansas' relative position in each of the above components, with respect to all states in the country.

Research and Development Inputs
Arkansas Rankings, 2004

	Research and Development Components	Rank
1	Federal Research & Development - $ per capita	50
2	Industry Research & Development - $ per capita	42
3	Academic Research & Development - $ per capita	48
4	Total NSF Funding - per $100k GSP	50
5	Total NSF Research Support Funding - per $100k GSP	49
6	R&D Exp on Engineering at PhD-granting Univs.	49
7	R&D Exp on Phys Sciences at PhD-granting Univs.	46
8	R&D Exp on Environ. Sciences at PhD-granting Univs.	48
9	R&D Exp on Math & Comp. Sci at PhD-granting Univs.	47
10	R&D Exp on Life Sciences at PhD-granting Univs.	39
11	R&D Exp on Agricultural Sciences at PhD-granting Univs.	8
12	R&D Exp on Biomedical Sciences at PhD-granting Univs.	41
13	Avg Annual # of STTR Awards per 10,000 businesses	29
14	Avg Annual STTR Award Dollars per $Million GSP	26
15	SBIR Awards per 100,000 people	49
16	Phase I SBIR Awards per 10,000 businesses	43
17	Phase II SBIR Awards per 10,000 businesses	50
18	Funding Rate for Competitive NSF Proposals	47

In 2004, Arkansas placed in the lowest quartile of the nation in all but three of the 18 research and development input measures—R&D expenditures on agricultural sciences at Ph.D.-granting universities, average annual STTR awards per $millions of GSP, and average annual number of STTR awards per 10,000 businesses. The state's individual rankings are inevitably affected by Arkansas' large rural population as well as its resource-based and manufacturing-intensive economy. These factors impact the state's overall position.

The 2004 index reflects Arkansas' receipt of $8.7 million in National Science Foundation funding which is partially made up of $6.14 million in NSF research funding per $100,000 of GSP. The state ranked 50th and 49th in the nation respectively on these two measures. No Phase II SBIR awards were received by Arkansas, making it the state's weakest and consequently lowest national ranking input.

More than 98 Arkansas companies make use of some $273 million in funds for industrial R&D. Arkansas's R&D spending is directly and positively correlated to the state's ranking in the 2004 index as follows: $273 million (ranking 42nd) on industry R&D; $140.741 million (48th) on academic R&D; and $116 million (50th) on federal R&D. Industry R&D spending is approximately double that of the state's academic and federal R&D spending. Arkansas is home to some fine university research units. Yet its underperformance in this funding indicator speaks to how its academic science and technology programs need additional commitment. In each of the two inputs, federal R&D and academic R&D per capita funding, Arkansas ranked below all of its comparable states.

The state's industry R&D per capita funding ranked above Louisiana, Mississippi and Oklahoma, but below that of the remaining comparable states.

Arkansas received almost $50 million in R&D expenditures on agriculture sciences. The state's eighth place ranking in this category is the only 2004 R&D input measure on which Arkansas scored in the top half of the country.

Research and development is Arkansas' weakest composite in the 2004 index. Although arguably discouraging, stakeholders in Arkansas' R&D base have lots of opportunities to improve the state's relative position. See the Recommendations section of this report where a number of funding options and web-link suggestions are presented. Initiatives to better communicate the availability of programs such as SBIR and STTR (to potential entrepreneurs for example) and to provide assistance in the application process in Arkansas are presented in order to increase the state's R&D competitiveness.

Risk Capital and Entrepreneurial Assets

Background and Relevance

Entrepreneurial capacity and behavior are prime drivers of economic growth and job creation. Entrepreneurs see the economic potential of new technologies and apply them to business concept innovations. Business-management author Gary Hamel describes business innovation as "the capacity to imagine dramatically different business concepts or dramatically new ways of differentiating existing business concepts. "[19]

In eras of rapid technological change, entrepreneurial skills have a unique role to play because new enterprises, having no history and no personal stakes, are better positioned to harness new forms of technology. The message is this: to be a successful state or region over the long haul calls for capable entrepreneurs and the risk capital infrastructure to support them. Perhaps more importantly, public policy officials must understand the role of entrepreneurial activities and serve as a catalyst in building the social network infrastructure to nurture success.

The focus on the role of individual entrepreneurs in local and national economic development has waxed and waned in the history of economic thought. Adam Smith[20] bestowed high importance on business owners and managers in promoting an efficient market-based economy. Much of our current understanding of industrial clusters, and what causes their formation and sustainability, dates back to Alfred Marshall.[21] Yet Marshall didn't see the entrepreneur as essential to his industrial districts, nor did he explicitly incorporate them into his neoclassical synthesis.

Joseph Schumpeter provided much of the modern thinking on the role of the entrepreneur in new firm formation dynamics. Writing in the 1930s, Schumpeter gave entrepreneurs a central role in the theory of economic development and capitalism itself.[22] Schumpeter saw innovation as the force behind capitalism, and entrepreneurs as driving innovation by efficiently combining factors of production. He attributed the success of regional business systems to organizational entities with differentiated practices based upon "experience and teamwork."

The ability to garner the required resources and overcome all impediments by seizing new business opportunities is what defines entrepreneurship. Entrepreneurs see stable careers as unfulfilling and embark on the financial uncertainty of creating something from their passion-held ideas.

Entrepreneurs are essential because new ideas are best implemented in new firms. Existing businesses often fear "cannibalizing" their current sales and hesitate to introduce new products.[23] Old, big and bureaucratic firms often do not even recognize the value of their own discoveries and how they could be applied. American technology innovation is full of examples of entrepreneurs adopting new technologies developed at established firms.

When Steve Jobs visited Xerox's PARC facility and witnessed an early prototype of the graphic user interface (GUI), Xerox did not envision application of that technology as it is used today. Later, Jobs founded Apple Computer, which used the GUI for its Macintosh personal computer. Similarly, Sun Microsystems, an outside startup, created the computer workstation market even though IBM held the patents to the technology. The world's leading pharmaceutical firms have used acquisition strategies to gain access to scientific breakthroughs in the field of microbiology and its commercial opportunities.

Inventions advance the store of human knowledge, but do not affect the local economic system until they are implemented as an innovation. Risk capital, by itself, will not turn new ideas into commercially viable products; that is the role of the entrepreneur. Innovation and economic impact occur when an entrepreneur garners financing, creates a business model and transfers the invention into the private sector.[24] Even MIT economist and best-selling author, Lester Thurow, altered his formerly negative view of the relative decline of U.S. industry. Thurow now believes that "entrepreneurs are central to the process of creative destruction, since they are the individuals who bring the new technologies and the new concepts into active commercial use. They are the change agents of capitalism."[25]

The explosion in the availability of capital to individuals has supported new firm formation and economic growth. In the old financial order, only organizations and individuals that had money were given access to borrowed funds for investment purposes. Consequently, more risk-tolerant, innovative entrepreneurs faced great difficulty obtaining early-stage funding.[26] The increased availability of risk capital to technology startups is particularly powerful because their product or service is unproven and the market potential is difficult to ascertain. Most traditional banks do not want to accept intellectual property as collateral for a loan, although some have established venture capital divisions to enter this expanding capital market.

Efficient capital markets promote economic development and facilitate wealth creation by channeling investments into productive enterprises. Broader access to capital and a wider distribution across the population improve ownership patterns that diffuse the benefits and boost economic growth.[27] Broadly diversified financial systems result in efficient capital allocation to alternative investment opportunities. This process is highlighted by the increasing shift to market-based financing, especially to an early-stage business investment market, and away from the traditional intermediated finance model.

Many new firms require large amounts of external financing for an extended period before they can tap traditional debt or equity markets. Private equity from pools of individual investors (angels) or highly specialized venture capital (VC) firms often fill this void.

Angel investors are groups of loosely organized individuals that pool financial resources to provide start-up or early-stage funds to firms. After either exhausting their own financial resources or those from friends and family, entrepreneurs might turn to angel investors. Angel investors fill smaller financing needs than traditional venture capitalists provide. VC funds may prove incompatible with new firms for a number of reasons: the limited size of early-round investments, modest future anticipated needs, or a higher risk profile associated with limited information on market potential for the product.

When angel-backed firms' financing needs expand beyond the capacity of the angel market, they approach venture capital firms. Contrary to public perception, VC firms rarely invest in start-ups, although some VC funds have been established solely to provide seed funding. The majority of their investments are follow-on funding placed in business sectors where rapid growth is expected. Venture capitalists look for high rates of return over a five-year period with an exit strategy of cashing out after a firm becomes publicly traded through an initial public offering or a merger or acquisition by an established firm.[28]

Venture capital has a history of funding new technologies. These are the most risky investments, but they can offer high returns. Venture capitalists backed fledgling semiconductor firms, then personal computers, followed by the disk drive industry, biotechnology in the very early 1990s, software in the mid-1990s, and dot-coms at the end of the decade. Intel, Microsoft, Apple Computer, Cisco, Genentech and Amazon were all venture-backed firms.

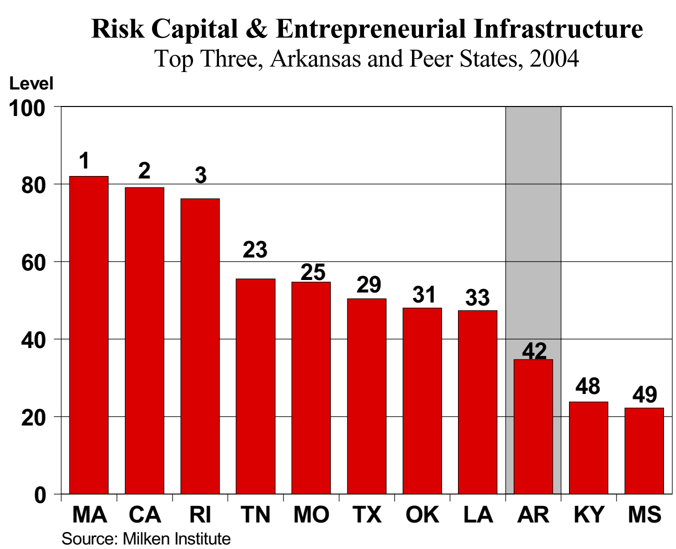
Venture capitalists often place high importance on the passion of the entrepreneur and the talent of the senior management staff. The product or service is central to the issue of whether to fund a firm, but VCs see passion and talent as critical determinants, as well. They evaluate other factors such as market potential, ability to establish branding, and whether their space is defensible against imitators. Venture firms are able to take substantial risks because of the large upside of a small number of their investments. The net returns of VC funds are accumulated from a small minority of investments with the bulk of the returns coming from 10 percent of the firms.[29]

Venture capital placement is an important later-stage measure of commercialization activity for new technologies and business concept innovations. Venture capital funding represents a small share of the overall capital markets, but its true value cannot be measured in dollars. VCs assist in business plan development, become board members, lend management skills, suggest strategic partnerships and alliances, assist in expansion plans, and can bring in key talent where needed. Venture capital activity is an excellent way to assess whether financiers have confidence in the new ideas and entrepreneurial infrastructure of a region.

A new conceptual framework for state and regional economic growth must be built that explicitly recognizes the role of entrepreneurship in the new intangible-based economics of place. First, it is important to recognize that entrepreneurial activity is molded by a consistent set of factors. This entrepreneurial framework includes training and support from the private and public sectors and the availability of early-stage financing. Then, the intensity of entrepreneurial activity is a function of the extent to which individuals recognize the entrepreneurial opportunities and possess the capacity, motivation and skills to exploit them.[30] The interaction between recognition of opportunities and the capacity to pursue them will increase the level of start-up efforts, new firm birth and job formation.

Risk Capital and Entrepreneurial Infrastructure Composite Index and Arkansas

Arkansas' risk capital and entrepreneurial infrastructure (RCI) component score in 2004 was 34.67, placing it 42nd in the nation (up from a score of 18.44 and rank of 47th on the 2002 Index). Risk capital infrastructure is Arkansas' strongest composite on the 2004 index. Of the states comparable to Arkansas, all rank above Arkansas on the RCI index with the exceptions of Kentucky and Mississippi.

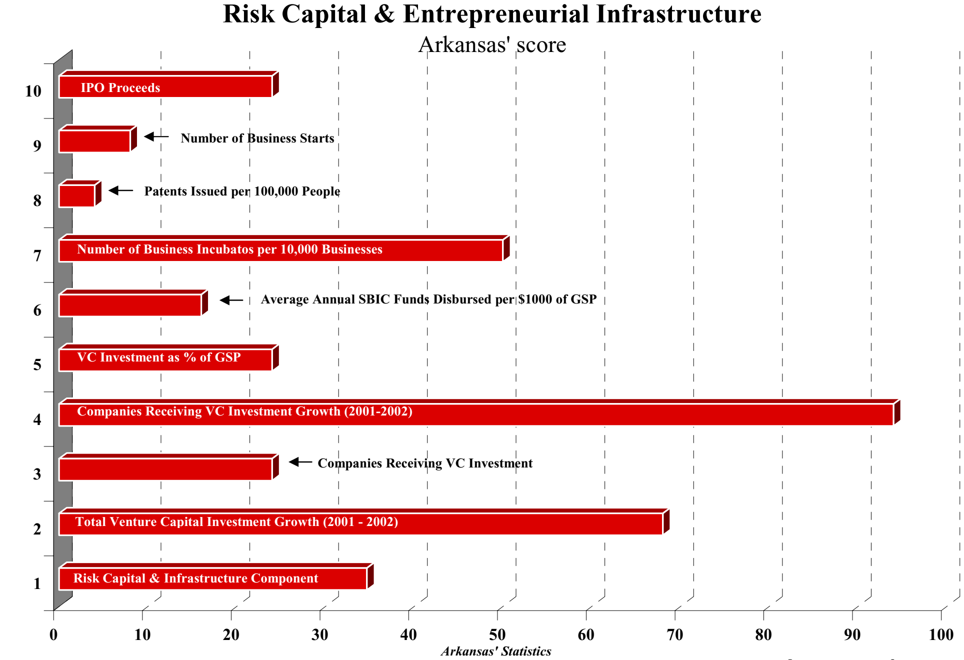


The risk capital and entrepreneurial infrastructure index is composed of nine individual measures, each benchmarked to a relevant indicator. The horizontal bar chart below shows each of the nine indicators included in the index, along with Arkansas' score and ranking. The RCI component aims to measure the state's entrepreneurial culture through the analysis of risk capital vehicles such as venture capital investment and IPO activity. The component further seeks to gauge the effects of such vehicles in terms of business creation and patents activity.

Arkansas' RCI is calculated by totaling the state ranks of each RCI indicator and dividing it by the total number of indicators. Several indicators on venture capital (VC) are included in order to capture its relative size and which states are witnessing rapid gains. A high growth rate in VC placements indicates that a state is witnessing early success in building technology-based firms for future economic development and job creation, and closing the gap with more advanced states. Growth in total venture capital funding and in the number of companies receiving VC investment captures this element.

The index includes the number of companies receiving venture capital investment per 10,000 firms and VC investment as a percentage of GSP to measure the flow and strength of each state's venture capital activity relative to its total economy. Venture capital's share of a state's economy is important because of the strong relationship between those states that have higher VC investment activity and entrepreneurial success, job creation, wealth creation and higher standards of living.

Risk Capital & Entrepreneurial Infrastructure



	1	2	3	4	5	6	7	8	9	10
Arkansas	34.67	4.30%	0.96	150.00%	0.01	0.09	1.27	8.24	198.56	0.00
State Avg.	51.53	-32.48%	5.87	8.27%	0.21	0.47	1.32	34.62	305.44	1.32

Five 'deals' or five companies received a total of $9.7 million in venture capital investment on the 2004 index. This represents a rise of 150 percent over the 2002 index when two companies received $9.4 million in VC. Arkansas ranks fourth in the nation on the 2004 index. The ranking for companies receiving VC investment growth showed considerable improvement over the state's 38th ranking on the 2002 index when Arkansas achieved no growth over the previous period. Arkansas is achieving considerable gains on this VC growth measure although the full economic impact, which occurs with a lag, may not be observable until future years. In 2004 Q1, no venture capital deals occurred in Arkansas.[31]

The listing below helps identify Arkansas' relative position in each of the above components, with respect to all states in the country.

Risk Capital & Entrepreneurial Infrastructure

Arkansas rankings, 2004

	Risk Capital & Infrastructure Components	Rank
1	Total Venture Capital Investments Growth	17
2	Ratio of Companies Receiving VC Investment	39
3	Growth of # of Companies Receiving VC Investment	4
4	VC Investment as Percent of GSP	39
5	Avg Annual SBIC Funds Disbursed per $1,000 GSP	43
6	# of Business Incubators per 10,000 businesses	26
7	Patents per 100,000 people	49
8	# of Business Starts per 100,000 people	47
9	IPO Proceeds as % of GSP	39

Arkansas' ranking on VC investment as a percentage of GSP rose from a rank of 42 (with a ratio of .03) on the 2002 index to 39 (0.14) in 2004. All of the states comparable to Arkansas ranked above it for VC investment as a percentage of GSP on the 2002 index. Arkansas' improved performance on the 2004 index ranked the state above both Mississippi, with a ratio of 0.008 ranking 42nd, and Kentucky (0.002 ranking 45th). Texas, with a ratio of 0.168, ranked highest among the states comparable to Arkansas, attracting the most VC investment as a percentage of GSP. VC receipts within the nation are highly skewed with the majority of funding going to a very few states.

The Small Business Investment Company (SBIC) program is geared toward business incubator-type establishments that award small businesses services ranging from various forms of financial capital to management consulting. SBICs are able to provide these services because they are leveraged by the Small Business Association (SBA). SBIC establishments behave in a manner similar to that of venture capitalists—their goal is to identify profit potential in unleveraged small businesses and fund it in hopes of high returns on investment. Business incubators aim to provide up-and-coming small businesses with guidance and various resources such as physical facilities, office equipment, business assistance services and management consulting in order to enable economic growth and development during the critical formative stages.

Patents are granted by the Patent and Trademark Office (PTO), a division of the U.S. Department of Commerce. Innovation and scientific advancement is protected through patents by prohibiting others to make, use or sell the invention. On a state-to-state basis, the greater the number of patents per 100,000 people the more inventive, innovative and scientifically curious are its agencies and institutions. Arkansas, recording a ratio of 8.24, ranked 49th in the nation on the 2004 index for the number of patents issued per 100,000 people. The state's position is poorer than its 48th-place rank (ratio of 7.49) on the 2002 index. Of its comparable states, only Mississippi ranked lower in 2004.

Business formation is important to a state's local economy because it is an indicator of entrepreneurship, innovative spirit and optimistic expectations. An initial public offering (IPO) occurs when a company decides to sell shares of its common stock to the general public. Companies that go public are typically those that have established a proven track record by means of revenue or sales history. The measure used in this study is the number of business starts per 100,000 people. On the 2004 index, Arkansas ranked 47th in the nation, below all of its comparable states. This is a poorer showing than its 35th–place position on the 2002 index when it ranked above its comparable states of Missouri (36th), Louisiana (39th), Kentucky (42nd), and Oklahoma (43rd). Attracting firms to the state and facilitating business startups is essential to Arkansas' economic development.

Human Capital Capacity

Background and Relevance

Knowledge and the innovation capacities of human capital are at the core of an intangible-asset-based economy. Today, a state or region's most important source of competitive advantage is the knowledge embedded in its people (intellectual capital). In the past, human capital was not seen as a reservoir of talent exploitable for economic development as it is today. Whereas firms and industries once attracted people, today, it is human talent that is attracting firms. Michael Milken was among the first to recognize these changing dynamics when he stated, "Today with the emergence of the information age, the strength of a country is based on knowledge. National greatness will arise not from our natural resources or our factories, but from our people—people with new ideas and skills."[32]

In the last century, labor was a rented, hired and fired factor of production that warranted little investment; it was an expense to be minimized in order to achieve superior financial performance. Even today, the balance sheets of most corporations are mired in our industrial past because labor is only discerned as an expense item. Yet human capital, or the value of the intellectual assets of U.S. companies, has been estimated to represent between 70 to 75 percent of their total asset value by University of Chicago Nobel laureate, Gary Becker. Many technology firms have market capitalization 10 to 20 times the value of their physical assets.

In the current economy, the knowledge, skills, experience and innovation potential of talented individuals have greater value than capital equipment or even capital itself. A successful enterprise accesses, creates and utilizes knowledge to sustain competitive advantage. It provides the required training, information technology, direction and proper motivational system to ensure that its employees build new knowledge and value. Places with firms that understand and live by these dynamics are well positioned to exploit human capital for economic development. Federal Reserve Chairman Alan Greenspan summarized this new reality very succinctly when he stated that "virtually unimaginable a half-century ago was the extent to which concepts and ideas would substitute for physical resources and human brawn in the production of goods and services. "[33]

Perhaps Jane Jacobs conveys the message on the importance of human capital most poignantly. Jacobs draws parallels between the vibrant and flexible processes of nature in order to build better models for economic planning. She culls examples from chaos theory to cell biology, to ecology and evolution. "Beginning with the very start of a settlement and continuing for as long as the place maintains an economy, human effort is combined with imports. …And the most important ingredient qualitatively, although not always quantitatively, is human capital. That means skills, information and experience—cultivated human potentialities—resulting from investments made by the public, by parents, by employers and by individuals themselves."[34]

Little research has been conducted on how people choose where to locate, but economists and others have lavished a great deal of attention on how firms[35] choose to do so. In the past, people tended to migrate to wherever jobs were located, but today they also take economic and lifestyle considerations into account. Richard Florida of Carnegie Mellon has studied this phenomenon and developed his "creative capital theory." In his book, *The Rise of the Creative Class*, he states:

> "Essentially my theory says that regional economic growth is driven by the location choices of creative people—the holders of creative capital—who prefer places that are diverse, tolerant and open to new ideas. (1) It identifies a type of human capital, creative people, as being key to economic growth; and (2) it identifies the underlying factors that shape the location decisions of people, instead of merely saying that regions are blessed with certain endowments of them."[36]

In other words, geography matters more than ever because skilled technical and creative people determine firm and regional success, and firms must consider where high-end human capital chooses to locate.[37] Skilled professionals—especially science and technical talent—increasingly determine the future economic prosperity of states and regions.

Many human capital skills have been transferred from knowledge created long ago. What is unique today is the high value associated with recently acquired knowledge and skills. Knowledge workers who possess the most current skills are witnessing dramatically higher earning power than ones with older skills. For example, computer programmers with knowledge of the latest programming languages earn more than twice as much as those with knowledge in older languages.

Knowledge is now being incorporated as a distinct factor into new growth theory. This body of work differentiates itself from traditional growth theory by emphasizing that economic growth is an outcome of a dynamic economic system. Endogenous growth theory postulates several channels through which technology, human capital, and the creation of new ideas enable a virtuous circle and feedback to economic growth.

New growth theory shows that knowledge has a separate and distinct impact on promoting economic growth. University of Chicago economist, Paul Romer, perhaps best captures what is at the core of this theory stating, "what is important for growth is integration not into an economy with a large number of people, but rather one with a large amount of human capital."[38]

Several studies have found that people are more productive when they work around other individuals with a strong investment in human capital. Our own work and others find strong statistical relationships between the depth of human capital, and urban and regional growth.[39] For example, differences in per capita income among states are most closely associated with the percent of the adult population that has at least a bachelor's degree.[40] Individual human capital is more productive in the presence of high collective human capital.[41]

In a pioneering study on why firms tend to cluster together in regional complexes, Edward Glaeser discovered that the need to access common pools of talent was stronger than access to suppliers and customers. Another way to test the sustainability of regional economic growth differentials is to study the migration patterns of knowledge workers. Analysis supports the pattern that knowledge workers are attracted to regions with higher returns to knowledge.

As with private firms, states and regions must access, create and utilize knowledge to sustain competitive advantage in an intangible economy. Talented individuals are highly mobile; the regions that attract them benefit and those that lose them, suffer. Regions must utilize their knowledge assets, such as universities, research centers, and most importantly, the talent that they create or attract, to fuel economic growth.

Human Capital Investment Composite Index and Arkansas

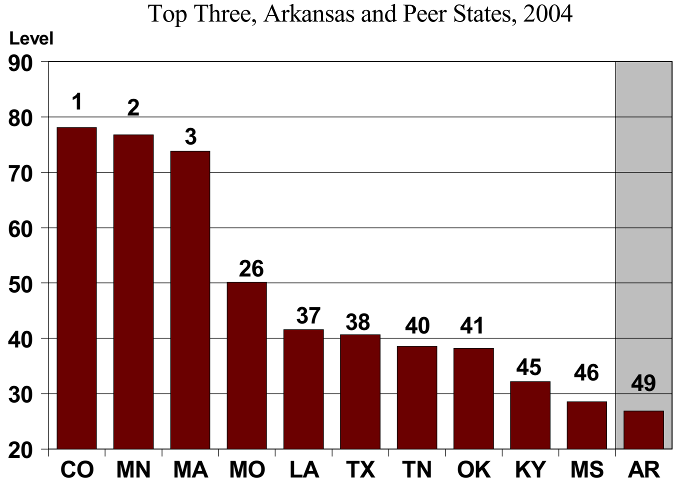
As discussed above, the key source of competitive advantage, be it among regions or industries, is its intellectual capital—that is, the knowledge embedded in its people. To attain a competitive advantage in a knowledge economy, Arkansas must access, create and utilize human capital. The state of Arkansas must tap its knowledge assets to benefit from the talent they attract to fuel local economic growth. Life-long learning and retraining programs will bolster Arkansas' economic success, forestalling the creation of a labor force that is "finished at forty."

Retention or attraction of knowledge-intensive human capital is essential to the formation and growth of technology clusters. Human capital will be one of the most important determinants of economic performance for Arkansas. Competition on a low-skill, low-cost formula is not the recipe for the creation of a successful long-term technology and science growth industry in the state.

Arkansas' overall score on the Human Capital Investment Composite 2004 Index (HCI) is 26.89, ranking the state 49th in the nation. This marks an increase from the state's performance score on the 2002 index (22.50), but placed Arkansas in the same 49th position. The top three states in this compound index are Colorado (78.11), Minnesota (76.89), and Massachusetts (73.78). The bar graph below shows that Arkansas ranked below each of its comparable states—Missouri, which scored 50.22 ranking 26th, Louisiana (41.67, 37th), Texas (40.78, 38th), Tennessee (38.67, 40th), Oklahoma (38.33, 41st), Kentucky (32.33, 45th) and Mississippi (28.67, 46th).

Human Capital Investment Component

Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

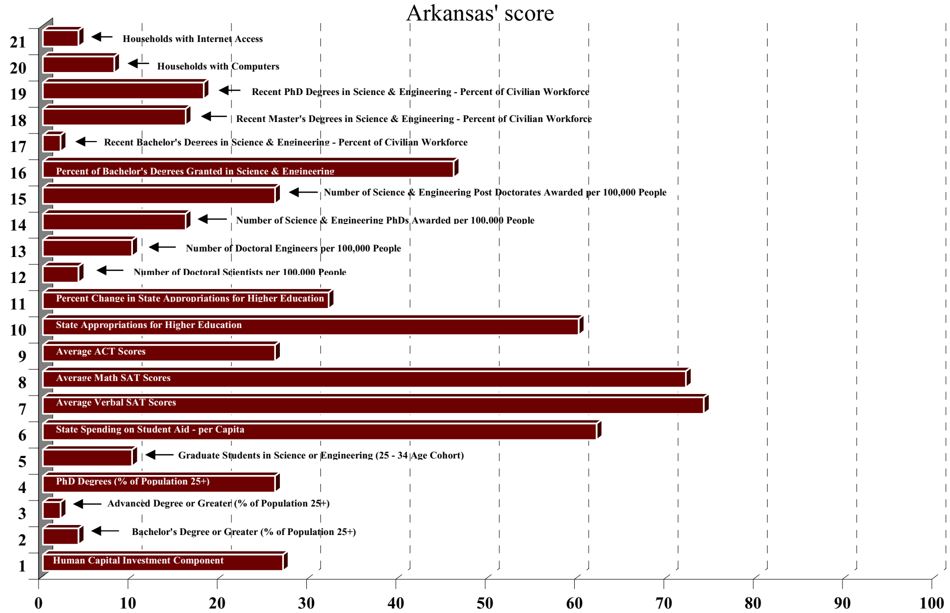
The accompanying horizontal bar chart on the following page highlights Arkansas' position in each of the 20 individual indicators included in the composite. The HCI aims to measure the stock of human capital and rate of investment (flow) between states by gauging the concentration and momentum of various science and engineering fields. It is calculated by totaling the state ranks of each indicator and dividing it by the number of indicators.

Bachelor's degrees are important to a state because it gives an indication of both the level of educational attainment and the type of skills that are demanded by the state's firms. The total number and percentage of a population with advanced degrees or higher are important to a state because large concentrations of people with advanced degrees are a good indicator of a state's labor pool's sophistication and level of skill development. Another measure included is the concentration of Ph.D. degree holders. States with high levels of Ph.D. degree holders are safely assumed to have quality research and development centers and a solid advanced educational system.

The presence and constant flow of graduate students in science and engineering are important to a state because it serves as a means to enhance the future of the science and engineering community in a particular state. The flow of scientists and engineers into the workforce and academia is conducive to developing new technologies. Post-doctorate work is important both to holders of Ph.D.s and institutions alike because such a program allows degree holders to further their knowledge in their field of intellectual interest. The share of bachelor's degrees granted in science or engineering fields is important because it demonstrates where professional interests lie among the college student population. Measuring the number of recent degrees granted in science or engineering, be it bachelor's, master's, or Ph.D. degrees, allows stakeholders and policy makers to assess momentum and popularity, and guide future efforts to attract students.

Human Capital Investment

Arkansas' score



Arkansas' Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Arkansas	26.89	18.30%	5.61%	0.81%	0.78%	14.53	560.00	556.00	20.2	231.00	0.10%	99.08	13.73	34.14	48.46	17.10%	0.41%	0.15%	0.03%	46.80%	36.90%
State Avg.	51.25	26.00%	9.16%	1.05%	1.22%	16.29	532.42	536.90	21.1	221.20	1.07%	185.51	39.12	63.26	107.75	17.30%	1.80%	0.41%	0.09%	56.50%	50.50%

The 2004 component indicators on which Arkansas scored above average include state appropriations for higher education, average math and verbal SAT scores, and state spending on student aid per capita.

The listing below helps identify Arkansas' relative position in each of the above components, with respect to all states in the country.

Human Capital Investment

Arkansas rankings, 2004

	Human Capital Investment Component	Rank
1	% Pop. 25+ With Bachelor's Degree or Greater	49
2	% of Pop. 25+ With Advanced Degree or Greater	50
3	% of Pop. 25+ With PhD Degree	38
4	# of Grad Students in Sci & Eng (25-34 Age Cohort)	46
5	State Spending on Student Aid - $ per capita	20
6	Average Verbal SAT Scores	14
7	Average Math SAT Scores	15
8	Average ACT Scores	38
9	State Appropriations for Higher Educ - $ per capita	21
10	% Change in State Appropriations for Higher Education	35
11	Number of Doctoral Scientists - per capita	49
12	Number of Doctoral Engineers - per capita	46
13	# Sci & Eng Doctorates Awarded (25 - 34 Age Cohort)	43
14	# Sci & Eng Postdoctorates (25 - 34 Age Cohort)	38
15	% Bachelor's Degrees Granted in Sci & Eng	28
16	% Work Force w/Recent Bachelor's Degree in Sci or Eng	50
17	% Work Force w/Recent Master's Degree in Sci or Eng	43
18	% Work Force w/Recent PhD in Sci or Eng	42
19	Percent of Households with Computers	47
20	Percent of Households with Internet Access	49

Arkansas scored below the national average in all of the 12 post secondary education measures shown in the above horizontal graph.

Scholastic aptitude test (SAT) scores are a highly imperfect measure of the verbal and math competence of high school students.[42] Given this caveat, Arkansas slightly improved its national ranking on the math SAT (from 17th position on the 2002 index to 15th in 2004) but lost ground with respect to students' verbal SAT performance (from 13th to 14th) in these same two index years.

States that are better able to utilize creative budget financing can become attractive competitors for graduate-level talent (for example by offering favorable supplemental aid packages). State appropriations for higher education are important because they show how much money is being allocated by the state to run its junior college and university systems. Increases in state appropriations for higher education give analysts insight into shifts in state spending patterns, and whether they are making wise investments in their future labor force. Arkansas' state appropriations for higher education per capita declined from the 2002 to 2004 index. Declines are evidenced in the state's national ranking, which dropped from 17th to 21st, a score which fell from 68 to 60, and statistic—231.0 in 2004 down from 242.3 in 2002. This state appropriation budget issue is a very important measure for policy review, analysis and more positive re-prioritization consideration in Arkansas.

Arkansas's state spending on student aid per capita increased from 21st place on the 2002 index to 20th in 2004. Performance also increased with its ratio rising from 12.13 in 2002 to 14.53 in 2004. Only two comparable states ranked above Arkansas on the 2002 and 2004 indexes—Louisiana, which ranked 10th and Kentucky, which ranked 17th.

Home computers allow children and adults alike to become technically proficient as well as to take advantage of knowledge and resources that would otherwise be difficult to attain. Access to the Internet gives people access to resources, both commercial and educational, for which they would otherwise have to travel long distances.

However, on the 2004 Index, the state of Arkansas ranks a low 47th in the nation for the number of households with computers and ranks even lower, at 49th place, for the number of households with Internet access. The table below provides interesting details for comparison.

Arkansas Households with Computers & Internet Access

Measurement Category	2002 Rank	Index %	2004 Rank	Index %
Computers	49th	37.3	47th	46.8
Internet Access	49th	26.5	49th	36.9

Although ongoing lackluster performance in technology access presents Arkansas business leaders and policy makers with unique challenges, it is important to point out that Arkansas has made inroads on each of these two measures as shown by the percentage increases. From the 2002 index to 2004, the percentage increases in the number of households with computers (up 25 percent) and Internet access (up 39 percent) were substantial. Each of the states comparable to Arkansas ranked well below the national average. Mississippi ranked below Arkansas on both the 2002 and 2004 indexes in both categories—households with computers and households with Internet access. Louisiana slipped below Arkansas for households with computers. All other comparable states ranked above Arkansas in both categories in each of the two index years.

The top five states in the U.S. for the greatest percentage of households with computers are Alaska (68.7 percent), New Hampshire (67.7 percent), Utah (67.7 percent), Washington (66.5 percent) and Oregon (65.8 percent). Computer ownership does not immediately correlate with high-tech industrialization—Alaska and Hawaii both score higher in this measure than California and Massachusetts, for example. Nevertheless, a high degree of computer access and literacy among a population is an important component of any modern economy that aspires to equitable economic participation for the members of its society.

Continued investment in higher education in urban as well as rural areas in Arkansas will be key for the state to grow and maintain its human resource potential. The Arkansas Supreme Court's decision in the *Lake View* case signals a fundamental change in how the state of Arkansas pays for education. The *Lake View* decision tells us not only that Arkansas does not currently provide adequate education for its children, but that this educational failure is partially attributable to the state and local tax structure. As a result, major changes in the Arkansas tax structure may be required to better fund and improve education in the state.

Technology and Science Workforce

Background and Relevance

Skilled knowledge and technical workers are key to the creation of economic value because they do not simply access knowledge and apply it to firm-specific objectives. Rather, they harness information, bringing both inductive and deductive analytic skills to complex problems, to synthesize and generate new knowledge, applications and processes. New knowledge can take the form of incremental innovation as well as radical innovation that propels a business into new endeavors.

Scientists, engineers, and other skilled technicians (S&E) are the new workforce elites. They are individuals either educated in the sciences and engineering fields or people who were not educated in those fields, but hold occupations in these categories. S&E workers comprise less than 5 percent of the workforce, but contribute far more to regional vitality than these figures may indicate.[43]

In 1999, there were approximately 13 million S&E staff (including all who were trained in these fields or employed in these occupations) in the U.S.,[44] with a major focus on employment in research and development. The number of college graduates working in narrowly defined S&E occupations (excluding technicians and computer programmers) and employed outside academia increased by 159 percent between 1980 and 2000 to a total of 3.6 million jobs. This represents a 4.9 percent average annual growth rate, much more than the 1.1 percent for all job categories in the U.S. over that time period. The most rapid growth was witnessed in mathematics and computer sciences, where employment rose from 177,000 in 1980 to 1.3 million in 2000—a remarkable increase of 623 percent.

Engineers represent the largest category of S&E workers nationwide comprising 39 percent (1.38 million) of all S&E workers. Computers scientists and mathematicians, however, are rapidly closing the gap and account for 33 percent (1.17 million) of S&E positions. Physical scientists account for about 9 percent of all S&E occupations. Bachelor's degree was the highest degree obtained by 56 percent of workers employed in S&E jobs; another 29 percent list a master's degree and 14 percent reported a doctorate.

In 1999, the latest year available, the median annual salary of employed bachelor's degree holders in S&E occupations was $59,000; master's degree holders earned $64,000, and doctorate-degree recipients earned $68,000. Computer scientists and mathematicians with bachelor's degrees reported higher salaries than those with a master's or doctorate. This partially indicates that more recently acquired knowledge in programming languages has a higher value in the marketplace, but also reflects that more computer scientists employed in the private sector hold bachelor's degrees, while doctorate degree holders tend to work primarily for universities and research centers.

Looking ahead, the demand for S&E workers is expected to be very strong. Over the next decade, employment in S&E occupations is projected to increase more than three times faster than total employment.[44] This translates into the need for an additional 2.2 million S&E workers. The U.S. has witnessed a rapid increase in the immigration of foreign-born scientists and engineers. The knowledge of scientists and engineers can be transferred across borders more easily than other skills because it is more codified. For example, one-third of doctorate-holders in S&E in the United States are foreign born. Among recent-degree recipients, the percentages are even higher. Global competition for S&E talent is intensifying such that the ready availability of outstanding foreign S&E talent is no longer assured. Threats to world peace and domestic security create additional constraints on employment of foreign nationals in the U.S. and hence the supply of S&E talent.[46]

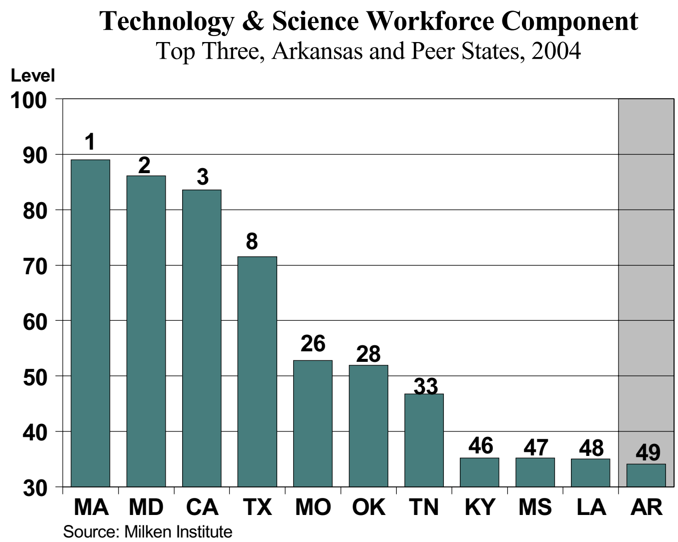
Technology-based economic development is largely dependent upon the supply of scientific and engineering talent required to staff rapidly growing technology firms and their larger cousins.[47] Innovation and the scientific and technical skill base of a region are two ingredients that are best combined for maximum performance. For state and local economic development the message is this: the quality of scientists, engineers, physicists, systems engineers, and other creative technical workers that states train, retain and attract from other locations, will profoundly impact their future technology industry development.[48]

Technology and Science Workforce Composite Index and Arkansas

The technology and science workforce composite measures the research and innovative capacity resident in a state, not what may be promised in the future. The intensity of the technology and science workforce is an excellent measure of the sophistication and technological competency of human capital in a state's economy.

On the composite index of its technology and science workforce, Arkansas scored a low 34.11, ranking 49th in the nation. This ranking remained the same as on the 2002 index, when Arkansas scored 32.0. All of the states comparable to Arkansas ranked higher on the 2004 index—Texas scored 71.56 ranking 8th, Missouri (52.78), Oklahoma (51.89), Tennessee (46.78), Kentucky

(35.22), Mississippi (35.22) and Louisiana (35.0). The bar chart below displays this composite for the top three ranking states in the nation and the states comparable to Arkansas.



There are 18 individual occupational categories that comprise the overall technology and science workforce composite index. Arkansas' strongest areas of performance in the 2004 index are for the measures of intensity of microbiologists, and intensity of agricultural and food scientists. On the 2004 index, Arkansas ranked 15th in the nation with 11.6 microbiologists per 100,000 members of the workforce for intensity of the state's microbiologists. Arkansas' improved performance over the 2002 index is reflected in both the state's intensity level of 8.96 and 21st-place ranking. Arkansas' intensity of agricultural and food scientists component maintained a rank of 18th in the nation on both the 2002 and 2004 indexes. However, the state's statistic in this measure decreased from 19.54 agricultural and food scientists per 100,000 members of the workforce on the 2002 index to 12.49 in 2004.

The intensity of computer and information science (I.S.) experts indicator is calculated by averaging the intensity scores of six different types of computer and information science-related occupations—computer and information scientists, computer programmers, software engineers, computer support specialists, systems analysts, and database and network administrators. Intensity is defined as the percent share of employment in a particular industry or occupation as it relates to total state employment. Computer and information science experts are important to a state's vitality because I.S. is considered to be a high value-added occupation and a sign of a technologically dynamic and entrepreneurial region. On this indicator, though Arkansas improved its score to 14.33 on the 2004 index, the state ranked 49th in the nation, below each of its comparable states.

The intensity of life and physical scientists' indicator is calculated by averaging the intensity scores of six different types of life and physical science-related occupations—agricultural and food scientists, biochemists and biophysicists, microbiologists, medical scientists, physicists, and miscellaneous life and physical sciences. These types of scientists are important to a region's scientific community because they help support and promote entrepreneurial activities. Regions benefit from a thriving life and physical sciences industry because these scientists make enormous contributions to building up the region's reputation as a high-technology, high value-added center. Arkansas scored 51.67 ranking 35th in the nation on this index. The state's improved performance over 2002 is reflected in its score (49.33) and ranking (38th in the nation). Arkansas ranked above its comparable states of Oklahoma, Mississippi, Louisiana, Missouri and Kentucky for intensity of the state's life and physical scientists.

The intensity of engineers indicator is calculated by averaging the intensity scores of six different types of Engineering-related occupations—electronics engineers, electrical engineers, computer hardware engineers, biomedical engineers, architectural engineers, and other engineers. Engineers are important to a region because they are the traditional creators and innovators of multiple technologies and processes. An abundance of highly skilled engineers leads to increased research and development funding and opportunities both from within and beyond the region. Arkansas' performance on this component declined from 44th in the nation in 2002 to 47th in 2004, below that of all of its comparable states.

Arkansas' weakest areas of performance are in its intensity of specialists per 100,000 members of the workforce. Arkansas has a statistically insignificant number of people employed in the following four occupations: computer and information scientists, physicists, biomedical engineers or agricultural engineers.

Apart from their contributions to technology sectors, engineers also contribute in important ways by serving as all-around innovators and problem solvers in areas ranging from workplace productivity to building construction. Arkansas' growing weakness in this indicator is a discouraging sign of the state's overall economic robustness in scientific and technological fields.

Arkansas does not have sufficient depth of high-end talent for employers to recruit locally and avoid the costs of relocating workers from other places or to attract new firms. Arkansas is not presently in a position to capture the advantages of diversity, as most technological advances are likely to be functionally collaborative in nature, requiring cross-disciplinary capabilities. More effort must be focused on training Arkansas' native population in the science and technical fields.

Technology Concentration and Dynamism

Background and Relevance

Where clusters of existing technologies expand and emerging science-based technologies form is a critical factor in determining economic winners and losers in the first half of the 21st century. As economic activity is increasingly based more on intangible assets, those states with vibrant technology clusters will experience superior economic growth. Because knowledge is generated, transmitted and shared more efficiently in close proximity, economic activity based on new knowledge has a high propensity to cluster within a geographic area.[49] In other words, a state with several leading clusters will have more innovations, less of which will escape to other regions, or at least, they will do so at a slower rate.

Regional and state viability are now linked to their ability to establish local technology clusters that are networked into the global business community. The paradox of the global-based economy is that the enduring competitive advantages lie in location-specific competencies—knowledge, workforce skills, customer and supplier relationships, entrepreneurial infrastructure, management practices, incentives and quality-of-place attributes that allow firms to thrive. In essence, thinking locally to succeed globally.[50]

Industry clusters and their associated support infrastructure are a region's best defense against being arbitraged in a global cost-minimization game. Firms, and the clusters to which they belong, can mitigate input-cost disadvantages through global sourcing. Location sustainability is contingent upon making more productive use of inputs, based largely on innovation competencies. Clusters linked to the outside world offer locales access to the best practices and latest industry developments.[51] Regions will excel to the extent that the firms and talent in them can innovate successfully by being there, rather than somewhere else.

To create international competitive advantage in an information-age economy, clustering innovative activity is imperative. The spatial dimensions of economic activity are becoming an interesting field of inquiry—space is central to understanding how an economy works.[52] Since the late 1980s, there has been renewed interest in "economic geography" mainly because of new statistical tools. If everyone really lived in a world of constant returns, the high level of specialized economic activity that exists within regions would not be. Clustering results from businesses and workers seeking geographic proximity with others engaged in related activities. Increasing returns lead to competitive advantages, as in, the more that is produced, the cheaper it is to make. Such externalities, or what an economist might call agglomeration effects, typically arise from three primary sources: labor-force pooling, supplier networks and technology spillovers.

A common misperception of clusters is that they are based upon a single industry. One single industry might be the core of a cluster, but without its partners, it may not endure for long. Clusters are agglomerations of interrelated industries that foster wealth creation in a region, principally through the export of goods and services beyond its borders. Industry clusters are geographic concentrations of sometimes competing, sometimes collaborating firms and their related supplier-network.[53]

Clusters depict regional economic relationships—local industry drivers and regional dynamics—more richly and aptly than do standard industrial methods. An industry cluster differs from the traditional definition of an industry group. It represents an entire value chain of a broadly defined industry sector from suppliers to end products, including its related suppliers and specialized infrastructure. A cluster of interdependent linked firms and institutions represents a collaborative organization form that offers its members advantages in efficiency, effectiveness and flexibility.[54]

Supplier networks are instrumental to the success of clusters and fostering sustained agglomeration processes. Clusters are interconnected by the flow of goods and services. This flow is stronger than the one linking them to the rest of the local economy. Cluster members usually include governmental and other nongovernmental entities such as public/private partnerships, trade associations, universities, think tanks and vocational training programs. These institutions provide specialized skill training, education, research and technical support. Cluster members include both high and low-value activities.[55]

Regional technology sustainability depends upon the diversity of its ecosystem. Locally based innovative technology firms that evolve into dominant players are necessary, but not sufficient for sustaining the system. These newly dominant firms assist regions in developing technology management capabilities that can be leveraged to quicken the pace of innovation for new entrants. Newly formed entrepreneurial firms can tap into the technology management capabilities resident in the region to rapidly exploit emerging technology market opportunities. Many high-tech regions have developed capabilities for rapid design changes at dominant firms, and more importantly, integrating new regional knowledge into new firm births.

The process of commercializing emerging technologies requires the capability to manage uncertainty and complexity. Many will be highly disruptive in nature, potentially threatening key regional businesses. The failures of established firms are well cataloged and commercialization models have explicitly incorporated attackers from the outside, generally required when an emerging technology threatens the existing regime.[56] The issues that can leave businesses ill-prepared stem from technological doubts, vague market signals and nascent competitive structures that differentiate emerging from established technologies. To cope and triumph requires innovative managerial competencies and new cross-functional skills.[57]

A region's technology-based ecosystem is not sustained only by its technology capabilities. Social capabilities are required to promote the ecosystem as well. The ongoing development of the leading technology centers go beyond accidents of history, scientific discovery or industrial networks.

Diversity of the technology-based clusters is important for regional success as well. A strong agglomeration in one to two technology industries such as telecommunications services or communications networking equipment can be an economic engine during a boom, but be a liability during a bust as many places have discovered.[58] Technology diversity can also act as a virtual unplanned innovation engine. Serendipitous confluences from seemingly unrelated technology fields can be a critical advantage for the regions that host them. In a broad survey of regional innovation processes, Ronald Kostoff found that "an advanced pool of knowledge must be developed in many fields before synthesis leading to innovation can occur."[59] Additionally, technology advances are likely to be from cross-disciplinary capabilities. For example, the leading centers of biotechnology may well be those with the proper mix of bioinformatics, mathematics and microbiology.

Technology-based clusters are determining which places are succeeding or falling behind. Without growth in high-tech industries, states risk not succeeding in the intangible-based economy. It is imperative for the state of Arkansas and its local development officials and business leaders to promote high-tech expansion and cluster formation, or they risk substandard economic growth. Although high-tech is not the only development strategy to pursue, it will be the key distinguishing feature of regional vitality in the 21st century.

Research and development are the raw materials of innovation that the technical and scientific workforce converts into commercially viable products and services. The most economically successful places are those with businesses whose innovation processes are organized in a collaborative framework with research, design and production engaging in dynamic, interactive learning processes.[60] More effective research and design occurs where it is located near production operations. The technical and scientific workforce of a region propels its technological sophistication, innovation and economic growth, not only for technology firms, but for all firms where innovation is a key competitive advantage.

Regions with a high concentration of skilled technical and science workers have another advantage. Industry clustering pools workers, creating a labor force with industry-specific skills.[61] As design engineers, programmers, biologists and the like migrate from other regions to a geographic cluster or remain in a cluster after graduating from local institutions, they reinforce the initial advantages that a region enjoyed, stimulating further localized growth. In this way a region gains the most fundamental source of its competitive advantage by attracting highly mobile, geographically discriminating labor assets.

In a local high-velocity labor market, scientific and technical workers benefit from the opportunity to move from one employer to another. Firms can also benefit when there is local technical talent that possesses the industry-specific skills they require, reducing the firms' searching costs. The ease with which locales can assemble, circulate and reassemble teams of highly skilled workers both helps foster new firm formation and sustain mature technology firms.[62]

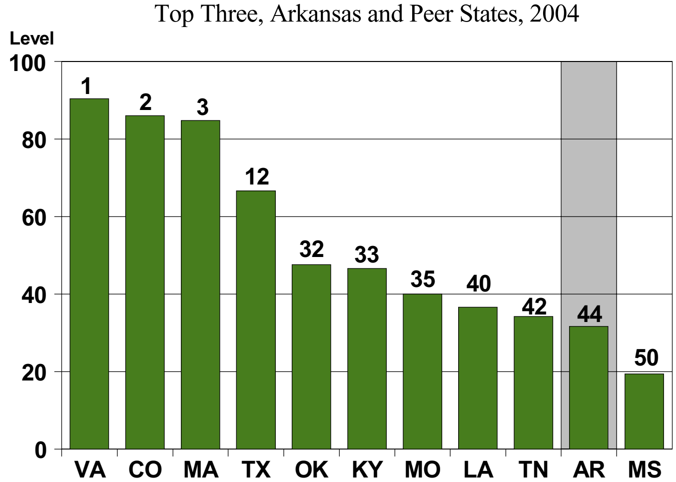
Technology Concentration and Dynamism and Arkansas

A technology cluster is a geographic concentration of interconnected domestic and foreign firms, specialized suppliers, service providers and research institutions. Each is embedded in the cluster. Partnerships, collaboration, cooperation, sharing and competition exist within clusters. A successful technology cluster for the state of Arkansas is one that:

- improves the state's competitiveness;
- improves the competitiveness of firms operating in the state as well as those conducting business with the state; and
- improves the competitiveness of individuals, i.e. constituents and those who trade and transfer knowledge with the state of Arkansas.

On the 2004 index, Arkansas ranked 44th in the nation for technology concentration and dynamism. Although this ranking is improved over its 45th position in 2002, its score slipped from 32.0 to 31.6 in 2004. Arkansas remains behind all of its comparable states with the exception of Mississippi.

Technology Concentration and Dynamism Component
Top Three, Arkansas and Peer States, 2004



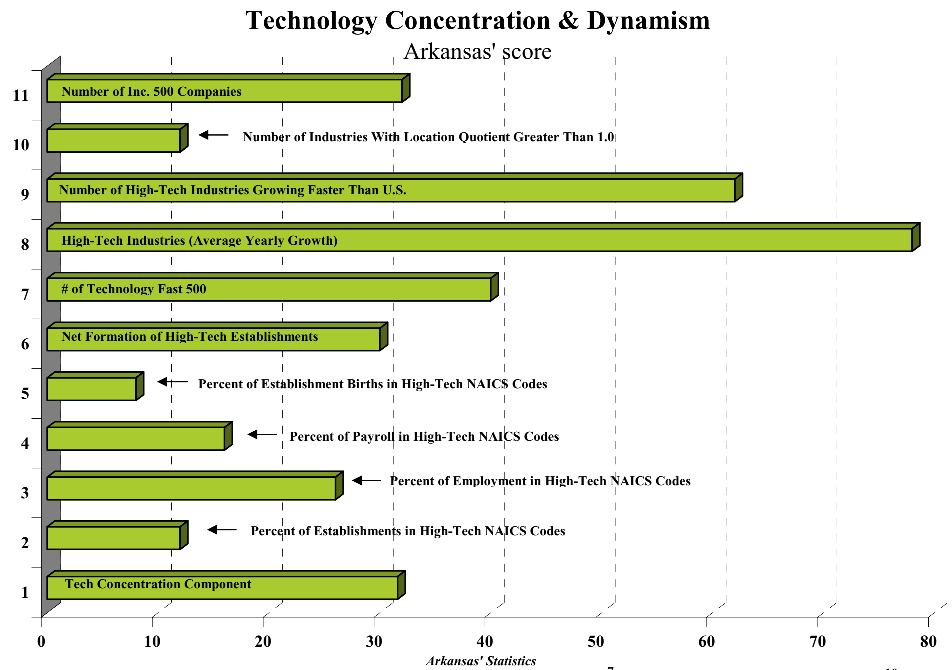
Source: Milken Institute

A whole host of elements must be in place to set the stage for the formation of technology and science clusters in Arkansas. Research facilities engaged in cutting-edge work are important preconditions to the creation of these sought-after industrial clusters. 'Cost-of-doing business' measures are important for technology firms, especially in manufacturing. But even more significant are access to a well-trained workforce, close proximity to excellent educational facilities and research institutions, an existing network of suppliers, the degree of technology spillovers, availability of venture capital and other 'quality-of-life' factors.

Economic regions are now more susceptible to an exodus of industries (and jobs) attracted elsewhere by the perception of greener pastures. Firms seeking to invest in an area for the first time have no "roots" and their investments are, therefore, highly location-sensitive. Those already established in a geographic area are able, albeit not without some difficulty and cost, to relocate to competing areas. Although investments are constrained by a whole set of exogenous and endogenous factors, many options may exist as to where these monies and associated activities can be directed.[63]

Probably the most important new aspect of the globalized economy is the international mobility of capital—financial portfolio, physical equity capital and human capital. Clusters of firms, due to the often tremendous costs of relocation, are more than just a temporary situation. A reason for their "stickiness"[64] is that the economic relations are embedded in networks and enhanced by other than pure economic forces—the local milieu. The popular notion of embeddedness[65] facilitates understanding of the conceptual interconnection between the structure of clusters and the social action which influences them. Embeddedness requires strong backward, forward and horizontal linkages.

Below is a horizontal bar chart that illustrates technology concentration and dynamism in the State of Arkansas.



	1	2	3	4	5	6	7	8	9	10	11
Arkansas	31.60	3.30	6.60	8.90	3.80	10.70	0.00	3.30%	6.00	0.00	0.30
State Avg.	55.66	5.90	8.90	14.60	7.70	18.80	0.60	2.64%	6.10	3.56	0.70

The above chart displays each of the 10 indicators included in Arkansas' technology concentration and dynamism composite, along with the state's score. In many respects, this index can be viewed as a measurement of technology outcomes. This composite index aims to measure the degree to which the state's economy is fueled by the technology sector. In essence, the composite illustrates the effectiveness of the state's entrepreneurial, governmental and policy-formulating success, or lack thereof. Measuring high technology employment, payroll activity, net business formations and growth displays the successes or failures of regional efforts. Technology concentration and dynamism should be viewed as an indicator of technology outcomes.

Arkansas' best scoring indicator within this composite is high-tech industries average yearly growth. Although Arkansas' growth of 3.3 percent on the 2004 index is down from 5.1 percent in 2002, the state's ranking rose from 18th to 12th in the nation on the 2004 index. This improved ranking places Arkansas above its comparable states of Oklahoma (2.4 percent), Texas (1.7 percent), Tennessee (0.8 percent), Mississippi (0.5 percent) and Missouri (which declined by 1.6 percent).

Having a high percentage of high technology businesses is important to a state's regional economy because it suggests that there is a large quantity of establishments whose model is centered on high value-added, dynamic products and services. States with large shares of high technology employment are expected to have high payrolls as high-tech jobs warrant above average salaries. Furthermore, it is an important inducement for technology firms based elsewhere to establish operations in the state and retain existing firms contemplating expansion. Drawing comparisons between employment and establishments in the high-tech sector to salaries being paid to high-tech workers allow analysts to determine the quality of jobs being created in the sector and in the economy as a whole.

The listing below helps identify Arkansas' relative position in each of the above components, with respect to all states in the country.

Technology Concentration & Dynamism

Arkansas Rankings, 2004

	Technology Concentration & Dynamism Components	Rank
1	% Establishments in High-Tech NAICS Codes	45
2	% Employment in High-Tech NAICS Codes	38
3	% Payroll in High Technology NAICS Codes	43
4	% Establishment Births in High-Tech NAICS Codes	47
5	Net Formation of High-Tech Co's. per 10k businesses	36
6	# of Technology Fast 500 Co's. per 10k businesses	31
7	High-Tech Industries Growth - 5-year Average	12
8	# of High-Tech Industries Growing Faster than U.S.	20
9	High Tech Industries Location Quotients Over 1	45
10	# of Inc. 500 Companies per 10,000 businesses	35

Arkansas ranked 45th in the nation for its percentage of high-tech firms on both the 2002 and 2004 indexes. Just over 3 percent of all Arkansas businesses operate as high-technology enterprises (3.1 in 1998, 3.3 in 1999 and 3.4 in 2000). All of Arkansas' comparable states, with the exception of Mississippi, rank ahead of Arkansas in this indicator.

Business births are important to a state because healthy gains in businesses are signs of economic stability, prosperity and optimism. Business births in the high technology sector are particularly important because regional prosperity during the last three decades has been linked to high technology expansion. Net high-tech business establishments' formations are important in analyzing a state's economy. Net high-tech establishment formation allows analysts and policy makers to gauge the supplier network and the state of a regional economy.

Arkansas ranked 49th in the nation for net high-tech firm creation on the 2002 Index. Improvement in this measure is shown with a ranking increase to 36th on the 2004 Index. The evidenced improvements have therefore been transitory. This up-down pattern is also seen for the number of Technology Fast 500 companies in Arkansas. Arkansas ranked 32nd in this indicator in 2002 and 31st on the 2004 index, lately dropping to 34th, suggesting that real improvement is still necessary. Of its comparable states, only Mississippi ranked below Arkansas for the percentage of establishment births in high-tech on the 2004 index.

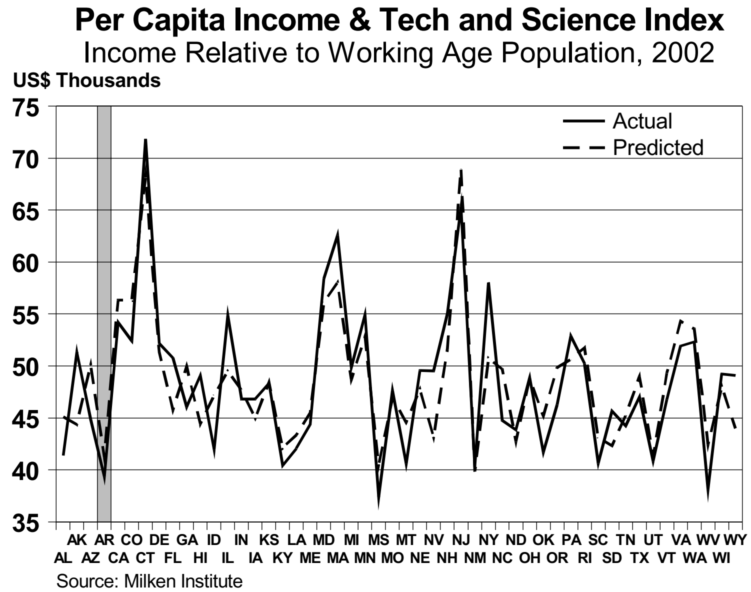
The number of Technology Fast 500 companies in a state is important in assessing its high-technology sector success. Since technology has been a primary driver of economic growth, an indicator that gauges the number of technology companies in terms of growth and expansion is crucial when assessing a state's technology sector. The presence of Fast 500 companies in any given state is important because it shows where the fastest growing privately held companies are located.

In 2002, Arkansas ranked 49th for net formation of high-tech establishments per 10,000 business establishments at 2.7, below all of its comparable states. The state's performance on this measure improved in 2004 to 10.7 and its rank rising to 36th in the nation. On the 2004 index, Arkansas ranked below comparable states Texas, Kentucky and Missouri, but well above the rankings of the remaining states —Oklahoma, Tennessee, Mississippi and Louisiana. Arkansas' ability to both create and sustain the formation of new high-technology businesses shows substantial improvement.

Net accumulation of high-tech firms = Incoming firms – Outgoing firms + Prior stock. The ratio of net high-tech business formations to the number of firms in Arkansas provides a measure that demonstrates the progress the state is making in adding to its high-technology sector. Nevada, New Jersey and Virginia performed best.

Examining where technology is prevalent does not correlate with where technology is growing. Average yearly growth in high-tech aims to capture where technology has grown fastest during the past five years regardless of industry base. The number of industries that are growing faster than the U.S. on average is important when performing cross-state analysis because it allows analysts to see what industries within the high technology sector are more successful in different parts of the country than in others.

Arkansas ranked 20th in the number of high-tech industries growing faster than the U.S. and it tied with 10 other states including Texas. The state with the largest number of industries growing faster than the U.S. was West Virginia with 10. Comparable-state Oklahoma tied six other states for second place with nine industries. Louisiana tied with six other states for ninth place with eight industries. All other comparable states rank below Arkansas—Tennessee (five industries), Kentucky (four industries), and Mississippi and Missouri (two industries).



One way to test the statistical relevance of our State Technology and Science Index is to look at its relationship to the per capita income across states. We examined a number of specifications. The dependent variable—the one whose changes we are trying to explain—was the working age per capita income of states for 2002. Based upon changes in the State Technology and Science Index, we were able to explain more than 75 percent of the variations in per capita income of the working age population across states. The chart above displays this relationship of the actual values versus those predicted from the equation. As can be observed in the chart, a clear correlation exists between Arkansas' actual level of per capita income and what can be predicted based on the Index. Only Mississippi and West Virginia have lower levels of per capita income.

Arkansas must aim to improve its quality-of-life standards as well as minimize its cost of doing business. Keeping business costs competitive will ensure that Arkansas can be more successful at attracting entrepreneurs. Low business costs alone are not sufficient to attract technology and science firms and industry clusters; still they can prove to be a comparative advantage in determining where a new technology cluster develops and whether it achieves critical mass.

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R&D Inputs

Risk Capital & Infrastructure

Human Capital

Tech & Science Workforce

Tech Concentration & Dynamism

State Technology and Science Index

Definition

Arkansas' position in technology and science is derived from five major compound indexes: Research & Development Inputs, Risk Capital and Infrastructure, Human Capital Investment, Technology and Science Workforce, and Technology Concentration and Dynamism. Each of the compound indexes is measured on a relative basis to a relevant indicator (population, Gross State Product, number of establishments, etc.). The five compound indexes are weighted equally in determining Arkansas's positioning. The data was collected from a number of governmental agencies, foundations and private sources, and was compiled and analyzed by the Milken Institute.

Why is it Important?

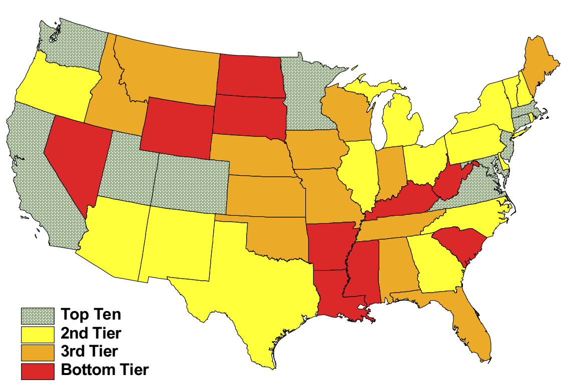
This overall index encapsulates a complete inventory of a state's technology and science assets. Its strength lies in the breadth, depth and relevance of the sets of indicators upon which the compound indexes are based. The indicators for Research and Development Inputs provide a clear, empirical picture of the extent to which R&D activities are supported. The Risk Capital and Infrastructure indicators reveal a state's existing capabilities to support entrepreneurial activity and the comparative performance of its risk capital funding mechanisms.

The indicators for Human Capital Investment index shows how well positioned states are for attracting and sustaining high-tech industries based on the educational preparedness of state residents and public financial support for higher education. Indicators for intensity of the Technology and Science Workforce drill down further to show the extent to which states have a sufficient base of high-end technical talent. The final set of indicators for Technology Concentration and Dynamism essentially measures technology outcomes, that is, how well the other sets of indicators examined do toward bringing states tangible results in regard to creating a sizable population of high-tech firms and workers.

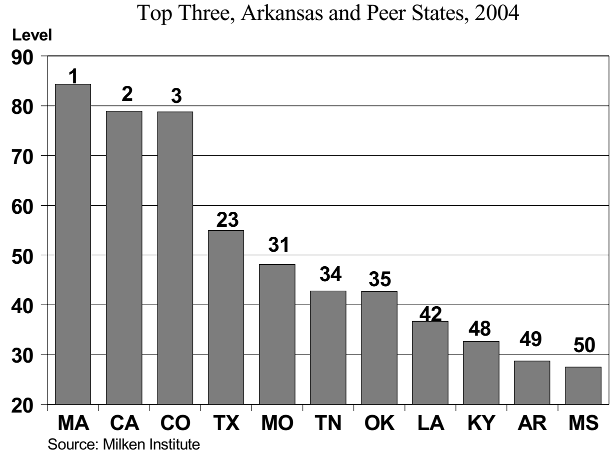
The Index and Arkansas

Arkansas' overall score in the 2004 Index is 28.73. This ranked the state 49th in the nation, nearly four index points behind 48th place Kentucky and more than a full 23 index points below the national average of 52.6. The states in the top 10 are Massachusetts, California, Colorado, Maryland, Virginia, Washington, New Jersey, Minnesota, Utah and Connecticut. Arkansas' ranking represents an improvement over the previous Index, on which it placed 50th. Arkansas has seen a clear improvement from its score of 22.8 on the 2002 Index, but it must make further strides to close the gap with the national average. Detailed interpretations of the state's strengths and weaknesses are contained in the analyses of the individual indicators of this report.

State Technology & Science Index
2004



State Technology & Science Index
Top Three, Arkansas and Peer States, 2004



Definition

The Milken Institute's assessment of Arkansas's position in technology and science is based on five primary sets of indicators, the first of which is Research & Development Inputs (RDI). The RDI compound index is derived by averaging its rankings for 18 RDI indicators (detailed in the following 18 pages). In calculating the RDI composite, the three basic types of research and development funding—academic, industry and federal—are assigned the weights of 1.15, 6.04 and 2.81 respectively. This is done to adjust for vast differences in dollar amount contributions. The RDI component data come from various sources and are compiled by the Milken Institute.

Why is it Important?

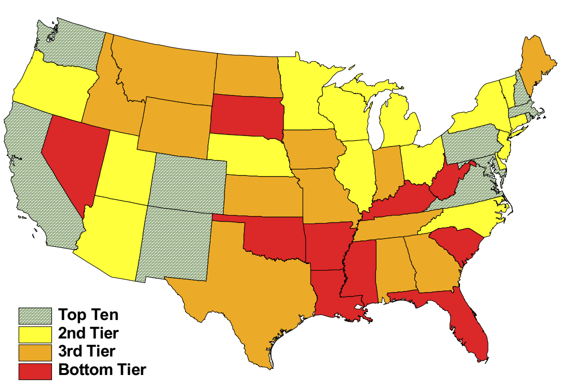
Research and development drives technological progress and, in turn, economic growth. Funding for scientific R&D carried out in federal, industry and academic organizations fuels important technical developments in engineering, the physical sciences, environmental sciences, math and computer sciences, and the life sciences. New discoveries not only lead to innovative products, they also stimulate the creation of new companies that bring growth and renewal to regional economies.

The RDI measures research and development activity across states by examining differing types of R&D funding, as well as where and how these funds are spent. The RDI helps us assess each state's research and development legacy as well as opportunities for future technological success.

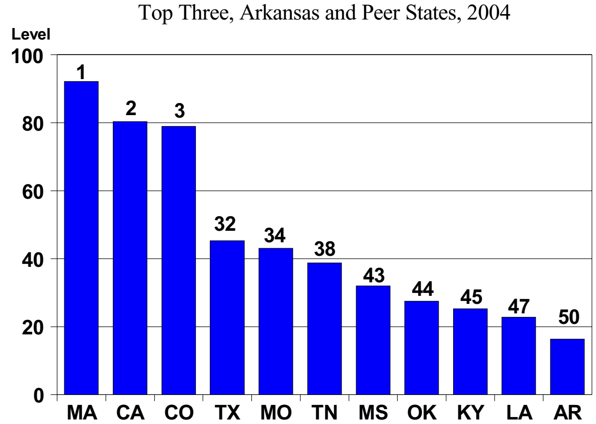
R&D Inputs and Arkansas

Arkansas' 2004 composite score for research and development inputs is 16.37 (out of a perfect score of 100). With this score, the state ranked 50th in the nation on this year's index. Although it also ranked 50th on the Institute's 2002 index, its overall score was 9.04, more than seven points lower than this year. While Arkansas remained stagnant in its position at the bottom of the index, its neighbor, Kentucky, rose up from 49th on last year's index to 45th this year. With significant budget woes facing most states in the region, slippage is evident in the rankings of other neighboring states. Tennessee fell from 30th to 38th, Mississippi from 42nd to 43rd, and Texas from 28th to 32nd. The nature and prospects for the state's individual component scores are detailed in the pages that follow. Arkansas ranks at or near the bottom of the list in indicators for federal R&D, academic R&D, and competitive NSF proposal funding. The state's one noticeable strength is in R&D expenditures on agricultural sciences.

Research & Development Inputs Component 2004



Research & Development Inputs Component
Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

Federal R&D, Dollars per Capita

Definition

Federal research and development dollars per capita is calculated by dividing the amount of a state's federal R&D by its respective population. Federal R&D is the sum of all basic and applied research in projects pertaining to national defense, health, space research and technology, energy and general science. The data is collected by the National Science Foundation. Population figures represent a state's total population and are collected by the United States Census Bureau.

Why is it Important?

This indicator illustrates the role of federal R&D in a state's economy. Latest figures show that total federal R&D for the 50 states reached $69 billion, an average of $244 per capita. The top two states in this category, Maryland and New Mexico, averaged out, receive over $1,000 per capita in federal R&D spending.

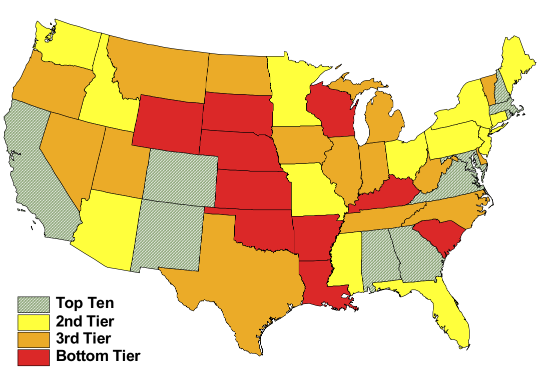
The leading recipients of federal R&D dollars are states significantly involved in health and national security matters. Maryland, New Mexico, Virginia, Massachusetts and Arkansas all serve as bases for major government research programs in these fields. Government research programs function as for the public good, but often have the ancillary benefit of providing the technological seeds for new technology ventures.

Federal research and development spending supports stand-alone research institutions, such as Maryland's National Institutes of Health and New Mexico's Los Alamos National Laboratory, as well as the work of research universities, such as the Massachusetts Institute of Technology and California's Stanford University. As with financial support of scientific research in general, the real value of federally funded R&D is not only in its dollar amount, but also in its ability to foster and sustain a state's pool of skilled human capital.

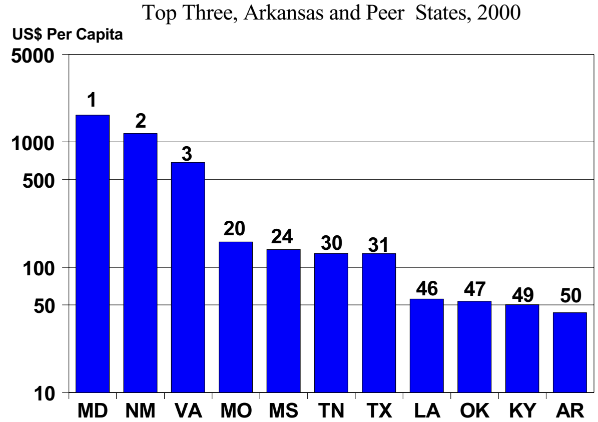
Federal R&D and Arkansas

Arkansas receives approximately $44 per capita in federal money for research and development activities. For the year measured (FY 2000), Arkansas received $11.7 million in federal R&D, the least of any state and less than 1/5000th of the national total. Averaged out per person, this amount of funding ranks the state 50th in the nation. The Natural State's funding level on an averaged per capita basis is dwarfed by the nation's top two per capita earning states of Maryland ($1,640) and New Mexico ($1,171). With the exception of South Dakota ($51), the only other states with similar finding levels are Arkansas' neighbors, Louisiana ($56), Oklahoma ($54), and Kentucky ($50). Missouri ($159) and Mississippi ($139) maintain much higher funding levels and rank 20th and 24th in the nation, respectively.

Federal Research & Development
Dollars per capita, 2000



Federal Research and Development
Top Three, Arkansas and Peer States, 2000



Source: Milken Institute; NSF

Industry R&D, Dollars per Capita

Definition

Industry research and development dollars per capita measures the degree of commercial industry financial support for R&D in a state as averaged out for a state's total population. The indicator is calculated by adding the amount of money each state's nonfarm industry sector spends on research and development and dividing the sum by its respective population. Industry research and development is the sum of all amounts spent by corporations on basic and applied research, including those amounts spent by corporations on federally funded R&D centers. Spending data is provided by the National Science Foundation. Population data comes from the United States Census Bureau.

Why is it Important?

This indicator illustrates the role of industry R&D in a state's economy. Latest figures indicate that total industry R&D for the 50 states is $190 billion, with an average of $675 per capita.

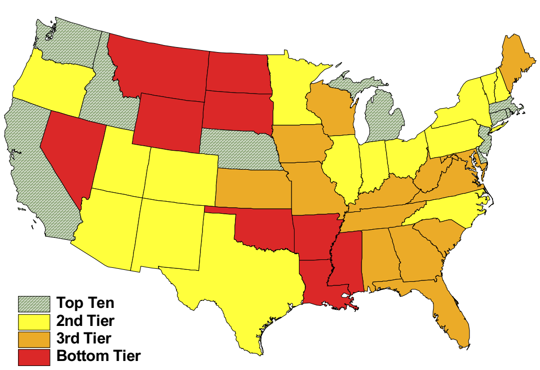
Industry R&D is by far the largest of the three types of R&D—federal, industry and academic—representing slightly more than 65 percent of total R&D. Thus, its weight on the State Technology and Science Index is six times that of academic R&D and three times that of federal R&D.

Corporate research and development is a strong indicator of how companies are investing in their future. While the fruits of R&D often take years to materialize, without it, companies are sure to lose their competitiveness in the marketplace. Firms choose to invest their R&D dollars primarily in states with a talented and educated workforce.

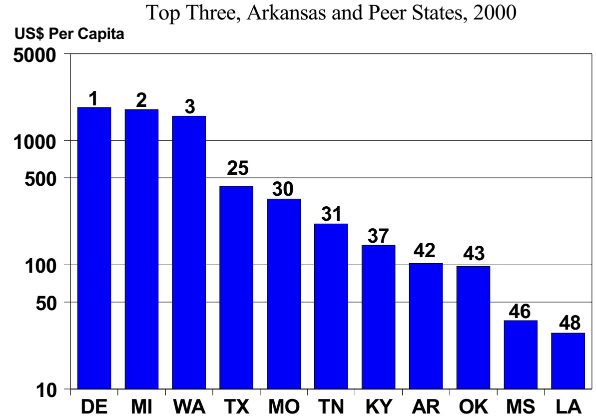
Industry R&D and Arkansas

Arkansas receives $102 per capita from private industry for research and development activities. This is more than twice the amount it receives in federal R&D dollars per capita—a sign of how essential a role private sector funding plays in the state's technology innovation capacity. This level ranks the state 42nd overall, which, although a low ranking, is a distinct improvement over its position in federal R&D of 50th place, and rank of 45th on the 2002 index. The top three states in the nation for this indicator are Delaware (with $1,843 per capita in expenditures), Michigan ($1,775), and Washington ($1,572). In Arkansas, industry R&D has primarily focused on locally significant sectors such as food and paper processing and, more recently, electronic components. Industry expenditures for R&D will likely remain focused on these fields unless efforts are made to introduce more research-intensive industries such as biotechnology.

Industry Research & Development
Dollars per capita, 2000



Industrial Research and Development
Top Three, Arkansas and Peer States, 2000



Source: Milken Institute; NSF

Definition

Academic research and development (R&D) Dollars per Capita is calculated by dividing the amount of money each state's colleges and universities spend on R&D by its respective population. All research, basic and applied, performed by colleges and universities may be funded by a combination of federal, industry and academic sources; that data is collected by The National Science Foundation. The population statistic is the state's total population, collected by the United States Census Bureau. R&D figures reported by academic institutions from federal sources will differ from those reported by the federal government for academic institutions because the funds are not necessarily spent in the same year that they are awarded.

Why is it Important?

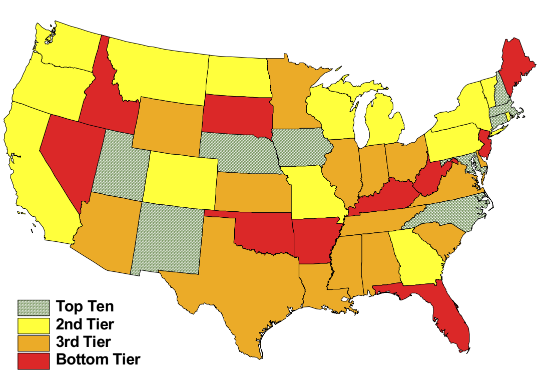
This indicator illustrates the importance of university research as well as the strength and competence of each state's university system. In contrast to R&D performed by the private sector, academic R&D tends to focus primarily on basic, rather than applied, research. Latest figures indicate that total academic R&D in the nation exceeded $32 billion, or an average of $114 per American.

R&D performed by colleges and universities differs from government and industry R&D because it typically focuses more on fundamental scientific discoveries than product or technology development. Although academic research is, traditionally at least, somewhat divorced from the marketplace, academic R&D serves as a magnet for fostering and attracting knowledge-intensive businesses that seek to hire academic researchers and benefit from their discoveries.

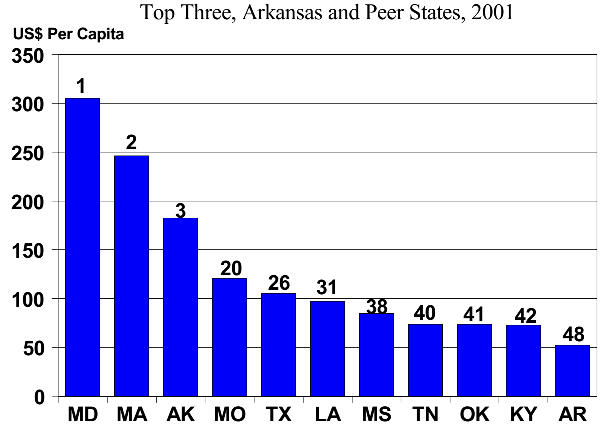
Academic R&D and Arkansas

Arkansas' spending on academic R&D per capita is significantly lower than its industry R&D levels, although slightly higher than its federal R&D levels. With $52.23 spent per Arkansas resident on academic R&D, the state places 48th in the nation—a clear drop from its industrial ranking, but still better than its federal ranking. This is also a decline from its ranking of 47th on the last index. The top two states in this indicator are Maryland and Massachusetts with $305 and $246 of academic R&D spending per capita. Arkansas rates higher than West Virginia and South Dakota, but its level of academic R&D clearly trails all of its peer states, with Kentucky spending in excess of $20 more per person than Arkansas. This indicator provides evidence that Arkansas is not fully utilizing the research potential of its higher educational system.

Academic Research & Development
Dollars per capita, 2001



Academic Research and Development
Top Three, Arkansas and Peer States, 2001



Source: Milken Institute; NSF

National Science Foundation Funding

Definition

National Science Foundation (NSF) funding per $100,000 Gross State Product (GSP) is calculated by deriving the dollar amount of funds awarded by the NSF for every $100,000 GSP. The National Science Foundation is an independent agency of the United States government that funds research and education in science and engineering through grants, contracts and cooperative agreements. The largest beneficiaries of NSF awards are universities and nonprofit nonacademic institutions such as museums and research laboratories. Data on NSF funding comes from the NSF itself. Gross State Product information is provided by the Bureau of Economic Analysis.

Why is it Important?

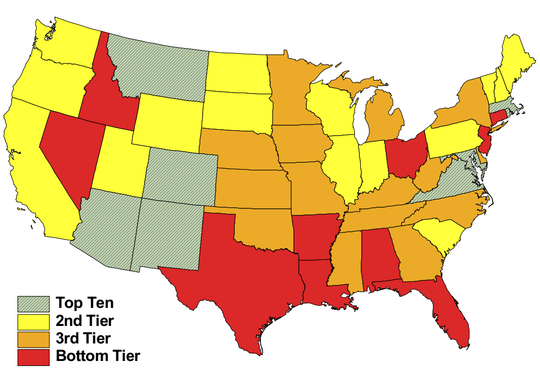
This indicator illustrates the impact NSF funding has on a state's economy. The Foundation accounts for about 20 percent of federal support to academic and research institutions for basic and applied research in science or engineering, or roughly $4.38 billion in 2002.

Since being created in 1950, the NSF has invested in the key driver of technological progress: intellectually creative people. NSF financial support of world-class research and education has led to multiple breakthroughs in science, engineering and other fields. NSF-supported researchers have been awarded more than 100 Nobel Prizes in physics, chemistry, physiology and economics. The NSF will continue to play a crucial role as its awards stimulate research in a world that persistently demands innovation across multiple disciplines.

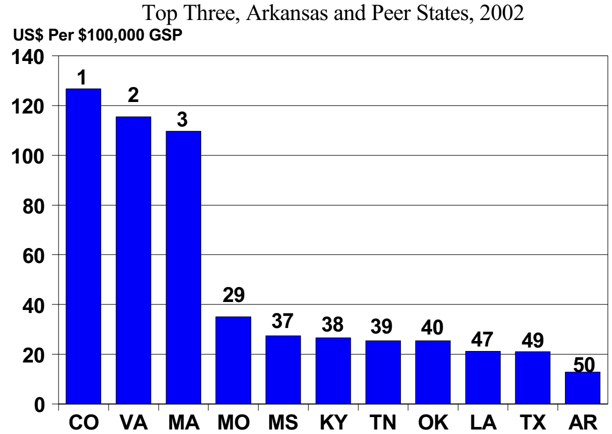
NSF Funding and Arkansas

Arkansas receives $12.84 of NSF funding for every $100,000 Gross State Product. This is more than $30 below the U.S. average as a whole. The top five states in the nation—Colorado, Virginia, Massachusetts, Montana, and Alaska—all receive around or above $100 per $100,000 GSP. In states like Montana and Alaska, this is a reflection of strong federal funding with a relatively small GSP (the size of these two states' GSPs rank them among the bottom 10 in the nation). While the 49th-ranked state, Texas, can partially explain its rate of funding by the size of its GSP, 50th-ranked Arkansas is unable to do so due to the much smaller size of its GSP. The lack of NSF funding both on an absolute and per capita basis suggests that Arkansas is not fully utilizing the potential of its research institutions to attract advanced funding for research and education in the physical sciences and other cutting-edge fields.

National Science Foundation Funding
Per $100,000 of GSP, 2002



National Science Foundation Funding
Top Three, Arkansas and Peer States, 2002



Source: National Science Foundation

Definition

National Science Foundation (NSF) research funding per $100,000 Gross State Product (GSP) is calculated by deriving the dollar amount of funds awarded by the NSF for every $100,000 of GSP. The difference between NSF funding and NSF research funding is that the former is more inclusive, representing funds awarded for research and education while the latter isolates funding awarded for research only.

The National Science Foundation is an independent agency of the United States government that funds research and education in science and engineering through grants, contracts, and cooperative agreements. The largest beneficiaries of NSF awards are universities and nonprofit nonacademic institutions such as museums and research laboratories. The data is collected by the NSF itself. Gross State Product data is collected by the Bureau of Economic Analysis.

Why is it Important?

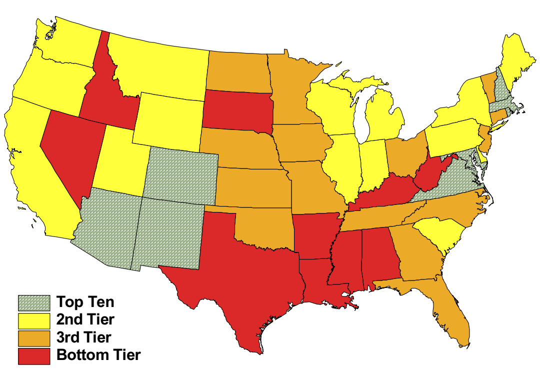
The indicator illustrates the impact NSF funding has on a state's economy. In 2002, NSF research awards exceeded $3.4 billion, almost $34 per capita when averaged for the total research funds per state GSP.

Through their work, recipients of NSF research funding help develop and expand a state's R&D track record and future capacity—elements that heighten recognition of a state's science and technology capabilities and in turn help attract more support for R&D activities. The National Science Foundation acts on the premise that institutions and their science and engineering experts are valuable resources that can influence a state's development.

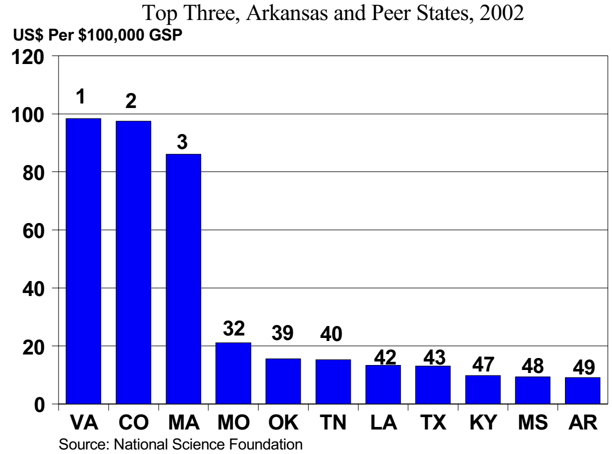
NSF Research Funding and Arkansas

With indexed earnings of $9.05, Arkansas holds a ranking of 49th in NSF research funding, a drop from its ranking of 47th place on the last index. This ranking places the state slightly higher than its showing for the more inclusive indicator of NSF research and education funding, although only by one rank. The level of NSF research funding is directly comparable to that of Mississippi ($9.28) and Kentucky ($9.81), and superior to 50th-ranked West Virginia ($4.72), although it lags far behind the national leaders. The top four states in the nation—Virginia, Colorado, Massachusetts, and Alaska—each receive more than nine times the amount that Arkansas does. The remaining top 10 states are Arizona (with $72.21), Rhode Island ($65.14), Maryland ($51.23), Hawaii ($45.38), New Hampshire ($41.34), and New Mexico ($41.03). The one figure not covered in the two graphs is the level of non-research NSF funding received by Arkansas, which has an indexed earning level of only $3.79.

NSF Research Funding
Per $100,000 of GSP, 2002



National Science Foundation Research Funding
Top Three, Arkansas and Peer States, 2002



R&D Expenditures on Engineering

Definition

Research and development expenditures on engineering dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting institutions on various basic and applied engineering programs by each state's respective population. All recognized engineering programs that spend funds on research are accounted for here. The data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as recorded by the United States Census Bureau.

Why is it Important?

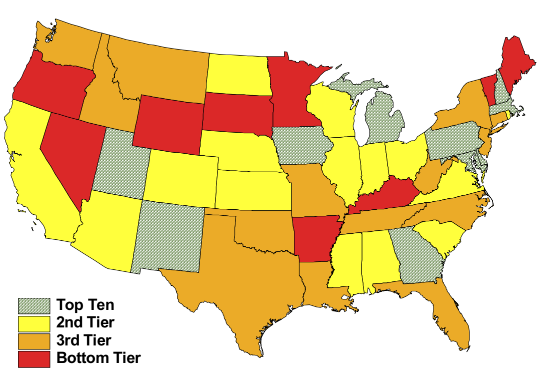
This indicator illustrates the population-based proportional amount of institutional R&D funding spent on engineering research projects. Nearly $4.9 billion of all R&D funding at doctorate-granting institutions was spent on engineering research in 2001 for an average per capita nationwide of $17.16. Nearly 17 percent of all R&D expenditures at doctorate-granting universities was spent on engineering research, second only to the amount spent on programs relating to the life sciences.

Advances and discoveries across multiple engineering disciplines—especially in areas such as computer science and nanotechnology—are important drivers of a state's high-tech economy. In the current age, they are also important contributors to improving national security capabilities. Universities in states with world-class engineering programs will continue to be well positioned in attracting research funding and producing a highly educated labor force.

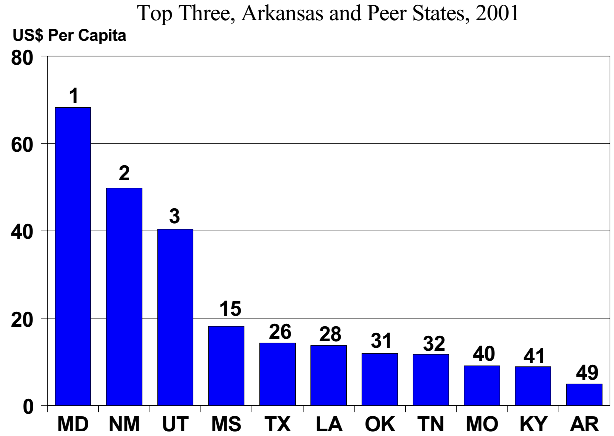
Engineering R&D and Arkansas

With the equivalent of $4.95 spent per state resident on engineering R&D, Arkansas ranks 49th in the nation. This places Arkansas ahead of only Vermont, which spends a paltry $2.84 per state resident on engineering R&D. On the plus side, funding levels have increased by more than $1 per person since 1999. This stands in direct contrast to Mississippi, which has seen its ranking rise to 15th with an expenditure of $18.20 per person on R&D in engineering. The state's inferior position is starkly demonstrated when compared to high performing states. The top-ranked state, Maryland, spends more than 13 times the amount Arkansas does on engineering R&D per resident. Other states in the top 10 that spend at significant levels include third-ranked Utah ($40.39), sixth-ranked Georgia ($27.24), and ninth-ranked Iowa ($23.49). Levels of per capita spending in neighboring states also are far above Arkansas, with Kentucky and Missouri spending 80 percent more on engineering R&D, despite being ranked 40th and 41st in the nation.

R&D Expenditures on Engineering
Per Capita, 2001



R&D Expenditures on Engineering
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

Definition

Research and development expenditures on physical sciences dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting universities on various basic and applied physical sciences programs by each state's respective population. All physical sciences programs, from mathematics and physics to astronomy and materials research that spend funds conducting research, are accounted for here. This data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as collected by the United States Census Bureau.

Why is it Important?

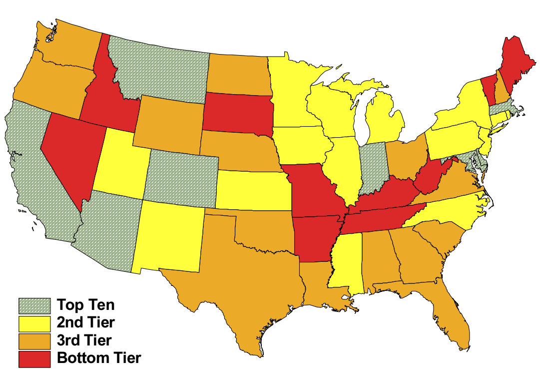
This indicator illustrates the population-based proportional amount of institutional research and development dollars spent on physical science projects. Some $2.7 billion of all R&D at doctorate-granting universities was spent on research relating to the physical sciences in 2001 for an average per capita of $9.45. Close to 9.2 percent of all institutional R&D at doctorate-granting universities was spent on physical sciences research, making it the third best funded category of R&D expenditures.

Significant advances in physical sciences such as the continuing discovery of planets that exhibit similar characteristics to those of earth (presently at nearly 80), and the discovery of pressurized nitrogen as a new form of semiconductor, continue to open new frontiers for science and technology. University-based research expenditures in this area help attract and retain the sorts of highly qualified individuals that contribute to the innovative dynamics of a state's economy. Even when carrying out basic research, the eventual impact on advances in commercial technology can be immense.

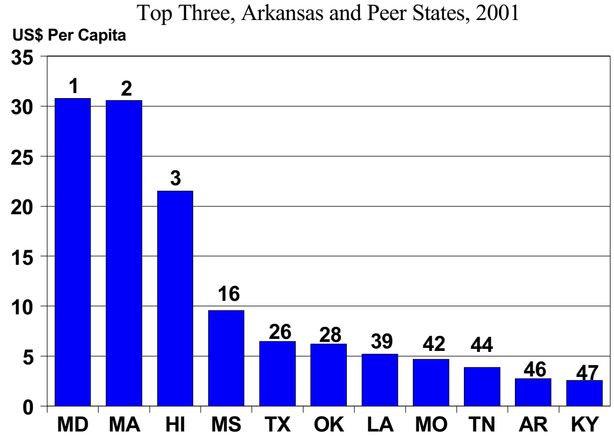
Physical Sciences R&D and Arkansas

Arkansas' average of $2.73 per capita spent on R&D expenditures for the physical sciences puts the state back into position of 46th place, a clear improvement over its previous ranking of 50th. This ranking actually places it ahead of Kentucky, which is ranked 47th with a spending ratio of $2.58 per capita. Compared to states with knowledge-intensive economies, however, Arkansas again finds itself dwarfed by other states' spending levels. First-ranked Maryland and second-ranked Massachusetts each spend more than $30 per capita. Arkansas also does not fare well against several neighboring states. Sixteenth-ranked Mississippi (at $9.56 per capita), 28th-ranked Oklahoma ($6.22), and 39th-ranked Louisiana ($5.20) also spend well above Arkansas' level.

R&D Expenditures on Physical Sciences
Per Capita, 2001



R&D Expenditures on Physical Sciences
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

R&D Expenditures on Environmental Sciences

Definition

Research and development expenditures on environmental sciences dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting universities on various basic and applied environmental sciences programs by each state's respective population. All programs—from those on environmental biocomplexity to studies of the human contribution and response to global change—that spend funds on research are captured in the data. This data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as collected by the United States Census Bureau.

Why is it Important?

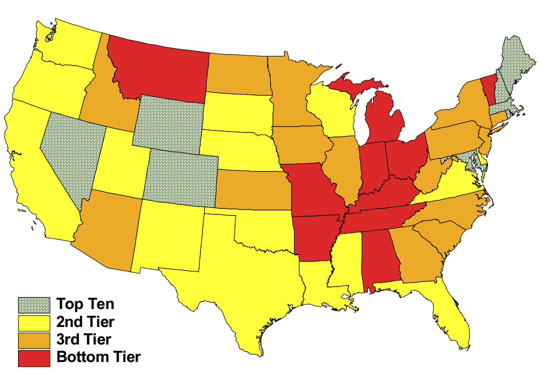
This indicator illustrates the population-based proportional amount of institutional R&D dollars spent on the environmental sciences. Some $1.8 billion of all R&D at doctorate-granting universities was spent on research in environmental science, an average of $6.21 per capita. In 2002, 6.1 percent of all institutional R&D at doctorate-granting universities was spent on environmental sciences research.

Environmental science supports such highly valued commercial fields as environmental technologies and even genomics. Regarding the latter, projects such as genome-enabled environmental sciences and engineering are exploring genomic approaches to environmental issues, gaining understanding of how organisms interact with, or adjust to, their environment. Further discoveries in environmental sciences will potentially heighten attention to the field allowing it to obtain even higher amounts of funding.

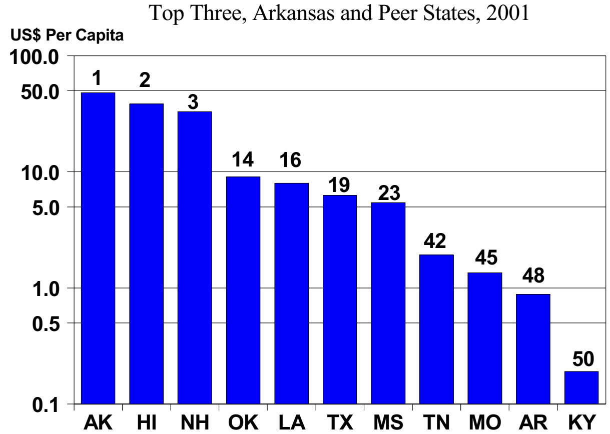
Environmental Sciences and Arkansas

Arkansas holds a ranking of 48th place in R&D expenditures on environmental science, with an expenditure of $0.88 per person. This is an improvement on the spending of $0.59 per person on the last index. The two highest ranked states in the nation for this category of R&D expenditure were Alaska and Hawaii—states whose university systems have taken advantage of their unique local environmental conditions to build proportionally well-funded university research programs. Arkansas' ranking stands above Kentucky's 50th place ($0.19), but lags far behind neighboring states such as 14th-ranked Oklahoma ($9.05), 16th-ranked Louisiana ($7.98), and 23rd-ranked Mississippi ($5.43).

R&D Expenditures on Environmental Sciences
Per Capita, 2001



R&D Expenditures on Environmental Sciences
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

Definition

Research and development expenditures on math and computer science dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting universities on various basic and applied math and computer sciences programs by each state's respective population. All math and computer science programs are included here. The data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as collected by the United States Census Bureau.

Why is it Important?

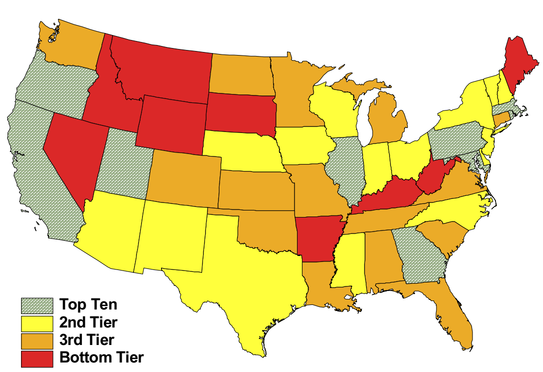
This indicator illustrates the amount of institutional research and development dollars spent on math and computer science projects. Of all R&D at doctorate-granting universities, $1.2 billion was spent on research relating to math and computer sciences in 2001 for an average per capita amount of $4.37. Roughly 4 percent of all institutional R&D at doctorate-granting universities was spent on math and computer science-related projects. Compared to the other R&D categories, math and computer science is the least well-funded research program.

Mathematics forms the basis of all quantitative science and is indeed the "core language" of high-technology development. Computer science represents the chief component of what we associate with high-tech today: information technologies. Because advanced computer technologies today are influenced by other disciples—engineering, physics and even life science—expenditures in this category may actually underreport the extent of research money going towards discovery and development in computer-related fields.

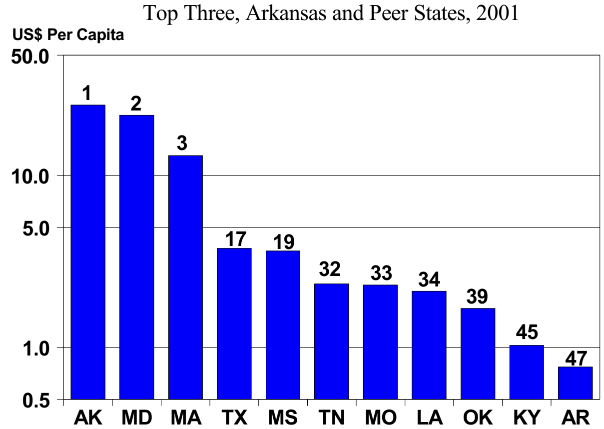
Math & Computer Science and Arkansas

Arkansas' 47th place ranking in computer science R&D reflects the continued low level of funding for most areas of scientific research. Arkansas' rate of funding per capita ($0.77) lags behind other states in the region, from Kentucky in 45th place ($1.03) up to Mississippi in 19th place ($3.64) and Texas in 17th place ($3.77). Arkansas' funding per capita is significantly higher than South Dakota in 50th place, which only funds computer science R&D at the rate of $0.02 per capita, and represents an improvement over its previous spending rate of $0.12 per capita. The two top scoring states this year are Alaska and Maryland—both at more than $20 per capita in expenditures—and Massachusetts, at slightly more than $13 per capita. With the exception of Kentucky, all other neighboring states spend at least twice Arkansas' per capital level on computer science R&D.

R&D Expenditures on Math & Computer Science
Per Capita, 2001



R&D Expenditures on Math & Computer Science
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

R&D Expenditures on Life Sciences

Definition

Research and development expenditures on life sciences dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting universities on various basic and applied life sciences programs by each state's respective population. All life science programs, be they in biology, physical anthropology, oceanography, or horticulture, that spend funds on research, are accounted for here. The data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as collected by the United States Census Bureau.

Why is it Important?

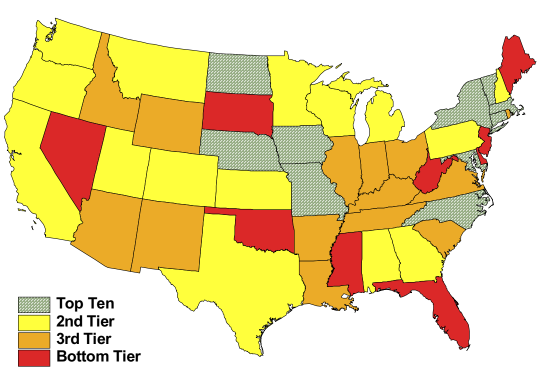
This indicator illustrates the amount of institutional research and development dollars spent on life sciences projects. Of all R&D at doctorate-granting universities, $18.8 billion was spent on research relating to the life sciences for an average per capita figure of more than $66. Over 60 percent of all institutional R&D at doctorate-granting universities was spent on life sciences projects, making programs in this category by far the largest recipients of R&D funds.

The concept of "high-tech" has been rooted in advanced electronics, a field that has historically been most directly influenced by such disciplines as engineering, physics and computer science. Ever since the field of biotechnology emerged in the 1970s, however, life sciences has become a growing force in the economics of high-technology. The disproportionately high amount of R&D funding for life sciences is reflective of this. Among the life science disciplines that show particular economic promise are genomics, biopharmacology, virology and agronomy.

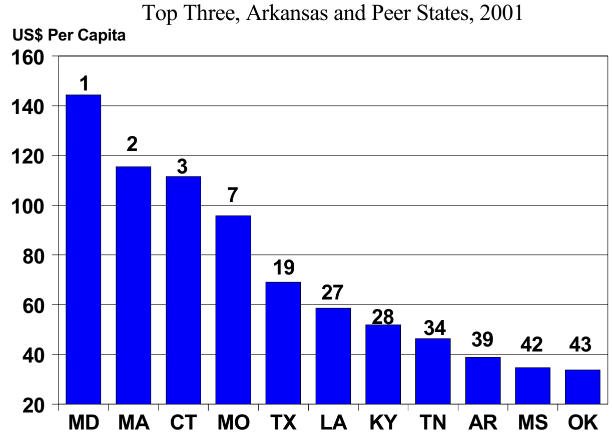
Life Sciences R&D and Arkansas

With $38.83 spent per capita on life science R&D, Arkansas ranks 39th in the nation, a stronger ranking for the state than in most other science R&D fields. This higher ranking is directly connected to the strength of Arkansas' agricultural sciences, which is reflected in the next ranking. The top four states in this indicator are all in the Northeast: Maryland ($144.41 per capita), Massachusetts ($115.44), Connecticut ($111.49) and Vermont ($108.25). The West North Central states also ranked prominently with Iowa, Missouri, Nebraska and North Dakota placing 5th, 7th, 8th and 10th respectively. A strong showing in this indicator is a reflection of a state and its surrounding region's strengths in biotechnology-related research and/or the agricultural sciences. Improved utilization of Arkansas' strong ranking in the agricultural sciences would help boost its position in life sciences and biotechnology.

R&D Expenditures on Life Sciences
Per Capita, 2001



R&D Expenditures on Life Sciences
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

R&D Expenditures on Agricultural Sciences

Definition

Research and development expenditures on agricultural sciences dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting universities on various basic and applied life agricultural science programs by each state's respective population. According to NSF classification, 12 scientific disciplines comprise agricultural sciences including animal sciences, plant sciences, soil sciences and forestry. The data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as collected by the United States Census Bureau.

Why is it Important?

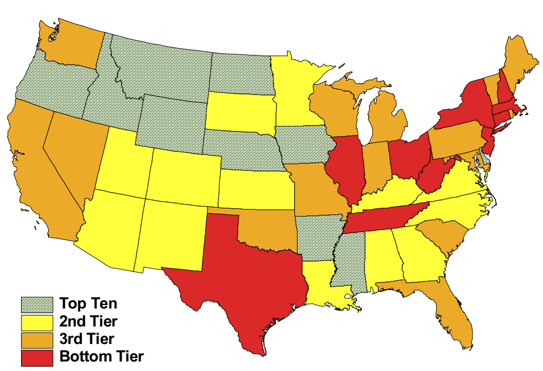
This indicator illustrates the amount of institutional research and development dollars spent on agricultural science projects. Some $2.3 billion goes to R&D at doctorate-granting universities for research relating to agricultural sciences. This figure is about 12 percent of the total $18.8 billion spent on R&D life science research. The average expenditure in the U.S. for this category of R&D is nearly $8 per person.

Although agricultural scientific research carries something of a "low-tech" image within the realm of the science, agriculture-related studies have long been—and remain—an important component of scientific advancement. Finding innovative solutions to such persistent issues as world hunger and forest degradation are major challenges for science today; agricultural R&D is at the forefront of efforts to address these challenges. The way in which agricultural science R&D blends old and new disciples—such as with innovations in genetically modified crops—also demonstrates how the field is radically modernizing as well.

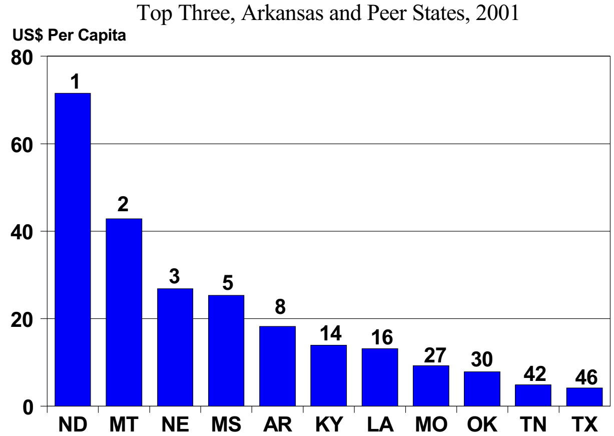
Agricultural Sciences R&D and Arkansas

With per capita R&D spending in agricultural science sat $18.26—more than twice the national average—Arkansas ranks in the nation's top 10 at eighth place. This is a new indicator to the Institute's annual index and was introduced to allow a better understanding of Arkansas' relative position in life science research. Taken in conjunction with the indicator for R&D expenditures in biomedical sciences (which follows on the next page), the agricultural sciences R&D indicator helps explain the state's ranking in overall life science research (described on the previous page). The top-scoring states in this indicator are, not surprisingly, those whose economies are heavily dependent on agriculture: North Dakota (at $71.51 per capita), Montana ($42.85), Nebraska ($26.82), Idaho ($25.65) and Mississippi ($25.34). The relative strength of Arkansas' position in this indicator compared with its position in others demonstrates the extent to which Arkansas' economy remains dependent on agriculture and food processing for growth.

R&D Expenditures on Agricultural Sciences
Per Capita, 2001



R&D Expenditures on Agricultural Sciences
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

R&D Expenditures on Biomedical Sciences

Definition

Research and development expenditures on biomedical sciences dollars per capita is calculated by dividing the statewide amount of funds spent at doctorate-granting universities on basic and applied biology and medical science programs by each state's respective population. Research fields herein accounted for include biochemistry, molecular biology, genetics, immunology, clinical medicine and pharmacy. The data is collected by the Division of Science Resources Studies of the National Science Foundation. The population statistic represents the state's total population as collected by the United States Census Bureau.

Why is it Important?

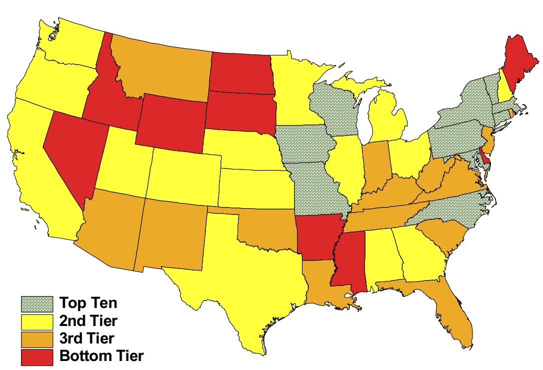
This indicator illustrates the amount of institutional research and development dollars spent on biological and medical science projects. Some $16 billion annually goes to R&D at doctorate-granting universities for research relating to biomedical sciences. This figure represents 85 percent of funding for life science research and more than half of all university R&D expenditures. The average expenditure in the U.S. for biomedical R&D is slightly more than $56 per person.

As reflected in their disproportionately large share of university R&D funding, the biomedical sciences comprise some of the most promising areas for scientific research. There is a virtually unlimited demand for technologies that deliver better health. Moreover, there are enormous attendant benefits, economic and otherwise, that more healthful living brings to individuals and societies. As the most scientifically advanced component of life science research, adequate biomedical R&D funding is a vital component to a well-rounded knowledge-based economic strategy.

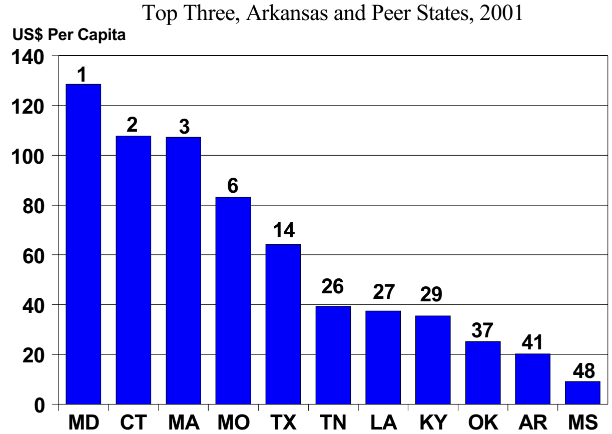
Biomedical Sciences R&D and Arkansas

Arkansas' ranking of 41st in biomedical sciences R&D is significantly lower than that in agriculture, but still an improvement over its ranking in many other fields. Spending $20.23 per capita, Arkansas is more than $30 below the national average and more than $70 behind the spending level of the top four states. Although the order has changed slightly, the top four states in this indicator are the same as those for life sciences R&D overall. Here, Maryland ranks first, spending more than twice the national average at $128.51, followed by Connecticut ($107.74), Massachusetts ($107.23), and Vermont ($90.70). Arkansas ranks behind all neighboring states except Mississippi, which is 48th ($9.16). Missouri, in sixth place ($83.13), Louisiana in 27th ($37.42) and Kentucky in 29th ($35.45), all have significantly higher funding per capita.

R&D Expenditures on Biomedical Sciences
Per Capita, 2001



R&D Expenditures on Biomedical Sciences
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

Definition

Small Business Technology Transfer (STTR) awards per 10,000 businesses is calculated by taking the average of the number of STTR awards in each state for the years 1999, 2000 and 2001, and dividing the result by the total number of business establishments in each state. STTR awards are the total of phase I and phase II federally funded research awards granted to small businesses and nonprofit research institutions with fewer than 500 employees. STTR award data is collected by the Small Business Administration (SBA). The data on the number of establishments is collected by the United States Census Bureau.

Why is it Important?

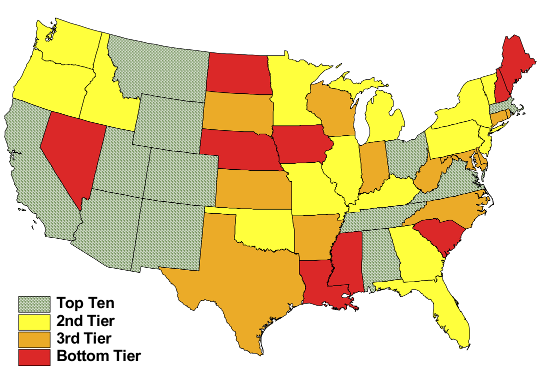
This indicator illustrates the synergy between small businesses or nonprofit research institutions and federally funded research and development resources. Latest figures indicate that the three-year average annual number of STTR awards granted was 317 for the United States.

The STTR program seeks to increase the participation of small businesses in federally funded R&D and to increase private sector commercialization of technology. Many newly chartered firms play an increasingly instrumental role in commercialization of technology innovations. Unencumbered by other core technology assets, small firms can bring new products and services to market quickly. One of the unique features of the STTR program is its requirement that participating small businesses formally collaborate with a research institution in phase I and phase II. STTR awards play a significant role in supporting the innovativeness of small firms and research organizations while helping to bolster the nation's scientific and technological capabilities.

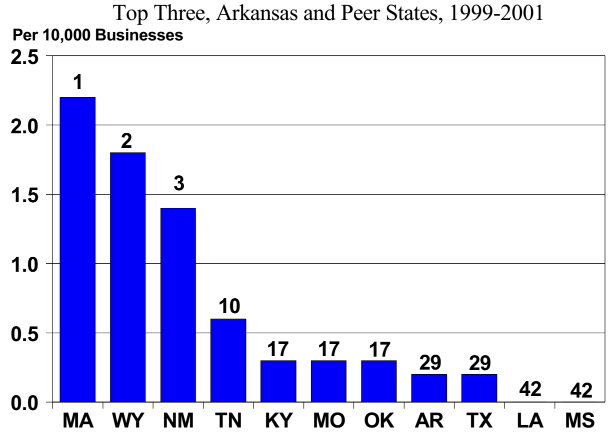
STTR Awards and Arkansas

Here and on the following five pages, R&D inputs are not evaluated on a per capita basis, but according to larger base figures. In this indicator, Arkansas earns 0.2 STTR awards per 10,000 business enterprises. This figure ranks the state 29th in the nation, a position it shares with Texas and Indiana, among others, to which it is statistically tied. This ranking is an improvement from its position of 40th on the Institute's 2002 index. The top three scoring states in this indicator are Massachusetts, Wyoming and New Mexico, which have 2.2, 1.8 and 1.4 STTR awards granted per 10,000 businesses, respectively. Although it would be preferable for Arkansas to rank higher, its position is an improvement, and places it above Mississippi and Louisiana, who have an average of 0 awards per 10,000 businesses.

Average Annual Number of STTR Awards
Per 10,000 Businesses, 1991–2001



Average Annual Number of STTR Awards
Top Three, Arkansas and Peer States, 1999-2001



Source: Small Business Administration

STTR Award Dollars per $Millions of GSP

Definition

The Small Business Technology Transfer (STTR) award dollars per-million-dollars of Gross State Product (GSP) is calculated by taking the average amount of STTR award dollars in each state for the years 1999, 2000 and 2001, and dividing the result by its respective GSP. STTR awards are the total of phase I and phase II federally funded research awards granted to small businesses and nonprofit research institutions with fewer than 500 employees. STTR award data is collected by the Small Business Administration (SBA). Gross State Product data is collected by the United States Department of Commerce.

Why is it Important?

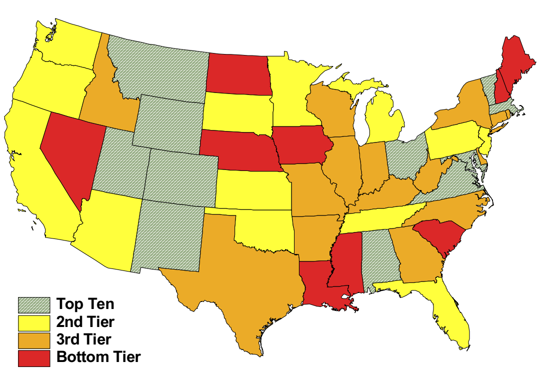
This indicator quantifies the magnitude of federal investment in the country's small businesses and research institutions. Each year, five federal departments are required to reserve part of their R&D funds for STTR awards. Latest figures indicate that average annual total federal funds spent in the small business and nonprofit institution sectors on research and development neared $60 million in the last three years, or $7 for every million dollars of Gross State Product.

Small businesses have long been key to entrepreneurial dynamism and innovation capacity. However, the risk and expense of undertaking R&D efforts is often beyond the means of small commercial operations. Both conditions also apply, usually even more so, to small nonprofit research laboratories. The STTR awards incentivize these components of a state's economy and can help support a state's overall innovation infrastructure.

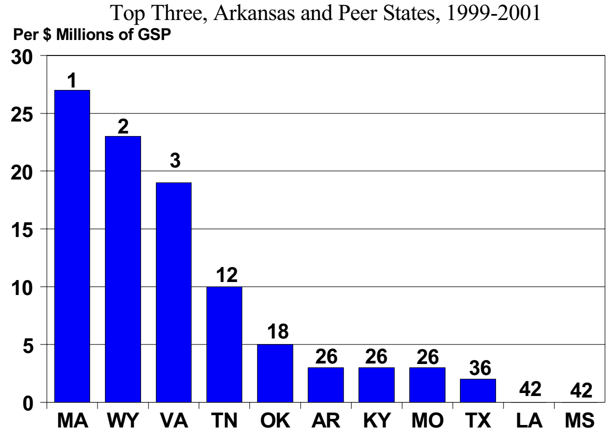
STTR Awards and Arkansas

Statistically, Arkansas receives $3 of STTR awards when averaged out per million dollars of the state's GSP. This ranks the state 26th in the nation, a significant improvement over its 43rd-place ranking on the 2002 index. The top five scoring states in this indicator were Massachusetts, Wyoming, Virginia, Montana, and Utah that receive $27, $23, $19, $18 and $17 in STTR awards per million dollars of GSP, respectively. Arkansas has made significant strides since the last index in its venture capital funding, which is reflected in its rising ranking. Arkansas is tied with Kentucky and Missouri for funding per million dollars of state GSP, and trails only Tennessee (12th) and Oklahoma (18th) among neighboring states.

Average Amount of STTR Award Dollars
Per $ Millions of GSP, 1999–2001



Average Annual Amount of STTR Award Dollars
Top Three, Arkansas and Peer States, 1999-2001



Source: Small Business Administration

Definition

The Small Business Innovation Research (SBIR) program awards per 100,000 people is derived by adding the total number of awards per state between 1999 and 2001 and dividing it by 100,000. Like STTR awards, SBIR awards are split into phase I and phase II; this component pools both phase I and phase II. SBIR awards fund a small enterprise's often costly startup and development stages, as well as encourage the commercialization of research findings. SBIR awards data is collected by the Small Business Administration (SBA). Population figures are collected by the United States Census Bureau.

Why is it Important?

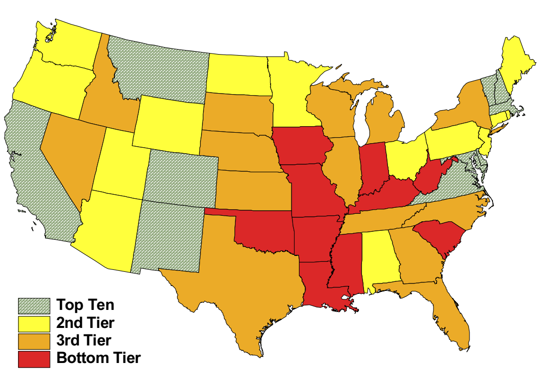
SBIR awards are granted on the basis of need and creative ideas that have commercialization potential. As such, this indicator partially illustrates the level of entrepreneurial creativity among states. Latest figures indicate that between 1999 and 2001, Massachusetts had almost twice the yearly number of SBIR awards than did Colorado, the state in second place. Throughout this same time period, the average number of yearly SBIR awards per state was almost five. Of the 50 states, 19 received more than the average of six awards.

For a firm to qualify for an SBIR award it must meet the following criteria: it must be a for-profit entity; American-owned and independently operated; employ the principal researcher; and have no more than 500 employees. The funding for the SBIR awards program is raised by the federal government's 10 largest departments and agencies.

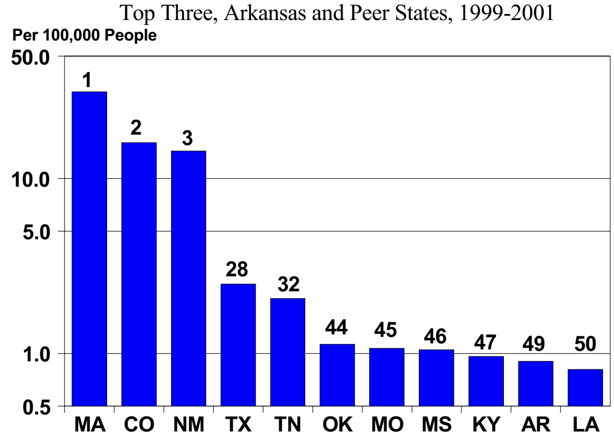
SBIR Awards and Arkansas

Arkansas ranked 49th with an average of 0.90 SBIR (phase I and phase II) awards per 100,000 people for the period 1999–2001. This marks a decline from the average of 1.22 in the 1990–1999 time period and results in Arkansas falling one place from the 2002 Index. The amount of awards to Arkansas is less than one-fifth the national average of 4.84 awards per 100,000 people. The five highest ranking states on the previous index are Massachusetts, Colorado, New Mexico, New Hampshire and Maryland, which receive an average of 31.37, 16.04, 14.35, 13.84, and 12.91 awards per 100,000 people, respectively. Arkansas trails Texas (2.49) and Tennessee (2.06) by significant margins, but has an average quite comparable to other neighboring states such as Mississippi (1.05), Kentucky (0.96) and Louisiana (0.81), albeit at the bottom of the rankings.

Number of SBIR Awards
Per 100,000 People, 1991–2001



Number of SBIR Awards
Top Three, Arkansas and Peer States, 1999-2001



Source: Small Business Administration

Phase I SBIR Awards per 10,000 Businesses

Definition

Phase I Small Business Innovation Research (SBIR) program awards per 10,000 businesses is calculated by adding the number of phase I awards per state and dividing them by units of 10,000 businesses active in the state. This calculation allows us to derive a standard measurement. Phase I SBIR awards data is collected by the NSF's Experimental Program to Stimulate Competitive Research (EPSCoR). Business establishments data is collected by the United States Census Bureau.

Why is it Important?

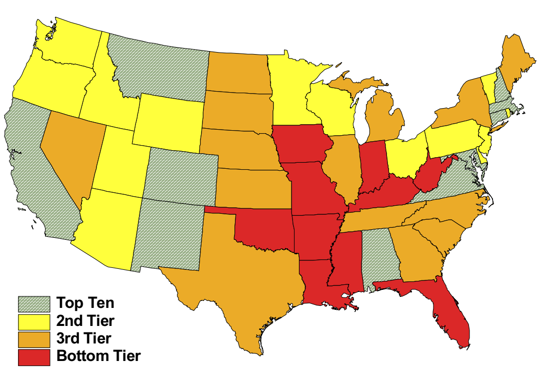
Small Business Innovation Research programs fund research and development efforts of a high risk nature that have commercialization potential. Through its funding, the SBIR program seeks to stimulate technological innovation, use small businesses to meet federal R&D demand, and encourage R&D participation by minority-owned or otherwise potentially disadvantaged firms.

Phase I awards are granted on the basis of research capability. A typical phase I award funds approximately six months of research and does not exceed $100,000. During these six months, the researching firm must establish the technical feasibility of the project as well as justify reasons for further federal, and sometimes private, financing. Not all phase I SBIR awards lead to further funding; however, obtaining one both creates the opportunity to initiate research and provides firms with the opportunity to market themselves to potential investors.

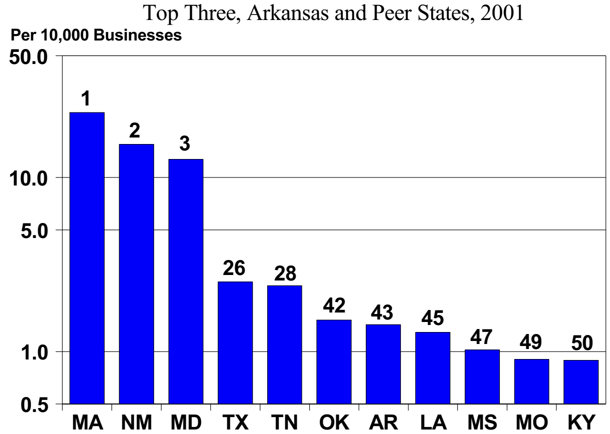
Phase I SBIR Awards and Arkansas

Phase I SBIR awards are particularly valuable to fledgling companies with limited capital. Because the awards are under $100,000 and only intended to last up to six months, they are ideally suited for small companies in need of funding to try out research of an exploratory nature. In this phase I category of SBIR awards, Arkansas places 43rd with an average of 1.43 awards per 10,000 businesses. This represents a slight decline from the state's 42nd-place ranking in the Institute's 2002 index. The five top ranked states in the nation are Massachusetts, New Mexico, Maryland, New Hampshire and Colorado, which respectively receive 23.61, 15.46, 12.68, 12.60 and 10.56 phase I awards per 10,000 businesses, respectively. Developing awareness of these awards among Arkansas businesses and assisting applications could help improve this score in the future.

Phase I SBIR Awards
Per 10,000 Businesses, 2001



Phase I SBIR Awards
Top Three, Arkansas and Peer States, 2001



Source: EPSCOR

Phase II SBIR Awards per 10,000 Businesses

Definition

Phase II Small Business Innovation Research (SBIR) program awards per 10,000 businesses is calculated by adding the number of phase II awards per state and dividing them by units of 10,000 businesses active in the state. This calculation allows us to derive a standard measurement. Phase II SBIR awards data is collected by the NSF's Experimental Program to Stimulate Competitive Research (EPSCoR). Business establishments data is collected by the United States Census Bureau.

Why is it Important?

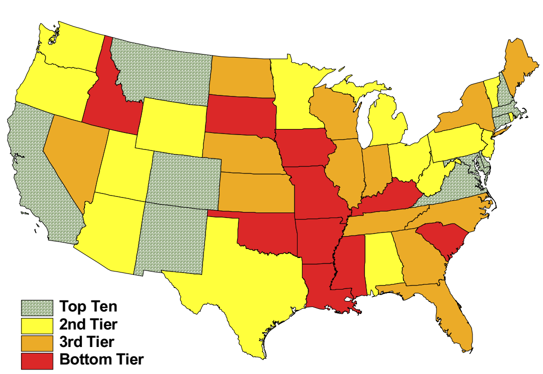
To be eligible for a phase II award, the firm must have been awarded a phase I SBIR award. Phase II awards are granted on the basis of findings from phase I research. The object of a phase II award is to continue the research and development commenced in the initial stage. Typically, phase II awards fund approximately two years of research and do not exceed $750,000. Phase II awards are fewer and harder to come by than phase I awards. On average, approximately two phase II SBIR awards per 10,000 businesses were granted in 2001 as opposed to slightly more than four phase I awards.

As the statistics indicate, phase II of the SBIR Program is competitive. The purpose of a phase II award is to facilitate more well-developed R&D efforts that are closer to the stage of commercialization than would be the case in most phase I projects. A phase II award allows a small business to reach a higher level in its innovation efforts. Without such funding, many small firms would likely be without the means to carry forward promising research activities.

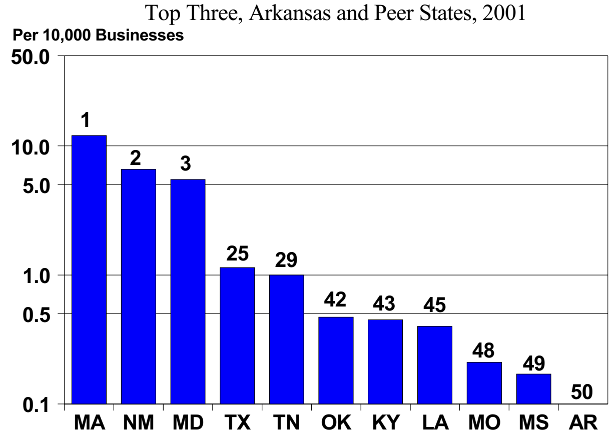
Phase II SBIR Awards and Arkansas

In the category of phase II SBIR awards, Arkansas places 50th, a significant drop from its 36th ranking in the 2002 Index. This drop is misleading as Arkansas was awarded the same number of awards in both indices—zero. However, while other states such as Kentucky, Louisiana and Missouri all received awards in the period between the two indices, Arkansas did not. The five top-ranked states are also the same as for phase I awards, although their order of rank is slightly different. Massachusetts ranked first (12.06 awards per 10,000 businesses) followed by New Mexico (6.56), Maryland (5.49), Colorado (5.03) and Virginia (4.81). As with Phase I awards, Arkansas could improve its score by making more small businesses aware of SBIR awards and following through on the successes with phase I awards.

Phase II SBIR Awards
Per 10,000 Businesses, 2001



Phase II SBIR Awards
Top Three, Arkansas and Peer States, 2001



Source: EPSCOR

Competitive NSF Proposal Funding Rate

Definition

The funding rate of competitive National Science Foundation (NSF) project proposals is calculated by taking the total number of competitive NSF awards granted in 2002 and dividing it by the total number of competitive NSF proposals submitted. Most NSF funding opportunities are in the areas of biology, computer sciences, education, engineering, geosciences, physical sciences, and social and behavioral sciences. Competitive NSF proposals and awards data is collected by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation.

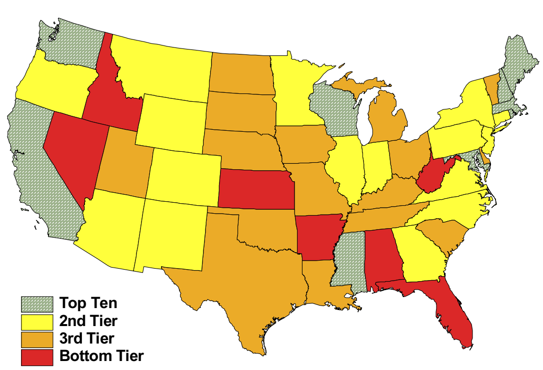
Why is it Important?

The National Science Foundation accounts for approximately one-quarter of total federal funds awarded for basic research to all U.S. colleges and universities. The average funding rate for competitive NSF proposals in 2002 was 28 percent. Without support from organizations such as the NSF, the range and quality of research in our colleges and universities would be severely limited. In addition, funding often supports highly theoretical "basic" or "blue-sky" research, the sort of R&D that is often frowned upon by private industry due to its high-risks and limited immediate commercial applicability. Awards and grants such as those provided by the NSF thus help support the bedrock of American scientific research and knowledge that is crucial to maintaining the nation's edge in knowledge-based economic competitiveness.

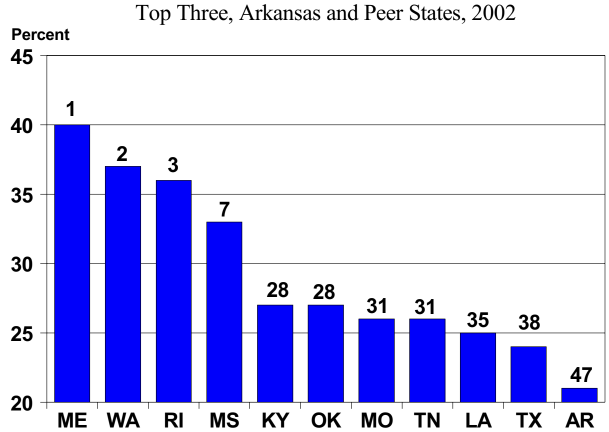
NSF Proposal Funding and Arkansas

The rate at which Arkansas institutions win competitive NSF proposals provides one of the clearest measures of the state's weaknesses in R&D. In this indicator Arkansas scores at the bottom, tied for last in 47th place with a funding rate of 21 percent. This news is compounded by the figure representing a slippage from Arkansas' rate of 26 percent in the Institute's 2002 index. Other states in the region have shown even more significant declines, particularly Tennessee which fell to 31st place from 8th place. However, two of Arkansas' main peers, Kentucky and Mississippi, showed significant improvement. Kentucky rose from 38th place to 28th place, and Mississippi rose from 14th place to 7th place. For the current index, the nation's top three states are Maine, Washington and Rhode Island, which enjoy success rates of 40 percent, 37 percent and 36 percent, respectively. As stated above, NSF funding has great strategic value as it supports basic research projects that private industries tend to shun.

Competitive NSF Proposals Funding Rate
2002



Competitive NSF Proposal Funding Rate
Top Three, Arkansas and Peer States, 2002



Source: EPSCOR

Definition

The second set of indicators for Arkansas's Position in Technology and Science covers Risk Capital and Infrastructure (RCI). The RCI component measures each state's entrepreneurial capacity through the indicators of risk capital performance such as venture capital investment and IPO activity. It also includes nonfinancial indicators such as number of business starts and levels of patent issuance. The RCI compound index is calculated by totaling the state ranks of each RCI indicator and dividing it by the total number of indicators. The RCI component data was collected from various sources and compiled by the Milken Institute.

Why is it Important?

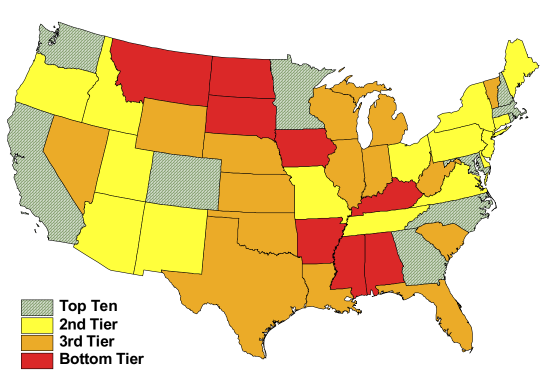
As described in the previous section, research and development efforts provide a raw material for knowledge-based economic growth. Risk capital and infrastructures catalyzes this material by incentivizing and aiding technological commercialization and entrepreneurial activity. In measuring risk capital finance, the RCI component analyzes both marketplace funding mechanisms such as venture capital flows from the private investors and government funding dispersed by the Small Business Investment Company (SBIC) program.

Items relating to facilitating infrastructure that we measure include the number of a state's business incubators, patents issued and number of business starts. A state's risk capital funding activity and infrastructure work in tandem to provide an environment that is conducive to entrepreneurship and entrepreneurial firm growth.

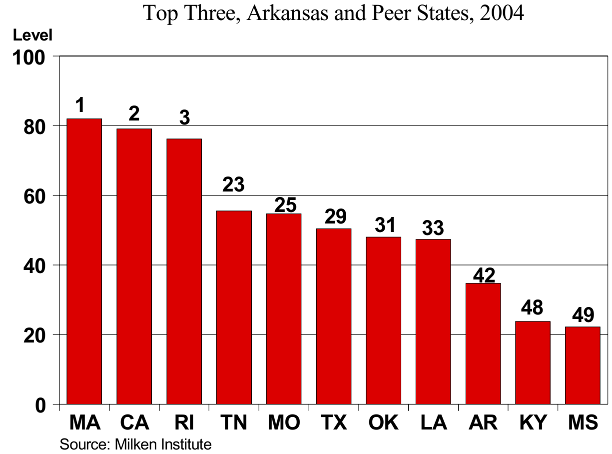
Risk Capital and Arkansas

Arkansas' risk capital and infrastructure component score is 34.67. This places it 42nd in the nation, an improvement over its 47th-place standing on the previous Index. The top 10 states in the nation are Massachusetts (which scored 82.0), California (79.1), Rhode Island (76.2), Colorado (72.0), Maryland (70.2), New Hampshire (69.6), North Carolina (69.1), Washington (67.3), Minnesota (66.2) and Georgia (66.0). Arkansas' strongest performance categories among the indicators for risk capital and infrastructure include Venture Capital Investment Growth and Total Venture Capital Investment Growth. The state's position and its component score place it well above Kentucky (23.8) and Mississippi (22.2). Other risk capital indicators also point to aspects of weakness, however. Business and government leaders should pay particularly close attention to those areas that call for improvement.

Risk Capital Infrastructure Component
2004



Risk Capital & Entrepreneurial Infrastructure
Top Three, Arkansas and Peer States, 2004



Total VC Investment Growth

Definition

Total venture capital investment growth is calculated by taking total venture capital investment for each state in 2002, dividing it by total venture capital investment for the previous year, and multiplying the result by 100. Venture capital (VC) refers to specially accumulated funds invested in or available for investment in a new or unproven business endeavor. Venture capital is also referred to as risk capital in recognition of its high-risk coefficient. Venture capital data used in this report is from ventureeconomics.com and the Money Tree survey conducted by PricewaterhouseCoopers in partnership with Venture One.

Why is it Important?

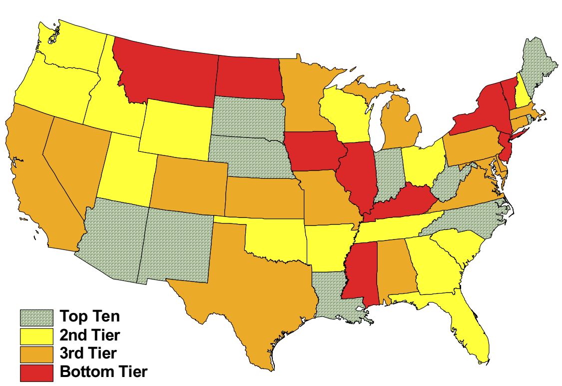
The goal of venture capital money is to invest in young, fast-growing businesses that exhibit potential for high growth and return on investment. Venture capital is an increasingly important source of equity funding for startups. Venture capital investment soared to all-time highs in 2000 as a result of the booming technology sector, finishing the 1990s with an average growth rate slightly above 220 percent for the U.S. on average from 1999.

The time period of 2001–2002, however, saw a massive retreat in investment with a total decline of some $10 billion, an average proportional decline of 32 percent. Venture capital financing remains highly important to new firm formation and growth, however. Former start-ups such as Digital Equipment Corporation, Sun Microsystems, Apple, Microsoft, Intel, Compaq, Federal Express and Genentech are examples of companies that benefited from early-stage venture capital investment.

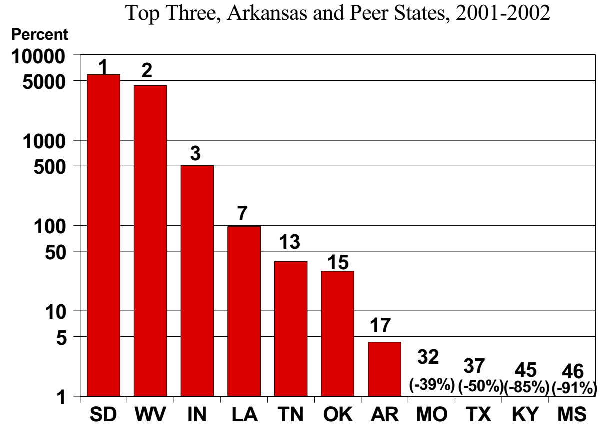
VC Investment and Arkansas

In a period where venture capital investment declined across most of the country, Arkansas actually saw a gain. With funding rising by 4.30 percent in 2002 over 2001 levels, Arkansas ranks 17th in the nation. This rise should be appreciated in comparison to the 50 percent decline in investment that occurred from 1999 to 2000. In terms of ranking, Arkansas does much better this year than on the previous index where it placed 45th. In 2003, of the top performing states in this indicator are South Dakota, ranked first with growth of more than 5,917 percent, West Virginia ranked second, with growth of 4,371 percent, Indiana ranked third (506 percent) and New Mexico ranked fourth (200 percent). Among states near Arkansas, Louisiana saw tremendous growth (90.09 percent) while Kentucky and Mississippi saw declines of more than 80 percent. Only 19 states in the nation attained neutral or positive growth for the period measured, a sign of an extremely tough market for venture capital investing nationwide.

Total Venture Capital Investment Growth
2001–2002



Total Venture Capital Investment Growth
Top Three, Arkansas and Peer States, 2001-2002



Source: Ventureeconomics.com

Definition

The number of companies receiving venture capital investment per 10,000 firms represents the total number of companies that received venture capital funding between the years 1993 and 2002 in each state. To reflect this population's significance in a state's overall business base, the figure for venture-funded companies is normalized by the number of state business establishments according to increments of 10,000. Data on the number of companies receiving venture capital funding is provided by ventureeconomics.com. Data on the number of business establishments comes from the United States Census Bureau.

Why is it Important?

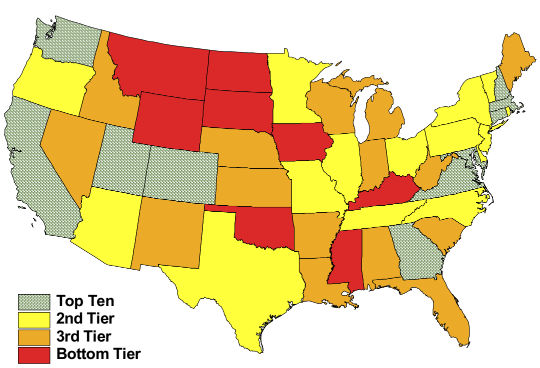
The majority of new business formation and new job creation in the U.S. comes from the small business sector. Financing new business ventures has historically come from family endowments and inheritances. Over the last few decades, however, more and more small enterprises have begun exercising structured credit and private equity opportunities as a source of financial capital. On average in the United States, approximately six out of 10,000 firms exercised venture capital as a source of financial capital in the last decade.

Although venture capital funding has been in a slump since a technology stock-driven market bubble peaked in 2000, venture capital remains a vital source of funding for new firms, especially those that operate in knowledge-intensive sectors. Because it is dispersed in stages, venture capital not only plays a vital role in getting a firm started, but also supports its early years of operation before it revenues or sales of its shares allow for other forms of financial sustenance.

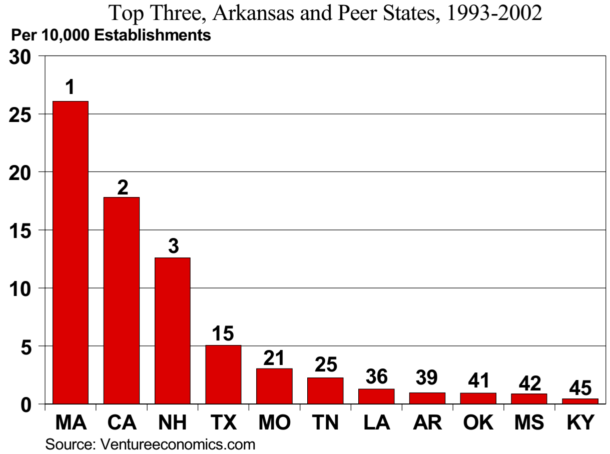
VC Investment and Arkansas

An average of about one Arkansas firm (0.96) per 10,000 received venture capital funding from 1993 to 2002. This is one-sixth the national average of 5.9 and places the state in the relatively low position of 39th in the nation. However, since the Institute's rankings on this indicator were conducted in 2002, the number of Arkansas companies receiving VC investment per 10,000 establishments tripled. Although the total numbers are not high, this increase shows that venture capitalists are beginning to discover the state. Top-ranked Massachusetts has an average of just over 26, far above the score of any state bordering Arkansas. Texas leads among neighboring states with an average of five per 10,000 companies, but this still marks a drop of two from the last index. Missouri's average rose from 2.43 to 3.05, and Tennessee's rose from 1.98 to 2.24. Kentucky saw a major drop from 1.12 to 0.45.

Companies Receiving VC Investment
Per 10,000 Establishments, 1993–2002



Companies Receiving VC Investment
Top Three, Arkansas and Peer States, 1993-2002



Definition

Growth in the number of companies receiving venture capital investment between the years 2001 and 2002 is calculated by comparing the number of companies that received venture capital funding in 2001 to the number of companies that received venture capital funding in 2002. This variable takes into consideration all firms, small and large, that received any form of venture capital funding. Data on the number of companies receiving venture capital funding data is provided by ventureeconomics.com and Pricewaterhouse Coopers.

Why is it Important?

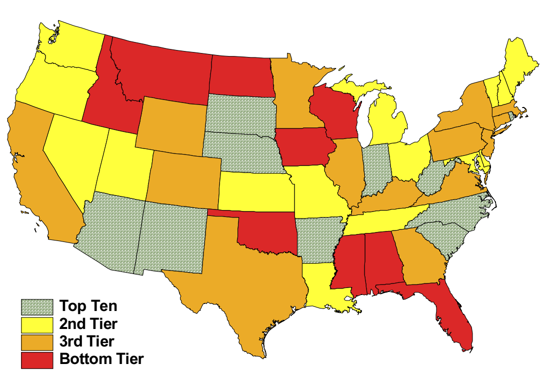
Analyzing the growth in the number of companies that receive venture capital investment is important because it allows stakeholders to measure the momentum of this form of risk capital available to companies. Trends in the growth of state-based companies receiving venture capital investment reflect how well the prospects of those companies are perceived by the leading class of risk capitalists. From 2001 to 2002, the average growth in companies receiving venture capital investment in the U.S. slightly exceeded 8 percent.

This risk capital growth indicator differs from that for Total Venture Capital Investment in that Companies Receiving VC Investment measures the trend in a state's firms for attracting VC investment; the former measures the amount of venture capital dispersed. Because all the venture capital funding allocated from a state does not necessarily go to firms in that state, the indicator for growth of companies receiving VC investment provides a focus for the risk-worthiness the marketplace deems for a state's businesses.

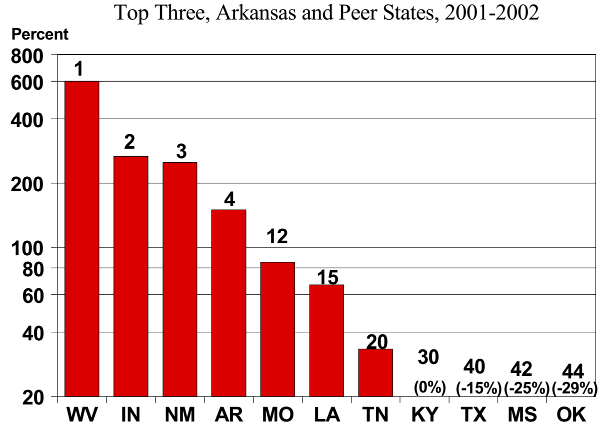
VC Investment and Arkansas

With a 150 percent increase in the number of Arkansas companies receiving VC investments, the state ranks an impressive fourth in the nation. In terms of ranking, this represents a significant improvement from last year's index on which the state ranked 38th, and had a growth rate of 0 percent. Downward momentum affected the growth of VC investments in many states. Massachusetts, for example, saw its growth decline from 39.2 percent to 7.3 percent (a factor of only about five). Texas saw growth slip from 39.3 percent to -15.0 percent. This year the top performing states in the nation for this indicator are West Virginia (600 percent growth), Indiana (266.7 percent), New Mexico (250 percent), Arkansas (150 percent) and North Carolina (120 percent). Missouri (85.0 percent) and Louisiana (66.67 percent) performed well among neighboring states, while Mississippi (-25 percent) and Oklahoma (-29 percent) saw significant losses.

Companies Receiving VC Investment Growth
2001–2002



Companies Receiving VC Investment Growth
Top Three, Arkansas and Peer States, 2001-2002



Source: Ventureeconomics.com

Definition

Venture capital investment as a percentage of Gross State Product (GSP) is calculated by dividing the dollar amount of each state's venture capital investments by its respective GSP. Monitoring venture capital investment as a percentage of GSP allows us to analyze the flow and strength of venture capital in terms of the total state economy. Venture capital investment data is collected by PriceWaterhouseCoopers. Gross State Product data is collected by the United States Department of Commerce.

Why is it Important?

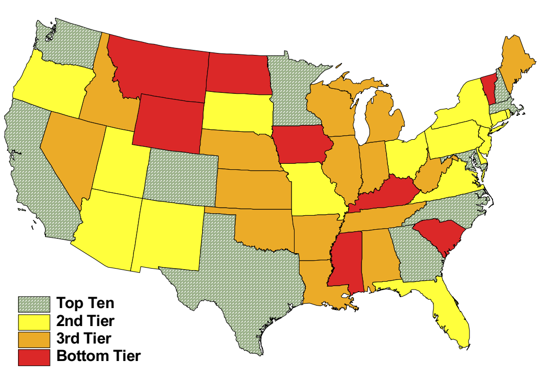
The proportion of a state's GSP that comes from venture capital investments reflects the degree to which risk capital figures in the value of a state's overall economic output. The indicator is a proxy of how adventuresome a state's economy is. In 2002, the average U.S. venture capital share of Gross State Product was 0.2 percent based on a total of $21.1 billion in venture capital investments made across all 50 states. This average is heavily skewed by top five states that scored above the average by wide margins. Most (43) states, however, scored below 0.2 percent average.

Massachusetts, California, New Hampshire, Maryland and Colorado, which all have well-developed knowledge-intensive economies, are responsible for attracting a disproportionate share of VC investment relative to their state GSPs. This is an additional indication of the close relationship between risk capital and high-tech economic development. It serves as a reminder that states eager to foster dynamic high-tech economies need to carefully consider the catalytic role of risk capital finance.

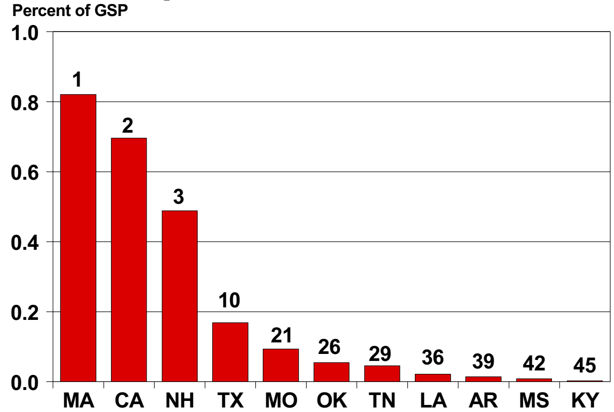
VC Investment and Arkansas

With venture capital investment contributing 0.014 percent of Arkansas' GSP, the state generates one-seventh the average percentage in the U.S. The state's 39th-place ranking is an improvement from its 42nd-place ranking in the previous index. As with the previous indicator, for the number of companies receiving VC investments, however, the levels of performance indicators have dropped in line with recessionary economic conditions. On the Institute's 2002 Index, both Massachusetts and California received around 3 percent of their respective GSPs from VC investment; this year both are well under 1 percent. Other top ranking states in this indicator include New Hampshire (0.49 percent), Maryland (0.32 percent) and Colorado (0.315 percent). Arkansas fares better than Kentucky (0.002 percent) and Mississippi (0.008 percent), but significantly worse than Texas at 0.168 percent.

Venture Capital Investment
As Percent of GSP, 2002



Venture Capital Investment
Top Three, Arkansas and Peer States, 2002



Source: Ventureeconomics.com

SBIC Funds Disbursed per $1,000 of GSP

Definition

The average annual Small Business Investment Company (SBIC) program funds disbursed per $1,000 of Gross State Product (GSP) is calculated by taking the average of all SBIC funds invested in the most recently recorded three year period, in this case, 1999–2001, and dividing that amount by $1,000 increments of each state's GSP. SBIC program data is collected by the Small Business Administration (SBA). Gross State Product figures are collected by the United States Department of Commerce. The SBIC Program was created in 1958 by Congress as a facilitating agency between lenders and borrowers.

Why is it Important?

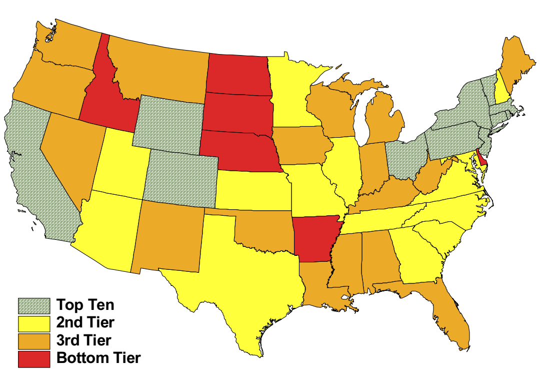
SBICs are business incubator-type establishments that provide services to small businesses ranging from financial capital to management consulting. SBICs are able to provide these services by virtue of being backed by the SBA. SBIC establishments behave in a manner similar to that of venture capitalists—their goal is to identify profit potential in small businesses and fund those companies in hopes of high returns on investment. Over the time period recorded, the SBIC funds invested in small companies has totaled nearly $5 billion. On average, almost 50 cents in SBIC funds are disbursed for every $1,000 of GSP.

SBIC funding represents a bridge between government and the private sector in two fundamental ways: first, in the way that government (that is, taxpayer) funding supports small enterprises; second, in the way that this funding serves to fill a gap in access to capital that small businesses may not be able to readily gain when going to the financial markets on their own. Although people may debate the proper role of government in these contexts, the fact remains that small businesses are supported by the SBIC program and in return contribute back to their state and national economies.

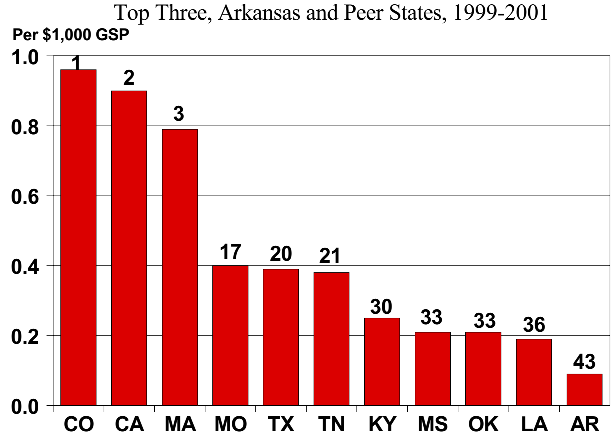
SBIC Funds and Arkansas

According to the amount of SBIC program funds disbursed per $1,000 of GSP, Arkansas ranks 43rd in the nation. This is a slight improvement, both statistically and in terms of monetary value, over the state's performance in 2002. In that year's index Arkansas ranked 47th with slightly more than 4 cents for every $1,000 of GSP coming from SBIC funds. According to the 2004 Index (which measures the period 1999–2001), Arkansas receives 9 cents for every $1,000 of GSP. Top-ranked Colorado receives 96 cents, followed by California with 90 cents. The top five are rounded out by Massachusetts (79 cents), Connecticut (78 cents) and Wyoming (76 cents). Missouri (40 cents), Texas (39 cents) and Tennessee (38 cents) lead neighboring states, and a significant gap exists between Arkansas and its nearest neighbor, Louisiana (19 cents).

Average Annual SBIC Funds Disbursed
Per $1,000 of GSP, 1991–2001



Average Annual SBIC Funds Disbursed
Top Three, Arkansas and Peer States, 1999-2001



Source: SBA; Office of Technology Policy

Definition

The number of business incubators per 10,000 business establishments is calculated by adding the total number of business incubators in each state and dividing that figure by the respective state-based population of business establishments (tallied in increments of 10,000). Data on the number of incubators for each state is provided by the National Business Incubation Association (NBIA). Although the NBIA data set is the most accurate, the association estimates that it accounts for only approximately half of all total incubators in the United States. Thus, the reported figures should be considered conservative. The number of business establishments by state data is collected by the United States Census Bureau.

Why is it Important?

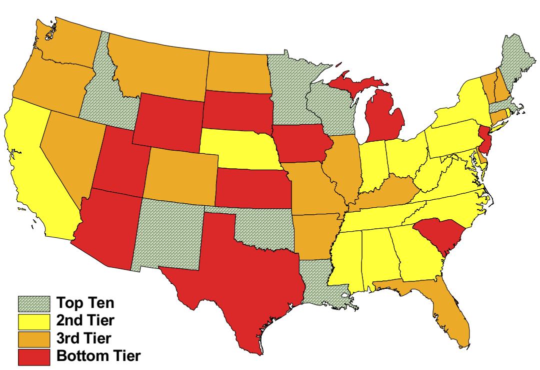
Business incubators provide embryonic businesses with guidance and resources that assist firm formation and growth. Incubator assistance encompasses provision of "hard" assets, such as office facilities and equipment, as well as "soft" assets, such as assistance services, and financial and management consulting. The right incubator environment can critically aid companies that otherwise would not survive on their own.

According to the latest NBIA statistics, there were more than 900 business incubators operating in the United States in 2002, or roughly 1.3 incubators per 10,000 business establishments on average. States with increasing numbers of business formations should appreciate the importance of incubators as a resource in addition to more conventional forms of assistance.

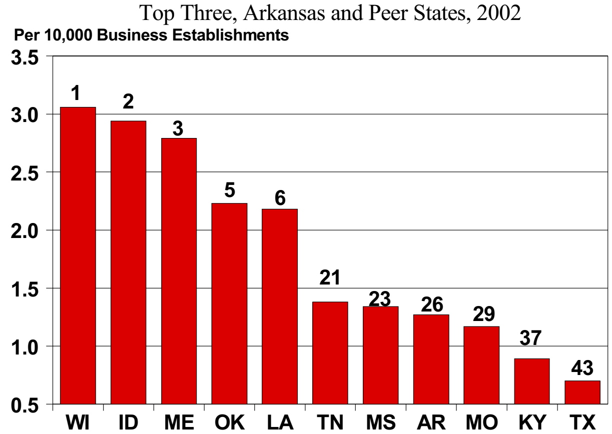
Business Incubators and Arkansas

Arkansas has an estimated 1.27 business incubators per 10,000 businesses, ranking the state near (but decidedly outside) the nation's average of 1.32 and in 26th place. A respectable showing, the state's performance in this year's index represents a slight increase from last year where with 1.12 incubators per 10,000 businesses the state ranked 31st. The top six states for business incubators in 2003 were Wisconsin (with 3.06 for every 10,000 businesses), Idaho (2.94), Maine (2.79), Massachusetts (2.27), Oklahoma (2.23) and Louisiana (2.18). Arkansas ranked near Tennessee (1.38) and Mississippi (1.34), and well above Kentucky (0.89) and Texas (0.70). The strength of Arkansas' ranking relative to its position in many other indicators strongly suggests that Arkansas has the potential to increase its overall science and technology ranking through increased development of its business sector.

Number of Business Incubators
Per 10,000 Business Establishments, 2002



Number of Business Incubators
Top Three, Arkansas and Peer States, 2002



Source: National Business Incubation Association; U.S Census Bureau

Number of Patents Issued per 100,000 People

Definition

The number of patents issued per 100,000 people is calculated by adding each state's number of named patents, both assigned and unassigned, that are issued to individuals and then dividing those figures by the respective state's population in increments of 100,000 residents. Patent documents included in this indicator are utility, design, plant and reissue patents, defensive publications, and statutory invention registrations. Most patents granted in the United States are utility patents, or patents for invention. Patent data is collected by the National Science Foundation. State population figures are collected by the United States Census Bureau.

Why is it Important?

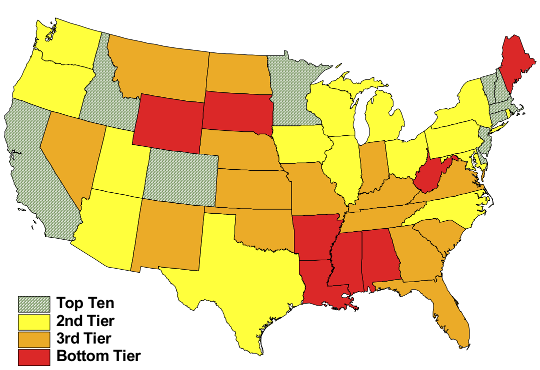
Patents are granted by the Patent and Trademark Office (PTO), a division of the United States Department of Commerce. The issuance of a patent aims to preserve and protect various forms of individual and corporate property. Innovation and scientific advancement is protected through patents by prohibiting others to make, use or sell the invention. The term of a new patent is 20 years from the time the application was filed.

When averaged out for a state's population, the number of patents issued serves as a measure of how technologically innovative and commercially prepared the people of a given state are. Nearly 100,000 patents were issued in the United States in 2001. The average number of patents per 100,000 people in the United States was roughly 35.

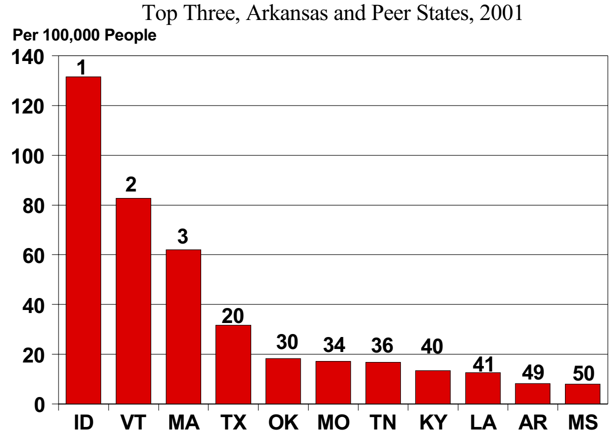
Patents and Arkansas

With slightly more than 8.2 patents issued for every 100,000 people, Arkansas ranked a disappointing 49th in the nation, just above Mississippi. The state's standing in this year's index is a slight decline from 2002 when it ranked 48th, albeit with a slightly lower average of approximately 7.5 patents issued per 100,000 people. Arkansas continues to greatly lag behind the leader in this category, which again is Idaho. Idaho's 131.5 patents issued per 100,000 people is more than 15 times that for the "Natural State." Idaho's attainment testifies to its success in fostering a healthy concentration of innovative industries. Other leading states in this category include Vermont (82.7 patents), Massachusetts (62.1), Minnesota (58.7), Delaware (53.5), New Hampshire (53.3), New Jersey (50.4) and Colorado (47.6). In the region, Texas (31.7) has a large lead, with all other states falling well below the national average of 34.6.

Number of Patents Issued
Per 100,000 People, 2001



Number of Patents Issued
Top Three, Arkansas and Peer States, 2001



Source: U.S. Patent and Trademark Office; Milken Institute

Definition

The number of business starts per 100,000 people is calculated by finding the difference between businesses that were recorded by the U.S. Census Bureau at the end of fiscal year 2001 and those that were recorded at the end of fiscal year 2002. The totals for each state are then divided in 100,000 increments of each state's population. Business starts are defined as the number of businesses with at least one employee that began conducting business during the time period evaluated. Business starts data is collected regularly by the United States Census Bureau. State population figures are also collected by the United States Census Bureau.

Why is it Important?

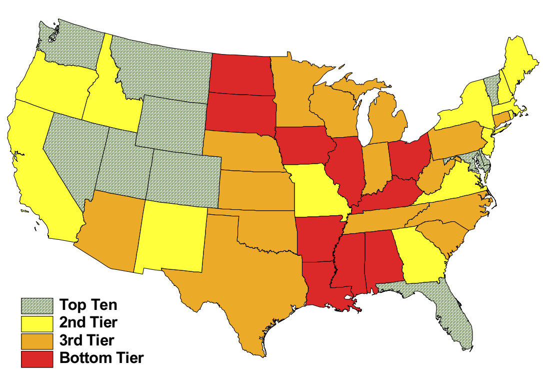
Business starts' data represents one of the clearest measures of a state's entrepreneurial dynamism. When considered on the basis of the presence of business starts within a state's population, additional layers of meaning concerning a state's overall economic creativity are brought out: factors such as a population's commercially adventuresome spirit and optimistic expectations, for example. A state's performance in new firm formation also reflects positively on its ability to attract financial resources, tolerate risk and create new jobs.

In 2002, there were almost 900,000 business starts in the United States. Averaged out on the basis of 100,000 people per state population, the average number of business starts is around 300. The early years of the 21st century have proved to be an especially difficult time for starting new businesses, particularly in light of a recessionary investment climate. Such downtimes are critical windows of opportunity, however, as businesses that ascend in such times tend to lead future waves of economic activity.

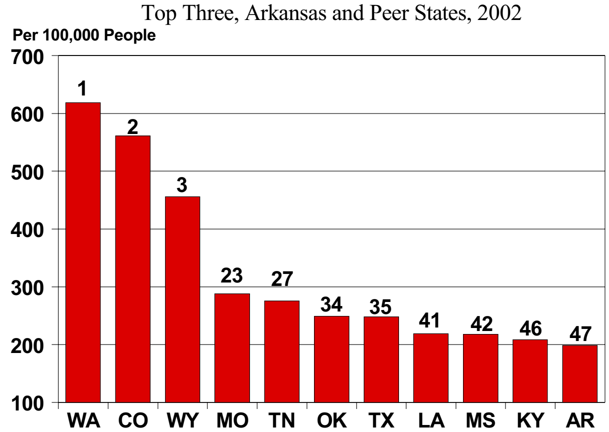
Business Starts and Arkansas

With approximately 199 business starts per 100,000 people, Arkansas rank 47th in the nation. This represents a decline from Arkansas' ranking on the 2002 index where it placed 35th. Conditions that impact the state's performance this year include the severity of the downturn in the business cycle for the Arkansas economy as well as new sources of competition. The top 10 states in this indicator are generally characterized by positive business growth momentum and/or being states with business friendly environments. They include Washington (619 business starts), Colorado (561), Wyoming (456), Utah (450), Florida (435), Nevada (406), Delaware (400), Montana (392) and Vermont (378). Among its neighbors, Missouri (288) and Tennessee (276) fare the best, with only Kentucky (208) having a rate near Arkansas.

Number of Business Starts
Per 100,000 People, 2002



Number of Business Starts
Top Three, Arkansas and Peer States, 2002



Source: Small Business Administration

IPO Proceeds as Percent of GSP

Definition

Initial Public Offering (IPO) proceeds as a percentage of Gross State Product (GSP) is calculated by summing the dollar amount raised in each state by all companies that issued publicly tradable shares in an initial offering during the years 2000–2002. These figures are then divided by corresponding state GSPs. An IPO is a company's first sale of stock to the public. IPOs are another method available to companies for raising capital in order to meet corporate goals and for risk capitalists to cash in on their investment. IPO data used is provided by both Securities Data Corporation and Thompson Financial. Gross State Product figures are collected by the United States Department of Commerce.

Why is it Important?

An IPO occurs when a company decides to sell shares of its common stock to the general public. Companies that "go public" typically demonstrate a proven track record in revenues or sales history and/or, as is increasingly the case, exciting new technologies. For the period 2000–2002, the United States average IPO proceeds as percent of GDP was 1.3 percent.

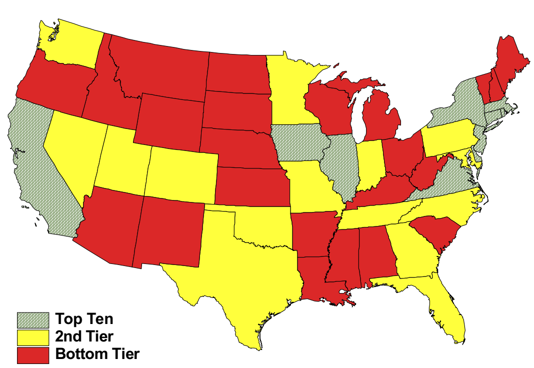
Only nine states registered above the U.S. average: New York, Delaware, Massachusetts, New Jersey, Iowa, Virginia, Connecticut, Illinois and California. The time period measured, 2000–2002, is characterized by severe peak and trough conditions for IPOs, which were at the height of their popularity in 2000, but since then have faced a challenging environment characterized by negative investor sentiment and increased regulatory scrutiny.

IPO Proceeds and Arkansas

With 0 percent GSP represented by IPO proceeds, Arkansas is tied for last place, 39th in the nation. The nation's top five performing states in this measure were New York (4.61 percent), Delaware (4.59 percent), Massachusetts (3.85 percent), New Jersey (3.74 percent) and Iowa (2.04 percent). The indicator captures data from the 2000–2002 time period. Although Arkansas rose one rank from 40th place on the 2002 index, the state actually decreased its proportion of GSP that is derived from IPO proceeds from 0.03 percent in 1998–2000 to 0 percent in 2000–2002. Current economic conditions have caused many companies to avoid IPOs, as evidenced by the 10 other states including Mississippi and New Mexico that also did not have any IPO proceeds in the 2000–2002 period.

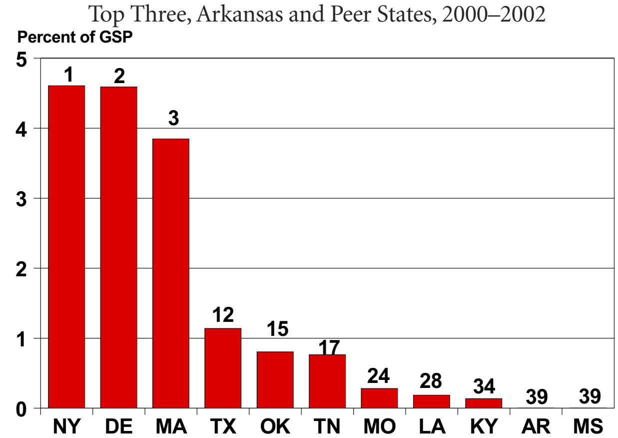
IPO Proceeds

As Percent of GSP, 2000–2002



IPO Proceeds

Top Three, Arkansas and Peer States, 2000–2002



Source: Security Data Corporation; Thompson Financial; Milken Institute

Definition

The third set of indicators relating to Arkansas's Position in Technology and Science measures the stock of and investment support for human capital in a state. It does this through 18 individual indicators and this compound index that comprehensively assess a state's human capital attainments. These measures emphasize the concentration and momentum of human capital in various science and engineering fields. The Human Capital Investment Composite Index reported on this page is calculated by totaling the state ranks of each human capital investment indicator and dividing that number by the number of indicators. Data for the indicators of the human capital investment component is collected from a variety of sources and compiled by the Milken Institute.

Why is it Important?

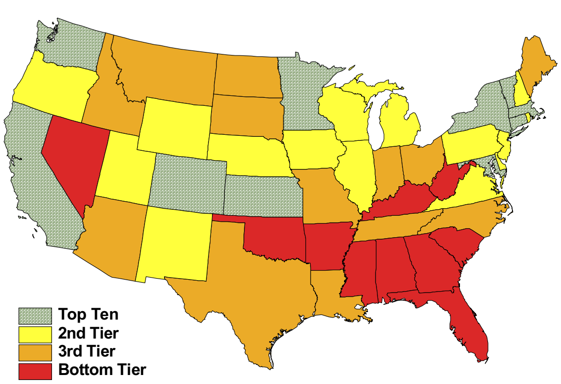
Human capital is arguably the most critical intangible asset of a knowledge-based economy. A state's depth of talent attracts and retains commercial firms, finance and research organizations. Human capital offers a state the latent creative capacity to build and grow firms indigenously as well. Robust and growing industries require a variety of talented and well-trained individuals. In the high-technology sector, science and engineering education are especially in demand. The R&D component of high-tech requires a particularly high degree of specialized training and knowledge.

This composite indicator of state human capital assesses such factors as percentage of population that has received higher education, various levels of concentration regarding those who are educated in science and in engineering, state support of higher education, average college entrance exam performance, and diffusion of key information technologies among the population at large. States that score well in this composite index have succeeded by nurturing and supporting a proportionally large base of highly trained people within their state workforces.

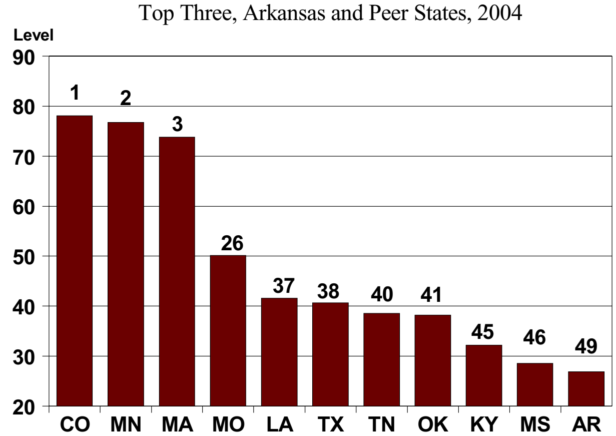
Human Capital and Arkansas

Arkansas' overall score on the Human Capital Investment Compound Index is 26.89, ranking the state 49th in the nation. Although very low, this score marks a rise from the state's score on the Milken Institute's 2002 Index, where its composite score was 22.50 and it also placed 49th. The top five states in this compound index are Colorado (which scored 78.1), Minnesota (76.8), Massachusetts (73.8), Maryland (73.6) and Vermont (68.1). Component indicators in which Arkansas scores best (within the top 20 of all states) include State Spending on Student Aid, and Average Verbal and Math SAT Scores. Arkansas lags behind comparably sized states such as Utah (63.89) and Iowa (60.67), and the state needs to increase its rate of improvement in order to catch up with its neighbors, let alone the rest of the country.

Human Capital Investment Component
2004



Human Capital Investment Component
Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

Percent of Population with Bachelor's Degrees

Definition

The percentage of the population aged 25 and above with a bachelor's degree or greater provides a broad measure of higher educational attainment by a state's population. This indicator is calculated by adding up the number of people in a state 25 years of age and older and dividing that figure by the state's entire population above 25. This demographic cohort was selected because current trends show that people are either starting college at a later age or taking longer than the traditional four years to complete a bachelor's degree. Bachelor's degree data is provided by the United States Department of Education. Population numbers are provided by the United States Census Bureau.

Why is it Important?

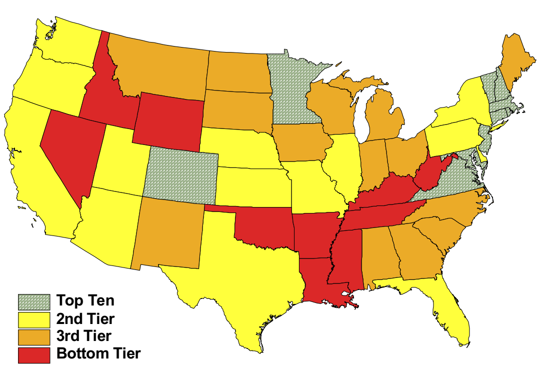
Having a well-educated population is one of the most fundamental requirements for supporting the science and technology assets of a state. A bachelor's level education represents the first rung on the ladder of advanced learning that is a requirement for much of the high-end work in a knowledge-based economy. There are additional benefits to a state as well. Better educated workers tend to earn higher wages that support state finances and feed into the marketplaces of its economy.

We have found this indicator to be more highly correlated with per capita differences among states than any other single measure. Latest figures indicate that more than a quarter of all people in the U.S. age 25 and above have bachelor's degrees. Twenty-nine states meet or exceed the national average, with Georgia matching the average exactly. Amassing a well-educated pool of human capital can be accomplished either by providing an adequate educational system to state residents or importing talent from outside. All states engage in both approaches to varying degrees.

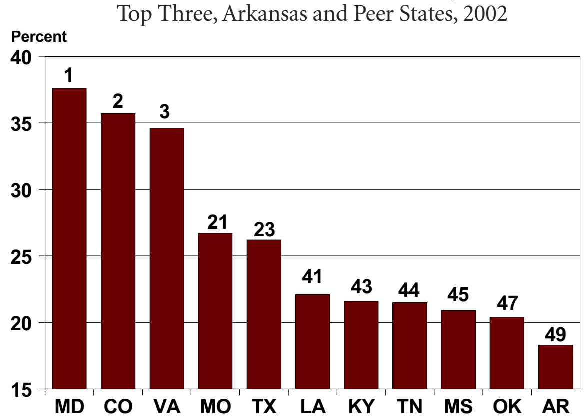
Bachelor's Degrees and Arkansas

Of Arkansans age 25 and above, 18.3 percent hold a bachelor's or higher degree. The statistic ranks the state 49th in the nation and places it well below the national average. This percentage represents an increase from the approximately 12 percent of Arkansans who held at least a bachelor's degree on the 2002 index when the state also ranked 49th in the nation. The top five states for this indicator are Maryland (with 37.6 percent of its population being college educated), Colorado (35.7 percent), Virginia (34.6 percent), Massachusetts (34.3 percent) and Connecticut (32.6 percent). Although Arkansas' percentage has improved, and placed it closer to neighbors such as Oklahoma, Tennessee and Louisiana, further improvement is clearly needed to help provide a skilled labor force for knowledge-based industries.

Percent Population 25+ w/ Bachelor's Degrees or Greater
2002



Percent of Population 25+ w/ Bachelor's Degrees or Greater
Top Three, Arkansas and Peer States, 2002



Source: U.S. Census Bureau; Milken Institute

Definition

The percentage of population age 25 and above with an advanced degree measures the proportion of people with master's degrees or higher among a state's population of people 25-years-old and above. This indicator is calculated by adding up the number of people 25 and above who have attained an advanced degree, then dividing it by the total population of people 25 and above. The 25 and above age cohort was selected because current trends show that people are taking longer than the traditional four years to complete a bachelor's degree and are taking longer breaks between completing bachelor's and advanced degrees. Advanced degree data comes from the United States Department of Education. Population numbers are provided by the United States Census Bureau.

Why is it Important?

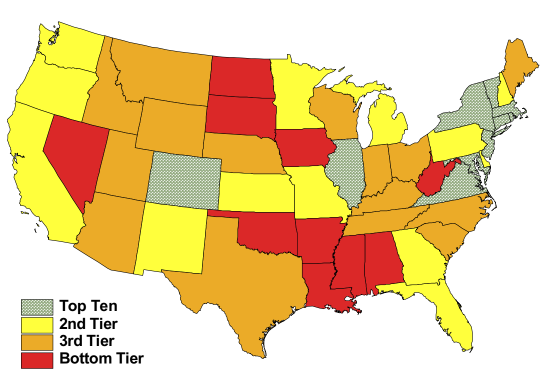
The percentage of population with advanced degrees is a reliable indicator of a state's capacity to support a knowledge-based economy. States with a large portion of their population holding advanced degrees such as Massachusetts, Connecticut and Maryland indeed have economies that are well known for their knowledge-intensity. Although degrees at the master's level and higher are hardly required by all sectors of an economy, they are often an important qualifier for upper management positions, especially in high-tech fields.

As mentioned in the definition of this indicator, people are taking longer to complete advanced degrees. Part of the reason for this is systemic to the nature of education today, such as increasing curriculum and research requirements. The cost of education is also a factor, however, and states eager to cultivate a high-tech economy must also consider the impact of matters like student aid and general appropriations for higher education (which we separately analyze as components of human capital investment) as impacting this indicator. Some 16.5 million Americans hold advanced degrees, for an average of 9.2 percent of all U.S. residents age 25 and above. Fourteen states exceed the average percentage; among these, New Mexico, with 9.7 percent, comes closest to the average.

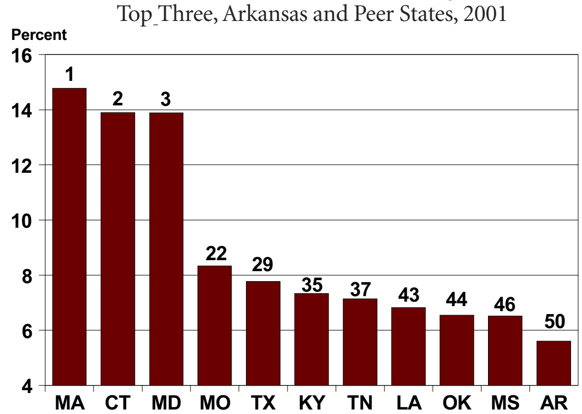
Advanced Degrees and Arkansas

Of Arkansans age 25 or older, 5.61 percent hold advanced (master's level or higher) degrees. This ranks the state 50th in the nation, but represents a statistical improvement over the percentage (3.82) on the 2002 Index, although the state's relative ranking has slipped from 49th place. The top five states in the nation for this indicator are Massachusetts (14.79 percent), Connecticut (13.90 percent), Maryland (13.89 percent), Virginia (11.93 percent) and New Jersey (11.68 percent). Arkansas still lags behind Mississippi (6.52 percent), Kentucky (7.33 percent) and Missouri (8.33 percent), although it has closed the gap somewhat. As with the ranking in bachelor's degrees, continuing this improvement is essential for Arkansas to be competitive.

Percent Population 25+ w/ Advanced Degrees or Greater
2001



Percent of Population 25+ w/ Advanced Degrees or Greater
Top Three, Arkansas and Peer States, 2001



Source: U.S. Census Bureau; Milken Institute

Percent of Population with PhD Degrees

Definition

The percentage of population age 25 and above with a Ph.D. degree measures the proportion of people with doctor of philosophy (Ph.D.) degree among a state's population of people 25-years-old and above. This indicator is calculated by adding up the number of people 25 and above who have attained a Ph.D. degree, then dividing it by the total population of people age 25 and above. The 25-and-above age cohort was selected because current trends show that people are taking longer than the traditional four years to complete a bachelor's degree and are taking longer breaks between completing bachelor's and Ph.D. degrees. Ph.D. degree data comes from the United States Department of Education. Population numbers are provided by the United States Census Bureau.

Why is it Important?

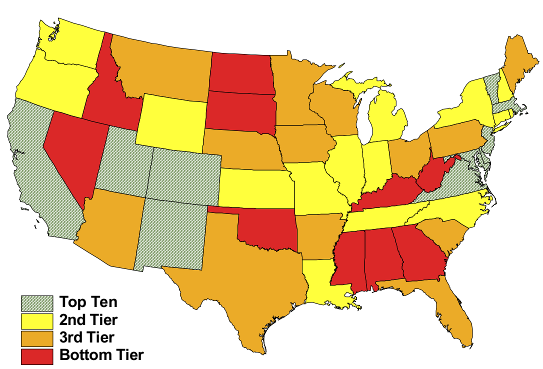
The percentage of population with Ph.D. degrees is another reliable indicator of a state's capacity to support a knowledge-based economy. States with a large portion of their population holding doctorate degrees such as Massachusetts and Maryland indeed have economies that are well known for their knowledge intensity. Although a doctorate degree is not widely required, various specialized knowledge-intensive occupations require doctorate degrees, such as in the area of high-technology research and development.

As mentioned in the definition of this indicator, people are taking longer to complete Ph.D. degrees. Part of the reason for this is systemic to the nature of education today. The cost of education is also a factor, however, and states eager to cultivate a high-tech economy must also consider the impact of matters like student aid and general appropriations for higher education (also analyzed here as components of human capital investment) as impacting this indicator. Some 1.9 million Americans hold Ph.D. degrees, for an average of 1.05 percent of all U.S. residents age 25 and above. Eighteen states exceed the average percentage, among them, New York, with 1.07 percent, comes closest to the average.

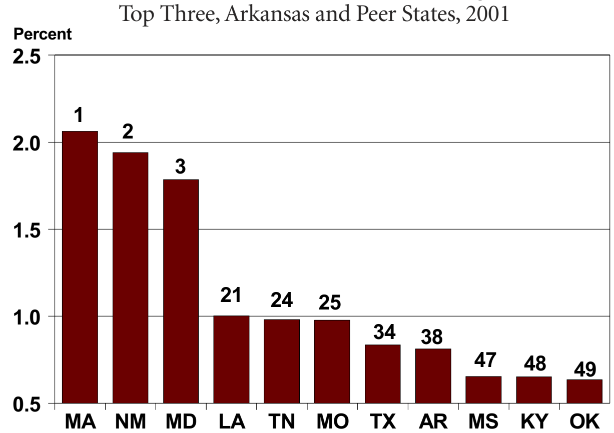
Ph.D. Degrees and Arkansas

Of Arkansans age 25 or older, 0.81 percent hold Ph.D. degrees. This ranks the state 38th in the nation, a strong competitive improvement over the state's performance on the previous index when Arkansas ranked 47th. Top performing states include Massachusetts (2.06 percent), New Mexico (1.94), Maryland (1.78), Virginia (1.46), California (1.32) and Vermont (1.24). Compared to the state's percentage of bachelor's and advanced degree holders, in regards to Ph.D. holders, the state has a clear comparative advantage over its neighbors—an indication of how the state is doing increasingly well at attracting those who are highly educated, even if it has not yet reached the levels of Utah (1.16), Oregon (1.14), Louisiana (1.00) or Tennessee (0.98).

Percent of Population 25+ w/ PhD Degrees
2001



Percent of Population 25+ w/ PhD Degrees
Top Three, Arkansas and Peer States, 2001



Source: U.S. Census Bureau; Milken Institute

Percent of Graduate Students in Science & Engineering

Definition

The percentage of graduate students in science and engineering in the 25- to 34-year-old age cohort measures the degree to which a state is training people with skills specific to science and technology. This indicator is calculated by taking the total number of individuals enrolled in each state's science and engineering graduate studies programs (who are between the ages of 25 and 34) and dividing that number by each state's entire population of 25-to 34-year-olds. Those enrolled in graduate studies programs have already completed a bachelor's degree and are pursuing a master's or Ph.D. degree. The number of students in graduate schools in science and engineering data is collected by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation. Population numbers come from the United States Census Bureau.

Why is it Important?

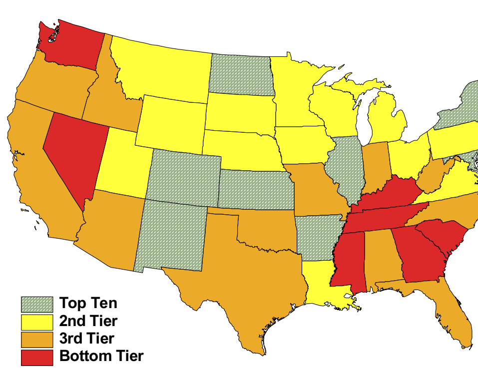
Measuring a state's level of graduate students in science and engineering provides one of the more direct indicators as to how well that state is preparing its population for the work that lies at the core of a high-tech economy. Strong, well-attended graduate studies programs in science and engineering also act as one of the most effective means of attracting high-tech companies to a state.

In 2001, the average percentage of students in science and engineering in the U.S. in the 25-to 34-year-old age cohort was 1.25 percent. A total of 23 states exceed the national average. South Dakota, at 1.27 percent, comes closest to the average among these higher performing states.

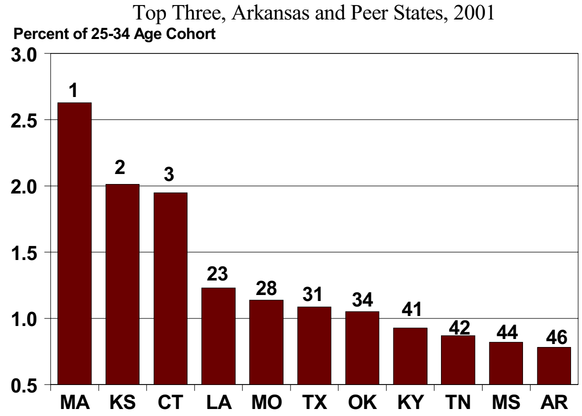
Science & Engineering and Arkansas

Of Arkansans age 25-34, 0.78 percent are enrolled in science and engineering graduate programs. This places the state well below the national average in 46th place. The state has not increased its percentage of people enrolled in science and engineering graduate programs significantly from last year's index. Arkansas placed well below the national average on the previous index where it ranked 47th with a percentage of 0.74. The top three states in the nation in this category are Massachusetts (with 2.63 percent of its relevant population studying graduate-level science or engineering), Kansas (2.01 percent) and Connecticut (1.95 percent). Arkansas ranks below neighboring states such as Louisiana (1.23 percent) and Mississippi (0.82 percent). Arkansas needs to increase its share of these students in order to benefit from them and prepare its population for a knowledge-based economy.

Percent of Graduate Students in Science & Engineering
25–34 Age Cohort, 2001



Percent of Graduate Students in Science & Engineering
Top Three, Arkansas and Peer States, 2001



Per Capita State Spending on Student Aid

Definition

Per capita state spending on student aid measures how much a state provides in student aid when averaged out for each member of that state's population. This indicator is calculated by taking the total dollar amount spent by each state on student aid and dividing that number by the state's total population. Student aid is defined as the funds spent by a state on any form of financial aid for a student to attend its colleges, universities or research institutions. Data on student aid comes from the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation. Population numbers come from the United States Census Bureau.

Why is it Important?

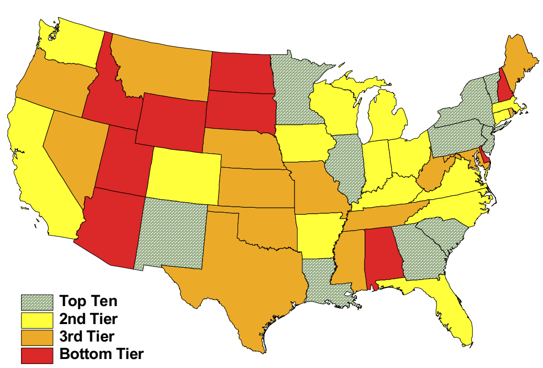
State-sponsored financial aid can be a vital form of assistance for people to receive a curriculum of higher education. State student aid typically complements federal forms of financial assistance. As with any human capital resource, states must compete with one another for talent. State-sponsored student aid is one of many factors that can help provide a state's population with advanced learning and bring in talented individuals to contribute to a state's knowledge economy.

In terms of economic indicators, state spending on student aid per capita can provide a useful gauge for just how committed a state's leadership is to facilitating access to higher education. In 2001, a total of $4.6 billion was spent by 48 states on student aid (the only states that did not provide any direct monetary assistance for students were South Dakota and Wyoming). This averages out to $16.29 per American. Seventeen states provide per capita levels of aid to their populations that exceed the national per capita amount. The state scoring above, but closest, to the national average is Kentucky, with $16.45 spent on student aid per each state resident.

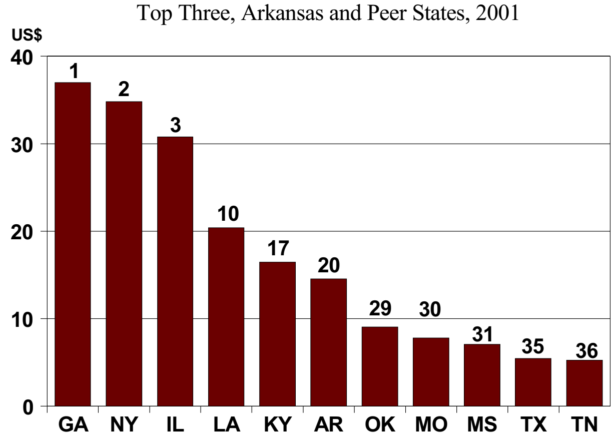
Student Aid Spending and Arkansas

Arkansas spends $14.53 per person on state-sponsored student aid. This places the state 20th in the nation. The state has managed to increase its per capita expenditures from $12.13 as well as its ranking from 21st on the previous index. The five states that spend the most per capita on student aid are Georgia ($37.00), New York ($34.81), Illinois ($30.77), Pennsylvania ($26.44) and Minnesota ($24.17). Arkansas' funding levels have improved, but it still trails Louisiana ($20.39) and Kentucky ($16.45) by significant margins and will have to maintain the level of funding in order to continue attracting students into higher education.

Per Capita State Spending on Student Aid
2001



Per Capita State Spending on Student Aid
Top Three, Arkansas and Peer States, 2001



Source: EPSCOR

Definition

The average verbal Scholastic Aptitude Test (SAT) scores measure how well a state performs in terms of the verbal portion of the most widely used form of college admissions testing. This indicator is calculated by averaging the verbal scores reported by each high school in each state. The SAT is composed of two general sections, covering verbal and math skills, with each section worth 800 points, for a maximum combined score of 1600. Verbal SAT scores data is collected by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation.

Why is it Important?

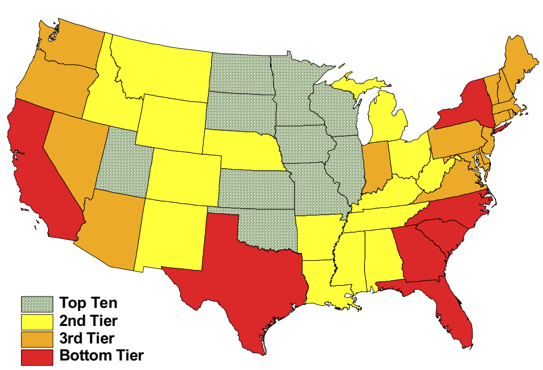
Verbal SAT scores reflect how well a state's high school students are prepared for competitive college admission in reading comprehension and sentence composition. States that have large university systems—such as California, Florida and New York—have a correspondingly large proportion of students (usually at or above 50 percent of all high school graduates) who take the SAT. With a broad range of students (a significant number of whom are first-generation immigrants) test scores tend to be low. In certain states—such as Iowa, North Dakota and Wisconsin—where less than 10 percent of all graduates take the SAT, students tend to score higher.

Although the verbal portion of the SAT is not as directly relevant to science and technology fields as the math portion of the test, the verbal scores still testify to the effectiveness of high school instruction and learning. Moreover, despite their association with liberal arts, verbal skills do relate to an individual's communication and analytical abilities—skills that are in fact vital to the workings of a knowledge-intensive economy. The average verbal SAT score in the U.S. is 532, which 23 states exceed. Among these, the state that places closest to the national average is 23rd-ranked Ohio, whose students earn an average score of 533.

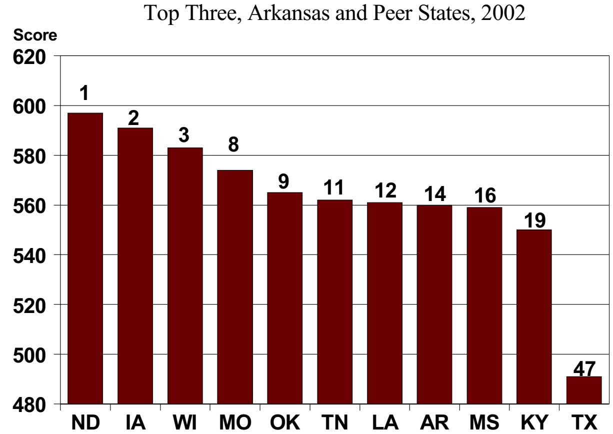
SAT Verbal Scores and Arkansas

Verbal SAT test-takers in Arkansas score an average of 560. This places the state 14th in the nation, a rank it shares with Alabama. Although the average score has changed only slightly since the previous index, its ranking has dropped from 13th to 14th. Among America's highest-ranking states, a disproportionate number hail from the West North Central region. The top 10 are comprised of North Dakota (with an average score of 597), Iowa (591), Wisconsin (583), Minnesota (581), Illinois (578) Kansas (578), South Dakota (576), Missouri (574), Oklahoma (565) and Utah (563). Arkansas' high ranking is somewhat misleading. Students bound for in-state schools are more likely to take the ACT, while students leaving the state for school are likely to take the SAT. This exodus of intelligent students is not unique to Arkansas, but does remain a problem.

Average Verbal SAT Scores
2002



Average Verbal SAT Scores
Top Three, Arkansas and Peer States, 2002



Source: EPSCOR

Average Math SAT Scores

Definition

The average math Scholastic Aptitude Test (SAT) scores measures how well a state performs in terms of the mathematics portion of the most widely used form of college admissions testing. This indicator is calculated by averaging the math scores reported by each high school in each state. The SAT is composed of two general sections, covering verbal and math skills, with each section worth 800 points, for a maximum combined score of 1600. Math SAT scores data is collected by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation.

Why is it Important?

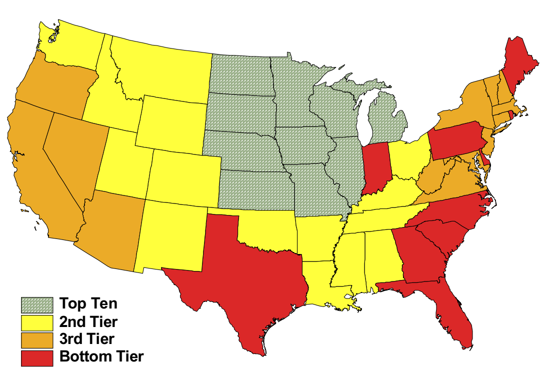
Math SAT scores reflect how well a state's high school students are prepared for competitive college admission in regards to mathematical problem solving and analysis. High math SAT scores are indicative, to some degree, of the quality and the intensity of algebra, geometry and general quantitative analysis education in each particular state and the ability of its students to master this instruction. Although not as clear-cut as the state-based disparities in verbal scores, once again, states that have large populations and university systems tend to score more poorly in this indicator than do less populous states with a select group of students taking the exams.

The aptitudes tested in the math portion of the SAT are directly relevant to science and technology fields. Students anticipating study in any scientific or quantitatively based discipline must possess the fundamental mathematical aptitudes the SAT is designed to measure. The average math SAT score in the U.S. is 537 (five points higher than the average verbal score). Twenty-four states meet or exceed this average with Wyoming high school students scoring at the national average.

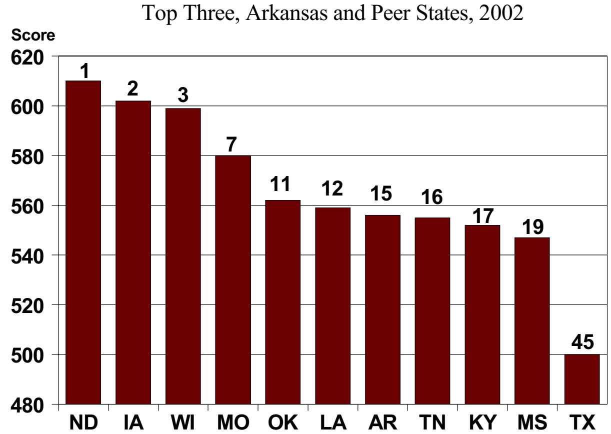
SAT Math Scores and Arkansas

Arkansas math SAT test-takers score an average of 556. This puts the state in the second tier of national rankings in 15th place. It represents a slight increase from the state's ranking on the 2002 Index, which was 17th. The West North Central region again dominates the top 10 component of the national rankings. This first tier of states is comprised of North Dakota (with an average score of 610), Iowa (602), Wisconsin (599), Illinois (596), Minnesota (591), South Dakota (586), Kansas and Missouri (both of which scored 580), Michigan (572) and Nebraska (570). In that math is the language of science and technology, Arkansas' improved ranking is a positive sign. However, as with the verbal SAT scores, it should be noted that the test-takers are more likely to leave the state for higher education than to remain.

Average Math SAT Scores
2002



Average Math SAT Scores
Top Three, Arkansas and Peer States, 2002



Source: EPSCOR

Definition

The average American College Testing Assessment (ACT) score measures state-based performance in this college admissions' test. This indicator is calculated by averaging the composite ACT scores reported by each high school in each state. Approximately one in 12,000 high school students took the ACT instead of, or in addition to, taking the SAT. The ACT is composed of four sections: English, mathematics, reading and science reasoning. The test is scored on a scale of 1 to 36, 36 being the highest possible score. ACT score data is provided by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation.

Why is it Important?

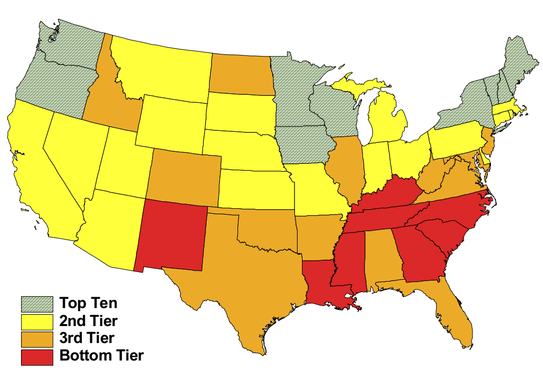
ACT scores, like SAT scores, provide colleges and universities with a means of measuring students' aptitude as well as an instrument to predict academic performance during the student's first year in college. ACT scores provide high schools with a tool to gauge the effectiveness of their curricula in preparing teens for higher education instruction.

Unlike the SAT, the ACT is a curriculum-based exam rather than a psychometric (IQ-type) test. That is, the ACT assessment tests students on their knowledge of specific subjects, not their given aptitudes for more broadly defined verbal and quantitative problem solving. The average national ACT score in 2002 was 21.1. Thirty states scored above the national average, the closest being North Dakota, which scored 21.2.

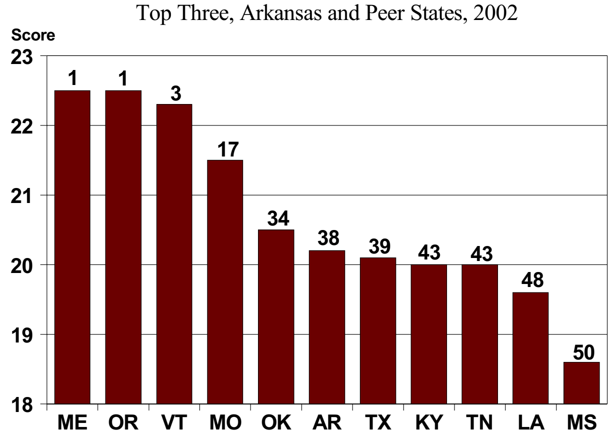
ACT Scores and Arkansas

With an average ACT score of 20.2, Arkansas ranks 38th in the nation. This ranking is a slight improvement from the state's rank of 41st on the 2002 Index. This score also places college-bound Arkansans who take the ACT a point below the national average and represents a performance well below those on the SATs. The top five states in this category are Maine and Oregon (which both have average scores of 22.5), Vermont and Washington (22.3), and New York and Wisconsin (22.2). As the ACT is more frequently used as a basis for college admission by in-state schools, Arkansas' lower performance here in comparison to its average SAT scores is in many ways a more accurate reflection of the state's overall academic performance. On the positive side, Arkansas' average score still places it above most of its neighbors, including Texas (20.1), Kentucky (20.0), Louisiana (19.6) and Mississippi (18.6).

Average ACT Scores
2002



Average ACT Scores
Top Three, Arkansas and Peer States, 2002



Source: EPSCOR

State Appropriations for Higher Education

Definition

Per capita state appropriations for higher education measures how much states spend on higher education averaged out for each member of a state's population. This indicator is calculated by taking the dollar amount that each state allocates for higher education and dividing it by its total respective population. Appropriations for higher education include the money spent on faculty and staff wages, building maintenance, athletic programs and various other allocations that pay for day-to-day operations of a state's colleges and universities. State appropriations data is provided by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation. Population numbers come from the United States Census Bureau.

Why is it Important?

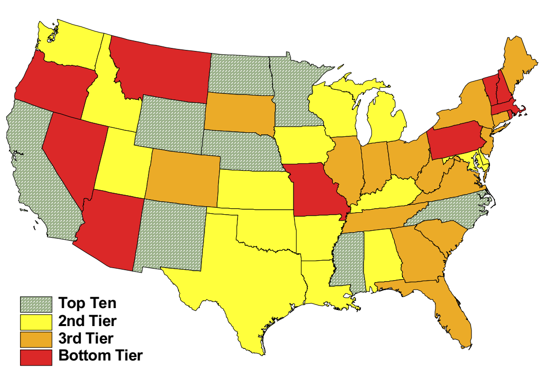
When averaged out on a per capita basis, the amount of state appropriations for higher education reveals just how much a state's government is committing monetarily to provide an infrastructure of higher learning for its people. Somewhat similar to an earlier indicator, State Spending on Student Aid per Capita, this indicator focuses on state money provided directly to institutes of higher learning. (The previous indicator looked at state money provided to students to help finance their education.)

Taken in conjunction with one another plus an additional indicator, Percent Change in Appropriations for Higher Education (found on the following page), these indicators provide a composite picture of the degree to which a state's government is providing higher education funding support for its population. In fiscal year 2003, state appropriations for higher education throughout the U.S. totaled $63.6 billion. Averaged out for the entire U.S. population, that figure represents approximately $221 per person.

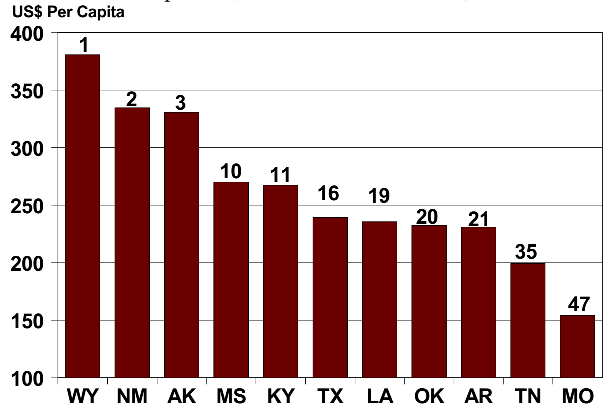
State Appropriations and Arkansas

The Arkansas government spends some $231 per resident on higher education. This puts the state within the top half of the country, ranking at 21st place. As the state's spending level has decreased somewhat from that recorded on the previous Index ($242), its ranking has declined from 17th in 2002. The good news for the beneficiaries of such educational support is that Arkansas has not cut back on its support levels nearly as severely as many other states in the current tough economic climate, though the state still trails most of its neighbors. Missouri's funding level declined from $188 on the last index to $154 on the current one. The top three states in this indicator are Wyoming (which appropriates $381 per capita), New Mexico ($335) and Alaska ($331).

State Appropriations for Higher Education
Per Capita, 2003



State Appropriations for Higher Education
Top Three, Arkansas and Peer States, 2003



Source: National Science Foundation; Milken Institute

Definition

Percent change in state appropriations for higher education measures the increases or decreases in state spending on higher education averaged out for each member of a state's population. The indicator is calculated by taking the dollar amount that each state appropriated for higher education in the years 2002 and 2003, then determining any upward or downward changes. Appropriations for higher education include the money spent on faculty and staff wages, building maintenance, athletic programs and various other allocations that pay for day-to-day operations of a state's colleges and universities. State appropriations data is provided by the Experimental Program to Stimulate Competitive Research (EPSCoR), a division of the National Science Foundation. Population numbers come from the United States Census Bureau.

Why is it Important?

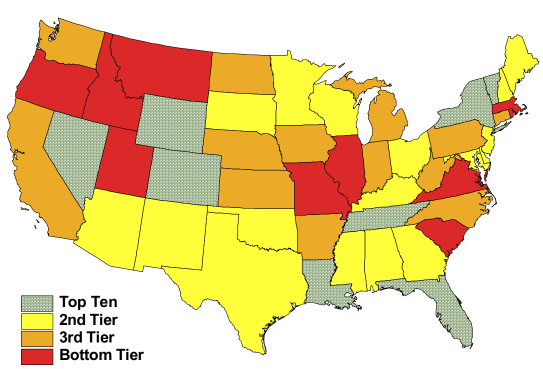
As noted in the previous indicator, when averaged out on a per capita basis, the amount of state appropriations for higher education reveals just how much a state's government is committing monetarily to provide an infrastructure of higher learning for its people. Whereas the previous indicator gives a static picture of appropriations for a given year, this indicator provides data on the momentum of those appropriations over the most recent two-year period.

Taken in conjunction with the two related indicators—State Spending on Student Aid per Capita and (especially) State Appropriations for Higher Education per Capita—this indicator on Percent Change in Appropriations for Higher Education provides a composite picture of a state's financial commitment to providing advanced education in its state. Between 2002 and 2003, the average growth among all states in their appropriations for higher education was a positive 1.1 percent. Twenty-nine states exceeded this rate of growth. The two states that came closest to meeting or exceeding the average growth rate were California and Connecticut, both of which experienced 1.2 percent growth.

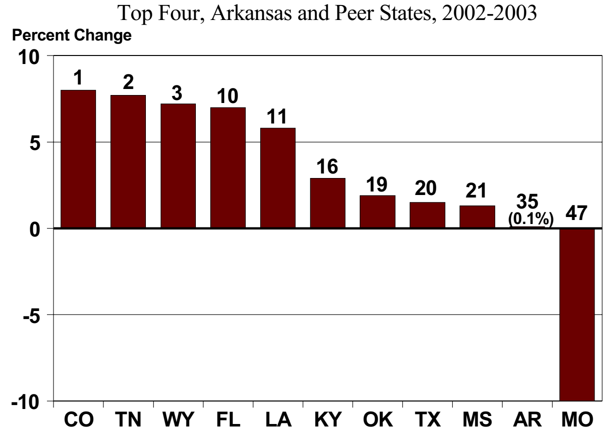
State Appropriations and Arkansas

Arkansas' Percent Change in Appropriations for Higher Education from 2002 to 2003 was 0.1 percent. This places the state 35th in the nation. Although the rate of change in appropriations dropped from 2.1 percent on the last Index, the state's ranking rose from 43rd due to actual declines in spending by numerous other states such as Utah (-3.4 percent) and Missouri (-10.2 percent). The fact that Arkansas has kept a positive rate of change during the economic downturn is positive, but the rate is far too low to keep pace with the majority of the country. If, in future years, education appropriations do not increase more quickly, Arkansas may fall behind its neighbors, let alone close the appropriations gap with the national leaders. The top three states in this indicator were Colorado (whose appropriations grew 8.0 percent), Tennessee (7.7 percent) and Wyoming (7.2 percent).

State Appropriations for Higher Education
Percent Change, 2002–2003



State Appropriations for Higher Education
Top Four, Arkansas and Peer States, 2002-2003



Source: National Science Foundation; Milken Institute

Doctoral Scientists per 100,000 People

Definition

The number of doctoral scientists per 100,000 people measures a state's intensity of scientists who have attained the highest level of formal academic training. This indicator is calculated by summing the total number of doctoral scientists in each state and then normalizing it per 100,000 of each state's respective population. Doctoral scientists are professionals with terminal degrees in such scientific fields as biology, chemistry, physiology, astronomy, physics and the life sciences. Data on doctoral scientists comes from the Division of Science Resources Studies of the National Science Foundation. Population figures are provided by the United States Census Bureau.

Why is it Important?

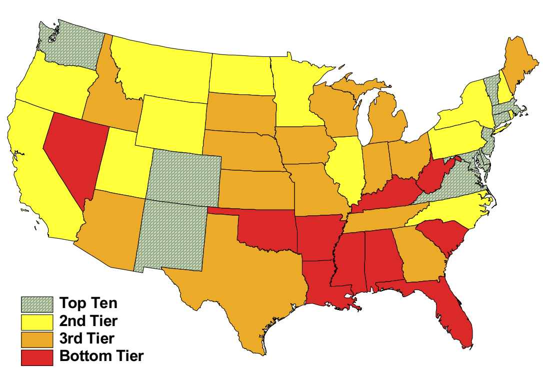
Doctoral scientists operate at the upper end of creative and managerial work in numerous scientific and technological fields. A noticeable presence of such individuals tends to be conducive to high-tech industry innovation, new firm formation and growth. A state labor pool with a sizable number of highly skilled workers, such as doctoral scientists, is also attractive to technology firms when they evaluate locations for their high-end operations.

There are some 543,000 doctoral scientists in the U.S. Normalized for 100,000 members of the nation's population, this means an average of 186 doctoral scientists for every 100,000 Americans. Twenty-three states exceed the national average. Among them is New Hampshire with 187 doctoral scientists per 100,000 members of its state population, coming closest to the national average. Doctoral scientists are a valuable human capital resource to any state wishing to perform well in a technology-intensive, knowledge-based economy.

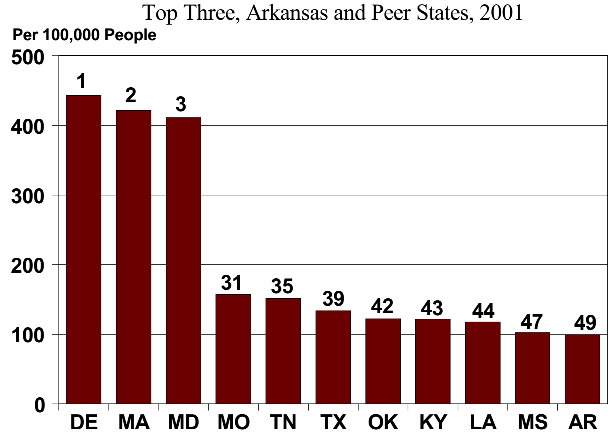
Doctoral Scientists and Arkansas

Arkansas has 99 doctoral scientists for every 100,000 members of its state population. This ranks the state 49th in the nation, a clear drop from its rate of 112 per 100,000 and 47th-place ranking on the previous index. The top five states in the nation for this indicator are Delaware (with 443 doctoral scientists), Massachusetts (421), Maryland (411), New Mexico (371) and Vermont (294). Arkansas scores lower in the indicator for number of doctoral scientists than for doctoral engineers (examined on the following page), as the state's engineering presence, particularly in universities, has risen. The decline of doctoral scientists in the state is hopefully temporary, as hopes for future developments in biotechnology require a reversal of the trend.

Number of Doctoral Scientists
Per 100,000 People, 2001



Number of Doctoral Scientists
Top Three, Arkansas and Peer States, 2001



Source: National Science Foundation

Definition

Doctoral engineers per 100,000 people measures a state's intensity of engineers who have attained the highest level of formal academic training. This indicator is calculated by summing the total number of doctoral engineers in each state and then normalizing it per 100,000 members of each state's respective population. Doctoral engineers specialize in a variety of engineering fields, including such branches as electrical, nuclear, molecular and chemical engineering. Data on doctoral engineers comes from the Division of Science Resources Studies of the National Science Foundation. Population figures are provided by the United States Census Bureau.

Why is it Important?

Like doctoral scientists, doctoral engineers operate at the upper end of creative and managerial work in numerous scientific and technological fields. Engineering disciplines tend to be more applied and technologically oriented than scientific ones, although both are relevant to a high-tech economy. A noticeable presence of such individuals tends to be conducive to high-tech industry innovation, new firm formation and growth. A state labor pool with a sizable number of highly skilled workers, such as doctoral engineers, is also attractive to technology firms when they evaluate locations for their high-end operations.

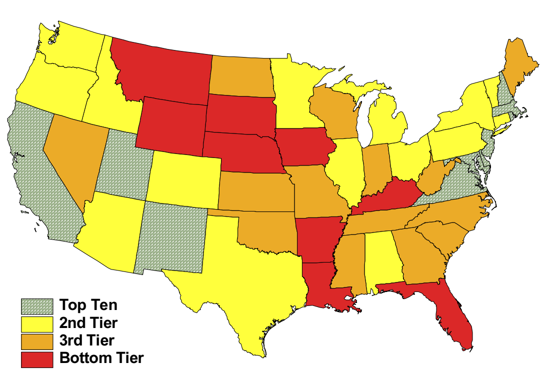
There are some 113,000 doctoral engineers in the U.S. Normalized for the nation's population, this means an average of 39 doctoral engineers for every 100,000 Americans. Twenty states meet or exceed the national average. Minnesota, with 39 doctoral engineers per 100,000 members of its state population, matches the national average. Doctoral engineers are a valuable human capital resource to any state wishing to perform well in a technology-intensive, knowledge-based economy.

Doctoral Engineers and Arkansas

Arkansas has 14 doctoral engineers for every 100,000 members of its state population. This ranks Arkansas 46th in the nation. Statistically the state has improved slightly over the previous index (on which it registered approximately 11 doctoral engineers per 100,000 members of the state population) and its ranking rose from 47th. States in the top five for this indicator include New Mexico (with 128 doctoral engineers), Delaware (105), Massachusetts (76), Maryland (64) and California (61). Arkansas scores slightly better in this indicator than that for doctoral scientists (examined on the previous page), although it lags far behind the national average in both indicators. If Arkansas is to utilize its higher rate of engineering undergraduates, this number will have to increase further.

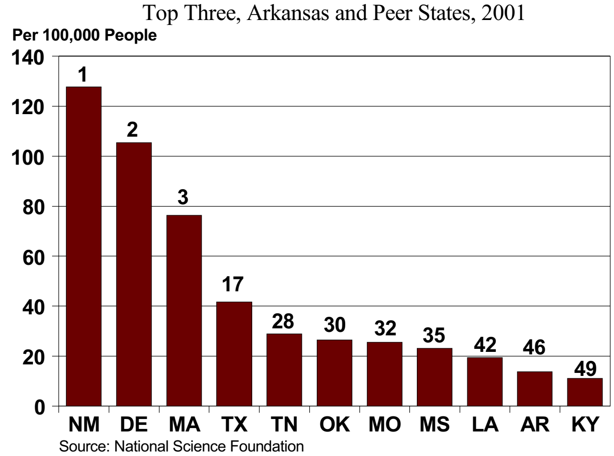
Number of Doctoral Engineers

Per 100,000 People, 2001



Number of Doctoral Engineers

Top Three, Arkansas and Peer States, 2001



Science & Engineering PhDs Awarded

Definition

The number of science and engineering Ph.D. degrees awarded measures how many science and engineering (S&E) doctorate degree holders a state produces. This indicator is calculated by taking the number of Ph.D. degrees awarded in the 25- to 34-year-old age cohort per 100,000 people of that demographic. Data on doctoral scientists and engineers include all graduate degree candidates and recipients in S&E fields, excluding doctoral degrees awarded in health fields and medicine. Data on science and engineering degrees comes from the Division of Science Resources Studies of the National Science Foundation. Population figures are provided by the United States Census Bureau.

Possessing an education system that produces a sufficient quantity of science and engineering doctoral candidates and degree holders is indicative of a state's generative capacity for upper tier knowledge-based economic activity. There are some 26,000 science and engineering degrees awarded in the U.S. Normalized for 100,000 of the nation's 25- to 34-year-old age cohort, this means an average of 63 doctorates awarded. Twenty states meet or exceed the national average. Wyoming, with 64 science and engineering doctorates awarded, comes closest to the national average. S&E doctorates, and the institutes that produce them, are a valuable human capital resource to states wishing to perform well in a technology-intensive, knowledge-based economy.

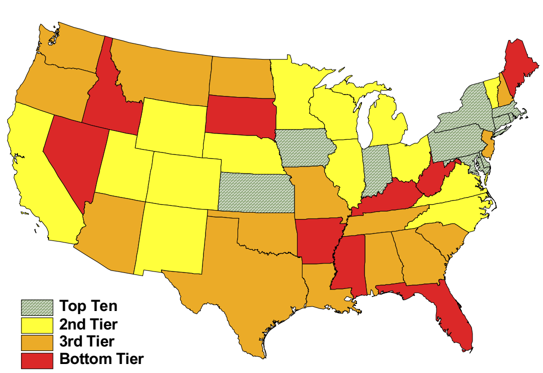
Why is it Important?

Whereas the previous two indicators measured doctoral scientists and engineers resident in a state, this indicator assesses how many doctoral scientists and engineers a state's higher education system produces. In this sense, the indicator measures a state's generative capacity of highly trained knowledge workers. Producing such highly trained individuals can be conducive to high-tech industry innovation, new firm formation and growth. Graduating a critical mass of science and engineering doctorate degree holders also attracts technology firms to locate in a state.

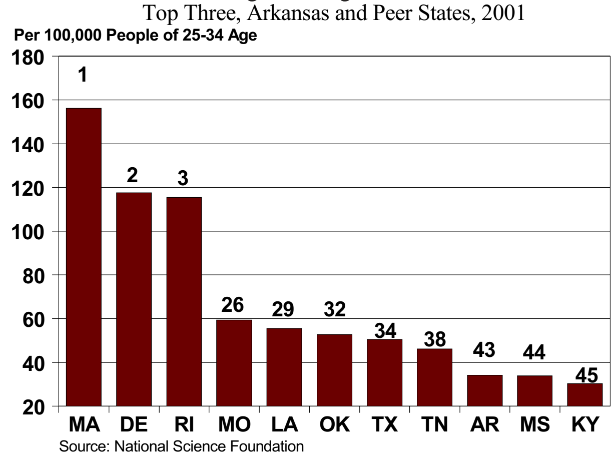
S&E PhDs and Arkansas

Arkansas produces approximately 34 doctoral scientists and engineers for every 100,000 members of the state's 25- to 34-year-old population. This puts Arkansas 43rd in the nation. Both this statistic and ranking are a strong improvement from last year's index, which saw Arkansas in 50th place with a level of 16. The position of the leader in this indicator, Massachusetts remains unchanged (with 156 doctorates awarded, down slightly from last year's level of 162), followed by Delaware (118), Rhode Island (115) and Iowa (104). Even with its improvement, Arkansas still lags behind peer states such as Missouri (59) and Louisiana (56).

Science & Engineering PhDs Awarded
Per 100,000 People of 25 to 34 Age Cohort, 2001



Science & Engineering PhDs Awarded
Top Three, Arkansas and Peer States, 2001



Definition

Science and engineering post-doctorates awarded measures the number of positions granted in a state for advanced academic or professional work immediately following a person's completion of doctorate degree studies. This indicator is calculated by dividing the number of Ph.D. degree holders in the 25- to 34-year-old age cohort that have been awarded an opportunity to conduct post-doctoral work by 100,000 members of a state's population in the same demographic. Post-doctorate programs allow participants to further specialize in their fields of interest following completion of the Ph.D. degree. Science and engineering post-doctorate awards data is provided by the Division of Science Resources Studies of the National Science Foundation. Population figures come from the United States Census Bureau.

Why is it Important?

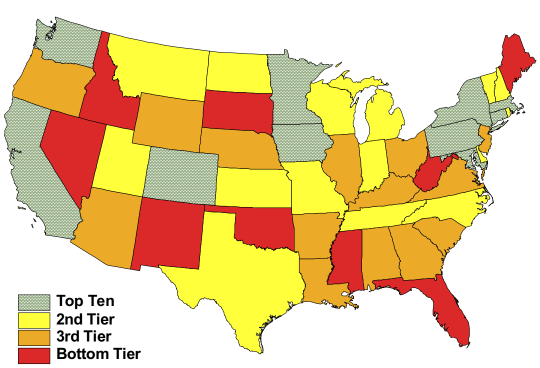
This indicator relates both to a state's ability to attract as well as generate highly trained knowledge workers. Post-doctoral work is important to both Ph.D. degree holders and institutions alike because such programs allow newly minted Ph.D. holders to further their knowledge in their field. Post-doctorate opportunities are predominantly awarded by universities. Oftentimes, participants teach in addition to performing post-doctoral research.

Data on post-doctorate awards include all graduate degree candidates and recipients in science and engineering fields, except for medical doctors. There are some 43,000 science, engineering science and engineering post-doctorates awarded in the U.S. to people in the 25 to 34 year-old age cohort. Normalized for 100,000 members of the nation's 25- to 34- year-old population means an average of 108 S&E post-doctorates are awarded. Fourteen states exceed the national average. North Carolina, with 119 science and engineering post-doctorates awarded, comes closest to the national average. S&E post-doctorates, and the institutes that hire them, are a valuable human capital resource to states wishing to perform well in a technology-intensive, knowledge-based economy.

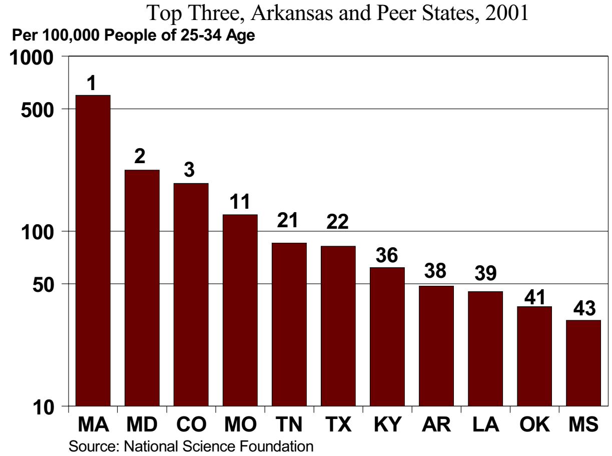
Post-Doctorates Awarded and Arkansas

Arkansas awards approximately 48 post-doctorates in science and engineering fields for every 100,000 members of the state's 25- to 34- year old population, which ranks the state 38th in the nation. Arkansas has risen from the 29 post-doctorates awarded as recorded in the previous index which had placed the state 43rd. Although the rate of post-doctorates awarded has grown, Arkansas still trails some of its neighbors, such as Missouri (124) and Tennessee (86), by large margins. The nation's top three performing states in this indicator are Massachusetts (with 598 post-doctorates awarded), Maryland (223) and Colorado (187).

Science & Engineering Post-Doctorate Degrees Awarded
Per 100,00 people of 25 to 34 age Cohort,2001



Science & Engineering Post-Doctorate Degrees Award
Top Three, Arkansas and Peer States, 2001



Percent of Bachelor Degrees in Sci & Eng

Definition

The percentage of bachelor's degrees granted in science and engineering measures the prevalence of science and engineering majors among a state's bachelor's degree recipients. This indicator is calculated by taking the number of bachelor's degrees granted in a state for science or engineering-related fields and dividing it by the total number of bachelor's degrees granted in all disciplines. The type of bachelor's degrees taken into consideration by this indicator are those conferred by Title IV eligible, degree-granting institutions. Bachelor's degree data is provided by the National Center for Education Statistics, a division of the United States Department of Education.

Why is it Important?

The share of bachelor's degrees granted in science or engineering fields reflects the popularity of science and engineering majors to a state's population of college students. Large shares of degrees granted in science or engineering suggest there is a correspondingly high interest in science and engineering-related professions.

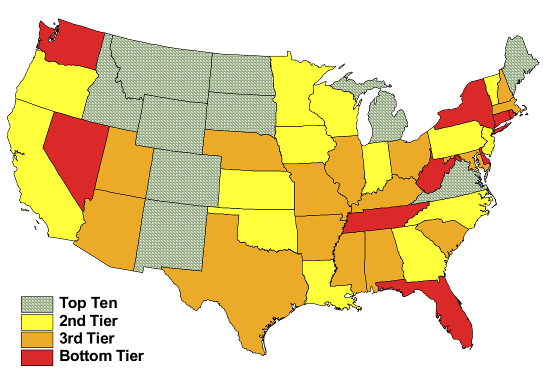
A high percentage of bachelor's degrees granted in science and engineering does not automatically correlate with a flourishing high-tech economy.

Many high-scoring states, such as Wyoming and Montana, likely attract a much higher percentage of science and engineering majors than recognizably high-tech states like California and Massachusetts because the university curricula of the former are comparatively more limited. Nevertheless, a large percentage of science and engineering graduates undeniably helps feed a high-tech labor pool. The national average percentage of S&E bachelor's degrees awarded is 17.3 percent. Twenty-five states exceed the national average, among these Minnesota (with 17.4 percent) comes closest to the national average.

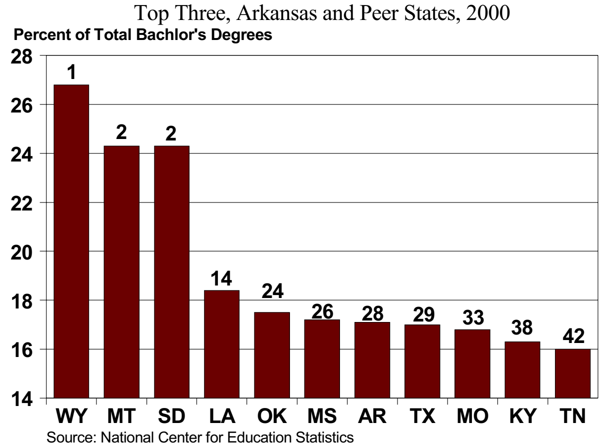
S&E Bachelor's Degrees and Arkansas

Of Arkansas' college graduates, 17.1 percent receive bachelor's degrees in science and engineering. This is right around the national average and ranks Arkansas 28th, placing it between Mississippi (17.2 percent) and Texas (17.0 percent). The state's current standing represents a rise from Arkansas' position on the previous index, where with some 16.5 percent of college graduates majoring in science or engineering, the state ranked 39th. The nation's top five performing states in this indicator are Wyoming (26.8 percent), Montana and South Dakota (both with 24.3 percent), Idaho (22.1 percent) and Maine (20.1 percent). The increasing proportion of degrees granted in science and engineering in Arkansas is promising, but unless the state retains these graduates, the overall impact of these students is extremely limited.

Bachelor's Degrees Granted in Science & Engineering
Percent of Total Bachelor's Degrees, 2000



Bachelor's Degrees Granted in Science & Engineering
Top Three, Arkansas and Peer States, 2000



Definition

Recent degrees in science and engineering measures the proportion of people in a state's workforce that recently graduated from some program in higher education for science or engineering. The indicator is derived by totaling the number of workers who earned bachelor's, master's and Ph.D. degrees in science or engineering between 1990 and 2001, then dividing that number by the figure for all civilian workers in a state. Data on degrees earned comes from the Science Resources Studies Division of the National Science Foundation. Civilian labor force figures are collected by the Bureau of Labor Statistics, a division of the United States Department of Labor.

Why is it Important?

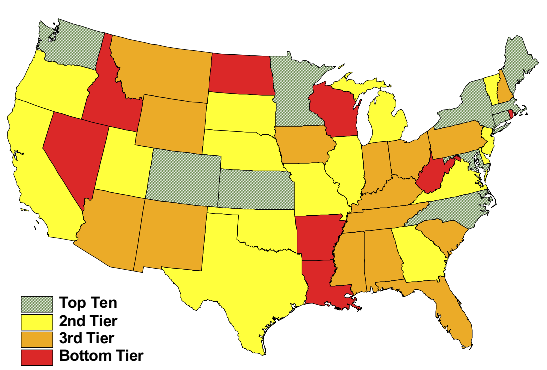
The percentage of a state's workforce with recent graduates in science and engineering offers a proxy for the extent to which a state's labor pool is being infused with new talent that could directly contribute to high-tech industries. As a group, recent graduates in S&E fields tend to gravitate to those states that offer the most promising job opportunities. States that combine a high-tech industrial base with a large proportion of newly graduated S&E degree holders in their workforce are well positioned to benefit disproportionately from a cohort that is characterized by intellectual curiosity and eagerness to develop a high-tech career.

A total of 3.3 million American workers recently obtained degrees in science or engineering disciplines. They constitute 2.3 percent of the national workforce, of which 1.8 percent comes from bachelor's degree holders in science or engineering. Seventeen states meet or exceed the average based on their own workforce percentages. Among these, South Dakota matches the average.

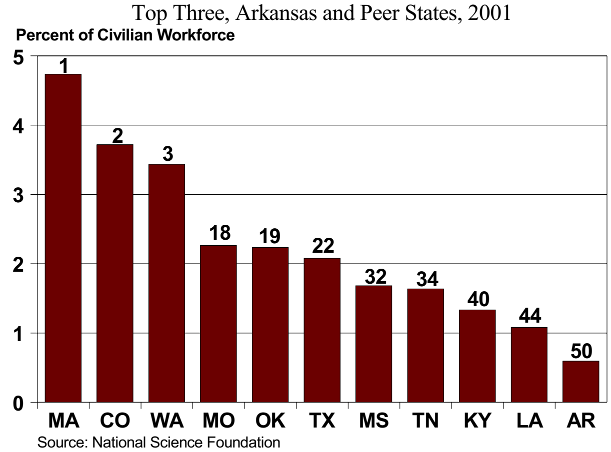
Recent Degrees and Arkansas

Of Arkansan workers, 0.60 percent are recent degree holders in science or engineering. This places Arkansas far below the national average and 50th in the nation overall. This is the same ranking the state held on the 2002 index, as a slight decline in the rate of science and engineering bachelor's degrees in the populace occurred despite the continued increase in the rate of currently enrolled science and engineering students. This measure of recent degree holders encompasses all S&E degrees—bachelor's to doctorate—and is therefore a broad gauge of how a state generates its own intellectual resources to drive a high-tech economy. The top five states in the U.S. are Massachusetts (4.74 percent), Colorado (3.72 percent), Washington (3.44 percent), North Carolina (3.36 percent) and New York (3.12 percent).

Recent Degrees Awarded in Science & Engineering
Percent of Civilian Workforce, 2001



Recent Degrees Awarded in Science & Engineering
Top Three, Arkansas and Peer States, 2001



Percent of Households with Computers

Definition

The percentage of households with computers measures the computer penetration rate in a state. The indicator is calculated by taking the number of households with computers and dividing that by the total number of households in each state. Traditionally, computer ownership rates were highest among the most educated and wealthiest segment of the general population. However, with falling prices and bundling schemes, computer ownership in lower-income and less-educated brackets has risen steadily over the past 10 years. Households and households-with-computers data is provided by the United States Department of Commerce.

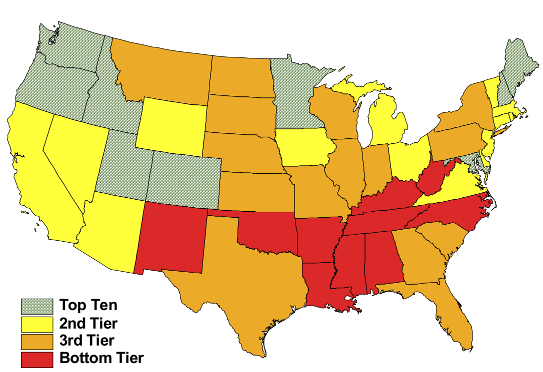
Why is it Important?

Having computers in the home enables children and adults alike to become technically proficient and take advantage of knowledge and resources that would otherwise be difficult to attain. While the digital divide is narrowing, it still exists. Black and Hispanic communities remain the largest racial/ethnic populations with the lowest computer ownership rates. On the upside, computer ownership rates among the two groups are increasing. Of all U.S. households, 56.5 percent are equipped with a computer. Twenty-six states exceed this rate of ownership. Among these, Kansas (at 57.5 percent) comes closest to the national average. A combination of lower prices per unit and an increased dependence on technology will push the national average to higher levels in years to come.

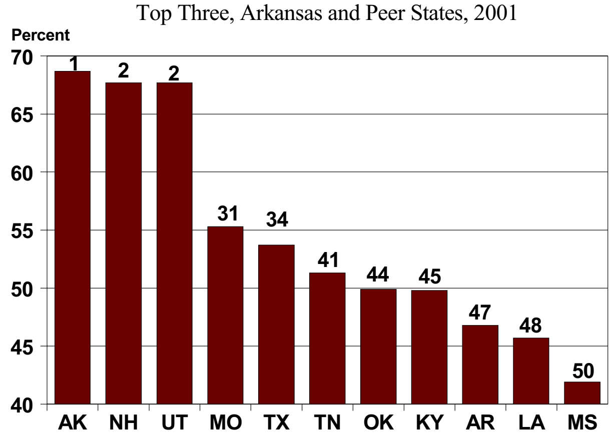
Wired Households and Arkansas

Of all Arkansan households, 46.8 percent are equipped with computers. This places the state 47th in the nation. While clearly improving upon its earlier computer penetration rate of 37.3 percent as measured on the 2002 Index, at the same time the state has risen by two notches from that year's 49th place ranking as well. The top five states in the U.S. for this indicator are Alaska (with 68.7 percent of households computer-equipped), New Hampshire (67.7 percent), Utah (67.7 percent), Washington (66.5 percent) and Oregon (65.8 percent). Although ahead of Louisiana (46.8 percent) and Mississippi (41.9), Arkansas still trails Missouri (55.3) and Texas (53.7) by sizable margins. Computer ownership does not immediately correlate with high-tech industrialization—Alaska and Hawaii both score higher in this measure than California and Massachusetts, for example. Nevertheless, a high degree of computer access and literacy among a population is an important component of any modern economy that aspires to equitable economic participation for the members of its society.

Percent of Households with Computers
2001



Percent Households with Computers
Top Three, Arkansas and Peer States, 2001



Source: U.S. Department of Commerce

Definition

The percentage of households with Internet access measures the Internet penetration rate in a state. The indicator is calculated by taking the number of households receiving Internet service and dividing that figure by the total number of households in each state. As the predominant form, Internet access in households comes via computer; this indicator is essentially a subset of the previous indicator and is impacted by similar factors. Households and households-with-computers data is provided by the United States Department of Commerce.

Why is it Important?

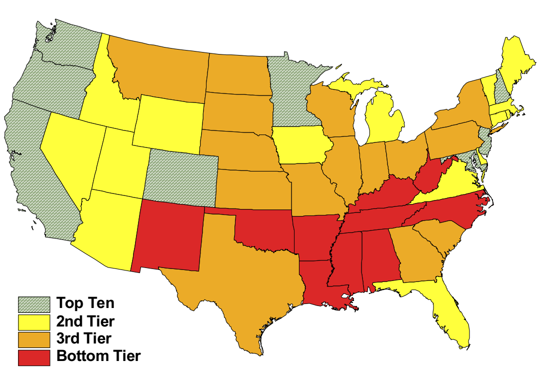
Access to the Internet offers people access to resources in a manner that, if properly structured, is efficient, fast and geographically unencumbered. The Internet enables people to retrieve and share data, communicate, shop, study, be entertained and perform other tasks. Internet usage tends to be more popular among the younger segments of a state's population. However, older Americans have increased Internet usage significantly over the past few years—a trend that is likely to continue given the trajectory of the diffusion of computer and Internet technology and general demographic shifts.

Of all U.S. households, 50.5 percent have Internet access: exactly 6 percent below the rate of households with computers. Twenty-seven states exceed this rate of ownership. Among them, Ohio and Kansas (both tied at a household penetration rate of 50.9 percent) come closest to the national average. Internet penetration is harder to achieve than computer usage because of the added cost of Internet service and the need for an appropriate telecommunications infrastructure. Being only 6 percent less than the average for households with computers, however, illustrates the extent to which the potential penetration level of the Internet has been reached.

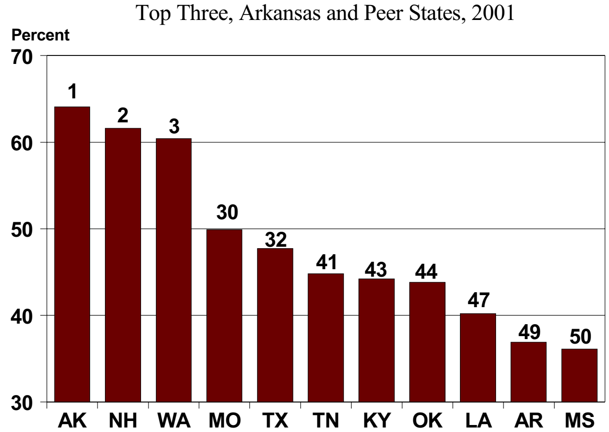
Internet Access and Arkansas

Of all Arkansas households, 36.9 percent have Internet access. This places the state near the bottom nationally ranking at 49th place. This is a statistical improvement over 2002's performance when the state had 26.5 percent of households with Internet access, but still ranked 49th. Having improved its mark for household Internet penetration by 10 percent, it can be said that the state is making progress toward closing the gap that constitutes the "digital divide." The top five states in this indicator are Alaska with 64.1 percent of households having Internet access, New Hampshire (61.6 percent), Washington (60.4 percent), Colorado (58.5 percent) and Oregon (58.2 percent). As with computer ownership, Internet access does not automatically correlate with high-tech industrialization, but it is a good gauge of the diffusion of modern information technologies among a state's population.

Percent of Households with Internet Access
2001



Percent Households with Internet Access
Top Three, Arkansas and Peer States, 2001



Source: U.S. Department of Commerce

Definition

The Technology and Science Workforce Composite Index is composed of three primary occupational areas: computer and information science experts, life and physical scientists and engineers. Each of these categories is made up of six individual components that measure employment intensity in various fields of science and technology. The composite indicator is then calculated by averaging the intensity scores of the three general occupational areas. This makes for a total of 18 individual components that comprise the index. Intensity is defined as the percent share of employment in a particular industry or occupation as it relates to total state employment. Technology and Science occupational data are collected by the Bureau of Labor Statistics and compiled by the Milken Institute.

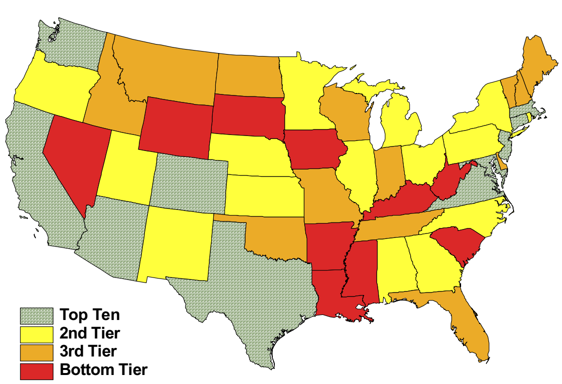
Why is it Important?

The intensity of the technology and science workforce is a revealing measure of the sophistication and technology competency of human capital in a state's economy. It reflects a state's capacity for technological innovation and attractiveness for high-tech employers who want to locate in areas with large talent pools. States that excel in only a limited number of scientific or technical specialties among the 18 individual components comprising the index, will not do well. Here, strength across the three primary occupational areas will bolster a state's performance. Strategically, high scoring on this index also bodes well because it is a proxy of a state's human capital potential. Combining that potential with stimulative factors such as adequate R&D funding, and risk and human capital investments, is key to catalyzing a state's high-tech development capacity.

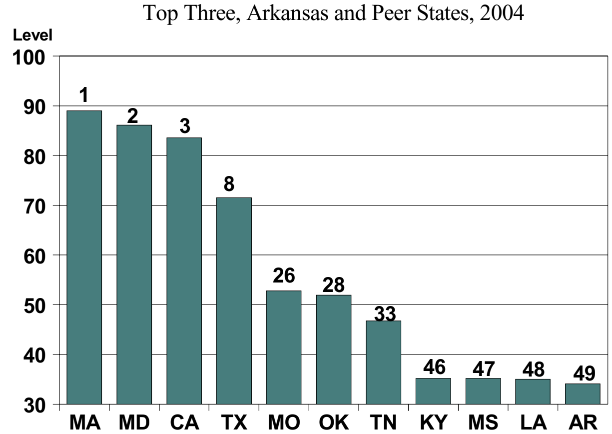
Tech Workers and Arkansas

Arkansas does not score well on this index, ranking 49th in the nation. Although this ranking is the same as in the previous index, the state's score did improve slightly from 32.00 to 34.11. Arkansas' technology and science workforce intensity will need to be improved and expanded if it is to advance from its bottom-tier position. Arkansas' strongest area of performance is its Intensity of Life and Physical Scientists, a compound indicator in which it ranks 35th, well above its rankings in other comparable indicators. The top 10 states in the overall index are those that are widely recognized for their high-tech economic dynamism: Massachusetts, Maryland, California, Virginia, Colorado, New Jersey, Washington, Texas, Connecticut and Arizona. A tech workforce tends to gather intensity in states that offer both the relevant job opportunities and a vibrant, growth-oriented business environment.

Texhnology & Science Workforce Component
2004



Technology & Science Workforce Component
Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

Definition

Intensity of Computer and Information Science (I.S.) Experts is calculated by averaging the intensity scores of six different types of computer and information science-related occupations: Computer and Information Scientists, Computer Programmers, Software Engineers, Computer Support Specialists, Systems Analysts, and Database and Network Administrators. Intensity is defined as the percent share of employment in a particular industry or occupation as it relates to total state employment. In this indicator, we combine total employment in the above fields and divide it for every 100,000 state workers to derive our intensity measure. Computer and Information Science occupational data and state employment data is collected by the Bureau of Labor Statistics and compiled by the Milken Institute.

Why is it Important?

Computer and Information Science professions are important to a state's economic vitality for a variety of reasons. In a basic sense, they are valuable because they represent high value-added occupations. There is a further strategic value in having knowledge workers who are skilled in these fields because so much in high-technology and other advanced sectors of a modern economy function upon an information technology platform.

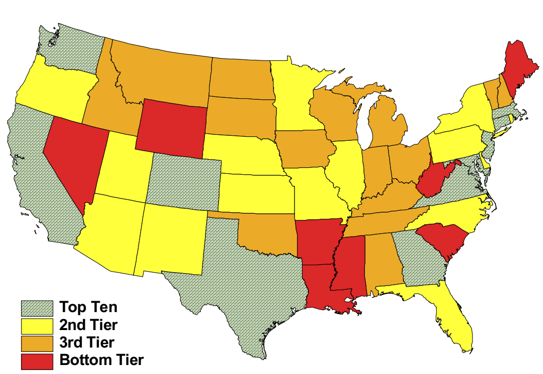
There are some 2.8 million Computer and Information Science Experts in the United States. Averaged across the nation, there are approximately 2,200 computer and I.S. experts per 100,000 U.S. workers.

Computer & I.S. Experts and Arkansas

Arkansas scores towards the bottom in this indicator with 707 computer and I.S. experts per 100,000 members of its working population, ranking the state 49th in the nation. This competitive positioning is an improvement by one place from that of the 2002 index. As the following indicators will show, the intensity of computer experts and engineers fails to keep pace with that of life and physical scientists. In this indicator, the top 10 states in the nation include Virginia, Massachusetts, Colorado, Maryland, New Jersey, Washington, Connecticut, California, Texas and Georgia. Today, many computer and I.S. experts are involved with activities such as call centers and the "back office" support operations of large companies, functions that are highly cost-sensitive but require a strong technology infrastructure. Arkansas has improved its position from the previous index, but still trails all of its neighbors in this category, in many cases by wide margins.

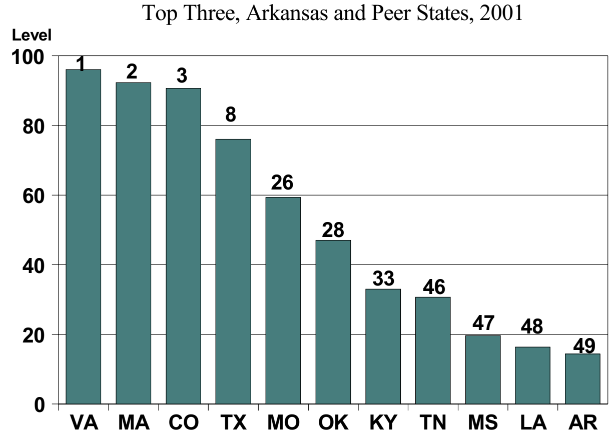
Intensity of Computer and I.S. Experts

2001



Intensity of Computer and I.S. Experts

Top Three, Arkansas and Peer States, 2001



Source: Milken Institute; Bureau of Labor Statistics

Intensity of Life & Physical Scientists

Definition

The Intensity of Life and Physical Scientists is calculated by averaging the intensity scores of six different types of Life and Physical Science-related occupations: Agricultural and Food Scientists, Biochemists and Biophysicists, Microbiologists, Medical Scientists, Physicists, and Miscellaneous Life and Physical Sciences. Intensity is defined as the percent share of employment in a particular industry or occupation as it relates to total state employment. In this indicator, we combine total employment in the above fields and divide it for every 100,000 state workers to derive our intensity measure. Life and Physical Sciences occupational data is collected by the Bureau of Labor Statistics and compiled by the Milken Institute.

Why is it Important?

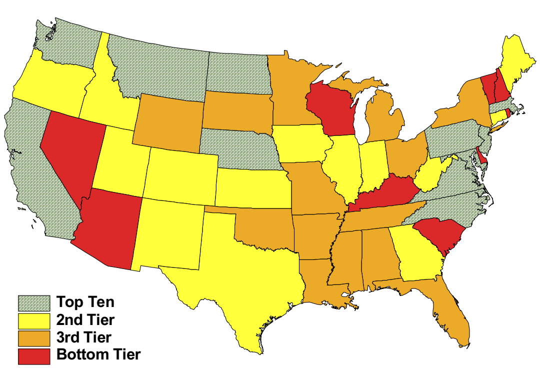
Life and physical scientists are leading developments in some of the most promising and fast-growing sectors of high-tech today. These sectors include biotech and medical devices and related fields that require in-depth knowledge of biochemistry, biophysics, microbiology and medical science.

Because the industries that life and physical scientists are involved with are growing and have a propensity toward innovation, these knowledge workers can disproportionately contribute to a region's techno-entrepreneurial dynamism. A strong concentration of life and physical scientists also helps promote a region to potential investors and corporations, and in turn stimulates an additional inflow of such scientists. There are over 117,000 life and physical scientists in the U.S., for an average intensity of almost 92 per 100,000 workers nationwide.

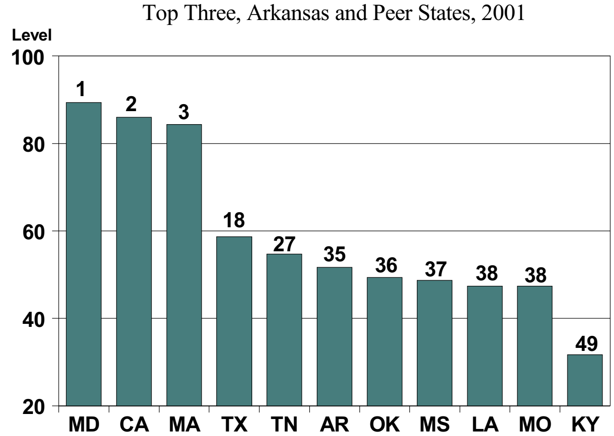
Life & Physical Scientists and Arkansas

Arkansas scores significantly higher in its intensity of life and physical scientists relative to its results in the two related indices. With 38 workers in this category for every 100,000 members of the working population, it ranks 35th in the nation, surpassing neighboring states such as Mississippi, Louisiana and Missouri. This positioning is a slight improvement from last year's index. In first place in intensity of life and physical scientists is Maryland, followed by California, Massachusetts, New Jersey, Nebraska and Washington. Arkansas' relative strength in this indicator is encouraging. It demonstrates that the state has potential to capitalize on its resources in agriculture and food processing to boost its overall position in the sciences.

Intensity of Life and Physical Scientists
2001



Intensity of Life and Physical Scientists
Top Three, Arkansas and Peer States, 2001



Source: Milken Institute; Bureau of Labor Statistics

Definition

Intensity of Engineers is calculated by averaging the intensity scores of six different types of engineering-related occupations: Electronics Engineers, Electrical Engineers, Computer Hardware Engineers, Biomedical Engineers, Agricultural Engineers, and various other types of engineers. Intensity is defined as the percent share of employment in a particular industry or occupation as it relates to total state employment. In this indicator, we combine total employment in the above fields and divide it for every 100,000 state workers to derive our intensity measure. Life and Physical Sciences occupational data is collected by the Bureau of Labor Statistics and compiled by the Milken Institute.

Why is it Important?

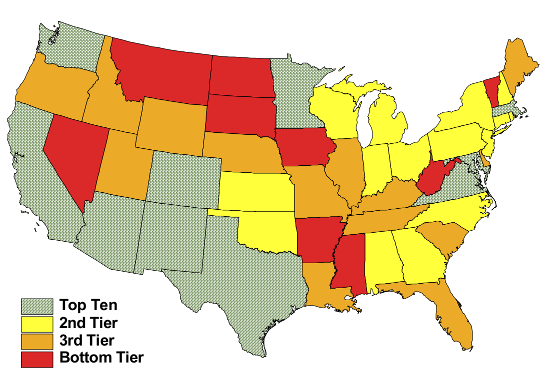
The field of engineering, broadly defined, is arguably the most fundamental to a technology-based economy. Engineering is an applied discipline and draws on a range of scientific knowledge in its endeavor to turn theories and concepts into reality. Engineering is especially important in such high-tech sectors as electronics, computers and medical devices.

There are nearly 600,000 engineers in the U.S. This figure is approximately six times the number of life and physical scientists but one-fifth the number of computer and IT experts. The average intensity of engineers is about 470 per 100,000 workers nationwide. In that engineers work on functions that can be either very basic or highly specialized, their presence in a state's economy is a reasonable indicator of both breadth and depth of its high-tech economic capacity.

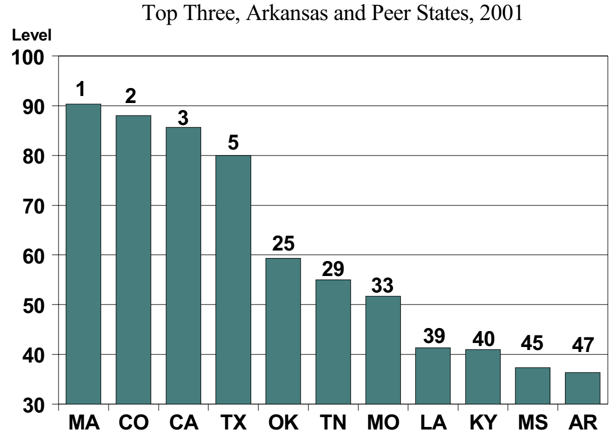
Engineers and Arkansas

With 225 engineers per 100,000 members of its state workforce, Arkansas ranks 47th in the nation. This represents a slight decline from its positioning on the previous Index where the state ranked 44th, despite an absolute increase in the number of engineers from 217 per 100,000 workers on the previous index. The top two performing states in the nation are Massachusetts (732 engineers per 100,000 workforce) and Colorado (699). Other states in the top 10 include California, New Mexico, Maryland, Texas, Virginia, Arizona, Washington and Minnesota. Apart from their contributions to technology sectors, engineers also contribute in important ways by serving as all-around innovators and problem-solvers in areas ranging from workplace productivity to building construction. Arkansas needs to retain the proportionately higher number of engineering students it produces in order to boost its profile in engineering as a whole.

Intensity of Engineers
2001



Intensity of Engineers
Top Three, Arkansas and Peer States, 2001



Source: Milken Institute; Bureau of Labor Statistics

Definition

The fifth set of indicators for Arkansas's Position in Technology and Science is that for Technology Concentration and Dynamism. This component measures the degree to which each individual state's economy is fueled by the technology sector. As such, it is a measurement of technology outcomes. The indicators that make up this component focus on entrepreneurial dynamism and growth in high-tech industries. The varying outcomes that states enjoy are the result of efforts made by leaders in the private and public sectors to facilitate economic growth, especially in regard to knowledge-intensive business. The following indicators explore such factors as high-technology employment, business formation, industry growth and industry concentration. The data used in these indicators was collected from various sources and compiled, modeled and interpreted by the Milken Institute.

Why is it Important?

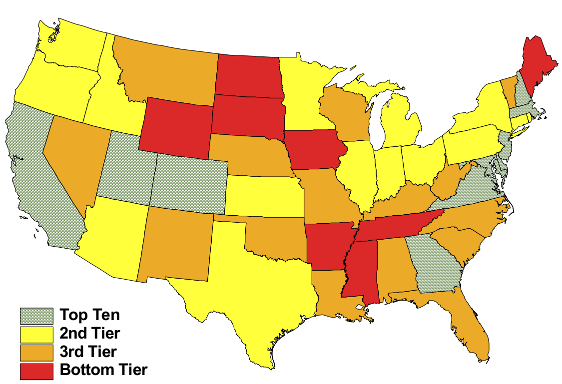
The concentration and dynamism of the high-technology industry in a state is brought about by the effectiveness of key inputs in areas already covered by this study: research and development, risk capital, human capital, and science and technology workforce.

Because of its relationship to other component measures, states wishing to enhance their performance in high-technology industry concentration and dynamism should first consider how various indicator scores on input indicators could be bolstered. Generally speaking, policies that encourage technopreneurial activity—and are conducive to high-tech industrial locations—are central to developing a more vibrant and densely concentrated high-tech business base.

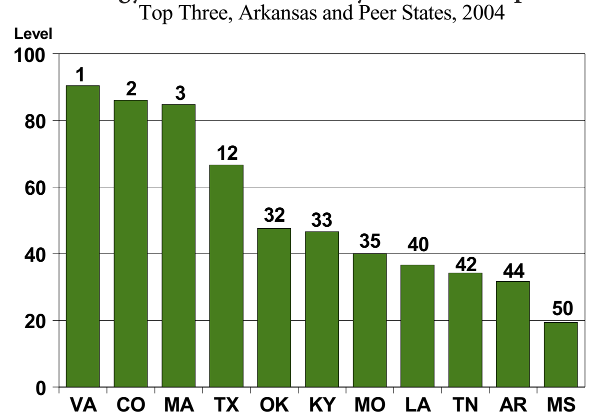
Technology Concentration and Arkansas

Arkansas ranks 44th in the nation in its high-technology concentration and dynamism, one rank higher than on the previous index. The top 10 states in the U.S. for this component are (in descending order) Virginia, Colorado, Massachusetts, California, New Jersey, Maryland, New Hampshire, Utah, Delaware and Georgia. Arkansas' best scoring indicators within this composite are the average yearly growth in high-tech industries and the number of high-tech industries growing faster than the nation as a whole. Although Arkansas' ranking rose since the last index, its actual composite score declined slightly, driven by a significant decline in the concentration of tech industries within the state relative to the country as a whole. This decline offset improvements by the state in almost all other components of the index.

Technology Concentration & Dynamism Component
2004



Technology Concentration & Dynamism Component
Top Three, Arkansas and Peer States, 2004



Source: Milken Institute

Definition

The percentage of businesses in the high-technology North American Industry Classification System (NAICS) codes is determined by totaling the number of businesses in 39 technology-intensive NAICS code industries as tabulated by the Bureau of Labor Statistics (BLS). This figure is then divided by the total number of a state's business establishments as collected by the United States Census Bureau. In this measure, any industry that allocates a significant portion of its revenues to research and development and employs a base twice the industry average in technology-oriented occupations is deemed to be high tech.

Why is it Important?

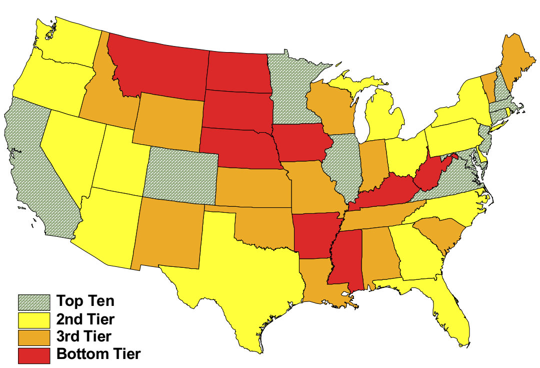
This indicator measures the high-tech business intensity of a state. In that its determining factors are R&D expenditures and technology-oriented occupations at businesses, it not only provides insight to a state's high-tech business population, but also sheds light on the high-tech orientation of the working population as well. Scoring well in this category is one indication of a state possessing both an advanced industrial base as well as a skilled and technologically proficient workforce.

There are more than 400,000 business establishments in the U.S. that qualify as high-tech according to NAICS classification standards. When measured as a portion of all U.S. business establishments, the average percentage of businesses with high-tech NAICS codes is 5.9 percent. This level is held by two states, Texas and Florida, which rank 17th in the nation on the basis of high-tech establishments within their respective states' overall business populations.

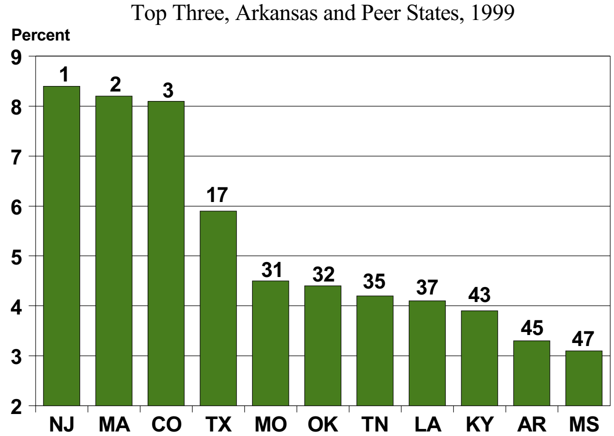
High-Tech NAICS Codes and Arkansas

Of all Arkansas businesses, 3.3 percent operate as high-technology enterprises. This represents an improvement over the state's performance on the 2002 Index where 3.1 percent of Arkansas businesses registered as high-tech. Despite this slight percentage increase, the state's competitive positioning has remained unchanged at 45th place. Because of unavoidable time lags in the Census Bureau's collection of the relevant data, this year's index uses 1999 figures whereas last year's use 1998 figures. Both years account for time frames prior to the onset of the high-tech slump affecting the nation as a whole. As a result, future index indicators are likely to show at least a statistical decline. The states at the top in this indicator for the 2004 Index are New Jersey (8.4 percent), Massachusetts (8.2), Colorado (8.1), New Hampshire and Virginia (tied at 7.7). Arkansas lags behind neighbors such as Texas (5.9 percent), Missouri (4.5), Louisiana (4.1) and Kentucky (3.9).

Percent of Businesses in High-Tech NAICS Codes
1999



Percent Businesses in High Tech NAICS Codes
Top Three, Arkansas and Peer States, 1999



Source: U.S. Census Bureau

Employment in High-Tech NAICS Codes

Definition

The percent share of employment in high-technology North American Industry Classification System (NAICS) codes is calculated by dividing the total number of employees in the 31 industries labeled "high technology" by the Bureau of Labor Statistics (BLS), by the total employment base in each state, respectively. Any industry that allocates a significant portion of its revenues to research and development and employs a base twice the industry average in technology-oriented occupations, is considered a high technology industry by the BLS. Employment data used in this indicator is collected by the United States Census Bureau.

Why is it Important?

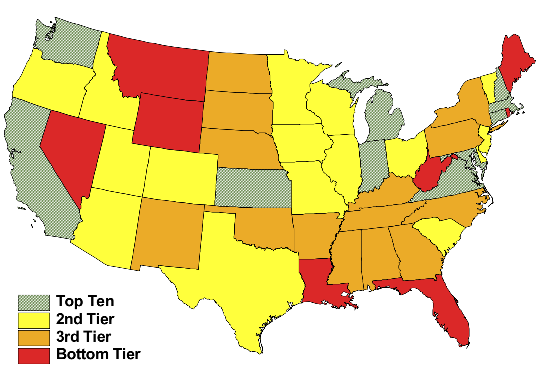
From an industrial perspective, states benefit from having a significant percentage of employment in technology-related fields because such workers are in industries with long-term growth potential that tend to contribute disproportionately to an economy overall. From a fiscal perspective, a benefit comes from high-technology employees tending to have jobs with above-average salaries and pay packages. High-tech employment concentration also serves as an inducement and restraint on industry concentration: attracting high-tech firms from outside while holding back existing firms from leaving.

There are some 9.8 million people directly engaged in high-technology employment throughout the United States. Averaged out for the nation's entire working population, this means 8.9 percent of employees have high-tech jobs. The one state whose state-based employment ratio of high-tech jobs matches the national average is Minnesota. High-tech workers are among the most skilled in the labor force. Thus, for a state to score well in this category requires not only the obvious sources of high-tech employment, but sources of training, such as universities, as well.

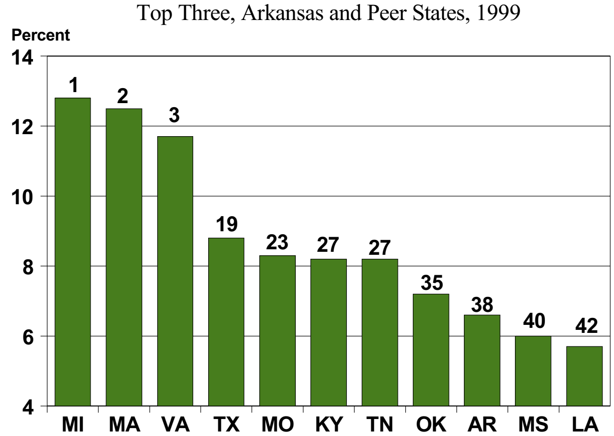
High-Tech Employment and Arkansas

With 6.6 percent of the state's workforce engaged in NAICS-designated high-tech industries, Arkansas ranks 38th in the nation. This represents only a small increase from last year's index and Arkansas' national ranking remains unchanged. Arkansas' percentage of high-tech workers is 3.3 percent higher than its percentage of high-tech establishments (described in the previous indicator). The difference illustrates the rising importance of high-tech in Arkansas' economy: even without working in high-tech firms, more than 6 percent of Arkansans nevertheless are employed in a variety of high-tech occupations. The states at the top in this indicator are Michigan (with 12.8 percent of all workers engaged in high-tech), Massachusetts (12.5 percent) and Virginia (11.7). Of Arkansas' neighbors, Texas (8.8 percent), Missouri (8.3) and Kentucky (8.2) fare the best on this index.

Percent of Employment in High-Tech NAICS Codes
1999



Percent of Employment in High-Tech NAICS Codes
Top Three, Arkansas and Peer States, 1999



Source: U.S. Census Bureau

Definition

The percentage of total payroll paid out to workers in high-technology North American Industry Classification System (NAICS) code industries is calculated by dividing the dollar amount paid out to high-tech workers by the total amount of wages and salary disbursements paid out in each state, respectively. Any industry that allocates a significant portion of its revenues to research and development and employs a base twice the industry average in technology-oriented occupations is considered a high technology industry by the Bureau of Labor Statistics. High-technology employment data are collected by the United States Census Bureau under contract with Taratec Corporation.

Why is it Important?

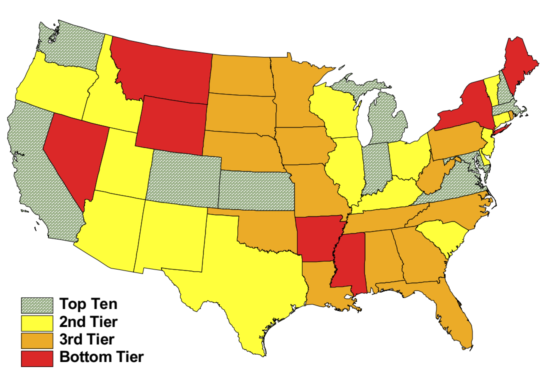
As noted in regard to the previous indicator, states benefit from having a significant percentage of employment in technology-related fields because such workers are in industries with long-term growth potential that tend to contribute disproportionately to an economy overall. From a fiscal perspective, a benefit comes from high-technology employees tending to have jobs with above-average salaries and pay packages. This indicator augments and expands on the previous indicator (percentage share of high-tech employment) by showing how much of total payroll income is generated by high-tech employment.

The data clearly indicates that indeed high-tech jobs pay disproportionately high salaries. The total value of annual payroll income from high-tech employment in the U.S. amounts to almost $520 million, which represents 14.6 percent of all payroll dollars in the nation. This proportion is over 60 percent more than the average percentage of high-tech workers (8.9 percent), showing that high-tech workers bring in far more in terms of income than their proportion of the working population would suggest.

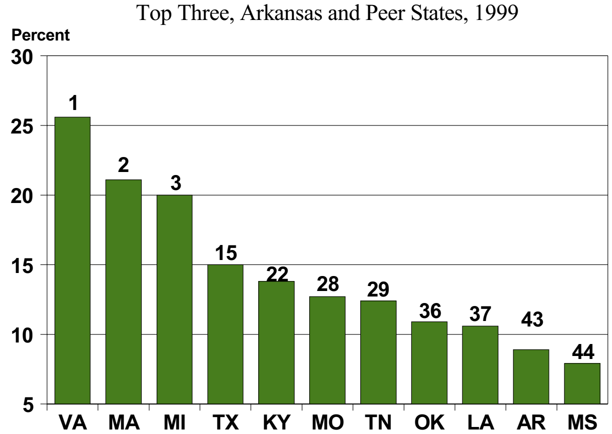
High-Tech Payroll and Arkansas

Of Arkansas' payroll wages, 8.9 percent come from high-tech jobs. Representing the same level as last year's indexed percentage, the state's 43rd-place ranking for this year has slipped from 42nd place. Although significant growth occurred in select states such as Virginia, most states in Arkansas' region also maintained approximately the same wage percentage. Only Kentucky (12.8 percent to 13.8 percent) showed a significant increase. The states in the top 10 are Virginia (25.6 percent), Massachusetts (21.1), Michigan (20.0), California (19.4), Washington (18.5), Indiana (17.6), Colorado (16.9), Kansas (16.8), and Maryland and New Hampshire (tied at 16.7). Although the statistics for this indicator are based on the latest available data, that data precedes the high-tech slump. Future indicators will likely reflect lower percentages, both for Arkansas and other states.

Percent of Payroll in High-Tech NAICS Codes
1999



Percent Payroll in High Tech NAICS Codes
Top Three, Arkansas and Peer States, 1999



Source: U.S. Census Bureau

Percent of Business Births in High-Tech Sector

Definition

Percent of business births in the high-technology sector is calculated by dividing the number of new high-tech businesses born in the year for which the most recent data is available and dividing that by the total number of new businesses created during the same year. A business establishment, as defined by the United States Census Bureau, is a "single physical location at which business is conducted." The distinction is worth noting because an establishment is not interchangeable with a company: a company can have more than one establishment and business establishment data also account for business branches. Nevertheless, the data is an accurate measure of high-tech business presence. Data on new high-tech firms and total business establishments are compiled by the U.S. Census Bureau under contract with Taratec Corporation.

Why is it Important?

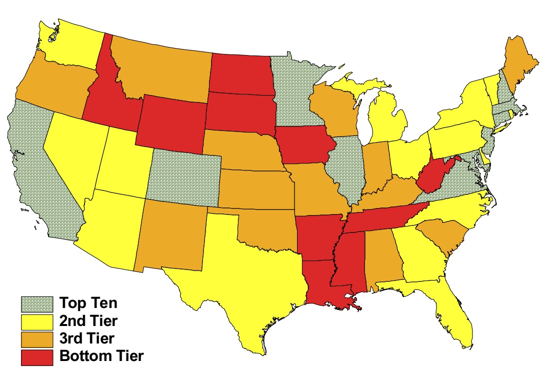
Business births are important to a state because new growth in business is a sign of economic dynamism, prosperity and optimism. Business births in the high-technology sector are particularly important because of such additional benefits as the sector's high wages, knowledge intensity and long-term growth prospects, among others.

Latest data indicate that 7.7 percent of all new business establishments formed in the United States were in the 31 industries categorized as operating in the high-technology sector by the U.S. Department of Labor. The two states whose percentage of high-tech business births precisely match the national average level are Rhode Island and Utah, which share the rank of 14th in the nation overall.

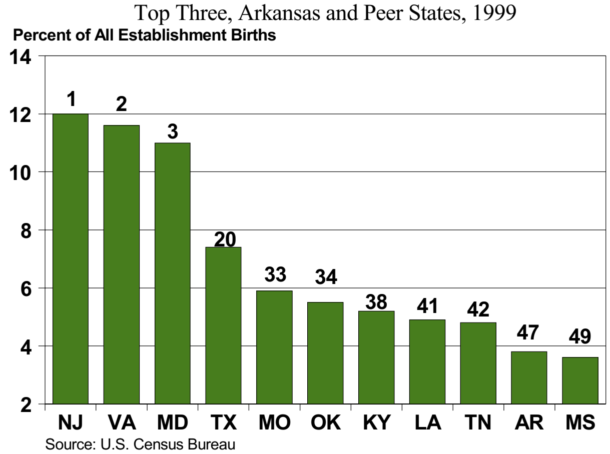
High Tech Births and Arkansas

The latest available data indicate that 3.8 percent of Arkansas' new business establishments occur in the high-tech sector. This ranks the state 47th in the nation, tied with South Dakota. Arkansas ranked 50th on the previous Index with 3.7 percent of new business in high-tech. While there was only a limited increase statistically, comparatively speaking the state is improving, due to clear declines in Mississippi, North and South Dakota. The states that hold a top five ranking are New Jersey (with 12 percent of new business establishments in high-tech industries), Virginia (11.6 percent), Maryland (11.0), Minnesota (10.0), Colorado and Illinois (tied at 9.9). As demonstrated by other indicators of technology concentration and dynamism, Arkansas' economy is less dependent on high-tech than the nation as a whole, as well as its region. Facilitating an environment that supports high-tech entrepreneurship benefits not only the state's knowledge-based sectors, but the economy overall.

Establishment Births in High-Tech NAICS Codes
Percent of All Establishment Births, 1999



Establishment Births in High-Tech NAICS Codes
Top Three, Arkansas and Peer States, 1999



Definition

Net formation of high-technology establishments per 10,000 businesses measures the number of high-technology business establishment births minus the number of high-technology business establishment deaths during a one-year period. This data is then divided by the number of 10,000 business establishments in each state respectively. A business establishment is considered in this indicator only if it has an Employer Identification Number (EIN) issued by the U.S. Census Bureau. High-technology and total establishments' birth data are compiled by the United States Census Bureau under contract with Taratec Corporation.

Why is it Important?

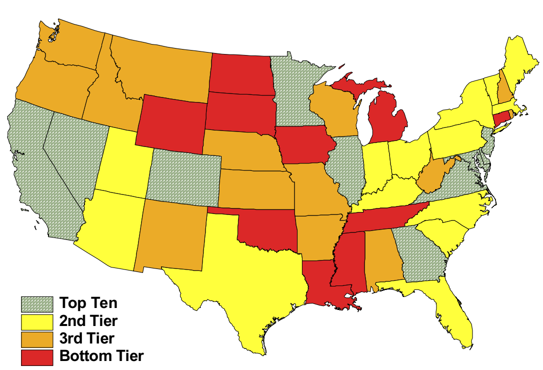
The previous indicator is a comparative absolute measure of business births: it looks at the total number of new firm formations in high-technology as a percentage of all business births. This indicator for net formation of high-tech establishments is more specific in ascertaining the "balance sheet" of high-tech firm births versus deaths. By basing the indicator statistic on the population of all businesses (in units of 10,000 establishments), a clearer picture of how this high-tech industrial life cycle plays out in the overall business environment emerges.

For the year measured, the net total of new high-technology business establishments across all 50 states was in excess of 13,000. This represents a net formation rate (per 10,000 businesses) of 18.8 percent nationwide. The one state whose internal rate of net high-tech firm formation matches the national average is 17th-place New York. States in this category tend to score at close to the same level as that for percent of high-tech business births (see previous), going up or down in their rankings depending on how prolifically high-tech firms multiply and how long they survive.

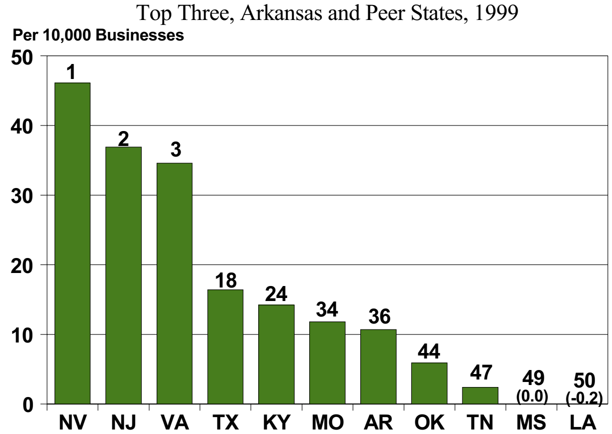
Net High-Tech Formation & Arkansas

With a net formation rate of 10.7 high-tech businesses for every 10,000 businesses total, Arkansas ranks 36th in the nation. This ranking is a significant improvement both numerically—from 2.7 on the previous index—and comparatively, rising from 49th. The top 10 states in this indicator are Nevada (with a formation rate of 46.1), New Jersey (36.9), Virginia (34.6), Maryland (32.5), Delaware (31.6), Minnesota (28.6), Colorado (27.4), Illinois (27.0), Georgia (26.5) and California (24.8). Net high-tech firm formation is a good indicator of high-tech entrepreneurial dynamism. Although certainly offering room for improvement, Arkansas' rising position in this measure is a sign of success. If the state can continue this proportion in the coming years, it bodes well for Arkansas improving its overall position.

Net Formation of High-Tech Establishments
Per 10,000 Businesses, 1999



Net Formation of High-Tech Establishments
Top Three, Arkansas and Peer States, 1999



Source: U.S. Census Bureau

Number of Technology Fast 500 Companies

Definition

The number of Technology Fast 500 Companies per 10,000 business establishments measures a state's relative performance in generating fast-growing high-tech enterprises. The number of Technology Fast 500 Companies is compiled annually by Deloitte, which ranks the fastest-growing technology companies in North America (22 U.S. regions and Canada) over the most recent five-year period. In our indicator, the relevant Technology Fast 500 figures are averaged out by increments of 10,000 businesses in each state. Deloitte considers a company to be high-tech if it produces technology, technology-related products, uses extensive technology, or allocates a large percentage of revenue to research and development efforts. Total number of business establishments is collected by the United States Census Bureau.

Why is it Important?

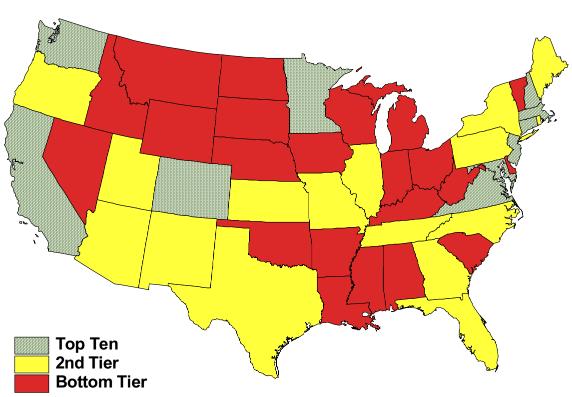
The Deloitte list of North America's fastest growing 500 high-technology firms relies on a combination of quantitative and qualitative data to identify innovative, rapidly expanding firms that demonstrate strong promise for long-term technological and economic impact.

The combination of factors used as evaluation criteria mean that the list of Technology Fast 500 companies is unavoidably subjective. Nevertheless, it is helpful for identifying new technology companies that demonstrate high growth and future potential. Taking a state's business population into account, as this indicator does, provides an indication of how rapidly a state's high-tech base is expanding. A total of 453 companies made the Technology Fast 500 list in the United States. Averaged out per 10,000 businesses nationwide, this leads to a ratio of 0.6, a statistic matched by the state of Georgia. Only 30 states are home to Technology Fast 500 companies, an indication of the relatively exclusive nature of the list.

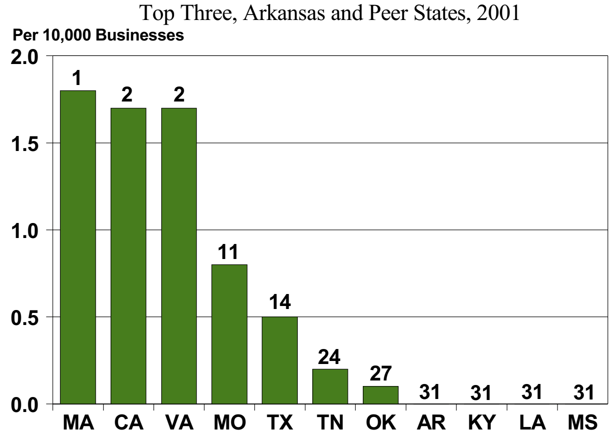
Tech-Fast 500 Companies and Arkansas

Arkansas registered zero Technology Fast 500 companies per 10,000 business establishments. This is the same number as were present in the state last year and tied Arkansas with 20 other states for last place. Other states with a dearth of Technology Fast 500 companies include Alabama, Kentucky, Louisiana, Mississippi, Michigan, Nevada and Ohio. The top performing states include Massachusetts, with 1.8 companies, California (1.7), Maryland (1.6), New Hampshire (1.3), Connecticut (1.2), Colorado (1.1), Washington (1.1), Minnesota (0.9) and New Jersey (0.9). The strongest state bordering Arkansas is Missouri with 0.8 companies per 10,000 establishments.

Number of Technology Fast 500 Companies
Per 10,000 Businesses, 2001



Number of Technology Fast 500 Companies
Top Three, Arkansas and Peer States, 2001



Source: Deloitte

Average Yearly Growth of High-Tech Industries

Definition

Average yearly growth of high-technology industries measures the dynamic of expansion in high-tech employment. It is calculated using the average yearly growth in the high-tech sector for a state during the most recent five-year period on record. Here the high-technology sector is delineated according to the Milken Institute's universe of 14 industries (nine in high-technology manufacturing and five in high-technology services) that spend an above-average amount of revenue on research and development and that employ an above-average number of technology-using occupations. Data for this indicator was provided by Economy.com and compiled by the Milken Institute.

Why is it Important?

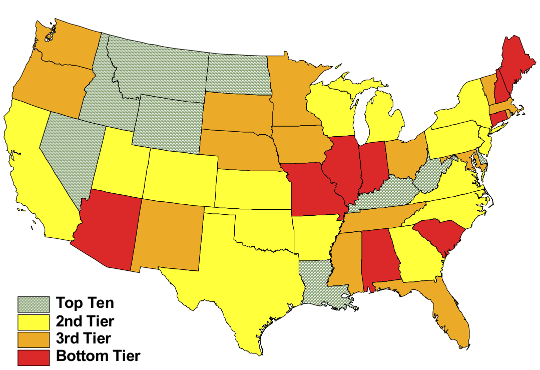
Examining where technology is prevalent does not necessarily correlate to where technology is growing. This indicator aims to capture where technology has grown fastest during the past five years regardless of industry base. Examining where technology has grown fastest during the past five years allows stakeholders to identify and assess where new technology opportunities are arising throughout the United States.

Average yearly technology employment growth for the U.S. as a whole during the five years measured was 2.6 percent. Because states with a small technology industry base will register disproportionately strong growth rates with even a small industrial expansion, this indicator is easily dominated by states with relatively limited high-tech industrialization.

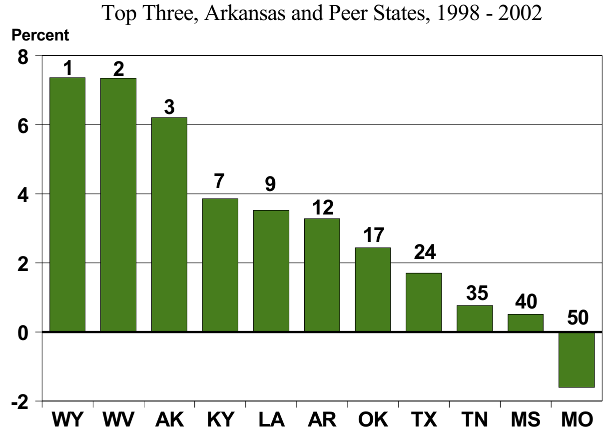
High-Tech Growth and Arkansas

Arkansas' average annual growth in high-tech employment is 3.3 percent, ranking it 12th in the nation. The state's position is just behind that of Georgia and places it in the second tier nationally. Despite Arkansas' growth rate declining from 5.1 percent on the last index, its overall rank actually improved from 18th to 12th place due to the tech bust affecting other states more severely. The best performing states in this indicator were Wyoming, West Virginia and Alaska with average growth rates of 7.4, 7.3 and 6.2 percent, respectively. They do, as mentioned above, fit the profile of states with small industrial bases where slight upward movement in absolute high-tech employment numbers equate to large percentage gains. A state like Massachusetts, which due to its exceptionally heavy concentration of science and technology assets outperforms Arkansas in nearly every other indicator, here fares far worse, earning only 0.7 percent growth and ranking 37th.

Average Yearly Growth of High-Tech Industries
Employment, 1998–2002



Average Yearly Growth of High-Tech Industries
Top Three, Arkansas and Peer States, 1998 - 2002



Source: Economy.com; Milken Institute

Number of High-Tech Industries Growing Faster Than U.S.

Definition

The number of high-technology industries growing faster than the United States measures how many high-tech industries a state has that are growing faster in terms of employment than the average employment growth rate of the overall U.S. economy. Growth rates are based on the most recent five-year period. Here the high-technology sector is delineated according to the Milken Institute's universe of 14 industries derived from the former SIC classification system (nine in high-technology manufacturing and five in high-technology services) that spend an above-average amount of revenue on research and development and that employ an above-average number of technology-using occupations. The data used in calculating this indicator was furnished by Economy.com and compiled by the Milken Institute.

Why is it Important?

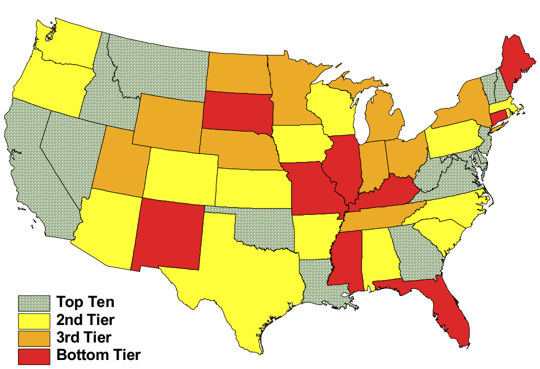
High-tech industries tend to be fast growing, although growth rates can be influenced by many factors and, depending upon the constituents in a state's high-tech sector, can expand or decline at various periods. In this indicator, successful performance comes from how closely a state scores to 14, the maximum number of high-tech industries that could register above the U.S. average growth rate.

The time period measured, 1998–2002, is one characterized initially by exceptionally high growth in employment for many high-technology industries (especially those related to information technology) followed by a precipitous decline. Employment in the U.S. economy as a whole followed that trend along with that for leading technology industries, though the national economy's employment growth rate both in ascendancy and descent was less severe than that for the tech sector. In the period measured, no state had the maximum number of industries, 14, outperforming the employment growth of the U.S. economy as a whole.

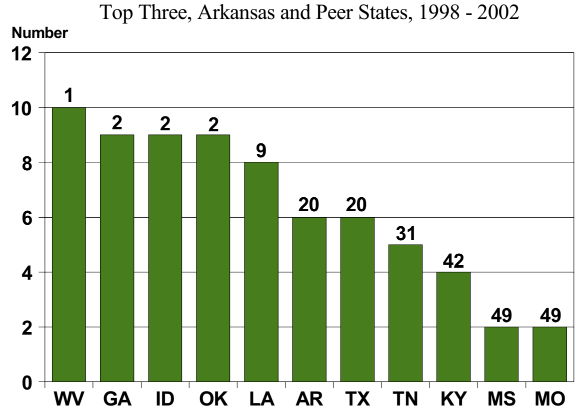
High-Tech Growth and Arkansas

Six out of a total of 14 high-tech industries in Arkansas based on the SIC code system have been growing faster in employment than the U.S. on average. This ranks the state 20th and ties it with 11 other states, including Arizona, Iowa, Pennsylvania, South Carolina and Texas. As the diversity of these states suggests, each state does not have the same six industries growing faster than that of the U.S. labor force, but rather varying combinations of six high-tech industries. The state with the largest number of industries growing faster than the U.S. is West Virginia, with 10. Seven states ranked second with nine industries: Georgia, Idaho, Maryland, Montana, Nevada, Oklahoma and Vermont. Arkansas slipped in this year's index from its 16th-place ranking previously, where it had seven high-tech industries growing faster on average than the U.S.

Number of High-Tech Industries Growing Faster Than U.S.
Employment, 1998–2002



Number of High Tech Industries Growing Faster Than U.S.
Top Three, Arkansas and Peer States, 1998 - 2002



Source: Economy.com; Milken Institute

Number of High-Tech Industries With LQ Higher Than 1.0

Definition

The number of high-technology industries with a location quotient (LQ) higher than 1.0, measures how many high-tech industries are densely concentrated in a given state. It is calculated by counting the number of high-tech industries out of 14 that have an above-average location quotient in employment. An industry's location quotient measures the level of employment concentration relative to the industry average across the United States in a given location, in this case, a state. A state with an employment LQ higher than 1.0 in a high-tech industry has a denser concentration of that industry than in the nation on average. Industry output numbers used in this indicator were provided by Economy.com and compiled by the Milken Institute.

Why is it Important?

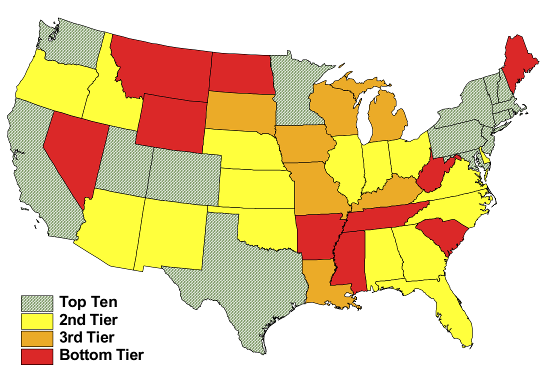
This indicator reveals how successful a state is in being home to an above-average mass of high-tech industries. States that exceed the national average in high-tech industry LQs have an edge in attracting and retaining high-tech firms due to their dense employment bases and other positive agglomeration factors.

Compared to above-average growth in employment (shown in the previous indicator), which measures industry momentum, this indicator on high-tech location quotients measures a more static, but also critical dynamic: density. Taken together, the two indicators give a perspective on how well a spectrum of industries from the high-tech sector are both anchored to and growing within a state. As with the previous indicator, no state has the maximum number of 14 industries all outperforming the national average.

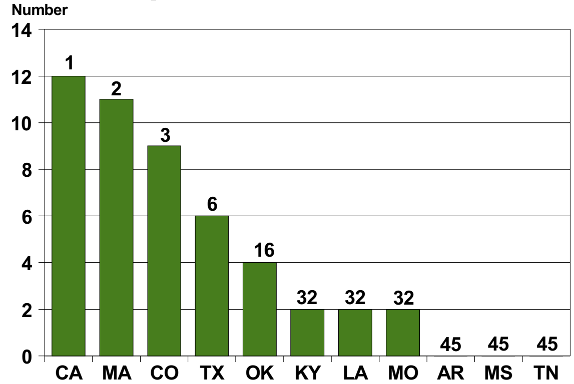
High-Tech Concentration and Arkansas

Arkansas is home to zero (out of a total of 14) SIC high-tech industries whose employment concentrations are higher than the U.S. average. This ties the state for last in the nation, and is a significant drop from the 15th-place ranking Arkansas held in the last index. The ranking and statistic of zero industries is a significant drop from the four industries with an LQ higher than 1.0 which Arkansas possessed on the last index. Leading states whose high-tech industries have above-average employment LQs are California (with 12), Massachusetts (11), Colorado (9), Utah (8) and Minnesota (7). Mississippi and Tennessee also lack any high-tech industries with an LQ higher than 1.0, while Oklahoma has four and Texas has six.

Number of High-Tech Industries with LQ Higher Than 1.0
Employment, 2002



Number of High-Tech Industries With LQ Higher Than 1.0
Top Three, Arkansas and Peer States, 2002



Source: Economy.com; Milken Institute

Number of Inc. 500 Companies

Definition

The number of Inc. 500 companies per 10,000 business establishments measures how many Inc. magazine top 500 companies are located in a given state. *Inc.* magazine's list ranks firms that apply to be on the list and can demonstrate that total net revenue (or, for financial companies, total net income) has more than tripled in the most recent five years. Our indicator is calculated by totaling the number of Inc. 500 companies in a state and normalizing the figures by increments of 10,000 business establishments in that state. Business establishments data is provided by the United States Census Bureau.

Why is it Important?

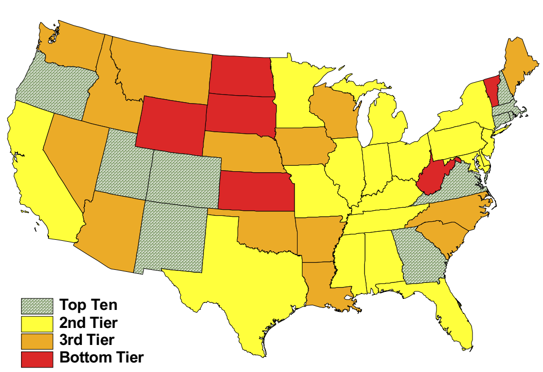
The Inc. 500 has a 21-year history and is recognized as a chief barometer of entrepreneurial venture growth in the United States. Although it is not specific to technologically or otherwise knowledge-intensive enterprise, it offers a window into the national landscape for fast-growing, entrepreneurially dynamic firms. When its rankings are assessed on a normalized state-by-state basis and considered in the context of other indicators, it provides as a usefully comparative measure of economic vibrancy and dynamism throughout the United States.

A total of 43 states are home to at least one company that makes the Inc. 500 list. This reflects the broader nature of this indicator as opposed the Technology Fast 500 ranking on which only 30 states have companies that qualify. The U.S. average for Inc. 500 companies per 10,000 businesses is 0.7. States whose ratio of Inc. 500 firms per 10,000 state-based businesses matches the national average are California, Maryland, Mississippi and Missouri.

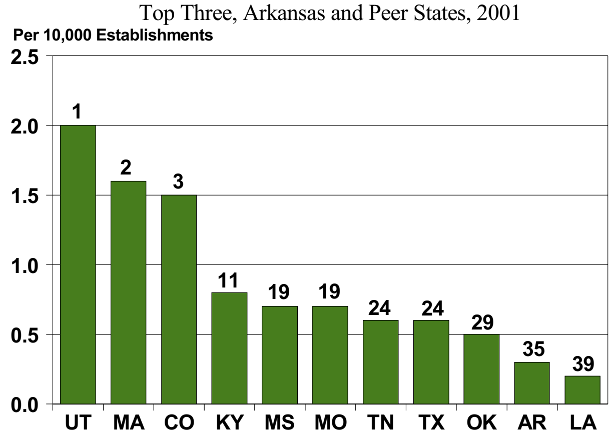
Inc. 500 Companies and Arkansas

Two Arkansas companies made the Inc. 500 list in the year studied (2001). This represents 0.3 firms for every 10,000 business establishments in the state, placing Arkansas 35th in the nation, a position it shares with Idaho, Maine and Montana. Utah, which ranked first in the nation, has two Inc. 500 companies for every 10,000 businesses, second-place Massachusetts, 1.6; and third-place Colorado, 1.5. In terms of absolute number of Inc. 500 companies, Arkansas' two entrants are dwarfed by California's 59, and still lag well behind Kentucky's 7. The two entrants within the state are in the diverse fields of marketing services and automobile retailing. Arkansas has improved from its position on last year's index, where it lacked any entrants in the Inc. 500, but it has clear room to improve both in absolute and relative numbers.

Number of Inc. 500 Companies per 10,000 Establishments
2001



Number of Inc. 500 Companies
Top Three, Arkansas and Peer States, 2001



Source: Inc. Magazine

R&D Inputs	
Federal R&D	NSF, Federally Funded R&D
Industry R &D	NSF, R&D in Industry
Academic R&D	NSF, Academic R&D Expenditure
National Science Foundation Funding, Percent	NSF, EPSCoR
National Science Foundation Research Funding , Percent	NSF, EPSCoR
R&D Expenditures on Engineering	NSF, Academic R&D Expenditure
R&D Expenditures on Phys Sciences	NSF, Academic R&D Expenditure
R&D Expenditures on Environ Sciences	NSF, Academic R&D Expenditure
R&D Expenditures on Math & Comp Sci	NSF, Academic R&D Expenditure
R&D Expenditures on Life Sciences	NSF, Academic R&D Expenditure
R&D Expenditures on Agricultural Sciences	NSF, Web Caspar
R&D Expenditures on Biomedical Sciences	NSF, Web Caspar
Average Annual # of STTR Awards	SBA; OTP
STTR Awards (Award Dollars)	SBA; OTP
SBIR Awards	SBA; OTP
SBIR Awards per 10,000 Business Establishments (Phase I)	NSF, EPSCoR
SBIR Awards per 10,000 Business Establishments (Phase II)	NSF, EPSCoR
Competitive NSF Proposals Funding Rate	NSF, EPSCoR
Risk Capital & Infrastructure	
Total Venture Capital Investment Growth	Ventureeconomics.com
# of Companies Receiving VC Investment	Ventureeconomics.com
Companies Receiving VC Investment	Ventureeconomics.com
Venture Capital Investment	Ventureeconomics.com
Average Annual SBIC Funds Disbursed	SBA; OTP
Number of Business Incubators	NBIA; OTP
Patents Issued	US PTO; Milken Institute
Number of Business Starts	SBA; Office of Advocacy
IPO Proceeds	Security Data Corporation; Milken Institute
Human Capital Investment	
Bachelor's Degree or Greater	US Census Bureau
Advanced Degree or Greater	US Census Bureau, DSS
PhD Degrees	US Census Bureau, DSS
Number of Students in Science & Engineering	NSF, EPSCoR
State Spending on Student Aid	NSF, EPSCoR
Average Verbal SAT Scores	NSF, EPSCoR
Average Math SAT Scores	NSF, EPSCoR
Average ACT Scores	NSF, EPSCoR
State Appropriations for Higher Education (per Capita)	NSF, EPSCoR
State Appropriations for Higher Education (percent Change)	NSF, EPSCoR
Number of Doctoral Scientists	NSF, State Science & Engineering Profile
Number of Doctoral Engineers	NSF, State Science & Engineering Profile

Number of Science & Engineering PhDs Awarded	NSF, State Science & Engineering Profile
Number of Science & Engineering Post doctorates Awarded	NSF, Web Caspar
Percent of Bachelor's Degrees Granted in Sci & Eng	NCES; OTP
Recent Bachelor's Degrees in Sci or Eng	NSF; OTP
Recent Master's Degrees in Sci or Eng	NSF; OTP
Recent PhDs in Sci or Eng	NSF; OTP
Households With Computers	US DOC; OTP
Households With Internet Access	US DOC; OTP
Technology & Science Workforce	
Intensity of Computer & Information Scientists	BLS, DOL; Milken Institute
Intensity of Computer Programmers	BLS, DOL; Milken Institute
Intensity of Software Engineers, Systems Software	BLS, DOL; Milken Institute
Intensity of Computer Support Specialists	BLS, DOL; Milken Institute
Intensity of Computer Systems Analysts	BLS, DOL; Milken Institute
Intensity of Database & Network Administrators	BLS, DOL; Milken Institute
Intensity of Agricultural & Food Scientists	BLS, DOL; Milken Institute
Intensity of Biochemists and Biophysicists	BLS, DOL; Milken Institute
Intensity of Microbiologists	BLS, DOL; Milken Institute
Intensity of Medical Scientists	BLS, DOL; Milken Institute
Intensity of Physicists	BLS, DOL; Milken Institute
Intensity of Other Life, Phys Occupations	BLS, DOL; Milken Institute
Intensity of Electronics Engineers	BLS, DOL; Milken Institute
Intensity of Electrical Engineers	BLS, DOL; Milken Institute
Intensity of Computer Hardware Engineers	BLS, DOL; Milken Institute
Intensity of Biomedical Engineers	BLS, DOL; Milken Institute
Intensity of Agricultural Engineers	BLS, DOL; Milken Institute
Intensity of Other Engineers	BLS, DOL; Milken Institute
Technology Concentration	
Percent of Establishments in High-Tech NAICS Codes	US Census Bureau; OTP
Percent of Employment in High-Tech NAICS Codes	US Census Bureau; OTP
Percent of Payroll in High-Tech NAICS Codes	US Census Bureau; OTP
Percent of Establishment Births in High-Tech NAICS Codes	US Census Bureau; OTP
Net Formation of High-Tech Establishments	US Census Bureau; OTP
Number of Technology Fast 500 Companies	US Census Bureau; OTP
High-Tech Industries (Average Yearly Growth)	Economy.com; Milken Institute
Number of High-Tech Industries Growing Faster than U.S.	Economy.com; Milken Institute
Number of High-Tech Industries With LQs Higher Than 1.0	Economy.com; Milken Institute
Number of Inc. 500 Companies	Inc. Magazine; OTP

* **Abbreviations**

BLS: Bureau of Labor Statistics	NSF: National Science Foundation
DOL: Department of Labor	OTP: Office of Technology Policy
EPSCoR: Experimental Program to Stimulate Competitive Research	SBA: Small Business Administration
NBIA: National Business Incubation Association	US DOC: US Department of Commerce
NCES: National Center for Education Statistics	US PTO: US Patent and Trademark Office

Competitive Advantage

The Competitiveness Debate[1]

Although the relevance of competitiveness has been debated,[2] what is essential to recognize, is that competition is a benchmark of performance. Competitiveness is relevant to our understanding of why firms have varying levels of efficiency.[3]

Competitiveness among firms, and the competitiveness of countries or subnational units such as states, are not alike—"firms, not nations, compete in international markets."[4] That is, Ford competes with Toyota, not the United States with Japan. Nor are the goals and territorial boundaries of firms, countries or states the same. Firms focus on increasing profits and market share (or competitiveness) regardless of where the activity is performed. Governments, such as the state of Arkansas, are concerned with increasing the welfare of the people located within their political jurisdictions. The government of the state of Arkansas is accountable to its electorate for its economic security, in addition to defense, law and order, etc.

The interesting aspect of the internationalization of business is that it highlights competitive differences among firms, countries, subnational entities and regional economies. Firms judge their success by how well they perform relative to other firms independent of where they produce their output. Entities such as the state of Arkansas, judge their success by the efficiency with which they can use their resources to create value for their own citizens.

This section benchmarks the performance or competitiveness of the state of Arkansas. Knowledge so gained provides insight into the means of achieving improved performance. The degree to which Arkansas' competitiveness can be sustained is a measure of the long- versus short-term effectiveness of the state's policies and its development coalition partners.

Arkansas' competitiveness should not be regarded as an end in and of itself. Indeed, it would be costly to Arkansas were the state to pursue the competitiveness race without regard to larger social issues. Nor can any state within the U.S. have a competitive advantage in every factor of production just as no one state can be intra- or internationally competitive in every industry. However, competitive advantage for entities such as Arkansas can be achieved via innovation, coordination and marketing.

Technological advances have improved the ability of investors, entrepreneurs and firms to scrutinize and compare location options. This transparency enables decision makers to better compare multiple localities and assess their benefits when going through the site selection process. Labor-saving technological advances have reduced the labor component of virtually every industry in the global economy. By contrast, the availability and real price of created assets, including skilled labor and physical infrastructure, have become a more important influence on location decisions.

Globalization and increasing structural unemployment worldwide have increased the relevance of competitiveness; the adjustments required everywhere by everyone will create opportunities that will be unevenly spread.[5]

Location Advantages

Arkansas' competitiveness revolves around the proposition that what one state does, affects or is affected by what is going on in other states in the country. Different states have different endowments. Arkansas' specific location advantages are those that favor production within the state. No single measure can capture the issue of competitiveness totally. The location-specific advantages examined in this report are:

- the cost of doing business (e.g., wages, taxes, real estate and electricity costs);
- differences in quality of infrastructures (e.g., Internet access, commuting, affordable housing);
- human resources (e.g., skilled labor);
- foreign direct investment;
- exports;
- agglomeration economies (i.e., clusters of industrial activity); and
- government and fiscal policies.

Chief among the location variables that influence site selection are the availability and associated cost of local resources and capabilities that an investing firm believes are necessary to make the best use of its core strengths. The nature of the investing firm's value-added activities, the industrial sector in which the firm operates, and the international competitive arena, all influence the significance or weight that the investing firm has on the specific location advantages of the host site. Today, businesses are increasingly influenced by both the direct (e.g., resources and markets) and indirect (network and alliance opportunities) effects of such location advantages.

In this framework, the location advantages specific to the state of Arkansas are defined by the determinants of the firms' decisions and are influenced by the relative bargaining power of the firms and the host government. The strategies of firms are likely to differ depending upon the nature of the investment. Competitiveness for the state of Arkansas can be enhanced through foreign firm activities in technology and science.

International Competitiveness

As the world economy becomes increasingly globalized and firms' core competencies continue to change, Arkansas' competitive advantages increase in significance.

Foreign direct investment (FDI)[6] tends to concentrate on industries that are of above average productivity or profitability.[7] The Organization for Economic Co-operation and Development (OECD, 1994) posits that foreign-owned companies are typically more efficient than domestic firms in both absolute values and in rates of productivity gains from added capacity and the use of advanced technology. By contrast, locally owned companies often increase productivity through downsizing and layoffs. To the extent that inbound FDI tends to be more productive than domestic firms, it warrants separate mention in the analysis of technology and science in the state of Arkansas.

Since 1981, foreign direct investment flows have consistently grown faster than gross domestic product (GDP), international trade or exports on a worldwide basis.[8] Understanding the role of FDI by multinational enterprises[9] is therefore critical to understanding the economic growth and competitiveness of Arkansas. Because of the potential transfer of technology resulting from FDI, the latter may create a social multiplier over and above what has been created by domestic projects channeled through wage and tax payments in the host state. In principle, benefits also include spillovers that positively impact the productivity and competitiveness of domestic firms.

1. Foreign Direct Investment Trends in the State of Arkansas

Arkansas is located on the same latitudes as Osaka, Japan and North Africa and is midway between Montreal and Mexico City, presenting excellent distribution opportunities[10] for domestic and especially foreign firms seeking to serve the U.S. market. The tables below show how many people were employed by foreign firms in Arkansas from 1977—the most recent year for which FDI state data is available—to 2000.

Macroeconomic Development Contribution

In 2000, 463 affiliates from 37 countries with property, plants and equipment in Arkansas employed approximately 40,900 people. This represents a four-fold increase from 1977 when foreign-owned businesses operating value-added activities in the state employed 9,800 people.

A useful way to analyze FDI in Arkansas is by comparison with other states in the nation. The table below ranks Arkansas and comparable states by FDI employment for the years 1977 and 2000. Arkansas ranked 34th nationally in employment by foreign companies in 2000, accounting for approximately 0.6 percent of all employment by foreign affiliates in the country. This ranking is lower however, than in 1977 when Arkansas ranked 29th accounting for 0.8 percent of all foreign employment in the United States, indicating that Arkansas' share of the total FDI coming into the nation has declined in absolute terms and relative to other states. In effect, Arkansas has been slowly losing ground in the competition for FDI in the U.S.

States Ranked as U.S. Affiliates of Foreign-Owned Firms
(in Thousands)

State	1977 Rank in U.S.	1977	2000 Rank in U.S.	2000
California	1	124.3	1	749.4
New York	2	121.6	2	479.1
Texas	5	66.2	3	445.2
Tennessee	16	26.2	15	153.2
Missouri	19	20.2	20	107.4
Kentucky	23	15.5	23	106
Alabama	24	14.3	25	77.9
Louisiana	21	18.4	28	61.3
Oklahoma	32	8.7	32	41.9
Arkansas	**29**	**9.8**	**34**	**40.9**
Mississippi	38	5.7	40	24.2

The next table has manufacturing employment figures for both the state of Arkansas and the U.S. as a whole in 1977 and 1999. We see that:

- Arkansas' share of U.S. FDI manufacturing employment decreased from 1.24 percent in 1977 to 1.03 percent in 1999.
- Arkansas' share of domestic manufacturing employment increased from 1977 to 1999.
- Arkansas' share of foreign manufacturing employment of all manufacturing employment in the state increased from 3.9 percent in 1977 to 9.6 percent in 1999. However, foreign manufacturing employment in the U.S. rose from 3.4 percent in 1977 to 12.4 percent in 1999.
- Arkansas' overall share of total manufacturing employment in the country increased from 1.07 percent in 1977 to 1.31 percent in 1999.

Therefore, Arkansas is capturing a larger share of the country's domestic and overall manufacturing employment, but a smaller share of the country's foreign manufacturing employment.

Employment in the Manufacturing Sector
(in Thousands)

Year	Domestic		AR %	Foreign		AR %	Foreign	% of All
	U.S.	AR	of U.S.	U.S.	AR	of U.S.	U.S.	AR
1977	19,682.3	209.3	1.06	685.6	8.5	1.24	3.4	3.9
1999	18,552.4	252.3	1.36	2616.7	26.9	1.03	12.4	9.6

Manufacturing employment in Arkansas fluctuated only slightly from 1977 to 1999, peaking in 1995 at 282,930 employees (259,330 domestic and 23,600 foreign). Arkansas experienced its lowest level of total manufacturing employment in 1982 with 207,130 manufacturing employees—195,180 in domestic firms and 11,950 in foreign firms.

Employment in the Manufacturing Sector in Arkansas
(in Thousands)

Year	Domestic	Foreign	Total
1977	209.27	8.50	217.77
1978	217.48	10.05	227.53
1979	217.87	10.58	228.45
1980	209.14	11.46	220.60
1981	209.70	13.61	223.31
1982	195.18	11.95	207.13
1983	200.27	12.31	212.58
1984	212.97	12.44	225.41
1985	209.55	10.85	220.40
1986	211.77	9.93	221.70
1987	219.59	11.90	231.49
1988	226.31	14.90	241.21
1989	230.97	17.50	248.47
1990	232.83	18.00	250.83
1991	233.71	18.20	251.91
1992	236.99	18.40	255.39
1993	244.27	19.60	263.87
1994	253.97	22.30	276.27
1995	259.33	23.60	282.93
1996	253.80	24.00	277.80
1997	252.85	24.30	277.15
1998	253.49	25.30	278.79
1999	252.15	26.90	279.05

2. Economic Significance of Foreign Direct Investment in the State of Arkansas[11]

Foreign direct investment employment as a share of total employment in the state of Arkansas increased from 1.4 percent in 1977 to 3.2 percent in 1999. FDI employment in the state grew from 9,800 employees in 1977 to 37,800 employees in 1999, almost four and a half times that of the rate of Arkansas' total domestic employment growth, which increased from 695,530 in 1977 to 1,141,780 over the same 22-year period.

The significance of foreign direct investment in Arkansas can also be measured by the gross book value of property, plant and equipment in the state. From the following table, we see that:

- the value of FDI in Arkansas increased from $155 million in 1977 to $4,603 million in 2000;

- the value of FDI in the state's manufacturing industry as a share of all FDI in the state rose from 49.7 percent in 1977 to 81 percent in 2000; and
- the state's foreign manufacturing share of all foreign U.S. manufacturing in the country more than doubled, increasing from .32 percent in 1977 to .73 percent in 2000.

Foreign Direct Investment into Arkansas
Gross Property, Plant and Equipment
in US$ Billions

Year	Total U.S. FDI	Total U.S. Mfg FDI	Total Arkansas FDI	Total AR Mfg FDI
1977	66.79	24.15	0.16	0.08
1978	80.63	29.45	0.21	0.11
1979	101.21	37.96	0.27	0.14
1980	127.84	46.79	0.42	0.23
1981	187.96	74.23	0.64	0.37
1982	225.24	84.74	0.83	0.40
1983	244.01	92.45	0.82	0.41
1984	269.46	101.93	0.99	0.48
1985	295.18	110.53	1.06	0.49
1986	320.22	114.07	1.14	0.43
1987	353.28	129.62	1.29	0.57
1988	418.07	153.87	1.71	0.95
1989	489.46	184.39	2.31	1.10
1990	578.36	223.89	2.34	1.22
1991	640.14	244.95	2.52	1.46
1992	660.83	24.15	2.79	1.78
1993	705.67	29.45	3.08	2.05
1994	754.38	303.70	3.60	2.37
1995	769.49	292.46	3.67	2.53
1996	825.70	303.92	3.83	2.62
1997	877.57	400.18	3.90	3.00
1998	990.33	506.47	4.07	2.98
1999	1,075.36	544.37	4.54	3.63
2000	1,176.13	507.66	4.60	3.73

Foreign real estate holdings in the state are also significant. By extracting the foreign real estate holdings from the total FDI in the state, we see that foreign firms increased the value of property, plants and equipment from $143 million in 1977 to $4,474 million in 2000. The share of Arkansas' foreign direct investment in manufacturing net of real estate increased from 53.85 percent in 1977 to 83.3 percent in 2000. Arkansas increased this net share of FDI more than all of its neighboring states with the exception of Texas. Arkansas rose from last position in 1977 for FDI in the state's net manufacturing industry, to sixth place above both Oklahoma and Mississippi in 2000.

Inward Foreign Direct Investment
in US$ Billions

State	1977 FDI	1977 GSP	1977 Ratio	2000 FDI	2000 GSP	2000 Ratio	Increase
Arkansas	0.16	14.92	1.04	4.60	66.79	6.90	6.63
Kentucky	0.65	28.51	2.28	21.93	117.22	18.71	8.19
Louisiana	3.16	39.37	8.03	31.05	144.98	21.42	2.67
Missouri	0.91	41.77	2.17	15.50	177.10	8.75	4.03
Mississippi	0.50	15.99	3.14	4.04	66.16	6.11	1.95
Oklahoma	0.80	23.89	3.33	7.82	90.94	8.60	2.58
Tennessee	1.34	33.55	3.98	20.31	177.40	11.45	2.88
Texas	6.74	131.61	5.12	110.85	738.27	15.02	2.93
U.S.	66.79	1,985.69	3.36	1,176.13	9,891.19	11.89	3.54

The table above clearly shows that FDI contributes significantly to the state's economy. With the exception of Kentucky, FDI in Arkansas was higher than in all of its neighboring states. Gross state product contributions from FDI in Arkansas is almost twice as much as the U.S. overall (6.63 vs. 3.54). Arkansas would benefit from increased FDI, especially FDI in high-tech, knowledge-based industries and/or high value-added manufacturing suitable to plants in the U.S. beyond wholesale distribution. Please refer to the recommendations later in this report where we suggest Arkansas strive to increase the employment contribution of FDI into the state.

Exports[12]

The table below shows the fluctuating trends in exports from the state of Arkansas and the U.S. overall. Arkansas' total exports increased from $2,304.78 million in 1997 to $2,816.6 million in 2003. Exports from Arkansas account for only a small but growing portion of exports from the entire country (approximately 0.4 percent).

Manufacturing export data reveals that 91 percent of all U.S. exports are manufacturing exports. In Arkansas, manufacturing exports grew from 93.7 percent of all of that state's exports in 1997 to 95.1 percent in 2003. Food and kindred products continues to be the largest export sector in Arkansas accounting for in excess of 20 percent of all manufacturing products exported from the state between 1997 and 2003.

Exports from Arkansas
Value of Shipments in US$ Billions, 1997 - 2003

Year	Arkansas	Arkansas Manufacturing	%	U.S.	U.S. Manufacturing	%	Total Exports AR % of US
1997	2.30	2.16	93.7	621.62	564.93	90.9	0.37
1998	2.29	2.14	93.7	618.75	567.67	91.7	0.37
1999	2.18	2.07	95.1	633.24	584.46	92.3	0.34
2000	2.60	2.50	96.0	721.96	667.89	92.5	0.36
2001	2.91	2.79	95.8	689.52	634.00	91.9	0.42
2002	2.80	2.66	94.9	658.79	603.59	91.6	0.43
2003	2.96	2.82	95.1	688.58	627.26	91.1	0.43

Trade Staff

Arkansas supports international trade and foreign direct investment through three international offices located in:

1. Tokyo (opened in 1985);
2. Mexico City (opened in the spring of 1994); and
3. Kuala Lumpur in Malaysia (opened in 1995).

Trade offices in foreign countries for states comparable to Arkansas are listed below:

- Texas (Mexico)
- Louisiana (Taiwan)
- Mississippi (Chile, the United Kingdom, Japan and Singapore)
- Missouri (Japan, Mexico, Ghana, Germany, the United Kingdom, Korea and Taiwan);
- Oklahoma (Korea, China, Mexico, the Netherlands, Vietnam, Israel and most recently Ghana);
- Kentucky (Japan, Mexico and South America); and
- Tennessee (Japan, Canada, the United Kingdom and Korea).

It is clear from the preceding analysis that foreign activity in Arkansas has an increasingly significant impact on the state's competitiveness. Exports of goods and services, particularly manufactured products, and foreign direct investment have the potential to further contribute to Arkansas' economic development.

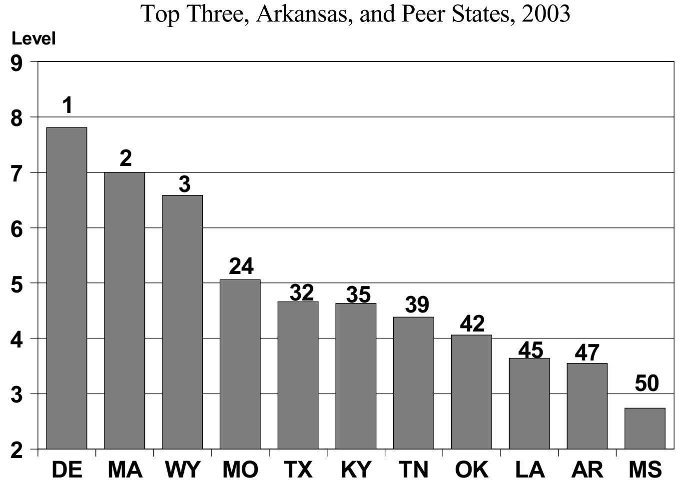
It is also important for state policy makers to recognize that relative to other states, Arkansas' share of the total U.S. foreign direct investment has declined. More specifically, Arkansas is capturing a larger share of the country's domestic and overall manufacturing employment, but a smaller share of the country's foreign manufacturing employment such that from 1977 to 1999 foreign manufacturing employment is less significant in the state than in the country as a whole. In effect, this data shows Arkansas slowly losing position in the competition for FDI into the United States.

It is interesting to note, however, that Arkansas's share of FDI in real estate is increasing in both absolute and relative terms.

Technological advances in logistics and the movement of goods and services are paramount to Arkansas' future success in attracting foreign firms into the state and exporting goods and services outside the state and the country.

Key Competitive Indices

Beacon Hill State Competitiveness Index
Top Three, Arkansas, and Peer States, 2003



Source: Beacon Hill Institute

Beacon Hill State Competitiveness Index

The Beacon Hill State Competitiveness Index provides a reference for measuring the long-term competitiveness of a state in direct comparison to the rest of the country. The Beacon Hill index is broken down into ten sub-indices that compare states on everything from state fiscal policy and finances to human capital and the local climate for business.[13] The index provides a useful tool for determining the relative strengths and weaknesses of a state in attracting new businesses as well as developing existing businesses within the state.

Beacon Hill State Competitiveness Index
Rankings for Arkansas, 2003

Sub-Indexes	Rank Among States (1=Best, 50=Worst)
Government & Fiscal Policy	20
Security	33
Infrastructure	48
Human Resources	48
Technology	50
Finance	5
Openness	44
Domestic Competition	50
Environmental Policy	15
Overall Competitiveness Index	47

Arkansas' key strengths, as identified by the competitiveness index, are in government and fiscal policy, environmental policy and finance—particularly the overall cost of doing business in the state. The state suffers in terms of per capita crime rate, computer and telephone use, human resources, openness, technology levels and how its companies fare against domestic competition.

On the Government and Fiscal Policy subindex, Arkansas fared relatively well in terms of overall tax rates and fiscal discipline. It trailed neighbors such as Tennessee and Kentucky in this regard, but performed better than Oklahoma, Mississippi and Louisiana. The state's fiscal policies provide an advantage relative to most of the country, and when combined with the low cost of operating within its borders, Arkansas proves quite competitive in attracting businesses that desire lower overhead and fiscal stability.

In terms of the Security subindex, Arkansas holds a position superior to most of its neighbors in terms of business views of its legal system, perceptions of public officials, and a relatively mild regulatory burden. Crime statistics are also lower on average than most of its neighbors. However, the state still trails the majority of the country in this category, suggesting it is viewed as less business friendly than many other states against which it is competing.

The Infrastructure subindex reveals significant competitive weaknesses for the state, particularly in terms of its technology infrastructure. Arkansas ranks in the bottom five in the nation in terms of percentages of households with computers, households with installed phones and households with Internet access. The state also trails all of its neighbors except Mississippi in these categories. These clear disadvantages outweigh any significant competitive benefits the state gains from its lower housing prices and relative lack of commute time.

Arkansas' overall standing on the Human Resources subindex is assisted by the state's relatively low labor costs, low union participation rates and low unemployment compensation costs. However, this is counterbalanced by significant deficits in worker training and education. Relatively poor resources in health care, both in terms of infant mortality rates and numbers of practicing physicians also harm the state's ranking in this regard. Arkansas ranked 48th on this subindex, placing it above Louisiana (49th) and Mississippi (50th), but well behind Missouri (19th).

Arkansas' ranking on the Technology subindex, 50th place, is the lowest of any of its ranking in the various subindexes. This subindex is comprised of many of the same indicators as used in the Milken Institute State Technology and Science Index, such as levels of research funding, numbers of scientists and engineers in the labor force, patents issued, and the role of high-tech companies in the state economy. Arkansas' score places it significantly behind neighbors such as Missouri (26th) and Texas (28th), but within a reachable distance of Kentucky (41st), Louisiana (47th) and Mississippi (47th).

Arkansas' ranking of fifth on the Finance subindex is its highest among all of the subindexes. This ranking is based on access to investment financing through the financial system and otherwise, as well as the cost of such financing. The ranking also includes such factors as cost of real estate and property rentals. The recent rise of venture capital in the state, combined with effective financial institutions and low overhead costs provide some significant comparative advantages to Arkansas in attracting businesses and benefiting those in the state. Arkansas ranked third in terms of apartment rental prices, which reflects the quantifiable advantages from the state's low cost of living.

The Openness subindex serves the purpose of measuring how well connected a state's economy is with the rest of the world, based on factors such as exports and air travel linkages. Although Arkansas has significant advantages for trade within the United States, including a central location, navigable rivers and a well-connected road network, these advantages do not apply as well when engaging in trade with the rest of the world. The state ranked 42nd in exports per capita and 43rd in outgoing foreign direct investment—almost all of which seems to be derived from large corporations such as Wal-Mart and Tyson Foods. Arkansas also lacks a major international passenger or freight airport with which to encourage tourism or conduct trade. The presence of a significant global cargo airfield in nearby Memphis does not seem to have a significant impact on the state's trade numbers. Although the state's international exposure is not essential to its economic role, it does limit the options of companies based there, leaving them less able to readily compete. The state's 44th place on this subindex lags all of its neighbors except Oklahoma, and contrasts sharply with the Texas' third place and Louisiana's fifth place.

Despite clear improvements in the state's venture capital network and significant job growth among existing companies in the northwest part of the state, Arkansas was 50th on the Domestic Competition subindex. The main reason for this ranking is the significant lack of businesses being created and companies based in the state staging initial public offerings of stock during the period covered by the index. The lack of new companies being created within the state is a significant handicap when trying to advance the position of the state in industries in which the state does not already have a clear presence. The ability to create new companies internally and have them flourish is at least as important as the ability to attract investment from companies based outside Arkansas.

Arkansas benefits significantly in terms of competition from its lower cost of compliance with its environmental regulations. The state's rank of 15th on the Environmental Policy subindex reflects this comparative advantage. The state's ranking places it into an equal or superior position to all of its neighbors, although it does lag well behind Kentucky's second place rank in terms of overall environmental policy. This more relaxed environmental policy has direct benefits to the bottom line for businesses operating in the state, and has certainly played a part in the location of new manufacturing there. Although a relaxed environmental policy does provide benefits to luring businesses, the state must reach a balance between the benefits to the local business climate and quality of life issues that may dissuade potential new workers from moving to the state.

Small Business Survival Index

Small Business Survival Index	Arkansas - 2003
Index Components	Rank Among States (1=Best, 50=Worst)
Personal Income Tax Rate	38
Capital Gains Tax Rate	24
Corporate Income Tax Rate	19
Property Taxes	5
Sales Tax	43
Unemployment Tax	35
Health Care Costs	9
Electric Utilities	9
Workers' Comp.	7
Crime Rate	26
Bureaucrats	28
Gas Tax	22
Overall Small Business Survival	25

The Small Business Survival Index is released annually by the Small Business Survival Committee in Washington, D.C. Its purpose is to rate the friendliness of state business climates to the establishment and survival of smaller businesses. According to the U.S. Small Business Administration, 90 percent of smaller businesses file as individuals and are thus affected by personal income tax rates. High consumption taxes discourage spending by consumers and can disproportionately affect smaller businesses. Texas (6th), Tennessee (7th), Mississippi (10th), Missouri (19th) and Louisiana (21st), all ranked higher than Arkansas on this index. Oklahoma and Kentucky trailed only slightly, in 27th and 28th place, respectively. Arkansas ranked much higher on this index than on the Beacon Hill index due to the fact that the state's business climate provides numerous cost advantages to small businesses, while its limited resources in technology, workforce training and infrastructure are more likely to hamper businesses looking to expand or relocate.

Arkansas' main advantages in providing a strong climate for small businesses are in lower workers' compensation costs, lower property taxes, affordable health care and moderate electricity costs. The state is hampered by higher-than-average personal income tax, sales tax and unemployment tax rates, and somewhat hampered by the crime rate and bureaucracy. Although the state's tax burden is lighter than most for mid-to-large-sized corporations, the tax burden more strongly affects small businesses in the state due to the higher relative costs for them in higher sales and personal income tax rates. It is important to note that lower corporate and property tax rates do not benefit startups and small businesses, since many are initially classified as corporations under state and federal tax law, and do not own the real estate on which they are located. Arkansas' overall ranking on this index does provide some positive indicators, and as seen from the Corporation for Economic Development Business Vitality subindex, businesses established in the state have a very high rate of survival.

Corporation for Economic Development Business Vitality Sub-Index

Business Vitality Sub-Index	Rank Among States (1=Best, 50=Worst)
Competitiveness of Existing Business	
Strength of Traded Sector	27
Business Closings	2
Manufacturing Investment	25
Industrial Diversity	15
Entrepreneurial Energy	
New Companies	45
Change in New Companies	1
New Business Job Growth	33
Technology Jobs	40
Initial Public Offerings	33

The Corporation for Economic Development issues an annual "Development Report Card for the States," which issues a grade for each state in terms of performance, development capacity and business vitality. The last of these is directly relevant to this study. Arkansas has an overall business vitality ranking of B for 2003. This grade is generated based upon nine different rankings divided into two categories: competitiveness of existing business and entrepreneurial energy.[15]

With its strong manufacturing sector and solid transportation links to other states, Arkansas is positioned fairly well in terms of competitiveness of existing businesses. The state ranked 27th on strength of the traded sector of its economy, which measures how many goods and services the state trades outside its borders. This rank is fairly solid, but could be improved considerably considering the presence of major trucking firms and other trade-related resources that could be further utilized. The state ranks 15th in terms of industrial diversity, a reflection of the many varied manufacturing concerns that have situated in the state due to its cost advantages. The lagging ranking of 25th in manufacturing investment, however, suggests that although many different kinds of industries have moved into the state, their overall commitment to the state is only average for the nation as a whole. Arkansas could improve its competitive position for attracting such investment by improving its transportation, business incentive and workforce training resources, among others. The one area in which the state stands out is in the rate of business closings, ranking second. This high ranking provides evidence that once businesses are established in the state, Arkansas' advantages in terms of costs and location help ensure the ability of such companies to remain in operation within the state.

The single most significant ranking for the state is in entrepreneurial energy—the percentage change in new companies within the state. Arkansas ranked first in the nation on the 2003 index, which is especially remarkable considering the state actually ranked 50th in the previous index. It must be made clear that the state still ranked 45th in the rate of new companies created, even though the rate of creation increased faster than any other state in the country. This improvement is significant in that it addresses one of the state's main weaknesses on the Beacon Hill Competitiveness Index—its poor ranking in terms of domestic competition. The state still ranked below the national average in terms of new business job growth and initial public offerings—33rd in each category—but continual increases in the number of small companies created should improve these rankings further. The relatively low ranking in technology jobs can only be addressed by providing a better climate for such companies to operate within the state and addressing the concerns outlined in this report.

[1] Much of the information contained in this section is based on the previous research of Wallace, Lorna H. 1998. 'Sub-National Competitiveness for Inbound Foreign Direct Investment,' *The Global Economy at the Turn of the Century.* Volume 1, International Trade. Gulser Meric and Susan Nichols eds., pp. 117-135.

[2] Krugman, Paul. 1994. 'Competitiveness: Does it Matter?' *Fortune*. March 7, pp. 109-112, and Dunning, John H. 1995. 'Think Again Professor Krugman: Competitiveness Does Matter' *The International Executive*. 37(4). July/August, pp. 315-324.

[3] Wade, R. 1989. 'The Role of Government in Overcoming Market Failure,' *Achieving Industrialization in East Asia*. Hughes, ed. Cambridge, Mass: Cambridge University Press.

[4] Porter, Michael E. 1990. *The Competitive Advantage of Nations*. New York: The Free Press.

[5] Gray, H. Peter and Lorna H. Wallace. 1996. *New Jersey in a Globalizing Economy*. CIBER WP Series. New Jersey: Rutgers University, No. 96.003, Sept.

[6] Foreign direct investment (FDI) is recognized as a particular form of economic involvement by firms outside their national boundaries. The investment is made outside the home country of the investing company, but inside the investing company. Unlike portfolio investment, FDI consists of a 'package' of assets, capabilities and intermediate products such as capital, technology, management skills, access to markets and entrepreneurship. The distinction between direct and indirect or portfolio investment is that in the former, resources are transferred internally within the firm rather than externally and financially between two independent parties (Dunning, 1993). Capital is simply a conduit for the transfer of these resources.

FDI is an investment involving a long-term relationship and reflects a lasting interest and control implying that the investing entity may exert a significant degree of influence on the management of the enterprise resident in any other economy. It may be undertaken by individuals as well as business entities (UNCTAD, 1995).

The precise definition of FDI differs among countries. In this research, the United States Department of Commerce definition is used because it forms the basis for the collection of much of the secondary data analyzed. The FDI component of any investment is, therefore, the ownership by a foreign person or business of 10 percent or more of the voting equity of a firm located in the United States (U.S. Dept. of Commerce, August, 1991). It includes investment in new plants and the purchase and development of real property (U.S. Dept of Commerce, ITA, 1981).

FDI stock, the net accumulation (incoming flows - outgoing flows + prior stock) of the direct investment activities of foreign multinational enterprises into the state of Arkansas, is analyzed as at the end of each of the calendar years under study. The particular interest in the research for this report is inward or inbound direct investment that flows into Arkansas from outside of the United States. It encompasses what some may call 'reverse investment'.

[7] Dunning, John H. 1988. *Multinationals, Technology and Competitiveness.* London: Allen & Unwin.

[8] United Nations Conference on Trade and Development (UNCTAD). 2003. *World Investment Report.* New York and Geneva: U.N. Press.

[9] The term multinational enterprise (MNE) is used interchangeably with that of the multinational firm, multinational corporation, transnational enterprise and transnational corporation. The MNE is defined as a firm that owns and controls value-adding activities in more than one country (Dunning, 1993).

[10] Arkansas Department of Economic Development Research. Little Rock. 2003 *Arkansas Economic Report.* and Research Team, Arkansas Department of Economic Development. Little Rock. 2001 *Arkansas International Business Climate Report.*

[11] Following the research of Graham and Krugman (1989; 1991; 1995) the significance of inward FDI to the economy of the State of Arkansas is measured by the percentage of foreign to total employment located in the State.

[12] The analysis of sub-national export share is derived from the international trade theory of comparative advantage. Since the research of David Ricardo (1817), economists have stressed that nations, regions and sub-national units should export those goods and services which they produce most efficiently (while importing those goods and services which they produce the least efficiently).

United States Trade Data, collected by the United States Customs Service, includes merchandise exports only on a state-by-state basis. No equivalent data set exists on trade in services. Due to the growth in significance of service sector production, this gap in the data is unfortunate. To this extent, export data from the state of Arkansas, is highly imperfect. It is however, for the years presented, consistent and relative (data from other states within the U.S. suffer from the same limitations) enabling comparisons and our analysis.

The export statistics are derived mainly from mandatory information supplied by commercial exporters to the Customs Bureau, which reports these figures to the Bureau of the Census. These figures are supplemented by data from some exporters who report their shipments directly to Census.

The United States Census Bureau issues two principal data sets that provide merchandise export statistics for sub-national jurisdictions. They are the Exporter Location series and the Origin of Movement series. The data set used for

this research is the Exporter Location (EL) series due to the regional nature of the issue under study.
The Exporter Location series allocates exports according to the physical location of exporters—it typically traces the export initiative to the point of sale. Because this series measures export sales activity by exporters of record only and that locations from which firms sell their products do not always coincide with the locations where export goods are produced, some caution must be exercised with use of these statistics. In addition, while export intermediaries are an important influence on the statistics, other circumstances can also cause production and sales locations to diverge. For instance, the marketing division of an exporting company, not the manufacturing division, may be the exporter of record. In such cases, and where marketing and manufacturing operations are located in different states, the state of the exporter of record and the state of production will not be the same. The EL series export information on a state-by-state basis is available (in total or aggregate form) for the years: 1987; 1991–1995. In addition, it is available on a limited state-by-state basis, with some (albeit limited) industry breakdown to a very few destinations. EL data has been discontinued as of 2002.
The Origin of Movement (OM) has complete data available back to 1987. The OM series seeks to determine the "origin of movement" of exports (i.e., the site from which exports begin their journey to the port of exit). Essentially, the origin of movement is the same as the transportation origin of exports. Because "point of origin" is defined primarily in terms of state location, the OM series (in contrast to the zip-code-based Exporter Location series), cannot provide export statistics for metro areas, towns or zip codes. The origin of movement and the origin of production are often identical because many manufacturers ship exports directly from the factory gate, or from a nearby distribution facility.
Data to analyze the state of Arkansas are based on the Origin of Movement Series. Historical comparisons are limited in that 1997 is the first year for which this data, on a state-by-state basis, is collected by industry. Because the OM series data will continue to be collected in this form, our analysis enables, or indeed provides the State of Arkansas with the option to review and update these figures for future year investigations.

[13] Beacon Hill Institute for Public Policy Research. Boston. *Metro Area and State Competitiveness Report 2003*.

[14] Keating, Raymond. *Small Business Survival Index 2003*. Washington, D.C.: Small Business Survival Committee.

[15] The Corporation for Enterprise Development. Washington, D.C. 2003 *Development Report Card for the States.*

Industry Group Analysis

Methodology

For the purposes of this report, the Milken Institute investigated 282 individual industries operating in the state of Arkansas from 1992 to 2002. The industries were separated into three groupings: Tier 1, high-tech industries; Tier 2, other knowledge-based industries; and Tier 3, all other industries.

One of the most difficult tasks in analyzing high-tech industries is determining which industries to include in the definition. The definition used will vary depending upon the research interests and data availability across a number of different dimensions. For the purposes of this study, a two-pronged approach that considers both industry and occupation characteristics is used. Our methodology attempts to capture the interesting dynamics of the combined industry/occupation relationship.

The industry level of assessment focuses on the value of output for industries that may be considered high-tech. Industries that reinvest a large portion of gross revenues back into R&D are captured along with those that employ an above industry-average number of technology-using occupations such as scientists, engineers, mathematicians and programmers. Each is actively engaged in the utilization of technology and innovation. The occupation approach includes technology-using occupations that are in specific high-tech industries. Not all occupations traditionally considered high-tech are included. For example, electrical engineers, regardless of which industry is employing them, will not automatically be included. Human capital requires high-skilled workers. With this methodology, the high-tech component of the occupation is isolated. Our combined approach best meets the needs of this study: the determination of the individual contributions of high-technology to economic performance in Arkansas.

Knowledge-based industries are nonhigh-tech industries that pay above average annual wages in both Arkansas and the country as a whole, and utilize workers with above average skill sets. The occupational mix of the industry is also taken into consideration in determining which industrial sectors contain a sufficient knowledge component for Tier 2 classification.

More than 20 high-tech industries and more than 60 knowledge-based industries contributed to the Arkansas' economy during the period 1992 to 2002. The results of our analysis—the significant findings within each tier, industry group and individual industry segment—are explained below for:

- the state of Arkansas overall;
- each of the major metropolitan areas in the state (i.e., Fayetteville-Springdale-Rogers, Little Rock-North Little Rock, Fort Smith, Texarkana, Jonesboro, Pine Bluff, Crittenden County and Hot Springs); and
- rural or de-localized areas in the state.

The bubble charts used in this report visually display a three-dimensional perspective on industry status in Arkansas by four-digit National American Industry Classification System (NAICS) code. Each bubble chart offers a snapshot of the industry structure in the state. The size of the bubble reflects employment size in each sector. The vertical y-axis positioning of each bubble corresponds to its concentration or location quotient, a visual perspective of the relative importance of the industry to the state as compared to the national average. The horizontal x-axis positioning of each bubble displays how fast a sector is growing relative to the national average. As a quick rule-of-thumb:

- the larger the circle, the more the people employed in that industry in the state or metro area;
- the higher up the bubble, the greater the significance of that industry to the state or metro area. The horizontal line at 1.0 indicates the U.S. national average concentration (equivalent to a location quotient of 1). For a high-tech or knowledge-based industry, you would want a location quotient of 1.0 or greater.
- the farther to the right the bubble is, the faster that industry is growing relative to the country as a whole. High-growth industries are represented by bubbles to the right of the vertical line at 100, which indicates the average growth in the U.S. for the industries; and
- a bubble positioned high up and to the right (i.e., the top right-hand quadrant) is, by definition, a key industry in the state or metro area.

A location quotient (LQ) measures the concentration of an industry in a geographic location relative to its national concentration. For example, a high-tech industry location quotient of 1.0 says that its high-tech activity has the same concentration in the state as the U.S. average. A location quotient of 2.0 means that the industry has twice the concentration in that area relative to the U.S. average, while a location quotient of 0.5 means that it has one-half the concentration. Location quotients are a proven method for analysis for determining what industries are of greatest economic importance to the state of Arkansas. Location quotient analysis is particularly useful in the area of regional economics and economic geography. Location quotients are an effective method for displaying the relative importance of an industry to the economy overall, or a sub-segment of it such as a metro area.

A number of separate data sources have been utilized in our statistical analysis in order to obtain the most complete information available on industrial activity in Arkansas. The principal data sources are: (1) the Bureau of Economic Analysis (BEA); (2) the U.S. Census Bureau; and (3) the Bureau of Labor Statistics. Other tertiary data sources have also been utilized in order to gain additional information regarding trend activity within the state. These data sources are accepted as comprehensive and reliable sources of information on industrial activity at the county, major metro, state and national levels.

Earlier sections of this report describe many of Arkansas' attributes and comparative advantages from which the state's overall competitiveness and its technology and science capabilities may be understood. A further drill-down into specific industries and segments that the state may consider for strategy initiatives and public policy recommendations, follows.

High-Technology Industries

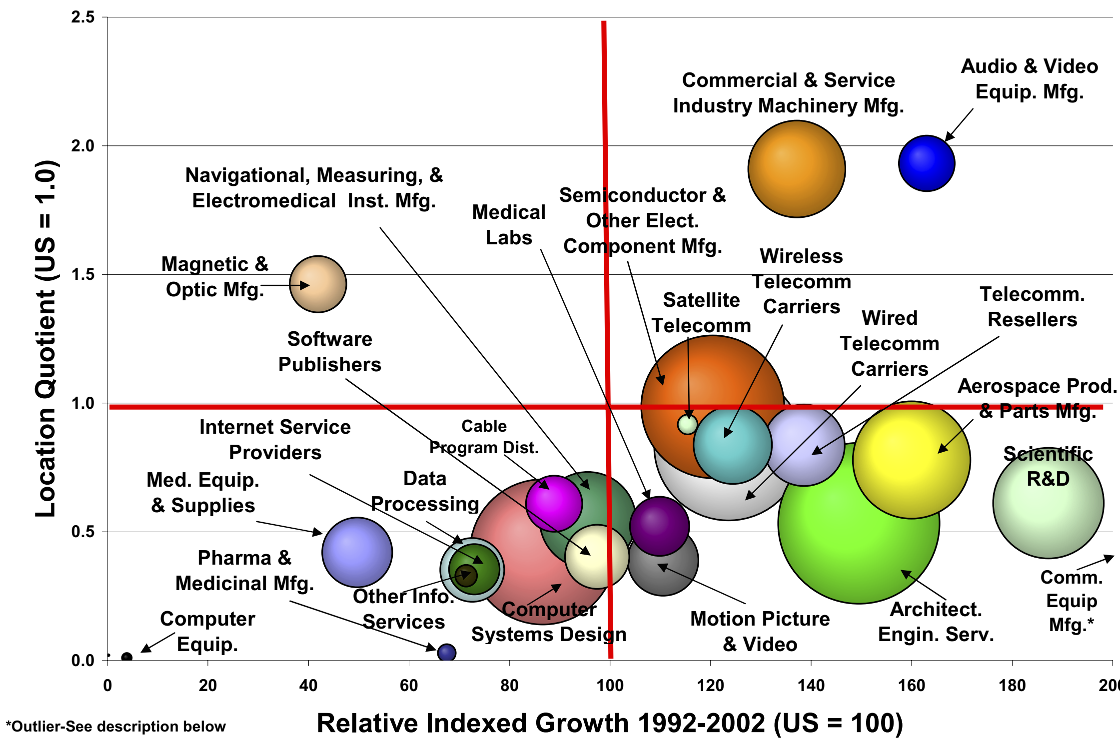
Background and Relevance

An assessment of Arkansas' high-technology industries is critical to gauging the performance of its economy. High-technology industries comprise an ever-increasing proportion of economic output by the country as a whole and therefore, are important for monitoring business-cycle developments. Most importantly, the high-tech sector can be a boost to the long-term potential economic growth path of Arkansas. Technological advancement embodied in new and more efficient traditional capital goods, and their innovative implementation in the business sector, are prime determinants of economic growth.[1]

Employment in Arkansas' high-tech sector as a share of total employment in the state increased from 1.7 percent in 1992 to 1.9 percent (10,739 persons) in 2002 (the U.S. average figure was 6.4 percent). Our analysis reveals that few of these high-tech industries contribute to Arkansas' economic growth in a meaningful way. A pictorial representation of Arkansas's high-technology industrial composition is presented on the following page.

Arkansas' High-Tech Industries

Employment by Size, Growth and Concentration



From the above chart we see that the commercial and service industry machinery manufacturing sector is the most export-intensive high-tech industry in Arkansas. That sector employed 2,194 people in 2002 (396 more than a decade earlier) ranking 7th for employment in the state's high-tech sector. Its significance to Arkansas is reflected in the location quotient for this sector—1.91 in 2002 up from 1.39 in 1992. In addition, commercial and service industry machinery manufacturing is a high-growth industry in Arkansas relative to that in the country as a whole.

Audio and video equipment manufacturing is also significant to Arkansas. Its location quotient was 1.93 in 2002, up from 1.19 a decade earlier. The size of that sector in Arkansas is relatively small however, employing only 722 persons in 2002 up from 554 in 1992. Audio and video equipment manufacturing is a high-growth industry relative to that of the U.S. as a whole. Employment growth in this sector over the 10-year period ranked just above average for the state at 12th out of Arkansas' total 25 high-tech industries.

The high-tech industry segments that employed the most people in Arkansas in 2002 were:

- Architectural engineering and related services (6,026 employees);
- Wired telecommunications carriers (5,138 employees); and
- Computer systems design and related services (4,909 employees).

Each of these three high-tech industries had strong positive rates of employment growth change in the state with 96 percent, 54 percent and 113 percent employment growth respectively from 1992 to 2002. In addition, each experienced above average or about average rates of employment growth relative to that in the U.S. overall. It is significant to note the decrease during this time period in the wage rate per employee in the architectural engineering and related services sector from $35,400 in 1992 down to $31,200 in 2002. Therefore, even though this sector experienced Arkansas' fifth highest rate of change in employment growth, its potential contribution to the state was constrained.

Of the total high-technology industries examined in Arkansas, the sectors that ranked highest for employment growth change over this decade were:

- Communications equipment manufacturing (a huge 1,893 percent); and
- Software publishers (139 percent).

Communications equipment manufacturing warrants special mention. No bubble appears on the above chart for this industry segment. Its circle falls way off the chart—relatively low and very far to the right—making it, in statistical terms, an "outlier."

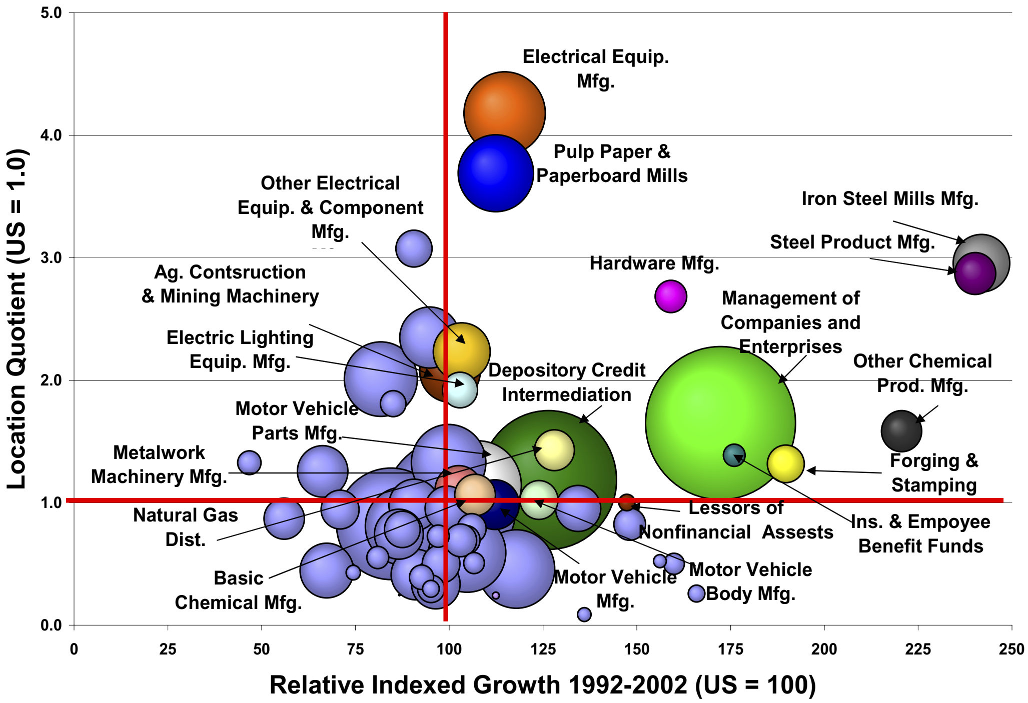
Of all the industry sectors in Arkansas, communications equipment manufacturing achieved the greatest employment growth from just 58 employees in 1992 to 1,156 in 2002, and the greatest GSP growth from $0.8 million in 1992 to $11.2 million in 2002. The location quotient for communications equipment manufacturing was 0.68, indicating that the concentration of this high-tech industry in Arkansas is less than in the U.S. overall. This is discussed further in the Recommendations section of this report as this industry may potentially be one of Arkansas' highest growth industries.

Nonhigh-Tech Knowledge-Based Industries

Employment in Arkansas' knowledge-based sector as a share of total employment in the state decreased from 8.4 percent in 1992 to 8.0 percent in 2002 (the U.S. average figure was 16.0 percent). Therefore, although the actual number of employees in this sector increased from 163,362 in 1992 to 186,092 in 2002, the contribution that knowledge-based industries made to Arkansas' economic growth, declined. A pictorial representation of Arkansas's knowledge-based industrial composition is presented below.

Arkansas' Nonhigh-Tech Knowledge-Based Industries

Employment by Size, Growth and Concentration



Employment in Arkansas' knowledge-based industries, in 2002, is the greatest in the management of companies and enterprises industry with 22,318 employees, and in the depository credit intermediation industry with 18,378 employees. Both of these segments employed a significant number of people in the state in 1992 and 2002, experienced double-digit employment growth and increased wage rates. In both 1992 and 2002, management of companies and enterprises and depository credit intermediation contributed substantial and increasing amounts to Arkansas' GSP. The concentration of these knowledge-based industry segments in the state increased to significant levels with location quotients for each rising above 1.0 in 2002.

The following 10 knowledge-based industry segments exhibited high and increasing location quotient, wages, employment and GSP from 1992–2002:

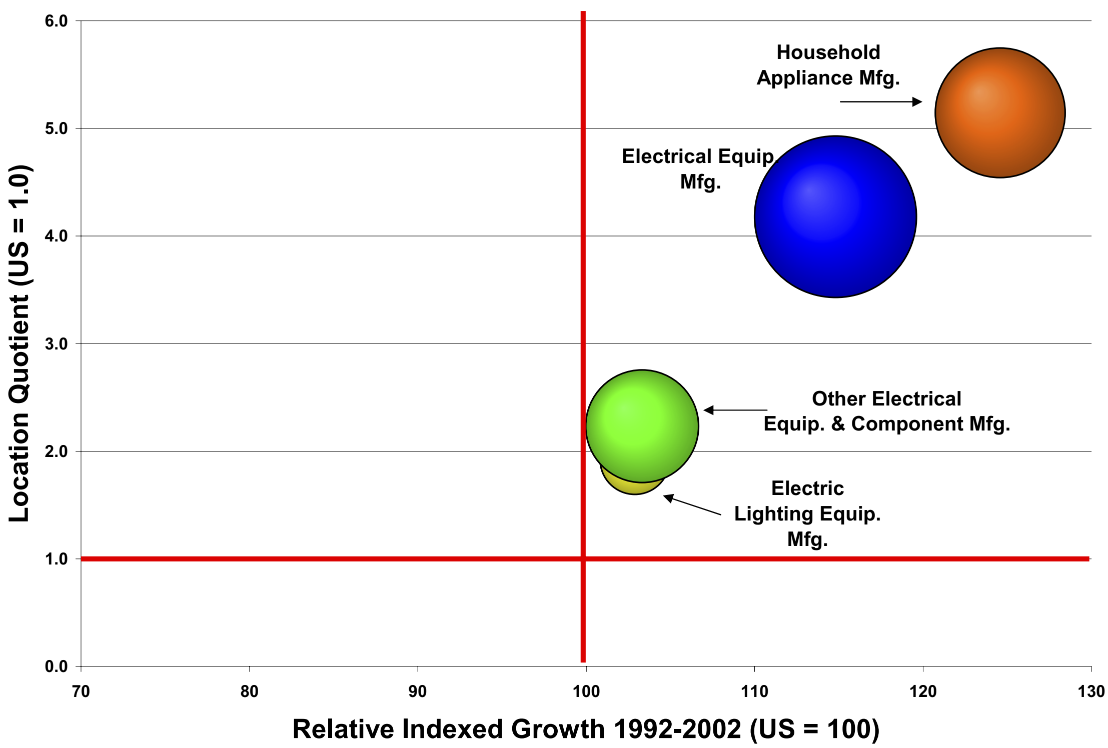
- Iron and steel mills and ferroalloy manufacturing
- Steel product manufacturing from purchased steel
- Hardware manufacturing
- Management of companies and enterprises
- Insurance and employee benefit funds
- Forging and stamping
- Depository credit intermediation
- Motor vehicle parts manufacturing
- Activities related to credit intermediation and
- Motor vehicle body and trailer manufacturing.

Arkansas' above-average knowledge-based industry performers in terms of employment concentration are electrical equipment manufacturing, and pulp, paper and paperboard mills (see the Texarkana metro section later in this report). Although the wage rate per employee increased in each of these two sectors from 1992 to 2002 by $6,900 and $14,800, respectively, the industries employed 1,382 fewer people. The electrical equipment manufacturing industry experienced the highest GSP growth overall for knowledge-based industries operating in the state from 1992 to 2002.

Among all of its knowledge-based industries, pulp, paper and paperboard mills, a traditional source of strength for Arkansas, experienced the state's fifth greatest decrease in GSP contribution (-37.2 percent) from 1992 to 2002. This is an industry in decline as evidenced by the decreases in employment and GSP contributions in rural Arkansas, in the state as a whole, and in the U.S. overall. It is interesting to note however, that the pulp, paper and paperboard mills industry is the most significant knowledge-based industry in the metro areas of Texarkana and Pine Bluff with each experiencing double-digit location quotients and employment increases of over 30 percent.

Arkansas' Electrical Equipment Manufacturing Industries

Employment by Size, Growth and Concentration



The bubble chart above presents a visual image of electrical equipment manufacturing in Arkansas. Each of these knowledge-based industry segments are located in the top right quadrant. The table below shows details of some of the key industry measures displayed above. Household appliance manufacturing is an industry that is not knowledge-based but has a high concentration in the state.

From the table below, we see that each industrial segment within Arkansas' electric industries equipment manufacturing sector contributes tremendously to the state given the high gross state product figures. Although wages in each sector have increased, the job losses from 1992 to 2002 clearly show that the industry is in decline. More macro statistics reveal that these declines are also being experienced in the U.S. overall. With the exception of household appliance manufacturing, the percent decreases in employment are greater in the U.S. overall than in Arkansas. This is evidence that the industry's decline is being felt more severely at the national level than statewide.

Arkansas' Electric Industries Equipment Manufacturing
Listed in Order of Location Quotient Value

NAICS	Industries	'92 Employees (Thousands)	'02 Employees (Thousands)	'92 - '02 Empl. Growth (Millions)	2000 GSP	1992 - 2002 GSP Growth
3353	Electric Equipment Manufacturing	6.743	6.556	-2.80%	1305	537%
3359	Other Elec. Equip/Component Mfg.	3.656	3.206	-12.30%	577	342%
3351	Electric Lighting Equip. Mfg.	1.299	1.222	-6.00%	251	387%
3352	Household Appliance Mfg.	3.897	4.224	8.40%	1254	765%

All Other Industries or Industries Key to Arkansas

The five top key industries in Arkansas, based upon overall size of employment, GSP contributions, LQ and increasing wage rates are shown in the table below.

Food Industry

Industry	2002 Employment	2002 LQ	2002 GSP	+ Wages
Food Manufacturing	53054	All >1	$2.356 B	Yes
Freight Transportation	36194	2/3 >1	$2.147 B	Yes
General Merchandise Stores	34654	All >1	$1.371 B	Yes
Wood Products Manufacturing	14750	All >1	744 M	Yes
Plastics, Rubber Product Mfg.	13851	All >1	$904 M	Yes

Background and Relevance

History matters. The spatial location of economic activity is path dependent. Industrial development within Arkansas is laid down, layer by layer upon inherited, previous location formations. This is the type of base from which clusters are formed.

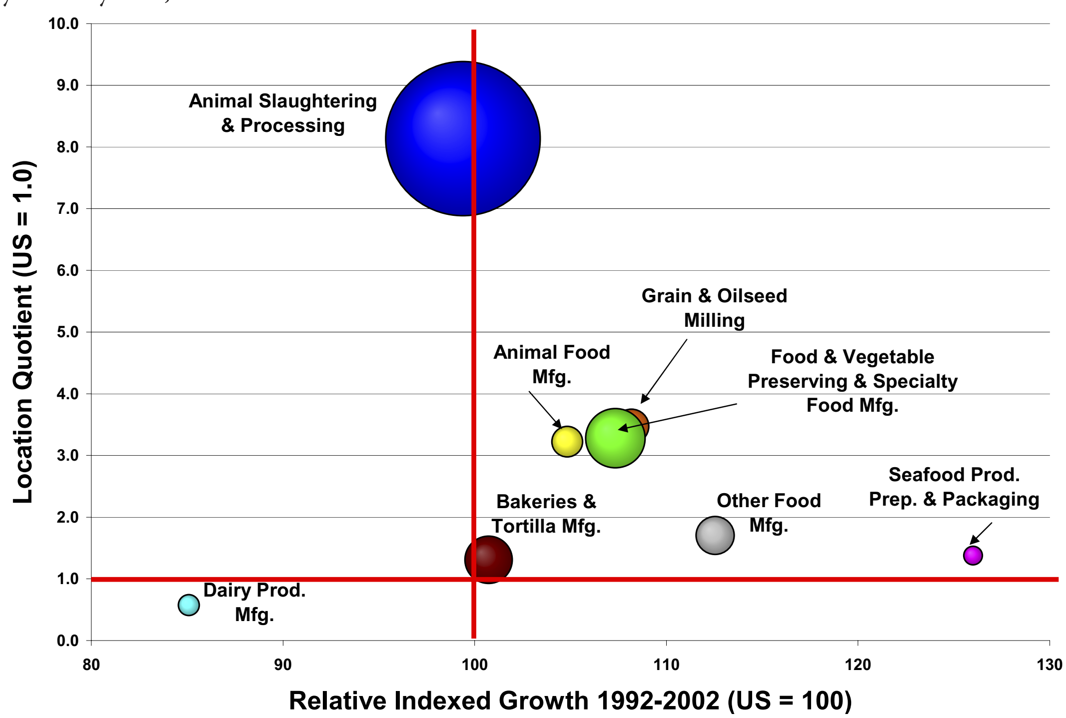
A striking feature of the economic history of Arkansas is Tyson Foods, the world's largest protein producer. The company was started in Arkansas by John Tyson's grandfather. Its global headquarters are located in Springdale. Within the state, Tyson Foods has a variety of economic activities including poultry complexes, processing plants, feed and blending mills, hatcheries, distribution and training centers, packaging warehouses and administrative offices to support its core and subsidiary operations.

The manufacturing industry overall is in decline with "the drop in manufacturing jobs in the United States unlikely to slow down soon."[2] Indeed, the loss of U.S. manufacturing jobs to offshore countries has been under way for the past three decades and is likely to continue into the foreseeable future."[3] Within manufacturing, food processing is one of the two most resilient industries (chemicals being the other) over the past three years. Although manufacturing job losses are extremely difficult for Arkansas, the state's strength in food manufacturing is a definite comparative advantage. Food manufacturing in and of itself is not a high-tech or knowledge-based industry. Within food manufacturing, however, there are many areas for increased technology and science applications. American consumers have highly sophisticated and increasing demands for fresh, healthy foods. Speed-to-market, logistics networks, quality control, and the accurate matching of supply and demand, are areas in which technology and science can be further applied in Arkansas's food industry. Arkansas's comparative advantage in food processing could lead to a competitive advantage in the nation.

The size, growth and concentration of Arkansas' food manufacturing industry are shown in the following bubble-chart snapshot of the region.

Arkansas' Food Manufacturing Industries

Employment by Size, Growth and Concentration

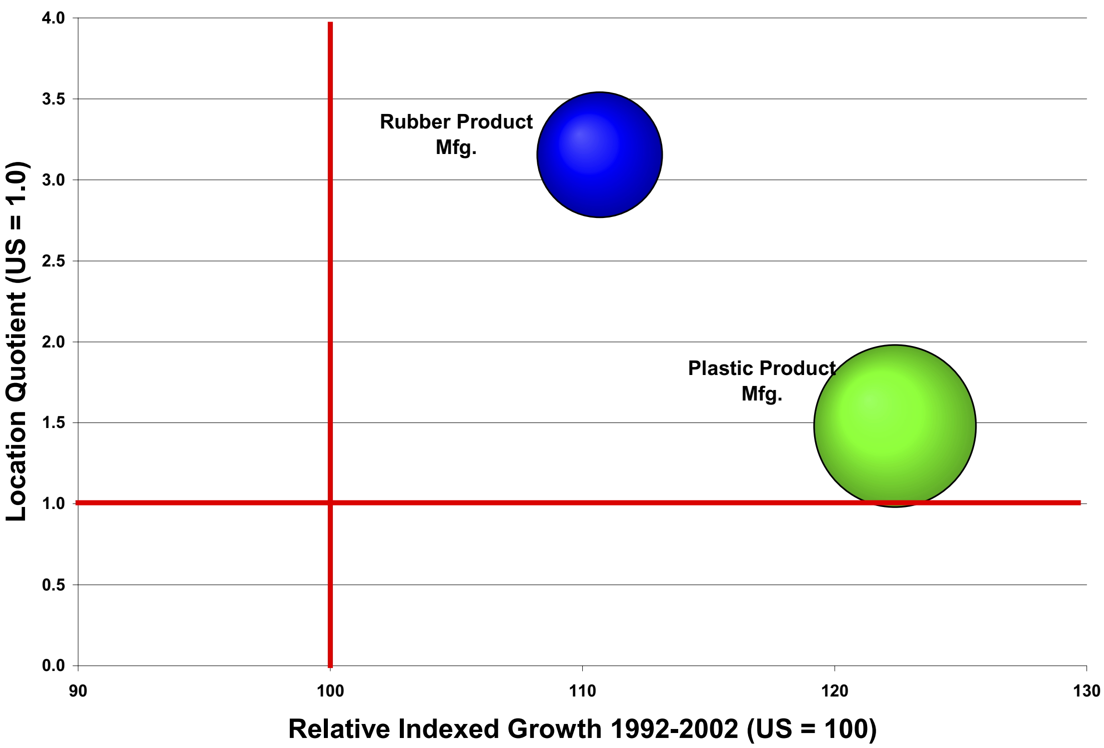


The previous bubble chart vividly illustrates that, with the exception of dairy product manufacturing, all of Arkansas' food manufacturing industries experienced high employment concentration and above average growth in the state. Although the number of people employed fluctuated (increasing in three sectors and decreasing in the remaining six) overall employment increased by close to 5,000 persons.

Animal slaughtering and processing is the food manufacturing industry with the highest concentration in the state. Employment in this segment increased from 31,565 in 1992 to 36,991 persons in 2002; productivity rose and its contribution to the Arkansas' GSP went up by 47 percent. Animal slaughtering and processing is clearly the key component of Arkansas's food industry.

Arkansas' Plastics and Rubber Product Manufacturing

Employment by Size, Growth and Concentration



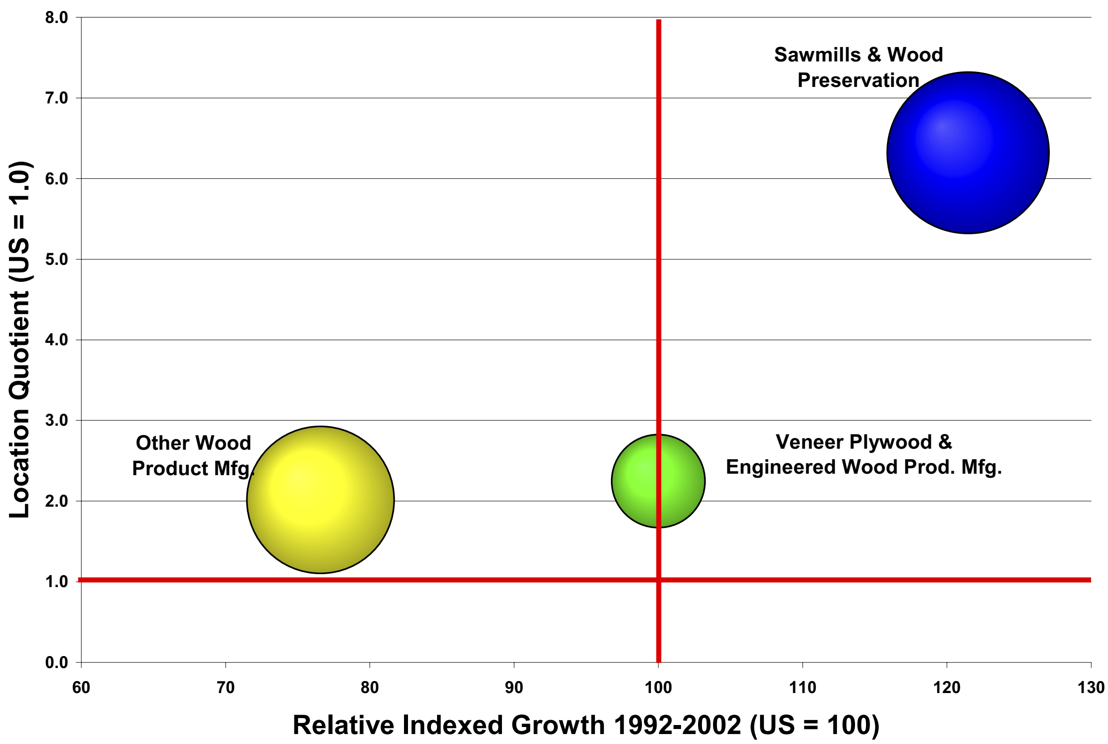
Although only two industry segments are captured in the above bubble chart, each is key to the Arkansas economy. From 1992 to 2002, both rubber product manufacturing and plastics product manufacturing:

- increased the number of persons employed in Arkansas, totaling 11,603 in 1992 and 13,851 in 2002;
- showed high growth and strong concentration in the state;
- contributed above-average and substantial revenue to Arkansas' GSP; and
- increased the wage rate per employee.

Plastics and rubber product manufacturing is a key industry in Arkansas.

Arkansas' Wood Products Manufacturing Industries

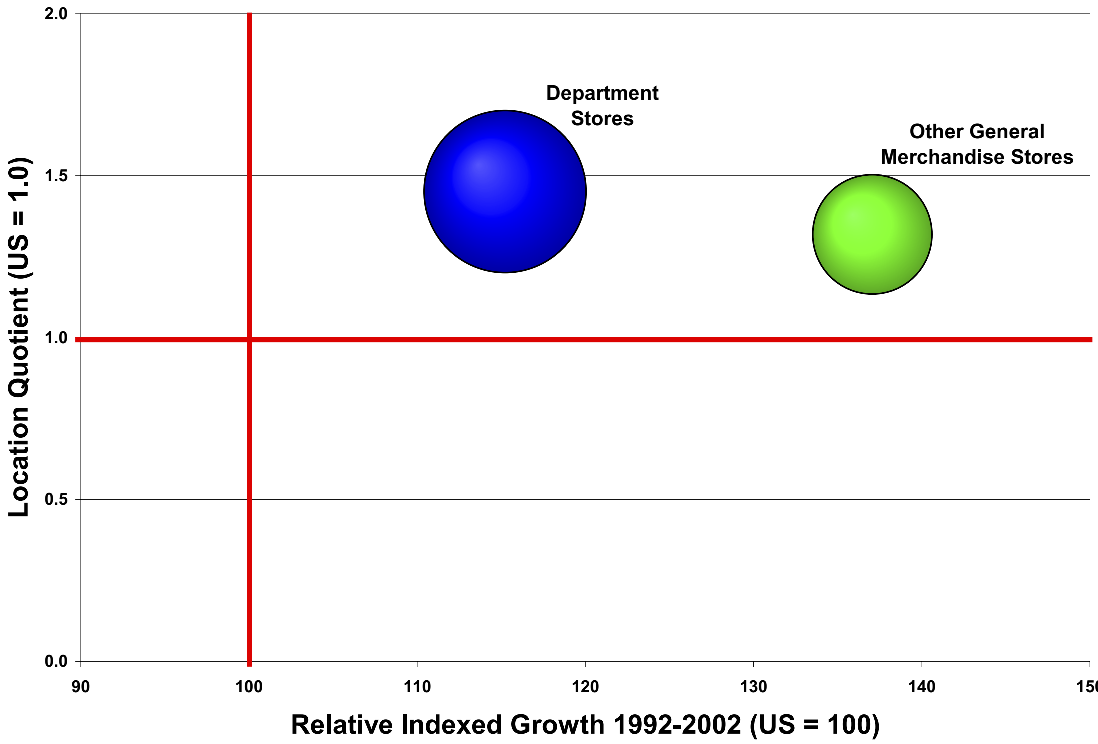
Employment by Size, Growth and Concentration



The above bubble chart shows the three industry segments within Arkansas' wood products manufacturing industry. The state's sawmills and wood preservation industry presence in Arkansas is greater than the U.S national average. It is a high growth industry in the state and it is the largest employer in the wood products manufacturing sector with 6,814 employees in 2002, up from 6,159 in 1992. Wood products manufacturing is a key industry in Arkansas, employing 14,750 people in 2002, up from 14,351 in 1992, and contributing almost $745 million to Arkansas' GSP in 2002. Rural Arkansas is the recipient of more than 75 percent of this industry's contribution to the state in employment (11,562 persons) in 2002.

Arkansas' General Merchandise Stores Industries

Employment by Size, Growth and Concentration



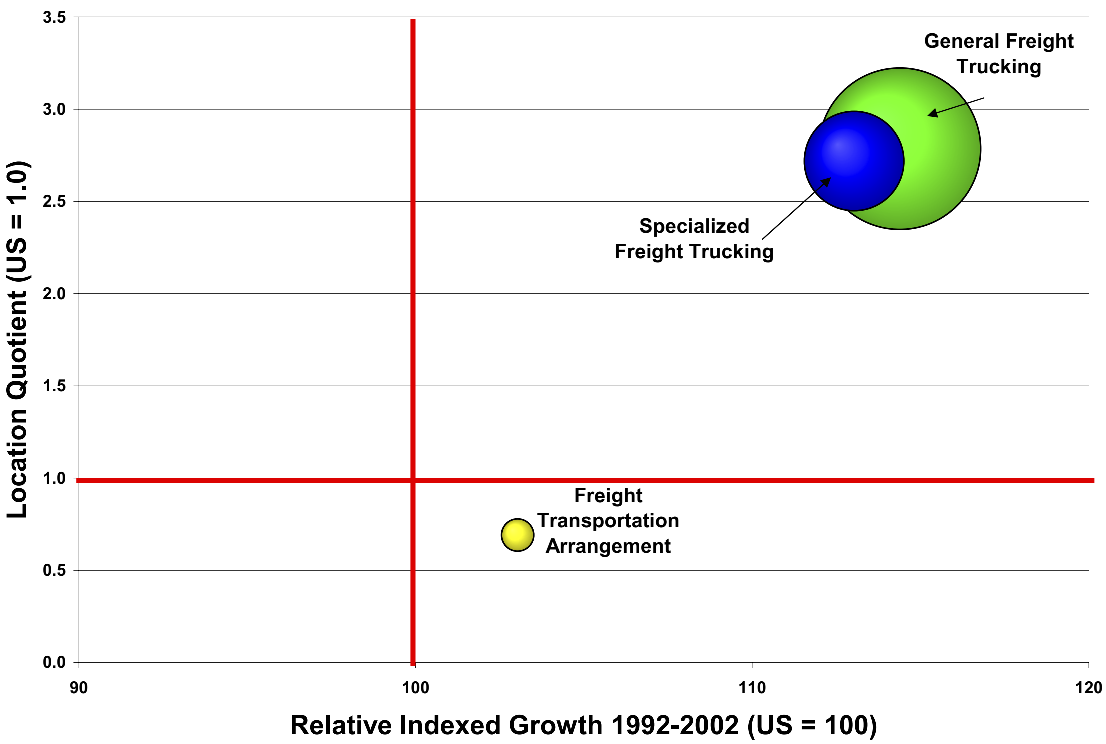
Each of the two industry segments captured in the above bubble chart—department stores and other general merchandise stores—are key to Arkansas in that over the period 1992 to 2002 both:

- increased the number of people employed in Arkansas with 34,654 employees in 2002, up from 24,516 in 1992;
- showed high growth and strong concentration in the state;
- contributed above-average and substantial revenues to Arkansas' GSP; and
- increased the wage rate per employee.

The general merchandise stores industries are key to the Arkansas economy.

Arkansas' Freight Transportation Industries

Employment by Size, Growth, and Concentration



The above bubble chart shows that each of Arkansas' freight transportation industry segments—general freight trucking, specialized freight trucking and freight transportation arrangement—are positioned well to the right of the y-axis displaying growth in Arkansas greater than the U.S. average. General freight trucking and specialized freight trucking are both high-growth and significant industries in Arkansas. GSP contributions in each totaled $1,508.33 million and $585.62 million, respectively, up more than 80 percent from 1992 to 2002.

From the size of the freight transportation arrangement bubble we know that this industry segment employs a smaller number of people in the state—1,038 in 2002, up from 758 in 1992. The freight industry overall, however, contributes greatly to overall employment with 36,194 employees in 2002, up approximately 50 percent from 24,310 employees in 1992. Wage rates in freight transportation rose above $34,000 per employee in 2002. Two major trucking companies contribute to Arkansas' strength in this industry—J. B. Hunt Transport Services, Inc. and ABF (Ark Best Freight).

J.B Hunt Transport Services, Inc. is a diversified transportation and logistics company and is the largest publicly held truckload carrier in the U.S. The company takes in more than $2.25 billion in revenue and utilizes the latest technology. J.B. Hunt was placed in *Computerworld's* top "10 Best Places to Work in IT" over the last decade. Its corporate headquarters are located in Lowell, Arkansas.

ABF Freight System, Inc. is one of North America's largest and most experienced motor carriers. The company has earned numerous awards for its excellence in technology-supported applications.

Major Metro Areas

Technology's Importance in Metro Growth Patterns

How important is geographic clustering of high-tech industries to the success of metropolitan areas, and how can this be quantified? Achievement in high-tech is a critical determinant of overall growth patterns in metros. Because of the growing role of high-tech industries in the national economy, metros that do not achieve some level of attainment in these critical industries will likely experience substandard economic growth in the future. While high-tech is not the only development strategy to pursue, it will be the key distinguishing feature of metropolitan vitality.

High-tech industries have large direct economic impacts on metropolitan economies, but the indirect and induced effects are critical to a complete synthesis of their role in promoting growth. The indirect effect—the incremental stimulus to nonhigh-tech industries—from high-technology industries on metro economies is substantial. The induced effects stem from the purchase of more goods and services by nonhigh-tech firms and their employees as a result of higher sales and increases in personal income. Because of the high value-added production and the greater demand for high-skilled labor, high-tech industries compensate their employees well.

As high-technology industries grow and clusters develop, a vast supplier-network infrastructure is formed. The demand for locally produced professional services expands. The demand for legal services with expertise in technology-specific industries rises. Other professional management consulting and financial services grow in the local economy. These are highly compensated occupations that further stimulate local economies. Other services benefit, including telephone communications, air transportation, hotel and other related travel services and utilities. High-tech manufacturing firms foster gains in manufacturers that supply inputs to them. Many high-tech services such as software development have larger multipliers than high-tech manufacturing because more of their inputs are purchased locally and labor represents a greater share of their total purchased inputs. High-tech service firms most often purchase components from local sources, either domestic or foreign, increasing the linkages within the metro economy. Another important channel through which high-tech industries promote growth locally is the in-migration of knowledge workers, other labor and their families.

The impact on construction markets can be large. Residential construction is stimulated from high rates of in-migration resulting in greater building of single-family homes, condominiums and apartments. The construction of new high-tech manufacturing facilities is a massive investment. A new semiconductor plant can cost upward of $3 billion to construct. High-tech plants under construction purchase large quantities of local building materials and provide employment to many construction workers. High-tech service firms can absorb an immense amount of office space leading to a decline in vacancy rates and, ultimately, new construction. Retail trade benefits indirectly from high-tech growth because of the greater purchasing power of tech workers and the stimulus to personal income throughout the metro area.

These impacts are dynamic and can lead to a virtual circle of positive economic feedback into the local economy. It may be impossible to trace all of the linkages throughout a metro economy, but the total multiplier can be very large. The multiplier effect stemming from high-technology clusters is a key determinant of the relative metro economic growth differential observed in the United States.

The general concept of a metro economy is one of a large population nucleus, together with adjacent communities that have a high degree of economic and social integration within the nucleus. Each metro economy contains: (a) a minimum population of 50,000; (b) one or more central counties; and (c) may include one or more outlying counties that have close economic and social relationships with the central county. An outlying county must have a specified level of commuting to the central county and must also meet certain standards regarding metropolitan character, such as population density, urban population and population growth. In brief, a metro economy may 'straddle' multiple counties and may even include more than just the state of Arkansas. Arkansas' eight metros[5] are analyzed below (in alphabetical order).

Crittenden County Metropolitan Statistical Area (MSA)

Crittenden County is a part of the greater Memphis metropolitan statistical area's economy. However, because the Memphis MSA includes several counties in multiple states—Tennessee and Mississippi as well as Arkansas—we have separated Crittenden out for the purpose of our analysis. To the extent that the vast bulk of activity in the Memphis MSA is located outside of Arkansas and that our specific interest in this analysis is the economic activity in Arkansas, Crittenden Country is investigated separately.

The population of Crittenden County was estimated at 51,155[6] and the labor force estimated at 22,8007 in 2003.

High-Technology Industries in the Crittenden County MSA

The only high-tech industry in Crittenden County is the relatively new manufacturing and reproducing magnetic and optical media industry. It will be an interesting segment for Arkansas to consider targeting given its high location quotient of 9.29 in 2002 even though the segment employed only 88 people. Note that the state of Arkansas is, overall, losing employment in this sector, but the national employment trend is increasing. Crittenden County metro appears to be capturing this segment's growth at the expense of other areas in the state.

Knowledge-Based Industries in the Crittenden County MSA

The table below shows that total employment increased by 1,000 from 1992 to 2002 in Crittenden County's knowledge-based growth industries with location quotients above 1.0. This is contrary to the declining employment trends in each of these industries in the country as a whole and the state, with the exception of Deep Sea Coastal and Great Lakes water transportation and other chemical product and preparation manufacturing. Wage rates at the state and national levels increased in each of these industries over the same decade.

Knowledge-Based Industries Growing in Crittenden County

Industry	1992 Employment	2002 Employment
Other Support Industries for Transportation	145	879
Other Chemical Product & Prep. Manufacturing	110	279
Electric Lighting Equip. Manufacturing	16	38
Rail Transportation	19	23
Deep Sea Coastal & Great Lakes Water Trans.	--	10
Other Electrical Equip. & Component Man.	27	44
Other Fabricated Metal Product Man.	16	60
Total	**333**	**1333**

Key Industries in the Crittenden County Metropolitan Statistical Area (MSA)

Those industry segments with: (a) more than 250 employees; (b) growing employment; and (c) location quotients above 1.0, are shown in the table below.

Key Industries in Crittenden County

	Employment		LQ	
Industry	1992	2002	1992	2002
Converted Paper Product Mfg.	413	715	6.95	11.42
Other Chemical Prod. & Prep. Mfg.	110	279	5.46	14.82
Department Stores	183	475	0.86	1.63
General Freight Trucking	235	449	2.06	2.65
Specialized Freight Trucking	210	451	4.74	6.86
Mach. & Equip. Repair & Maintenance	156	260	7.22	9.94

Fayetteville-Springdale-Rogers Metropolitan Statistical Area (MSA)

Benton and Washington counties, both located in Arkansas, contribute to the Fayetteville-Springdale-Rogers metro economy.

Much of the growth in the Fayetteville-Springdale-Rogers MSA can be attributed directly to the emergence of Wal-Mart, the world's number one retailer, headquartered in Bentonville. Wal-Mart is the largest private employer in the world, employing more than 1.2 million people with sales exceeding $256 billion in the fiscal year ending January 31, 2004. Over the past five years, many of Wal-Mart's vendors, including many Fortune 500 companies, have established offices in Rogers and Bentonville to facilitate interaction with the retailer, bringing with them higher-wage jobs and derived demand for goods and services. There are a number of challenges ahead, however, for Wal-Mart. First, legal and compliance problems continue to mount as the retailer grows ever larger and ever more visible. Second, Wal-Mart's expansion into some new domestic markets, in certain parts of California and New York, for example, has met with significant opposition from local communities. These issues notwithstanding, the retailer looks set to grow at a brisk pace for years to come and will remain a key driver of the Fayetteville-Springdale-Rogers MSA economy.[8]

Contrary to some people's beliefs, the Fayetteville-Springdale-Rogers MSA is not a "one-horse town." The MSA is home to food giant Tyson Foods, trucking giant J.B. Hunt and the state's flagship institution of higher education, the University of Arkansas. The University of Arkansas, located in the city of Fayetteville, provides the basis for a metro food cluster. Pinnacle Foods, in operation in Fayetteville for nearly 50 years, produces Swanson frozen foods at the Fayetteville facility. A relatively new food-processing company that contributes to the food-processing cluster is Ozark Mountain Poultry, Inc., located in the town of Rogers, Benton County.

The automotive industry contributes to Arkansas' economy with Evans Enterprises, a subsidiary of Franklin Electric located in Rogers that employs motor service personnel, and Superior Industries' engineering plant, which designs, tests and produces sophisticated, high-volume parts for automobiles.

High-Technology Industries in the Fayetteville-Springdale-Rogers MSA

The following table shows the four high-tech employment growth industry segments in the metro with demonstrated high concentration (i.e., LQ > 1.0). More than 3,500 employees were added overall in these segments from 1992 to 2002.

High-Concentration High-Tech Industries Growing in NW Arkansas

Industry	Employment 1992	Employment 2002
Scientific R&D Services	578	1,633
Architectural, Engineering & Related Services	1,159	3,407
Commercial & Service Industry Mach. Mfg.	144	239
Cable & Other Program Distribution	80	195
Total	**1,961**	**5,474**

Fayetteville-Springdale-Rogers MSA Knowledge-Based Industries

The largest knowledge-based industry employers with above-average and growing location quotients in 2002 were in management of companies and enterprises, depository credit intermediation, motor vehicle parts manufacturing and natural gas distribution.

Employment in this MSA grew, in the natural gas distribution segment by almost 200 percent from 354 employees in 1992 to 1,043 in 2002. Fayetteville metro is growing, contrary to the declining employment trends in the state (-1.2 percent) and in the country overall (-22.8 percent) from 1992 to 2002.

Key Industries in Fayetteville-Springdale-Rogers MSA

The overall food manufacturing industry is key to the Fayetteville-Springdale-Rogers MSA. Within this industry, however, two trends are evidenced that are contrary to the experiences at the state and national levels.

Fruit and vegetable preserving and specialty food manufacturing grew significantly in this MSA from 1992 to 2002. Employment and concentration more than doubled to 2,636 employees with a location quotient of 10.89 in 2002. This is contrary to the trend experienced by the state of Arkansas overall and nationally where employment decreased by 8.4 percent and 14.7 percent respectively. Note that GSP and GDP contributions also decreased in this segment in Arkansas and the U.S. over this period.

Employment in the animal slaughtering and processing segment decreased in the MSA by 2.3 percent from 1992 to 2002. This is contrary to the increases experienced at the state level (17.2 percent) and nationally (17.9 percent). Note that wage rates and GSP/GNP also increased at the state and national levels. The MSA is slowing losing employees in this sector to other areas in the state and perhaps to states other than Arkansas.

The Fayetteville-Springdale-Rogers MSA's motor vehicle parts manufacturing segment experienced significant employment growth (84.6 percent) with 1,314 employees in 2002 up from 712 in 1992. Employment is growing faster in this industry in the MSA than in either the state or the nation as a whole.

Fort Smith Metropolitan Statistical Area (MSA)

The Fort Smith MSA is defined to include Crawford and Sebastian counties in Arkansas and Sequoyah County in Oklahoma. A large percentage of the MSA's population and labor force reside in Sebastian County, where the City of Fort Smith is located. The MSA is heavily dependent upon manufacturing. Beverly Enterprises contributes to the MSA in the education and health services sector.

Industries such as Baldor Electric, Whirlpool, Franklin Electric and Rheem Air Conditioning represent the electronics/industrial machinery sector (which includes electronics, industrial and commercial machinery and computer equipment) in the Fort Smith metro. Rheem Air Conditioning has its division headquarters in Fort Smith.

The appliance and furnishings industry is also among the MSA's leading employers. This industry has benefited from the national housing boom for some time, but as a mainstay of the economy, it makes the Fort Smith MSA vulnerable to future moderation in national housing market activity.[9]

The MSA's trucking industry is benefiting from a firming national economy. Profit margins have improved measurably and industry employment looks set to expand. Large freight trucking companies, such as key employer Arkansas' Best, are especially well-placed to benefit from improved demand as the recent recession squeezed many smaller players out of the market. However, increases in fuel costs are a downside risk in this sector. Quanex Corporations' MacSteel Division, and Arkansas' Best Corporation are two companies that have contributed to increases in Arkansas' average hourly wage rate. In 2001, information and biotechnology companies also launched expansions in Fort Smith.

High-Tech Industries in the Fort Smith Metropolitan Statistical Area (MSA)

Semiconductor and other electronic component manufacturing is the largest high-tech industry segment in the Fort Smith metro. Employment in this segment is growing rapidly. It increased 53.6 percent, employing 3,068 people in 2002, up from 1,998 in 1992, paralleling statewide and national trends that reflect a growing wage rate and GSP/GNP contributions in this period.

Knowledge-based Industries in the Fort Smith Metropolitan Statistical Area (MSA)

Eighteen knowledge-based industries with location quotients greater than 1.0 were identified in the Fort Smith metro in 2002. The three largest growing segments, as measured by employment, are:

- depository credit intermediation with 1,547 employees in 2002 up from 1,163 in 1992;
- electrical equipment manufacturing with 1,440 employees in 2002 up from 1,308 in 1992; and
- management of companies and enterprises with 1,402 employees in 2002 up from 1,293 in 1992.

Employment growth in the Fort Smith MSA's electrical equipment manufacturing segment is contrary to the declines seen in the state and in the nation overall.

Key Industries in the Fort Smith Metropolitan Statistical Area (MSA)

Electrical equipment appliance and component manufacturing is the largest industry employer in the Fort Smith metro. It grew 35.8 percent from 4,739 employees in 1992 to 6,086 employees in 2002. This employment growth is contrary to the declines experienced at both the state and national levels over this same period.

Hot Springs Metropolitan Statistical Area (MSA)

The Hot Springs MSA, defined as Garland County, is the newest metro economy in Arkansas. It had an estimated population of 91,188 and an estimated labor force of 37,697, in 2003[10]. Since 1992, the annual unemployment rate for the MSA ranged from 3.9 percent to 7.6 percent.[11]

High-Tech Industries in the Hot Springs Metropolitan Statistical Area (MSA)

The aerospace product and parts manufacturing sector increased its employment in the Hot Springs MSA by 257.4 percent from 1992 to 2002, growing from 209 employees to 747 employees. This employment growth contributed to the gains in this sector's location quotient from 1.05 in 1992 to 5.73 in 2002.

Knowledge-based Industries in the Hot Springs MSA

Ten knowledge-based industries increased employment and location quotients in the Hot Springs MSA from 1992 to 2002. The most significant employer in this group were offices of physicians, which showed employment gains of 161.6 percent, rising from 476 employees in 1992 to 1,245 in 2002.

Other sectors that substantially increased employment from 1992–2002 were securities and commodity exchanges (285 employees in 2002), industrial machinery manufacturing (295 employees in 2002), depository credit intermediation (609 employees in 2002) and construction of buildings (426 employees in 2002).

Key Industries in the Hot Springs Metropolitan Statistical Area (MSA)

A total of 16 industry segments were significant to and growing in the Hot Springs metro in 2002. Those with more than 250 employees and location quotients greater than 1.0 are:

- rubber product manufacturing (937 employees in 2002);
- industrial machinery manufacturing (295 employees in 2002);
- aerospace product and parts manufacturing (747 employees in 2002);
- grocery and related product wholesalers (356 employees in 2002);
- automobile dealers (481 employees in 2002);
- department stores (1,211 employees in 2002);
- other general merchandise stores (431 employees in 2002); and
- automotive repair and maintenance (413 employees in 2002).

Jonesboro Metropolitan Statistical Area (MSA)

Craighead is the only county in Jonesboro's metropolitan area. The Jonesboro MSA is heavily dependent on the manufacturing sector. In 2002, manufacturing employment accounted for roughly 22 percent of private employment in Craighead County.[12] The Jonesboro MSA's three key manufacturing industries—food, semiconductors and motor vehicle parts—are vulnerable to excess capacity and limited pricing power.[13]

As a hub of agricultural production, the Jonesboro MSA has delta cotton land to the east, and rice and soybean fields to the southwest. Jonesboro is the home of Riceland Foods, the largest rice mill in the world. Several large firms in Jonesboro include Nestle USA, (whose frozen-food plant produces for the Stouffer's and Lean Cuisine labels), Hytrol Conveyor Company, Kraft Foods-Post Division, ASE-DELI Products, Thomas & Betts, Frito Lay and Haworth.[14] Strong growth from Asia is boosting rice and cotton exports. The large presence of Arkansas State University and the health services industry will ensure stable growth. However, over the long run, the lack of high-growth industries will preclude above-average performance; low industrial diversity also serves to limit growth potential.[15]

High-Tech Industries in the Jonesboro Metropolitan Statistical Area (MSA)

Arkansas State University at Jonesboro is a base from which a high-technology metro cluster could be formed.

The semiconductor and other electronic component manufacturing sector is the largest and most significant high-tech industry segment in the Jonesboro MSA. Employment grew 15.5 percent from 583 in 1992 to 620 in 2002. This growth, although slightly lower, parallels the national and state-level trends over the same period in this industry.

Knowledge-Based Industries in the Jonesboro Metropolitan Statistical Area (MSA)

The largest and most significant knowledge-based industry segment in the Jonesboro MSA is offices of physicians. Employment in this segment increased by 22.5 percent from 918 persons in 1992 to 1,125 persons in 2002. The metro's location quotient declined slightly over this period from 1.9 to 1.87 indicating that employment in this segment is increasing in the Jonesboro MSA, but at a decreasing rate compared with the gains evidenced at both the state and national levels.

Key Industries in the Jonesboro Metropolitan Area (MSA)

A key industry with significant employment in the Jonesboro MSA—1,046 in 2002 up 25.7 percent from 832 in 1992—is other general merchandise stores.

Little Rock-North Little Rock Metropolitan Statistical Area (MSA)

The Little Rock-North Little Rock MSA includes the counties of Faulkner, Lonoke, Pulaski and Saline County in central Arkansas. It has the largest and relatively best-educated labor force among the MSA's in Arkansas. Of the Pulaski County population 25 and older, 28.1 percent holds at least a bachelor's degree and 25.2 percent of the Faulkner County population 25 and older holds at least a bachelor's degree. Since 1992, the Little Rock-North Little Rock MSA's annual unemployment rate has ranged from 3.2 percent to 5.1 percent.

This MSA is located in the central portion of the state and straddles the Arkansas River, which serves as a conduit for goods traveling to and from the Mississippi River as well as a source of recreation for area residents. The city of Little Rock is the seat of the state's government; as such a relatively large portion of employment in this MSA, particularly Pulaski County, can be attributed to state and local government. The MSA is also home to many colleges and universities, including the University of Arkansas Medical School located in Little Rock.

Budget cuts in the state and local governments negatively effect economic development in this MSA. Weak state and local government sector finances therefore remain an important impediment to job growth. Hospitals and health care providers are among the metro area's top employers and will continue to be a stable source of new jobs in the years ahead. A word of caution is that although rising health care premiums point to increased profitability within the industry, associated state and local government budget problems and the attendant cutbacks in health care entitlements are significant detriments to industry revenues.

High-Tech Industries in the Little Rock-North Little Rock MSA

The Little Rock-North Little Rock MSA's high-tech cluster, has suffered recently from its dependence upon the telecommunications industry, mired in a slump for the last couple of years. ALLTEL, which began its Little Rock operations in 1943, developed technology for the growing wireless industry. Its employment decreased from 4,750 at the end of 2001 to 3,500 in 2002, and slipped further to 2,730 based on the latest data available. Acxiom Corporation, one of *Fortune* magazine's "100 Best Companies to Work for in America" is a data software company located in Little Rock. Employment at Acxiom declined from 2,800 in 2001 to 2,600 in 2002. Although employment declines in this sector may be attributable somewhat to corporate divestitures such as the spin off of the Systemmatics division from ALLTEL, economic development in this industry has contracted.

The presence of the University of Arkansas Technical School, the University of Arkansas at Little Rock, and the University of Arkansas Medical Center provide the base for a medical research and technology cluster. Sweet Goods, Inc. in North Little Rock is part of Arkansas' key food-processing industry. Arkansas' Bio-Ventures, a business development initiative at the University of Arkansas for Medical Sciences, is involved in a technology business incubator program. In July 2001, the Center for Toxicology and Environment Health LLC, was the first biotech company launched from the Bio-Ventures incubator. Another startup company that graduated from the incubator was Safe Foods Inc. of North Little Rock, which produces a spray that reduces and prevents the recurrence of pathogens on foods.[16]

The Arkansas Biotechnology Association is housed at the Little Rock Regional Chamber of Commerce. Research centers at the University of Arkansas include the Arkansas Cancer Research Center, Biomedical Biotechnology Center, Center for Agricultural Medicine, Myeloma and Transplantation Research Center, Arkansas Children's Hospital Research Center, and Donald W. Reynolds Center on Aging.

Expansion at 3M Company in Little Rock has helped raise wage rates in this metro.

Network-Logistics is a warehousing and distribution company located in Jacksonville.

The three high-tech industry segments with the greatest growing employment in the Little Rock-North Little Rock MSA and location quotients greater than 1.0 were:
- computer systems design and related services (3,762 employees in 2002);
- wired telecommunications carriers (2,970 employees in 2002); and
- communications equipment manufacturing (1,090 employees in 2002).

The communications equipment manufacturing sector in the Little Rock-North Little Rock MSA demonstrated the greatest employment and concentration growth, increasing from 12 employees to 1,090 and from a location quotient of 0.02 to location quotient to 2.37 between 1992 and 2002. Nationwide, employment in this sector decreased as a whole (-10.5 percent) and the wage rate in this sector decreased in Arkansas over this same period from $24,400 to $22,500.

Knowledge-based Industries in the Little Rock-North Little Rock MSA

Knowledge-based industries in the Little Rock-North Little Rock MSA include Graybar, an affiliate of Central Maloney, Trane Corporation, Mueller Copper Wire and Lockheed Martin Missiles and Fire Control, which has operations in Camden.

Nineteen knowledge-based industries in this MSA have a location quotient greater than 1.0. The largest growing knowledge-based segments in this metro in 2002 were:
- Physicians' offices, with 5,999 employees in 2002 up from 4,933 in 1992;
- Building construction with 4,720 employees in 2002 up from 3,205 in 1992;
- Insurance carriers with 4,336 employees in 2002 up from 4,048 in 1992);
- Management of companies and enterprises with 3,953 persons in 2002 up from 3,124 in 1992;
- Legal services with 2,757 employees in 2002 up from 2,269 in 1992;
- Agencies, brokerages and other insurance related activities with 2,294 employees in 2002 up from 2,464 in 1992;
- Activities related to credit intermediation with 1,934 employees in 2002 up from 192 in 1992;
- Hardware, plumbing and heating equipment and supplies merchant wholesalers with 1,214 employees in 2002 up from 502 in 1992;
- Securities and commodity exchanges with 1,205 employees in 2002 up from 1,198 in 1992; and
- Radio and television broadcasting with 602 employees in 2002 up from 542 in 1992.

The increasing employment trends in the metro parallel those experienced at both the state and national levels over this same period. Wages are also increasing in each and every one of these segments in Arkansas and the U.S.

Key Industries in the Little Rock-North Little Rock MSA

The two largest industry employers in the Little Rock-North Little Rock MSA are general merchandise stores with 7,937 employees in 2002 up from 7,295 in 1992 and freight transportation with 6,888 employees in 2002 up from 6,874 in 1992. While wages at the state and national levels are increasing in each area, each is an area for economic development concern in that:
(1) location quotient values in department stores and the freight transportation industry are declining, which is contrary to the trend in the state overall; and
(2) employment increases are smaller than those being experienced in the state and nation overall.

This means that the Little Rock-North Little Rock MSA is capturing a smaller share of the employment increases available in this sector.

Pine Bluff Metropolitan Statistical Area (MSA)

Jefferson County, home to the city of Pine Bluff, is the sole county in Pine Bluff's metro economy. The MSA's economy is heavily dependent upon the manufacturing sector. The Pine Bluff MSA's large manufacturing base concentrates on the nondurable goods sector. Economic expansion has provided a lift to the two key industries: food processing and paper products. To the extent that both industries suffer from periods of excess capacity and weak, though improving, pricing power and, in the case of the paper industry, high input prices, significant expansion ventures are unlikely in the near future. Profits of both International Paper Company (the MSA's fourth largest employer) and Tyson Foods (the MSA's largest employer) soared in the second half of 2003.[17]

A concern for Pine Bluff is that the MSA is dominated by mature industries and prospects for significant new job creation are bleak. A poorly educated workforce and weakening demographic trends render the metro area relatively unattractive to new industries. A weak labor market and perceptions of health risks from the presence of a chemical weapons disposal facility reinforce the negative demographic trends.[18] One strong potential source of higher-paying jobs is the National Center for Toxicological Research (NCTR) of the U.S. Food and Drug Administration in the town of Jefferson. Companies working in conjunction with the center could provide a significant boost to both Pine Bluff and Little Rock.

High-Tech Industries in the Pine Bluff Metropolitan Statistical Area (MSA)

The multinational enterprise TREFILARBED, based in Luxembourg, has subsidiary operations in Arkansas. Insourcing, as a result of foreign direct investment from this corporation, has helped increase wage rates in Pine Bluff.

There are two high-tech industry segments in the Pine Bluff MSA with location quotients greater than 1.0 in 2002. The details are outlined in the table below:

High-Tech Industries in the Pine Bluff MSA

Industry	Employment 1992	Employment 2002	'92 -'-02 Empl. Change	LQ 1992	LQ 2002
Mfg. & Reproducing Magnetic & Optical Media	642	333	-48%	47	21.2
Cable & Other Program Distribution	18	37	106%	0.8	1.01
Total	**660**	**370**			

The declining employment in Pine Bluff's manufacturing and reproducing magnetic and optical media sector is contrary to the trend evidenced in the country overall, which increased its employment in this sector by more than 30 percent from 1992 to 2002. The state of Arkansas and the Pine Bluff MSA specifically, appear to be losing this valuable high-tech employment to other states in the country.

Employment in Pine Bluff's cable and other program distribution sector is small but healthy and may be an industry segment that the Pine Bluff MSA could build upon.

Knowledge-based Industries in the Pine Bluff Metropolitan Statistical Area (MSA)

Of the 16 total knowledge-based industries in the Pine Bluff MSA that had location quotients above 1.0 in 2002, nine segments lost employees from 1992 to 2002. The remaining industry segments generated total employment of 3,133 employees in 2002, up from 2,061 a decade earlier (see table below).

Knowledge-Based Industries Growing in the Pine Bluff Area (MSA)

Industry	Employment 1992	Employment 2002
Pulp, Paper & Paperboard Mills	1,174	1,604
Forging & Stamping	104	170
Metalworking Machinery Manufacturing	38	133
Offices of Physicians	517	836
Motor Vehicle Parts Manufacturing	178	276
Motor Vehicle Manufacturing	39	76
Chemical & Allied Prod. Merchant Wholesalers	11	38
Total	**2,061**	**3,133**

The Pine Bluff MSA employment gains in pulp, paper and paperboard mills, and metalworking machinery manufacturing are contrary to the declines experienced at the state and national levels.

Key Industries in the Pine Bluff Metropolitan Statistical Area (MSA)

The nonknowledge-based, nonhigh-tech component of the pulp, paper and paperboard mills industry is key to the Pine Bluff MSA. Employment is this industry increased 36.6 percent from 1,174 in 1992 to 1,604 in 2002. The increasing significance of this segment to the MSA is evidenced by its location quotient, which more than doubled from 15.93 in 1992 to 34.17 in 2002. This trend is contrary to the state and national level experiences in this sector.

Texarkana Metropolitan Statistical Area (MSA)

The Texarkana MSA includes Miller County, located in Arkansas, as well as Bowie County, located in Texas. The MSA's population was estimated at 131,591 in 2003 and its labor force was estimated at 57,417 people that year.[19] A majority of the MSA's population, 68.2 percent, reside in Bowie County, home to Texarkana, Texas. Since 1992, the MSA's annual unemployment rate has vacillated between 4.5 percent and 9.2 percent.[20]

The Arkansas side of the Texarkana MSA faces an interesting challenge when it comes to economic development. The state of Texas does not levy personal income taxes, which puts a significant constraint on growth possibilities for communities in Arkansas near the Texas border. The Arkansas state legislature passed a measure many years ago that exempts residents of border cities such as Texarkana, Arkansas, from paying Arkansas income taxes.

Although the large presence of low-paying service industries has dampened overall per capita income growth in the Texarkana MSA, service employment remains its main growth prospect. Together, the service-related industries will account for the majority of jobs created in the MSA over the next few years. In particular, education and health services are expected to account for 94 percent of all net new jobs in the coming five years. Already, service industries make up 81 percent of total private employment, with a heavy concentration in the retail industry and health services.[21]

High-Tech Industries in the Texarkana Metropolitan Statistical Area (MSA)

The high-tech industry in the Texarkana MSA is the medical and diagnostic laboratories industry. It is a significant industry segment to the MSA, with a location quotient of 4.67, however employment is minimal. Employment growth—from 102 people in 1992 up 230.4 percent to 337 in 2002—and concentration exceed the positive patterns experienced in both the state and nation overall.

Knowledge-Based Industries in the Texarkana Metropolitan Statistical Area (MSA)

The pulp, paper and paperboard mills industry is the knowledge-based industry key to Texarkana's MSA. From 1992 to 2002 employment grew by more than 30 percent and the location quotient almost doubled to 13.62. Almost 1,000 people were employed in this industry in the MSA in 2002.

From our earlier comments in this report in the knowledge-based Industries section, we know that growth in the pulp, paper and paperboard mills industry in the Texarkana MSA, is contrary to the declining experiences in the state overall (-17.4 percent) and in the country (-26.6 percent) as a whole. Note also, that Arkansas' GSP and the country's contribution to GDP in this segment are also declining. Therefore, although wages appear to be increasing in this segment, Texarkana is attracting employment in a declining industry.

Key Industries in the Texarkana Metropolitan Statistical Area (MSA)

General merchandise stores, comprising the two industry segments—department stores and other general merchandise stores—is the largest, significant key industry in Texarkana. Overall employment grew by 196 from 1,645 in 1992 to 1,841 in 2002. This positive trend parallels that being experienced in the state and country overall. A concern for the MSA, however, is that this sector employs largely low-paying, lower skill-level service industry personnel.

Rural Arkansas

The challenge of cluster-based, high-tech economic development in the state, the raison d'être of our research, is magnified for rural Arkansas. Some of the rural areas do not possess the kind and sophisticated level of infrastructure necessary for many high-technology industries. And economies of scale, demanded by efficiency-seeking firms, may be unachievable throughout most of rural Arkansas.

We recognize that not all rural communities are in an equal position to adopt cluster-based economic development. According to a report by the University of Minnesota,[22] rural clusters differ from industry clusters in that they focus on knowledge. The metro industry cluster concept includes knowledge, but accentuates agglomeration, scale economies and inter-industry collaboration often not present in rural areas. Knowledge is therefore paramount for rural clusters. Rural knowledge can be evidenced in the unique conditions and/or other dynamics understood particularly well by local residents. An educated labor force is a necessary, if not sufficient condition, for successful and sustainable rural cluster formation.

Rural America comprises 2,052 counties, contains 75 percent of the nation's land and is home to almost one-fifth of its people.[23] Employment is one of the largest, if not the largest issue that policy makers struggle with throughout rural America.

High-Tech Industries in Rural Arkansas

In 2002, Klipsch Audio Technologies built and opened a new 46,000-square-foot warehouse and distribution center near its main manufacturing facility in Hope, Arkansas. This construction project was a multimillion dollar capital investment that included significant renovation of the main manufacturing facility and created 80 new jobs. Employment in the audio and video equipment manufacturing sector rose to 607 employees in 2002 up 121.5 percent from 274 employees in 1992. Klipsch Audio Technologies contributed to these high-tech gains in rural Arkansas.

Two other high-tech industry segments with location quotients greater than 1.0 and growing employment from 1992 to 2002 that contributed to economic development in rural Arkansas are:

- commercial and service industry machinery manufacturing with 1,241 employees in 2002, up 66.8 percent from 744 employees in 1992; and
- medical and diagnostic laboratories with 609 employees in 2002, up 170.7 percent from 225 employees in 1992.

The largest high-technology industry in rural Arkansas in terms of employment is aerospace product and parts manufacturing. Employment in this sector decreased 5.7 percent from 1,981 employees in 1992 to 1,868 employees in 2002. It is necessary not only to attract firms into Arkansas but also to retain those firms and the associated accompanying gains in the state.

Trying to start a cluster from scratch is almost always a formula for failure.[24] The rural industrial segments listed above may be good industry prospects for Arkansas to consider building from.

The Monsanto Corporation, through its Asgrow Seed subsidiary located in Marion County, has increased the opportunity for skilled high-wage-rate employment opportunities in rural Arkansas

The food industry, as noted earlier in this report, is key to the state's economy. Food-processing companies located in rural Arkansas are H&L Poultry in Warren (Bradley County) and the multinational enterprise Alcan Thermaplate in Russellville (Pope County).

Knowledge-Based Industries in Rural Arkansas

The 15 knowledge-based industry segments with growing employment, location quotients greater than 1.0 and increasing wage rates (in the state and U.S. overall) that contribute to rural Arkansas are listed in the following table.

Knowledge-Based Industries in Rural Arkansas

Industry	1992 Empl.	1992 LQ	2002 Empl.	2002 LQ
Securities & Comm. Exchanges	316	15.63	594	19
Iron, Steel Mills & Ferr Mfg.	1,295	2.14	2,763	7.63
Electrical Equip. Manufacturing	4,390	5.56	4,437	7.52
Steel Prod. Mfg. Purchased Steel	683	2.89	1,470	6.89
Agric, Const. & Mining Mach. Mfg.	2,585	3.58	2,844	4.22
Other Chem. Prod & Prep. Mfg.	469	0.90	1,123	2.93
Vent, Heat, Air & Comm Ref. Mfg.	1,384	2.39	1,526	2.70
Metalworking Machinery Mfg.	1,500	1.72	1,807	2.47
Forging and Stamping	489	1.11	892	2.33
Mgt. of Companies & Enterprises	4,215	0.72	10,647	1.85
Depository Credit Intermediation	5,913	0.93	8,902	1.52
Motor Vehicle Body & Trailer Mfg.	641	1.41	724	1.41
Petroleum & Coal Pro. Mfg.	462	0.84	476	1.19
Deep Sea G. Lakes Water Transport	38	0.28	129	1.18
Radio & TV Broadcasting	777	0.95	937	1.15
Total	**25157**		**39271**	

Electronics contributes to the economies of rural Arkansas through Lewis Electric Company, a subsidiary of Franklin Electric (Russellville); and Graybar, an affiliate of Central Maloney (Conway County and Springdale). Trane Corporation also has a parts center operation in Springdale. The ICT Group Inc., a contact center, has located in Conway. Champion Parts is an automobile manufacturing company which relocated its corporate operations from the Chicago area to Hope, in Hempstead Country, southwest Arkansas. Champion produces remanufactured auto motor parts.

Key Industries in Rural Arkansas

The wood products manufacturing industry is a nonmetro, nonhigh-tech and nonknowledge-based industry. Rural Arkansas employs more than 75 percent of the people employed in this industry—11,562 employees in 2002.

Total employment in the industry segments of plastics product manufacturing and rubber product manufacturing rose by almost 1,250 employees from 1992 to 2002 to a total of 7,129 employees. The location quotient for each—2.10 and 3.88, respectively—show high concentration in the state.

Employment in the department stores and other general merchandise stores' industries was 13,234 employees in 2002, up from 7,763 employees 10 years earlier. The presence of Wal-Mart contributed to this increase.

The freight transportation industry is also of significance to rural Arkansas. Total employment increased from 7,907 persons in 1992 to 11,363 in 2002. It also has high location quotient values—1.68 and 4.57, respectively. General freight trucking and specialized freight trucking experienced employment gains in rural Arkansas since 1992. Employment rose in each of these segments by 30 percent and 55 percent, respectively. Freight transportation is an industry that is key to the state's rural economy.

[1] Jarboe, Kenan P., and Robert D. Atkinson. 1998. *The Case for Technology in the Knowledge Economy: R&D, Economic Growth, and the Role of Government*. Policy Briefing. Washington. D/C.: Progressive Policy Institute (June).
[2] Conference Board, May 2004. www.theManufacturer.com. June 2004.
[3] Kenney, Martin UC Davis Industry scholar (ed.) and Richard Florida. 2004. *Locating Global Advantage: Industry and Dynamics in the International Economy*. Stanford University Press, Stanford, California.
[4] U.S. Department of Agriculture, Economic Research Service. 2003. Rural Development Research Report No. (RDRR97-1). September.
[5] Subsequent to us embarking on the data analysis for this study, the Office of Management and Budget (OMB), U.S. Bureau of the Census, revised the definition of each MSA. Changes to these MSA definitions released by the Bureau of the Census were too recent for the changes to be included in this report. See http://www.census.gov/population/estimates/metro-city/0312msa.txt
[6] *Annual estimates of the Population for Counties: April 1, 2000 to July 1, 2003* .U.S. Census Bureau, Population Division. http://eire.census.gov/popest/data/counties/CO-EST2003-01.php
[7] Local Area Unemployment Statistics. Bureau of Labor Statistics, U.S. Department of Labor. www.bls.gov/lau/home/htm
[8] Précis METRO 2004 Economy.com Inc., www.economy.com
[9] Précis METRO 2004 Economy.com Inc., www.economy.com
[10] Local Area Unemployment Statistics. Bureau of Labor Statistics, U.S. Department of Labor. www.bls.gov/lau/home.htm.
[11] DINA: Welcome to Hot Springs, Arkansas. Development Information Network of Arkansas. http://hotsprings.dina.org/
[12] Jonesboro Regional Chamber of Commerce, Commun ity Briefing, Economy. www.jonesborochamber.com/view/php/id/16.
[13] Précis METRO 2004 Economy.com Inc., www.economy.com.
[14] *Metropolitan and Micropolitan Statistical Areas and Components, 2003, with Codes*. www.census.gov/populationestimates/metro-city/03mfips.txt.
[15] Précis METRO 2004 Economy.com Inc., www.economy.com
[16] Arkansas Location On-Line 2004.
[17] Précis METRO 2004 Economy.com Inc., www.economy.com
[18] Précis METRO 2004 Economy.com Inc., www.economy.com
[19] Local Area Unemploymnet Statistics. Bureau of Labor Statistics, U.S. Department of Labor. www.bls.gov/lau/home.htm.
[20] *Metropolitan and Micropolitan Statistical Area and Components, 2003, with Codes*. www.census.gov/population/estimates/metro-city/03mfips.txt.
[21] Précis METRO 2004 Economy.com Inc., www.economy.com.
[22] Schuh, G. Edward. 2002 'Globalization and Rural Development' Paper presented at the Conference on Rural Community Vitality in a Global Economy' Humphrey Institute of Public Affairs, University of Minnesota, Minneapolis. September 13-14.
[23] U.S. Department of Agriculture, Economic Research Service. 2003. Rural Development Research Report No. (RDRR97-1). September.
[24] Schuh, G. Edward. 2002 'Globalization and Rural Development' Paper presented at the Conference on Rural Community Vitality in a Global Economy' Humphrey Institute of Public Affairs, University of Minnesota, Minneapolis. September 13-14.

Arkansas Institutions Serving the Knowledge-based Economy (KBE)

This section of the report contains a review of key current and historical initiatives, both within the state of Arkansas and in other states and regions. Further, this section contains an analysis of critical institutions that must function well for the successful development of Arkansas' knowledge-based economy. To understand better the current position of the state of Arkansas vis-à-vis its ability to promote, encourage, and create knowledge-based industry and employment, the following research questions must be addressed:

- What are the key existing institutions, resources, and partnerships within Arkansas that are important for the successful creation and growth of knowledge-based industry and employment?
- What financing mechanisms are available to improve **existing** institutions or establish nonexisting institutions critical to the success of the initiative?
- What centers of excellence exist or could be developed with a reasonable degree of success in the state upon which to build the state's knowledge-based economy?
- What has been the impact of regional growth strategies on knowledge-based industry initiatives?
- Finally, what recent initiatives, growth strategies and partnerships have been established in other states that could be applied to Arkansas?

Introduction

The development and growth of the Arkansas knowledge-based economy (KBE) depends upon a wide range of factors. Public and private institutions play an important role in shaping and fostering a pro-KBE environment through the delivery of various programs, services and initiatives. These programs, services and initiatives are (or ought to be) developed to provide specific functions necessary for a thriving KBE. A primary and secondary education system emphasizing a strong grounding in math and science encourages students to enter science and engineering fields. Colleges and universities produce the majority of highly skilled workers that knowledge-based companies demand. Through partnership-based university-industry research centers, academic research translates into industrial innovation, new production processes, and improved productivity. Technology incubators provide knowledge-based entrepreneurs with office space and shared services to help them succeed and grow. State and local economic development agencies provide financial incentive programs that facilitate existing industries to relocate or reduce risks for entrepreneurs and investors in startup knowledge-based companies. These and a host of other critical institutions provide necessary support for the development and operation of knowledge-based industry.

Any reasonable vision of an Arkansas economy that includes knowledge-based industries as more than an anomaly must be based on the development and nurturing of critical public and private institutions whose express missions include the goal of supporting Arkansas knowledge-based companies. Failure to support existing institutions tasked with providing critical functions to the KBE, failure to create those institutions that are necessary, but missing from the state, dooms any effort, no matter how well-conceived.

Three Paths

The following narrative describes the various paths by which high-wage, high-skill employment is created. Note that we do not focus on the creation of knowledge-based industry as our primary goal. Our reasoning is simple; achieving the core goal of raising Arkansas' per capita personal income to the national average does not and cannot rely solely on the creation of industries that most would recognize as "high-tech." Indeed, a great deal of employment that can be defined as knowledge-based occurs in traditional economy firms. Also, given the economic and political realities of the state, all available paths to increasing per capita personal income by creating high-wage employment must be pursued.

There are three broadly defined possible paths to building knowledge-based employment. The **first** is through the creation of knowledge-based companies within the state built from the ground up. The **second** is through the recruitment of existing knowledge-based companies from other geographies. Obviously these strategies are not mutually exclusive, and moreover, synergies are likely from the simultaneous pursuit of both paths.

Building new knowledge-based companies or recruiting existing knowledge-based companies from other states or countries are clearly not the only means of creating high-wage/high-skill employment. The **third** path for the development of knowledge-based employment occurs through the creation of knowledge-based jobs within sectors of the state economy that are not commonly thought of as technology intensive. An example of an Arkansas industry, which on the surface many people would not consider a target for the creation of knowledge-based employment, is the poultry industry. Evidence of a firm using this third path comes from Tyson Foods,[1] Inc., which invested $5.2 million to expand its existing Northwest Arkansas research and development center.

The success or failure of each path depends on the existence and performance of a set of factors. A great deal of literature on development of the knowledge-based economy has focused on, for example, the circumstances that created the North Carolina "miracle" or the explosion of tech firms in the Austin, Texas region. To the extent that a consistent set of institutions performing specific functions necessary for the creation and nurturing of the knowledge-based economy is evident, the potential exists for the development of an agenda designed either to create or strengthen those institutions in the state of Arkansas.

Of the three paths, the most likely to have significant, immediate impact is the development of homegrown knowledge-based companies. Knowledge-based companies are unlikely to relocate to Arkansas given their predisposition to co-locate, and their dependence upon a sufficiently large and educated workforce from which to draw talent. This is not to imply that developing a strategy for recruiting knowledge-based companies is unnecessary or unwise at this time. It does imply though that a strategy based on traditional industrial recruitment models is unlikely to be effective.

The recruitment of knowledge-based companies to Arkansas is a strategy that is more likely to be successful if it is targeted at niche companies that could benefit from existing assets such as burgeoning centers of excellence,[2] leading, nationally recognized researchers in disciplines critical to the success of a given technology, or if companies targeted for recruitment are very small, high-risk companies that are unlikely to be on the radar screen of other states or countries.

Key Institutions, Programs, Initiatives and Partnerships

This section develops an Arkansas KBE resource inventory by categorizing Arkansas institutions, their programs, initiatives and partnerships with regard to various pro-KBE factors. The purpose is twofold:

- To help Arkansas KBE stakeholders quickly grasp an overview of the level of involvement and the extent of commitment that key institutions devote to KBE; and
- To develop a pro-KBE public policy agenda to address gaps where they exist and identify resource needs.

Pro-KBE Factors

This section is intended to provide a broad discussion of critical pro-KBE factors that jointly impact the creation of startup knowledge-based companies. These six factors have been culled from a review of the literature. They are:

- Technologically skilled workforce
- Entrepreneurial culture
- Knowledge spillovers from research universities
- Accessibility to financial capital, especially venture capital
- Intellectual property support
- Quality of life

The efficacy of pro-KBE factors in facilitating the formation, growth and sustainability of the KBE in Arkansas depends upon the efficiency of statewide institutions at translating programs, initiatives and partnerships into critical outcomes.

Technologically skilled workforce

Successful creation of the KBE in the state of Arkansas is more dependent on human capital formation than on any other single pro-KBE factor. In the KBE, rewards are directly tied to education, skills and talent. As knowledge-based employment has become a more prominent component of total employment, the demand for workers with mathematical skills, computer skills and management skills has increased as well. This requires an education system that produces a continual, substantial supply of skilled and educated workers. Further, the supply of knowledge workers is dependent upon a labor force, or at least some significant fraction of it, committed to lifelong human capital investment. Success in today's highly competitive, global economy is a function, not only of one's current skills, but, more importantly, of one's ability to acquire new skills quickly. This requires a commitment to providing lifelong learning opportunities for workers.

Entrepreneurial culture

Entrepreneurship is the critical force behind innovation and new wealth creation.[3] A recent National Academy of Engineering report summarized the critical role played by high-technology entrepreneurs: the principal economic function of small entrepreneurial high-tech companies is to probe, explore and sometimes develop the frontiers of the U.S. economy—products, services, technologies, markets—in search of unrecognized or otherwise ignored opportunities for economic growth and development.[4]

Knowledge spillovers from research universities

University research is a key source of innovation in many industries, especially to those related to the biological sciences.[5] The proximity of university research and development (R&D) is one of the primary location decision factors for adjacent firms due to spillovers from neighboring university research that translate to commercial innovation. Thus, expanding the networks of business and research institutions to infuse the flow of knowledge between university research and commercial innovation will enhance knowledge-based industry (KBI) clustering.

Accessibility to financial capital, especially venture capital

The value of venture capital lies in providing not only money but also ancillary services.[6] This includes selecting firms for investment with a high probability of success, mentoring entrepreneurs, hiring executives, formulating strategies, "professionalizing" companies and helping innovators establish themselves in the marketplace. Making capital accessible to seed and early-stage technology companies through angel investors or angel investor networks is critical for bridging the gap between the innovation of a product, process or service and its commercialized application.

Intellectual property support

Intellectual property is the foundation of wealth creation in the KBE. Its value includes intangible assets such as customer relationships, patents, trademarks, brands and knowledge.[7] In the knowledge-based economy, the supply and protection of knowledge and information will determine the competitive edge and the success of knowledge-based companies. Accessibility to patent attorneys, engineering and technical outreach, due diligence firms specializing in technology-based companies, and a host of related entities are necessary to protect and facilitate wealth creation from intellectual property.

Quality of life

In the new economy, knowledge and capital are extremely mobile. Digital communications enable work to occur where individuals choose to live. Surveys show that most employers and employees cite quality of life as a critical factor influencing their location decisions.[8] Factors of quality of life include physical environment, recreational opportunities and cultural amenities. A region must create a sense of place that embraces these physical and intangible magnets to draw high-skilled workers and high-technology businesses.

List of Key Arkansas KBE Institutions

The following discussion is intended to provide a comprehensive list of critical institutions within the state of Arkansas. Each institution has at least a tangential role in fostering one of the pro-KBE factors. To carry out that role, each institution develops programs, initiatives and partnerships, etcetera that either directly or indirectly provides support for the creation of the KBE. Interestingly, many institutions fail to explicitly address their role in promoting the state's KBE. It is imperative that the responsibility for performing these critical functions be acknowledged. Failure to explicitly acknowledge, and more importantly, base resource allocation decisions on the institution's role in creating the KBE in Arkansas is highly likely to imply inefficiencies and poor outcomes from programmatic or other efforts.

Institutions Providing Technologically Skilled Workforce

The production of a skilled workforce is a collective effort of general education institutions and career-specific training institutions. These institutions can be grouped into four categories: preK-12, two-year colleges and technical institutes, four-year universities, and workforce development institutions. The following table provides a complete list of institutions that are directly involved in education and workforce development in Arkansas.

Institutions Providing Skilled Workforce

Broadly defined Institutions	Key Institution	Web Page
Pre K-12 Education Institutions	Arkansas Department of Education	http://arkedu.state.ar.us
	Arkansas pre K-12 Schools	http://anythingarkansas.com/Education/School_Distric.html
	Arkansas School for Mathematics Sciences and Arts	http://asmsa.net
	Arkansas Council on Economic Education	http://www.arkeconed.org
	Arkansas DHS/Division of Childcare and Early Childhood Education	http://www.state.ar.us/childcare
	Arkansas Education Association	http://www.aeaonline.org
	Arkansas Business and Education Alliance	http://www.arkbea.org
	Arkansas Parenting Education Network	http://www.arctf.org/apen.html
	Arkansas Head Start Association	http://www.arheadstart.org
	Arkansas Early Childhood Commission	http://www.state.ar.us/childcare/commission.htm
	Arkansas Advocates for Children and Family	http://www.aradvocates.org
	Crowley's Ridge Technical Institute	http://www.crti.tec.ar.us
Technical Institutes	Northwest Technical Institute	http://nti.tec.ar.us
	Arkansas Association of Two-Year Colleges	http://www.aatyc.org
	Arkansas Northeastern College	http://www.anc.edu
	Arkansas State University-Beebe	http://www.asub.edu/
	Arkansas State University-Newport	http://www.asun.edu/
	Arkansas State University-Mountain Home	http://www.asumh.edu/
	Black River Technical College	http://www.blackrivertech.org/
	Cossatot Community College of the U of A	http://www.cccua.edu/
	East Arkansas Community College	http://www.eacc.edu/

Two-Year Community Colleges	Mid-South Community College	http://www.midsouthcc.edu/
	National Park Community College	http://www.npcc.edu/
	North Arkansas College	http://www.northark.edu/
	Northwest Arkansas Community College	http://www.nwacc.edu/
	Ouachita Technical College	http://www.otcweb.edu/
	Ozark College	http://www.ozarka.edu/
	Phillips Community College of the U of A	http://www.pccua.edu/
	Pulaski Technical College	http://www.pulaskitech.edu/
	Rich Mountain Community College	http://www.rmcc.edu/
	South Arkansas Community College	http://www.southark.edu/
	Southeast Community College	http://www.seark.org/
	Southern Arkansas University Tech	http://www.sautech.edu/
	U of A Community College at Batesville	http://www.uaccb.edu/
	U of A Community College at Hope	http://www.uacch.edu/
	U of A Community College at Morrilton	http://www.uaccm.edu/
Four-Year Public Universities and Institutions	Arkansas Department of Higher Education	http://www.arkansashighered.com/
	University of Arkansas	http://www.uark.edu/
	University of Arkansas for Medical Sciences	http://www.uams.edu/
	University of Arkansas at Little Rock	http://www.ualr.edu/
	University of Arkansas at Pine Bluff	http://www.uapb.edu/
	University of Arkansas at Monticello	http://www.uamont.edu/
	University of Arkansas at Fort Smith	http://www.uafortsmith.edu/Home/Index
	Arkansas State University	http://www.astate.edu/
	University of Central Arkansas	http://www.uca.edu/
	Arkansas Tech University	http://www.atu.edu/
	Henderson State University	http://www.hsu.edu/
	Southern Arkansas University	http://www.saumag.edu/
4-Year Independent Colleges and Universities	Arkansas Baptist College	http://www.arbaptcol.edu/
	Central Baptist College	http://www.cbc.edu/
	Crowley's Ridge College	http://www.crowleysridgecollege.edu/
	Harding University	http://www.harding.edu/
	Hendrix College	http://www.hendrix.edu/
	John Brown University	http://www.jbu.edu/
	Lyon College	http://www.lyon.edu/
	Ouachita Baptist University	http://www.obu.edu/
	Philander Smith College	http://www.philander.edu/
	Shorter College	http://shortercollege.4t.com/index.html
	University of Ozarks	http://www.ozarks.edu/index_shocked.html
	Williams Baptist College	http://www.wbcoll.edu/
Workforce Development Institutions	Arkansas Workforce Investment Board	http://www.arworks.org/statcon.html
	Arkansas Workforce Development One-stop Centers	http://www.arworks.org/local.html
	Arkansas Department of Workforce Education	http://www.work-ed.state.ar.us/
	Arkansas Manufacturing Solutions	http://www.mfgsolutions.org

PreK-12 Education Institutions

The role of preK-12 education is to provide the foundation for lifelong learning and help develop valuable social skills. It prepares the future workforce with basic reading and computing skills and knowledge in arts and science. It nurtures creativity and imagination. A preK-12 education system that plants the seeds of an entrepreneurial culture will help children think in innovative ways that will be rewarded in the marketplace when they become part of the labor force. These are the long-term, direct rewards to investing in preK-12 to the KBE.

There are also short-term, indirect rewards. A quality primary and secondary educational system is essential to attracting educated adults with families. Educated adults value and expect quality educational opportunities for their children. Failure to provide that level of education, at least in areas that are likely to have geographic advantages for the location of knowledge-based companies will significantly reduce the effectiveness of initiatives or programs designed to promote the KBE.[9]

There is an important trade-off that must be recognized. The direct rewards from a quality preK-12 system are unlikely to be realized for a substantial period. In addition, given the mobility of the knowledge-based workforce, it is unclear that the net benefit of improving preK-12 is positive if it comes at the expense of providing for other key KBE institutions.

While schools, districts and the state department of education pursue a wide range of programs designed to improve educational outcomes, not all of these directly develop the state's ability to compete in the KBE. One measure of effort by state preK-12 institutions is expenditures on technology. For example, the Arkansas Department of Education allocates or will allocate the following amounts this year:

- $1.5 million/year on the EAST program and Explornet program
- $5-$6 million/year from a federal grant to fund technology infrastructure improvement in poor school districts
- $3 million/year on developing distance-learning courses and infrastructure
- $10 million to set up interactive video system in public schools and upgrade technology in 2004

Programs and initiatives undertaken by preK-12 schools that have a direct effect on the creation of a workforce capable of functioning in the KBE, achieve one or more of the following goals:

- Promote competency in mathematics and the sciences
- Make routine the utilization of technology to promote and facilitate learning
- Provide experiential learning opportunities
- Reinforce the relationship between learning and economic opportunity
- Promote college or university attendance as a logical and obvious next step to creating economic opportunity for the student
- Build an understanding and appreciation for the role of entrepreneurship in the economy

- Market both the existing quality of, and improvement in, the state's preK-12 educational system

Key Current Programs, Initiatives and Partnerships

The following narrative highlights critical programs and initiatives that nurture entrepreneurial culture in Arkansas, particularly with respect to knowledge-based industries. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list.

Environmental and Spatial Technology Project (EAST)
The EAST Project directly addresses many of the goals that must be accomplished to prepare primary and secondary students for participation in the KBE.

Per the EAST Project website:[10]
The EAST model is grounded in solid pedagogical theory related to the use of technology as a catalyst for learning, collaborative learning and performance-based learning. Research outcomes that support the EAST model show that the following can occur when using this model:

- Technology is used to promote collaboration, higher order thinking and problem-solving
- Professional development is an important component of the education technology program
- Technology is effectively integrated into the curriculum
- Students are allowed to select appropriate technology tools to obtain, analyze, synthesize and assimilate information
- Effective use of technology allows the creation of new learning environments
- Home/school connections are enhanced through technology
- There is adequate access to technology for all students
- Teachers encourage students to utilize technology to find and make sense of information

EAST labs specifically provide experiential learning, integrating technology into the educational process. This model, gaining national recognition for its innovativeness, provides a platform for the development of other programs. Of particular interest is whether or not participation in the EAST project makes students more likely to matriculate from high school to college. Also, does the program encourage students to pursue degree programs in the sciences, engineering or other technology related fields? Judging the efficacy of the EAST project in fulfilling its promise of preparing and encouraging high school students' participation in the KBE requires instituting a system for tracking their educational and career paths.[11]

Regardless of the availability of data to quantify the value of the program, the model addresses many of the goals identified as important to preparing primary and secondary students for participation in the KBE.

In 2004, approximately 145 Arkansas high schools along with the University of Arkansas at Little Rock and the two-year campus of the University of Arkansas at Morrilton will participate in the program. EAST project participating schools have significantly benefited from an influx of technology. Each EAST lab offers students exposure to a variety of hardware and software. The applications provide a diverse learning experience. Some examples of the applications available to EAST lab participants are network system administration, global positioning systems, architectural design, web page design, computer animation, database management and other IT skills.

Arkansas Scholars[12]
The Arkansas Scholars program was developed by the Arkansas Business and Education Alliance. It is designed to bring together the business and education communities to promote the importance of education. The method is based on interaction between business leaders and high school students (grades 9-12). It begins with in-class presentations by local business leaders to second semester 8th graders. The presentations attempt to build students' understanding of the way in which employers make hiring decisions, the importance of education in job performance and salary differentials for various jobs that are tied to educational attainment. This program directly links economic opportunity to education. Further, it provides students with credible information on the rewards of higher education. The program does not directly focus on knowledge-based employment, the relationship between economic opportunity and the KBE, or on entrepreneurship.

In 2004, approximately one-third of all 8th graders in Arkansas will participate in the program. Again, although the program directly addresses several of the goals for preK-12 educational institutions, no method for ascertaining the programs efficacy is evident. Of the benefits from the program that would be difficult if not impossible to quantify, providing business leaders with access to both facilities and students is likely to generate an understanding by the business community of the challenges faced by Arkansas schools.

Entrepreneurial Education
Finally, specific programs for providing entrepreneurial education to students in preK-12 are not widely available. Indeed, a study conducted in February 2003[13] titled *Entrepreneurial Arkansas: Connecting the Dots*, concluded that a number of measures were necessary to promote entrepreneurship across the state. Specifically addressing primary and secondary students, the authors of the report recommended, "bringing entrepreneurial education programs to at least half of Arkansas' [at that time] 310 school districts within five years."

Several existing programs could serve as the basis for developing content and as a model for delivery. First, the EAST lab is clearly entrepreneurial in its approach and could serve as a base from which to "piggy-back" entrepreneurial training. In addition, the study recommends utilizing existing infrastructure. For example, the Arkansas Council for Economic Education provides curricula, teacher development programs and resources to promote economic literacy. These programs, based on a teach-the-teacher model, could be augmented with curricula for entrepreneurial education.[14] Further, there are six university-based centers for delivering content. These centers are potentially positioned to participate in development of entrepreneurial content and delivery using the established method for economic education. Finally, several foundations focus on entrepreneurship and entrepreneurial education, most notably the Ewing Marion Kauffman Foundation.

The Arkansas School for Math and Science Office of Distance Education[15]
One of the dominant challenges facing the state is providing access to math and science curricula for preK-12 students across the state. In July 1998, the Arkansas School for Math and Science, Office of Distance Education began delivering content to 23 rural schools in calculus, Spanish and German. Given the lack of access to science and foreign language courses for many of Arkansas' preK-12 students, the use of distance education provides in many cases, the only means of obtaining this curriculum.

Currently, the Arkansas School for Mathematics and Sciences, Office of Distance Education offers a wide range of courses serving over 1,000 students statewide.

Conclusions
The legislative response to the Lakeview decision by the Arkansas Supreme Court has provided an unequaled opportunity for improvement in Arkansas preschool, primary and secondary education. Several key pieces of legislation have direct impact on the educational goals directly linked to the ability of the state's preK-12 system to provide the foundation for development of a sufficient and continual supply of talent upon which to build knowledge-based companies in Arkansas. The legislation provides for increased funding (Act 94 and Act 107); more equitable distribution of funding (Act 59); stronger accounting standards (Act 61); greater accountability (Act 35); long-term monitoring of school performance (Act 57); consolidation of small, poor performing districts (Act 60); and finally securing the preeminence of preK-12 in the prioritization of state fiscal responsibilities (Act 108). Unfortunately, it is unclear whether these steps will lead to improved educational outcomes directly linked to promoting the KBE in Arkansas.

Several reasons for pessimism exist.

First, a great deal of emphasis and **resources** are designated to improve failing schools. While this response is understandable and indeed called for by federal "No Child Left Behind" legislation, it limits resources available for other programs and initiatives. Potentially, the resulting redistribution of funds could reduce the efficacy of programs within the preK-12 realm that positively effect pro-KBE factors or force redistributions from other state investments in institutions more directly related to promoting the KBE.

Second, the **scale and scope** of current initiatives or programs (for example, the Arkansas Scholars Program) designed to achieve many of the goals directly related to building the educational foundation of the KBE, is insufficient to yield substantial results. In the case of entrepreneurial education, it is extremely underdeveloped. Third, **technology** is often seen as a luxury or "special" in the educational process. This attitude, reinforced by budget limitations, implies the use of technology in education cannot be routine.

Wynne High School is a model for efforts to make technology available for each student. The school recently purchased 475 laptops for use by its roughly 800 students.[16] At a cost of $800,000, the laptops are intended to be as integral to the school day as textbooks or paper. The ultimate goal is to have one laptop per student.

“We feel that we can’t afford to let another child graduate from this school without truly teaching them how to implement technology on a day-to-day basis,” stated Beth Boeckmann, Wynne High School assistant superintendent.

Finally, the structure and method of **accountability** incentivizes a reversion to the mean. That is, lifting up the bottom, at the expense of providing excellence at the top. The outcomes from preK-12 education critical to promoting the KBE in Arkansas are unlikely to be important to educators if the system of accountability does not explicitly include their measure.

Two-year Community Colleges and Technical Institutes

Community colleges provide cost-effective general education for students seeking to transfer to four-year institutions. In addition, they provide vocational, occupational and technical education that benefits students and employers alike by improving worker productivity. These institutions are relatively nimble, capable of responding quickly to changing training needs of industry. As the needs of the local business community change, community colleges serve as a primary source of continuing education and workforce development.

The “customers” of community colleges can be divided into three distinct groups: students looking to obtain general education credits for transfer to four-year institutions, students seeking associate degrees or certificates to improve their employment opportunities, and lastly, nondegree seeking students interested in specific course offerings for personal or professional reasons.

Arkansas currently has 23 community colleges and two technical schools. Two-year college enrollment has grown rapidly, from 17,533 students in 1990 to 41,275 in 2003.[17] These institutions have the potential to promote the KBE in Arkansas in two principal ways. First, they are low cost, both in terms of tuition and also psychic costs for students matriculating from state high schools, many of whom are the first in their immediate families to attend college. Theoretically, reducing the costs of pursuing a college degree, whether the costs are psychic or monetary, should translate into increased demand for higher education, particularly when coupled with growing rewards to education. Second, two-year colleges and technical institutes provide point of access to continuing education opportunities for people currently in the workforce who cannot afford travel time or extended periods away from work.

Programs and initiatives undertaken by community colleges and technical institutes that have a direct effect on the creation of a workforce capable of functioning in the KBE achieve one or more of the following goals:

- Promote matriculation to four-year colleges and universities, optimally to pursue degrees in the sciences, engineering or other technical fields
- Facilitate the adoption of new technology, processes and production techniques by providing specific training for industry partners
- Provide access to advanced technical courses through distance education
- Provide access to entrepreneurial education initiatives
- Support pro-KBE programs and initiatives in local preK-12 institutions

Key Current Programs, Initiatives and Partnerships
The following narrative highlights critical programs and initiatives that nurture development of a technologically skilled workforce in Arkansas. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list.

Workforce Training Consortium
The consortium is designed to provide specialized training to support the local business community, in effect, acting as an outsourced training department. Operating through the Arkansas Association of Two-Year Colleges, the 23 two-year colleges provide statewide coverage. The consortium was formed in 1997. It currently provides services to more than 2,100 businesses annually. Course offerings are developed through interaction with the business community, professional organizations and state agencies such as the Arkansas Department of Workforce Development.

The Workforce Training Consortium is a response to the needs of existing industry. The potential exists for this program to facilitate the adoption and integration of technology into existing industries. This is especially true for smaller firms that do not have the resources to provide onsite training.

Access Arkansas
Access Arkansas is a distance education consortium of the state's two-year colleges. A wide range of courses are delivered online through 15 of the state's 23 two-year colleges. Examples of courses available include general education, introductory business courses, computer literacy and programming and interestingly, "walking for fitness." Providing general education via distance learning enhances the effort to promote the KBE if it leads to development of a workforce capable of competing for knowledge-based employment. Whether or not students are more likely to pursue a bachelor's degree given the increased availability to college courses that Access Arkansas provides ,is an open question.

Cisco Academies
Two-year colleges across the state have developed Cisco Academies both on their campuses and within approximately 60 state high schools. Cisco Academies provide a "comprehensive, global e-learning program [that] offers students an opportunity to pursue IT curricula through online instructor-led training and hands-on laboratory exercises. As a result, students can apply classroom learnings to actual technology challenges, which ultimately prepares tomorrow's workforce for life-long learning opportunities."[18]

The curriculum was originally designed to prepare students for the Cisco Certified Network Associate (CCNA) and Cisco Certified Network Professional (CCNP) degrees. Currently, the curriculum includes IT courses that reach beyond Cisco Systems. These include: Fundamentals of Web design sponsored by Adobe Systems; IT Essentials: PC Hardware and Software and IT Essentials; Network Operating Systems sponsored by Hewlett-Packard; Fundamentals of Voice and Data Cabling sponsored by Panduit; and Fundamentals of UNIX and Fundamentals of Java sponsored by Sun Microsystems.

The involvement of the states two-year colleges in the Cisco Academies program is based on training instructors who facilitate the e-learning process, and on their own in-house Cisco Academies. The Cisco model depends upon a train-the-trainer approach combined with web-based course work. That is, the "program delivers web-based content, online assessment, student performance tracking, hands-on labs, instructor training and support, and preparation for industry standard certifications."

Conclusions

Two-year colleges and technical institutes have grown rapidly over the last decade, both in terms of students and number of institutions. As recently as 1990, only 11 institutions existed across the state. Legislation passed in 1991 created an additional 14 institutions. The obvious potential benefit of growth in the system is improved access to higher education. Improved access is evidenced by the state's rank of 10th nationally in number of postsecondary schools per capita.

Two-year institutions are remarkably entrepreneurial in developing and delivering content. A recent article in the *Northwest Arkansas Business Journal* details the corporate associations of NorthWest Arkansas Community College. Among the corporations served are Wal-Mart, the Wal-Mart vendor community and Tyson Foods. Learning opportunities spawned through these affiliations include the ability to earn a marketing analyst certificate or a program designed for Hispanics that teaches personal finance skills. Obviously, two-year schools serve a wide range of educational needs.

Two-year schools also compete for scarce resources. Heavily dependent upon tuition and state support for the majority of their funding, these institutions are clearly incentivized to generate as many full-time equivalent hours as possible. To maximize potential revenue, two-year institutions have aggressively pursued expansion through satellite campuses and course offerings. With 11 public four-year schools competing for many of the same students offering many of the same courses, the effect has been to create an atmosphere of destructive competition.

Compounding the problems that arise from frenzied competition, students attending Arkansas two-year colleges and technical institutes are far less likely than their national counterparts to earn a four-year degree. Nationally, 13 percent of students entering two-year public institutions graduate with a bachelor's degree within six years. In Arkansas, only 3 percent eventually graduate from a four-year institution. This implies that any potential efficiency gains from lower monetary or psychic costs are not be realized.

Finally, it is impossible to judge the efficacy of various programs or institutions without a standardized system of accountability. Accountability that includes measurement of potential performance goals, such as percentage of students who matriculate and graduate from a state four-year institution, would provide a powerful incentive to meet the challenges of building a technologically skilled workforce.

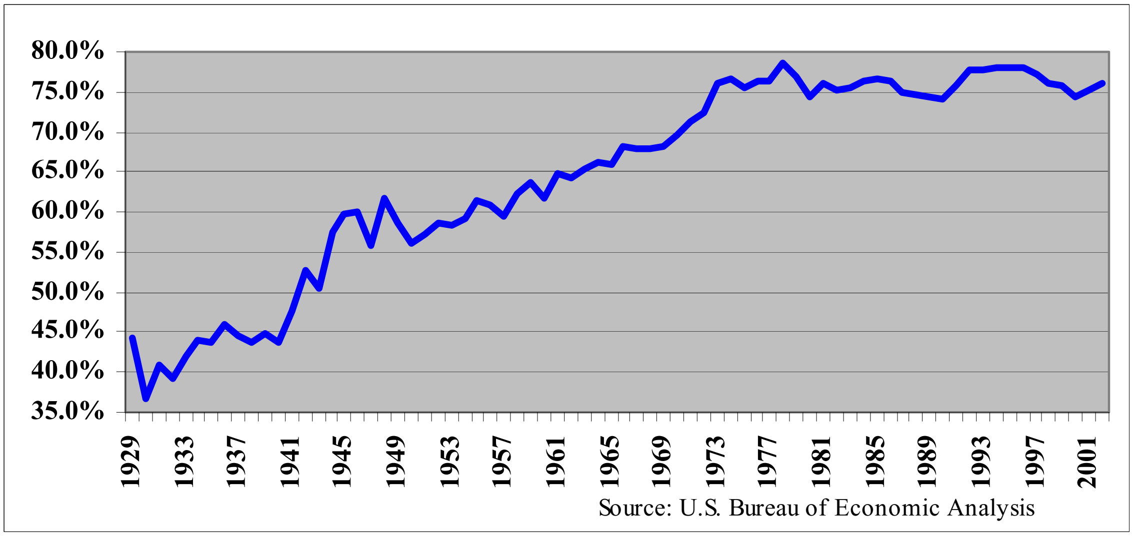
In the end, two-year schools play a vital role in meeting the flexible training needs of local business, providing professional development, facilitating programs to preK-12 such as the Cisco Academies, etc. However, the benefits of these activities accrue primarily to the existing economy. Given the shear number of institutions supported by a relatively small population, the benefits must come at the expense of programs and initiatives designed to prepare the Arkansas workforce for the KBE.

Four-year Universities

The common perception of the role of four-year colleges and universities is to produce highly skilled graduates in a variety of disciplines. In as much as this is the case, four-year colleges and universities are the primary workforce development institutions of the KBE. However, this is only a fraction of the impact that four-year institutions have on the KBE. In addition to training a technologically skilled workforce, universities produce basic and applied research, provide access to testing and laboratory equipment for businesses, create intellectual property upon which to build new businesses, promote the development of centers of excellence and industry clusters, train graduate students that eventually become faculty members at state two-year and state four-year colleges and universities, and a variety of other functions that directly or indirectly impact the growth of the KBE. Most importantly, universities and in particular research universities, are centers of discovery and innovation. All institutions of higher education are designed to create an educated and skilled workforce; research universities have the ability to create high-wage/high-skill employment through the creation of intellectual property.

During the 1950s, 1960s and 1970s, Arkansas made substantial economic progress, raising per capita income relative to the national average roughly 23 percentage points from the end of WWII to the mid-1970s. Progress was the direct result of improving high school graduation rates and implementing successful industrial recruitment strategies.

Arkansas per Capita Income Relative to the National Average



During the almost three decades since Arkansas personal per capita income peaked relative to the national average, significant efforts to improve access to higher education have taken place. These efforts have not translated into rising relative per capita income for Arkansans. It was the ability of the state to simultaneously improve employment opportunities through industrial recruitment and the quality of the state workforce through an improved educational infrastructure that translated directly into improved economic statistics. The development of the KBE in Arkansas is dependent upon the creation of a similar two-pronged approach: one that creates both a technologically skilled workforce and employment opportunities commensurate with their skills, talents and abilities.

Programs and initiatives undertaken by four-year universities that have a direct effect on the creation of a workforce capable of functioning in the KBE, achieve one or more of the following goals:

- Broadly encourage enrollment in a four-year institution
- Encourage study of technical fields such as engineering, computer sciences, biological sciences, etc.
- Promote retention and degree completion
- Encourage graduate education
- Expose students to the process of innovation
- Build relationships that provide economic opportunity either immediately or over time
- Provide entrepreneurial education across disciplines, including coursework and/or experiential learning as part of the degree requirements where possible
- Promote accountability and efficient resource utilization

Key Current Programs, Initiatives and Partnerships

The following narrative highlights critical programs and initiatives that nurture the development of a technologically skilled workforce in Arkansas. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list.

University of Arkansas at Little Rock (UALR) – Donaghey Cyber College
The UALR-Cyber College offers degree programs in information science and systems engineering. Established in 1999, the Cyber College benefits substantially from relationships with industry. Based on extensive input from Arkansas knowledge-based companies such as ALLTEL and Acxiom, the curriculum and research agenda of the Cyber College was designed to meet local industry needs. By developing symbiotic relationships with industry, the Cyber College strengthens both the KBE in Arkansas and builds demand for the graduates of Arkansas' four-year institutions.

Development of the Cyber College has meant the availability of new technologies, technologies that promote innovation and experimentation for Cyber College students. For example, in October 2003, the school's Virtual Reality Center obtained a new piece of technology referred to as a "cove." The $500,000 high-tech tool, funded by appropriation through the U.S. Department of Education, allows viewers to have the sensation of walking through a virtual reality generated by computer.[19]

In addition to providing educational opportunities in technical fields, the UALR Cyber College is addressing accountability, encourages enrollment through various scholarship opportunities including the CyberScholars scholarship, which is tied to enrollment in the Cyber College, and has a successful public-private partnership that directly generates economic opportunity.

The primary challenge facing the Cyber College lies in its ability to secure sufficient funding to realize its potential. Started with one-time money, the Cyber College was, as recently as January 2003, in jeopardy due to lack of funding.

Walton Gifts to the University of Arkansas
In October 1998, the Walton Family Charitable Support Foundation made a $50 million gift to what was later renamed the Sam M. Walton College of Business at the University of Arkansas, Fayetteville.[20] On April 11, 2002, the University of Arkansas received the largest gift in history as of that date to American public higher education—a $300 million commitment from the Walton Family Charitable Support Foundation of Bentonville, Arkansas, to establish and endow an undergraduate honors college and endow the graduate school.

Per the press release announcing the $300 million gift:

> "This gift will allow the University of Arkansas to realize its vision as a nationally competitive, student-centered research university serving Arkansas and the world," John White [Chancellor of the University of Arkansas] added. "Our goal is to build a 'Top 50' public research university to help lift our state, and this gift will do two extremely important things to propel us in that direction.

"First, it will allow the University to recruit highly talented undergraduate and graduate students and significantly greater numbers of them," he said. "This is essential because Arkansas ranks next to last among the 50 states and the District of Columbia in the percentage of the adult population with bachelor's and advanced degrees. Our state cannot compete in a global economy without a better-educated citizenry.

"Second, through the recruitment of new faculty and new graduate students, we will be able to build significantly stronger research programs in critical areas—in nanoscience, electronics packaging, spatial and sensing technologies, finance, food science, the life sciences, biotechnology, the physical and social sciences, logistics and transportation, engineering, retailing and many other key areas. This will enable us to create new products, processes, inventions, insights and interpretations that will help attract knowledge and technology-based business and industry to the state while also helping keep existing Arkansas companies competitive," White said.

The press release further explains how the extraordinary gift is to be allocated. The $200 million dedicated to the Honors College will be allocated thus:

- $113 million for student support, including the endowment of honors fellows, honors college academy scholars, research support for undergraduates in the honors college and support for international studies;
- $58 million for faculty, including funds to endow faculty chairs to recruit scholar-teachers to the honors program, funds to endow faculty positions, funds to endow distinguished professorships in the honors college, and funds to endow the chair for the dean of the honors college; and
- $29 million for library and technology support of the honors college.

The Graduate School

The $100 million to endow the University of Arkansas Graduate School will be apportioned as follows. The intent is to double the size of graduate enrollments from 2,936 at present to 5,500 by 2010 in the University's 34 doctoral and 96 master's programs, and to support the growth of University research programs. The $100 million will be allocated thus:

- $64 million for graduates students, including endowing distinguished doctoral fellow ships and endowing a fund for graduate assistants;
- $24 million to endow eight new graduate faculty endowed research chairs to recruit eight top new faculty members who have been elected to the National Academies of Science or Engineering or equivalent organizations worldwide; and
- $12 million for library and research support of graduate education.

The funding outlined for student support, support designed to attract the best talent to the University's undergraduate honors college and to the University of Arkansas Graduate School, directly builds enrollment and pursuit of graduate education. Further, the funding provides incentives for students to not only attend, but to complete their degrees. The funding allocated to graduate research faculty chairs will directly enhance research efforts, build critical mass in specific technical fields and disciplines, and ultimately build relationships that provide economic opportunity. This is a unique opportunity to create, in a relatively short time, a nationally and internationally recognized research university.

However, significant risks remain. Without attracting or building companies and industries from the ground up that provide opportunities for the graduates of the University of Arkansas or other state universities, opportunities that reward the acquisition of skills, graduates will look elsewhere for employment. This exodus not only enriches the economies of other states at the expense of the state of Arkansas through attrition, but the ability of the state to maintain its economic position relative to its peers is eroded. Declining economic opportunity relative to other states implies a continual inability to retain talent or improve employment opportunities, thus continuing the "brain drain." This is a slow but devastating spiral that becomes more difficult to reverse with each turn.

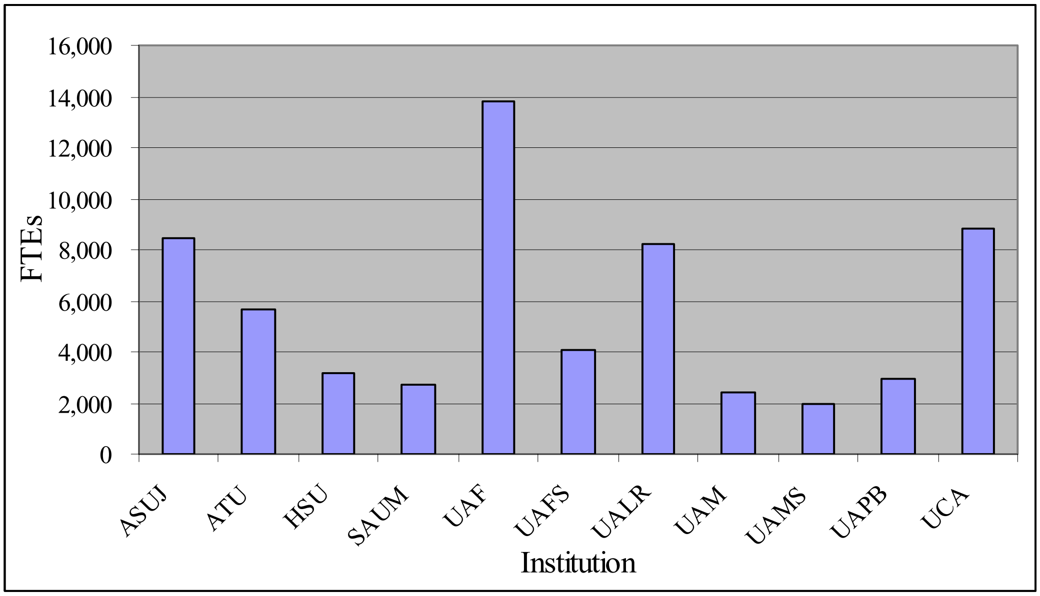
Arkansas Technical Careers Student Loan Forgiveness Program (Act 652 of 1999)
In an effort to stem the "brain drain," the state legislature passed the Arkansas Technical Careers Student Loan Forgiveness Program (Act 652 of 1999).

> *The purpose of this act is to establish a loan forgiveness program to assist and encourage people to enter and complete programs qualifying them to fill the demand for employees in various technical fields. The program will provide repayment for students admitted to high-demand technical training programs which shall be forgiven if the recipient works in a high-demand technical occupation in Arkansas and satisfies other requirements as set out in this act.*[21]

The program was extended in 2003 to include non-residents that graduate from an approved Arkansas postsecondary institution and plan to work full-time in Arkansas in the high-demand technical field for which they received training.[22] Despite being passed and appropriated by the legislature, the program has not been funded.

Conclusions
The state of Arkansas has 11 four-year institutions. Of these, two, the University of Arkansas, Fayetteville and the University of Arkansas for Medical Sciences, have research as a fundamental part of their missions. The four-year institutions are geographically dispersed throughout the state, although an "education corridor exists along I-40/I-30 from Ft. Smith (UAFS) through Little Rock (UALR) to Pine Bluff (UAPB). In general, with the exception of the state's research universities, each institution serves a municipal/regional constituency. In 2002/2003, total nonduplicated enrollment for the 11 four-year institutions was 89,087. Of the total, 20,524 students were enrolled in the state's two research universities and 68,563 were enrolled in the nine predominantly teaching universities. The full-time equivalent (FTE) student population for all four-year universities was 62,212 in 2003. This represents a 7.3 percent increase since 1999. Disaggregating the total, the state's two research universities generated 15,769 FTE students and the nine predominantly teaching universities generated 46,443 FTE students.

Full-time Equivalent Enrollment by Institution: 2002/2003 [23]



Note: Abbreviations for state four-year and two-year higher education institutions are included in the appendices.

Immense efforts and substantial commitments have been made to the state's four-year universities to improve quality. The effect of these efforts is obvious. Newspapers are replete with announcements by state institutions of generous gifts, national research awards won through competitive peer review processes, and faculty and student accomplishments. In short, students seeking educational opportunities that provide them with the ability to compete with peers from any other state need to look to another state for a four-year university education.

Specific difficulties are evident or impending that imperil gains made over the last several years. First, reform of preK-12 is going to be expensive. The final tally is unknown, but it is likely to imply stagnant or potentially reduced funding for other state agencies. Given the political difficulties of reducing funding for corrections or social services such as health care, the politically least painful source of new money to meet the needs of primary and secondary education is higher education. Barring new taxes or other unforeseen sources of funds, the state resources available to support higher education are likely to be uncertain.

Recall that Act 108 of the Second Extraordinary Session of the 2003 state legislature elevated preK-12 to a new funding category (A+)[24], the highest priority in the state budget. If we couple this legislation with the potential for an economic downturn that reduces state revenues, the impact on higher education could be severe. Simply by eliminating preK-12 from the programs available to absorb reductions in funding if revenues do not meet forecast, implies significantly larger and more painful cuts in the remaining budget categories.

Next, the current system of two-year and four-year institutions is difficult if not impossible to justify given the population and resources available. Specifically, the total number of state institutions of higher education is not dissimilar to the state of Florida. Florida has 11 four-year institutions (the same number as Arkansas) and 27 two-year institutions (two more than Arkansas). The population of Florida is 16.3 million; Arkansas' population is 2.6 million. The state of Iowa, with a population of 2.8 million supports three four-year institutions and 17 two-year institutions.[25]

Third, the only way to judge the net benefit to the state from ranking 10th nationally in terms of institutions per capita is to view the costs relative to the benefits of access. While developing an acceptable and valid measurement strategy for higher education and implementing that strategy would constitute a complete study in its own, several statistics provide proxy measures for the efficacy of the current system. The first is retention.

Retention Rates of Arkansas Two-year and Four-year Institutions[26]

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Four-Year	71.5	72.2	72.0	73.3	74.3	74.2	74.8	75.0	76.9	77.1
Two-Year	48.4	44.6	46.6	48.9	50.1	51.3	52.8	53.8	55.3	56.7
Total	65.1	64.8	65.8	66.8	67.6	67.4	67.8	68.1	70.2	70.3

The second relevant measure of performance is the translation of student enrollment into graduation.

The following table provides statistical outcomes for Arkansas' four-year and two-year universities and colleges.

Six-year Graduation Rates of Arkansas Four-year and Two-year Institutions[27]

Institution Type	Fall Cohort Year	Cumulative % Graduated
Public Four-Year Average	1992	35.3
	1993	37.4
	1994	38.7
	1995	39.8
	1996	41.8
Public Two-Year Average	1992	39.3
	1993	34.8
	1994	32.6
	1995	32.9
	1996	31.1
Total Four & Two-Year Average	1992	36.4
	1993	36.7
	1994	37.2
	1995	37.9
	1996	38.8

Obviously, there is room for improvement both in terms of retention of freshmen and the productivity of Arkansas institutions of higher education. That is, the translation of inputs into critical outputs for the success of the KBE-college graduates.

The next table specifically examines the six-year graduation rate of state four-year institutions for the most recent year for which data is available—1996.

Cumulative Graduation Rates for Native and Transfer Students after 6 Years[28]

Institution	Native % Bachelors	Transfer % Bachelors	Cumulative % Graduating	Cumulative as a % of Average
ASUJ	33.6	3.1	41.7	100%
ATU	39.7	4.6	49.1	117%
HSU	27.0	4.0	36.1	86%
SAUM	26.9	2.3	36.3	87%
U of A	43.3	3.1	48.2	115%
UAFS	0.0	5.6	34.9	84%
UALR	17.0	2.8	24.1	58%
UAM	23.6	4.4	35.1	84%
UAMS	N/A	N/A	N/A	N/A
UAPB	27.0	0.3	28.7	69%
UCA	39.1	6.7	51.0	122%
Average	31.7	3.9	41.8	100%

The intent of access is to improve the percentage of Arkansas high school students achieving a postsecondary degree, ultimately improving the educational attainment statistics for the state workforce. In 2000, Arkansas' college-going rate ranked the state 36th nationally in terms of high school graduates that choose to attend a college or university. In 2002, the percentage of adults, 25 or older with at least a bachelor's degree in Arkansas was roughly 18 percent, ranking the state 50th.

Finally, the current system promotes destructive and wasteful behavior for several reasons:

- No plan is evident that links state institutions of higher education to a strategic plan for economic development of Arkansas.
- In lieu of codified responsibilities, and limitations on expansion not directly tied to the performance of the core mission of the institution, significant mission creep has occurred.
- Resource scarcity combined with frenzied competition has eroded one of the most effective attributes of higher education institutions—cooperation.
- Lastly, no comprehensive system exists to measure outcomes relative to resource allocation, in short, the system lacks accountability.

Workforce Development Institutions

Workforce development institutions cover a range of public and private entities, including employer organizations, state workforce development agencies, community colleges, community technology centers and community action agencies. They provide training programs that bridge the gap between industry-based skill shortages and dislocated workers, job seekers and the continuing education needs of the workforce.

Programs and initiatives undertaken by workforce development that have a direct effect on the creation of a workforce capable of functioning in the KBE achieve one or more of the following goals:

- Provide wide ranging access to continuing education
- Utilize all effective means of delivering content
- Are focused on current business needs
- Facilitate the evolution of the state's economy to service-oriented and knowledge-based
- Promote use of technology
- Provide accountability

Key Current Programs, Initiatives, and Partnerships

The following narrative highlights critical programs and initiatives that nurture workforce development in Arkansas, particularly with respect to knowledge-based industries. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list.

Tech Prep Associate Degree Program [29]
The Tech Prep Associate Degree Program [TPAD] is a program by which Arkansas high school students are able to earn 6–21 hours of articulated college credit for technical courses by the time they graduate without paying tuition. The college credits earned are held in escrow until the student completes at least six hours or one semester at the postsecondary institution granting the credit.

TPAD links high school academics and technical curricula with postsecondary curricula to create a career focus program of study without duplication of coursework. Key elements of this process include:

- Career guidance and counseling for students, informing them of program and career options, and encouraging goal setting;
- In-service training for secondary and postsecondary teachers to enable effective implementation of TPAD programs;
- In-service training for secondary and postsecondary counselors to more effectively recruit students, ensure successful program completion and place students in appropriate employment; and
- Preparatory and support services to assist program participants, including provisions for equal access for special-populations students.

To enter the program, a student (and parent) must sign an agreement to follow a career focus program of study, beginning in grades 9–11, which leads to the attainment of a postsecondary degree, certificate or approved apprenticeship. Currently, more than 150 secondary schools have articulation agreements with 35 postsecondary institutions.

This national program is funded under Title II of the Carl D. Perkins Vocational and Technical Education Act of 1998 and is administered by the Arkansas Department of Workforce Education. Annually, more than $1 million are allocated to 15 regional consortia (partnerships of local school districts, two-year and four-year colleges, and business/industry) to coordinate the program mission and to work in concert with other initiatives, such as Career Academies, High Schools That Work, Arkansas Scholars and Arkansas Career Opportunities.

Arkansas SkillsUSA[30]
SkillsUSA is a national organization serving more than 264,000 high school and college students and professional members enrolled in training programs in technical, skilled and service occupations, including health occupations. Approximately 14,500 teachers and school administrators serve as professional SkillsUSA members and instructors. More than 1,000 corporations, trade associations and labor unions actively support SkillsUSA on a national level through financial aid, in-kind contributions and involvement of their people in SkillsUSA activities. Many more work directly with state associations and local chapters. SkillsUSA programs include local, state and national competitions in which students demonstrate occupational and leadership skills. During the annual national-level SkillsUSA Championships, more than 4,100 students compete in 75 occupational and leadership skill areas. SkillsUSA programs also help to establish industry standards for job skill training in the classroom.

Efforts in Cross County, Arkansas[31]
In 2001, The University of Arkansas College of Engineering and subsequently the University of Arkansas Economic Development Institute developed a partnership that has been ongoing with the residents of Cross County in eastern Arkansas. The Cross County Economic Development Corporation (CCEDC) was created in 1999 by a three-year, 1 percent sales tax that generated $4.5 million for economic development in a county of 20,000 people located 50 miles west of Memphis. The major thrusts of the Cross County—University of Arkansas partnership are the creation of rewarding employment opportunities and improved quality of life for the people of Cross County and surrounding counties. Examples of partnership efforts include:

- **Technology Center for the Delta:** The Technology Center, born out of discussions between residents of Cross County and the University of Arkansas, is to be located in Wynne, the county seat of Cross County. It is to be a comprehensive center for broad-based (economic, community, educational, leadership) development and will serve as a launching pad in the region for University of Arkansas programs and others to include the Workforce Investment Board and the East Arkansas Community College.

- **SEED (Student Efforts in Economic Development):** CCEDC has worked with instructors and students in Interior Design and Landscape Architecture on two projects. The Interior Design project was to provide ideas for space planning in the Technology Center of the Delta. The Landscape Architecture class project was to develop ecotourism possibilities for the historic Wittsburg community located in close proximity to Village Creek State Park and the Parkin Archeological State Park in Cross County.

Various entities in Cross County have partnered with University of Arkansas faculty to submit a number of proposals to the NSF, U.S. Department of Commerce and U.S. Department of Education as well as a number of other public and private funding sources. To date, The Delta Regional Authority has funded one of these proposals ($310,000) designed to enhance distance-learning capabilities among the three school districts in Cross County, the Technology Center for the Delta, East Arkansas Community College and the University Arkansas, Fayetteville.

Conclusions

The evidence suggests that a variety of programs exist to develop Arkansas' workforce, many of them novel in their approach. The current structure of delivery and content offerings reflect the existing nature of the Arkansas economy. It is paramount that the structure of the current system be flexible enough to support the needs of a changing economy. Referring back to the discussion of two-year colleges, the system appears poised to take advantage of opportunities as they arise.

In addition, four-year institutions also offer a wide range of programs and delivery methods to provide as much access as possible. The primary impediment to workforce development designed to build the knowledge-based workforce is not the lack of institutions with the capacity to deliver or develop content, it is the lack of current demand for that content.

Institutions Nurturing an Entrepreneurial Culture

Colleges and universities, small business development centers, state and local chambers of commerce and entrepreneur network groups are critical players in creating a vibrant entrepreneurial climate for the KBE. The following table provides a list of institutions that are involved in developing entrepreneurial culture in Arkansas.

Institutions Nurturing Entrepreneurial Culture

Broadly Defined Institutions	Key Institutions	Web Site
Universities	Refer to Higher Education Institution List	
Small Business Development Centers (SBDC)	Arkansas SBDC Lead Office – Little Rock	http://www.asbdc.ualr.edu
	Arkansas SBDC Regional Office – Arkadelphia	http://www.hsu.edu/dept/sbdc/index.html
	Arkansas SBDC Regional Office – Fayetteville	http://sbdc.waltoncollege.uark.edu
	Arkansas SBDC Regional Office – Fort Smith	http://www.uafortsmith.edu/SBDC
	Arkansas SBDC Regional Office – Jonesboro	http://www.deltaced.astate.edu/asbdc.htm

	Arkansas SBDC Regional Office – Magnolia	http://www.saumag.edu/sbd
	Arkansas SBDC Regional Office – McGehee	http://www.uamont.edu/McGehee/SBDC/SBDChome.htm
State and Local Chambers of Commerce	Arkansas State Chamber of Commerce	http://www.statechamber-aia.dina.org
	Local Chambers of Commerce	http://www.dina.org/resources/chambers.html
Entrepreneur Networking Organizations	Arkansas Venture Forum	http://arkansasventureforum.com
	ARKWIT (Arkansas Chapter of WorldWIT, the leading global online and offline network for women in business and technology)	http://worldwit.org/ChapterDetails.aspx?C=12

Colleges and Universities

Colleges and universities house entrepreneur centers that offer courses, conferences, internships, web sites and research activities designed to promote entrepreneurial education. Universities can provide incentives to faculty startups to conduct research with potential commercial applications. University-sponsored technology incubators and research parks provide supporting services that nurture technology-based small businesses until they can survive in the open market.

Small Business Development Centers

Administered by the U.S. Small Business Administration (SBA), Small Business Development Centers (SBDCs) provide up-to-date counseling, training and technical assistance in all aspects of small business management, including financial, marketing, production, organization, engineering and technical problems and feasibility studies. SBDCs also make special efforts to reach socially and economically disadvantaged groups, veterans, women, minorities and the disabled. They provide assistance to small businesses applying for Small Business Innovation and Research (SBIR) grants from federal agencies.

State and Local Chambers of Commerce

State and local Chambers of Commerce provide networking and collaborating opportunities among their members. They also provide small business resource guides that open the door for small business owners seeking to team with established companies.

Entrepreneur Networking Organizations

Networks are a central component of an entrepreneurial climate.[32] They serve “brokering roles” that link entrepreneurs and resources until the entrepreneur has established his or her own network. They provide a vehicle for aggregating and projecting the voice of small entrepreneurs and emerging industries, helping entrepreneurs, civic leaders and public policy makers alike to better understand and address barriers for growth. Networks help “brand” a region by sending a message that a community supports entrepreneurs and desires their presence in the region.

Without a pipeline of entrepreneurs and a culture that values and nurtures entrepreneurial behavior, economic growth, both in the knowledge-based economy and the economy at large, will not reach its potential and will likely stagnate.

Programs and initiatives undertaken by institutions promoting and supporting the development of an entrepreneurial culture that have a direct effect on the creation of the KBE achieve one or more of the following goals:

- Achieve sufficient scope and scale to have measurable impact
- Reinforce entrepreneurial education programs
- Coordinate with institutions providing financial or technical support
- Provide successful translation of promising concepts into promising companies
- Promote the role of entrepreneur in the state's economy
- Reach those people most likely to start knowledge-based companies

Key Current Programs, Initiatives, and Partnerships

The following narrative highlights critical programs and initiatives that nurture entrepreneurial culture in Arkansas, particularly with respect to knowledge-based industries. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list.

Governor's Awards for Entrepreneurial Development

With a vision for promoting entrepreneurship, business school deans from several universities and business leaders conceived the Governor's Award for Entrepreneurial Development.[33] With one of the largest cash awards pools in America, the Graduate & Undergraduate Business Plan Competition of the Governor's Awards for Entrepreneurial Development is designed to encourage students of Arkansas' universities and colleges to act upon their ideas and talents in order to produce tomorrow's businesses. Since its inception in 2001, $269,000 in cash was awarded to 14 student teams and their faculty advisors that submitted business plans showing significant potential.

Students involved in the competition gain access to networks of successful entrepreneurs, lenders and investors, teambuilding opportunities, business planning skills and media exposure. One of the goals of the competition is to encourage the development and commercialization of ideas and technologies being discovered in Arkansas universities. Multidisciplinary teams that combine members from technical disciplines with members from the colleges of business are encouraged. Multidisciplinary teams bring together the pieces necessary for bridging the gap between technology and the marketplace.

Capital Resource Corporation, an affiliate company of the Arkansas Capital Corporation Group, manages the competition in association with the Arkansas Small Business Development Center, the Arkansas Department of Economic Development, the Arkansas Development Finance Authority and the Arkansas Science and Technology Authority.

Entrants also compete in a competition for the "Best Business Plan Involving Technology." The plan that best incorporates technology in both the undergraduate and graduate competitions receives a cash award. Technology is defined as the systematic application of science, especially to industrial or commercial objectives, and focused in the following areas: advanced materials; agriculture, food, and life sciences; biotechnology and bioengineering; environmental; manufacturing systems; transportation and logistics; and information technology.

Entrepreneurial Education Programs of the Arkansas Small Business Development Center (ASBDC)

The Arkansas SBDC is a partnership funded by the U.S. Small Business Administration, the University of Arkansas at Little Rock College of Business and other Arkansas institutions of higher education.[34] ASBDC's Research Center contains various research materials to help in the business formation process. Some of the resources include sample business plans, industry start-up guides, books on varying business topics, Internet access and CD-ROM databases. In addition, ASBDC provides one-to-one professional consulting for business owners and entrepreneurs at no cost. Help available includes advice on operating challenges in existing businesses, review of business plans and strategies, guidance in starting new businesses, preparation of loan requests, financial analysis and budget development. Finally, ASBDC offers seminars and training sessions on a variety of business topics offered around the state. The topics and scheduling vary among ASBDC's offices.

Arkansas Techpreneur and the Rural Entrepreneurship Project

These two programs are recent initiatives by the Capital Resource Corporation. The purpose of the Techpreneur organization is to foster the growth of entrepreneurs and their technology-based companies in central Arkansas by creating an open environment for education and entrepreneurship.[35] The purpose of the Rural Entrepreneurship Project is to develop communities with systems to support rural entrepreneurs.

Pilot Project for Entrepreneurship in Arkansas

The Arkansas Science and Technology Authority received a grant of $443,750 from the Winthrop Rockefeller Foundation to fund a pilot Project for Entrepreneurship in Arkansas.[36] This pilot project when completed will identify critical educational and economic development indicators upon which entrepreneurship depends; develop information and policy options for entrepreneurship that would influence the performance indicators; establish a model delivery system for information; test policy options; and inventory and assess relevant public policy from the 2003 legislative session. Funding for this project spans 31 months starting April 1, 2003 and ending on October 31, 2005.

Small Business Innovation Research Program

The Small Business Innovation Research Program (SBIR) is a highly competitive program that encourages small business to explore their technological potential and provides the incentive to profit from its commercialization.[37] SBIR targets the entrepreneurial sector because that is where most innovation and innovators thrive. However, the risk and expense of conducting serious R&D efforts are often beyond the means of many small businesses. By reserving a specific percentage of federal R&D funds for small business, SBIR protects the small business and enables it to compete on the same level as larger businesses. SBIR funds the critical startup and development stages and it encourages the commercialization of a technology, product or service that in turn, stimulates the U.S. economy. Since its enactment in 1982, as part of the Small Business Innovation

Development Act, SBIR has helped thousands of small businesses compete for federal research and development awards.

Small businesses must meet certain eligibility criteria to participate in the SBIR program: they must be American-owned and independently operated; they must be a for-profit firm; the principal researcher must be employed by the business; and the company size must be limited to 500 employees.

Each year, 10 federal departments and agencies are required by SBIR to reserve a portion of their R&D funds for award to small business, including the departments of Agriculture, Commerce, Defense, Education, Energy, Health and Human Services, and Transportation; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation. These agencies designate R&D topics and accept proposals.

Following the submission of proposals, the agencies make SBIR awards based on small business qualification, degree of innovation, technical merit and future market potential. Small businesses that receive awards or grants then begin a three-phase program.

Phase I is the startup phase and includes awards of up to $100,000 for approximately six months. The awards support exploration of the technical merit or feasibility of an idea or technology. Phase II awards can be up to $750,000 for as long as two years to expand Phase I results. During this time, the R&D work is performed and the developer evaluates commercialization potential. Only Phase I award winners are considered for Phase II. Phase III is the period during which Phase II innovation moves from the laboratory into the marketplace. No SBIR funds support this phase. The small business must find funding in the private sector or other non-SBIR federal agency funding.

The State of Arkansas had a total of eight SBIR awards totaling $2.03 million in 2002, the latest year for which data are available. Arkansas ranked 46th among the states in terms of total SBIR funding in 2002.[38]

Small Business Technology Transfer Program

The Small Business Technology Transfer Program (STTR) expands funding opportunities in the federal innovation research and development arena.[39] Central to the program is expansion of the public/private sector partnership to include the joint venture opportunities for small business and the nation's premier nonprofit research institutions. STTR's most important role is to foster the innovation necessary to meet the nation's scientific and technological challenges in the 21st century.

Small businesses must meet certain eligibility criteria to participate in the STTR Program: they must be American-owned and independently operated; they must be a for-profit firm; the principal researcher need not be employed by the small business; and the company size is limited to 500 employees. There is no size limit for the nonprofit research institution, but it must be located in the U.S. and be either a nonprofit college or university, a domestic nonprofit research organization or a federally funded R&D center.

Each year, five federal departments and agencies are required by STTR to reserve a portion of their R&D funds for award to small business/nonprofit research institution partnerships: the Department of Defense, the Department of Energy, the Department of Health and Human Services, the National Aeronautics and Space Administration, and the National Science Foundation. These agencies designate R&D topics and accept proposals.

Following the submission of proposals, the agencies make STTR awards based on small business/nonprofit research institution qualification, degree of innovation and future market potential. Small businesses that receive awards or grants then begin a three-phase program.

Phase I is the startup phase. Awards of up to $100,000 for approximately one year fund the exploration of the scientific, technical and commercial feasibility of an idea or technology. Phase II awards of up to $500,000, for as long as two years, expand Phase I results. During this period, the R&D work is performed and the developer begins to consider commercial potential. Only Phase I award winners are considered for Phase II. Phase III is the period during which Phase II innovation moves from the laboratory into the marketplace. No STTR funds support this phase. The small business must find funding in the private sector or other non-STTR federal agency funding.

The State of Arkansas had one STTR award totaling $99,972 in 2002, the latest year for which data are available. Arkansas ranked 42nd among the states in terms of total STTR funding that year.[40]

University of Arkansas Innovation Incubator/microEP Program

The Innovation Incubator (I^2) is an outreach program of the University of Arkansas and the Arkansas Science and Technology Authority. The program, a National Science Foundation Partnerships-for-Innovation Project, is targeted at increasing the number and quality of knowledge-based business startups within the state of Arkansas.[41] The program is tied to the microelectronics-Photonics (microEP) graduate program at the U of A. Science and engineering students in the program are required to take at least six hours of graduate courses in management, including a three-hour course titled "Entrepreneurship of Technology." I^2 matches graduate students with client companies and provides access to university facilities and resources. I^2 also works proactively to help companies create and submit SBIR proposals.[42]

Conclusions

In September 2002, the authors of the *Report of the Task Force for the Creation of Knowledge-based Jobs* wrote, "Another indicator often used to gauge a state's progress in economic development is the extent to which entrepreneurial activities are encouraged and nurtured. There is still much to do in this area, but significant progress has been made." Indeed, progress continues at a rapid pace. In 1999, the state received a total of three SBIR awards in the amount of $222,000. In 2002, the state received eight awards totaling slightly more than $2 million.

Moving forward, strategies most likely to accelerate current momentum will:

- Identify individuals or groups most likely to have both the capacity and desire to start a knowledge-based company
- Determine whether existing initiatives and programs are sufficient to induce/encourage entrepreneurial activity
- Address barriers to participation in the entrepreneurial community, if such barriers exist

For example, faculty at research institutions have opportunities to develop commercially viable technologies that could form the basis for a new company. They are also constrained by the current system of performance measurement that does not explicitly recognize pursuit of this type of technology. Further, significant barriers exist that inhibit faculty from leaving the university to pursue entrepreneurial opportunities, or dedicating the necessary time to existing responsibilities as well as developing a startup company.

Other factors that impede Arkansas from realizing its full potential include the lack of entrepreneurial education, especially in conjunction with technical degree programs, a lack of critical mass in science and technology graduate programs, and a thin but improving system of financial support including angel and venture capital.

Institutions Creating and Facilitating Knowledge Spillovers

Localized clusters of high-technology firms are closely associated with geographically-bound knowledge spillovers from universities and federal laboratories. University research is a source of significant innovation-generating knowledge that diffuses initially through personal contacts to adjacent firms, especially those based in a university affiliated research and technology park. Information flows are usually attributed to the use of faculty as technical consultants and graduate or post-graduate students as research assistants; the use of university facilities; informal communication among individuals at trade shows, industry conferences, seminars, talks and social activities; or joint participation in commercial ventures by university and corporate scientists through contracted research projects. Since both basic and applied university research may benefit private enterprise in various ways, it induces firms to co-locate all or part of their operations.

The following table provides a list of institutions that are involved in the creation of commercially viable knowledge, and institutions that facilitate its use in the creation of knowledge-based companies.

Institutions Providing Knowledge Spillovers

Broadly Defined Institutions	Key Institutions	Web Site
Research Parks	University of Arkansas Technology Development Foundation	http://www.uark.edu/admin/rsspinfo/industry/index.html
	Arkansas Research and Technology Park	http://www.uark.edu/admin/rsspinfo/techtransfer/index.html
	UA Innovation Center	http://www.uark.edu/admin/rsspinfo/industry/index.html
Centers of Excellence	National Center for Toxicological Research	http://www.fda.gov/nctr/overview/mission.htm
	Arkansas Children's Hospital	http://www.archildrens.org/
	John L. McClelland Memorial Veterans Hospital	http://www.vamclr.org/AMMS/
	Arkansas Biosciences Institute	http://www.arbiosciences.org/
	UAMS Memory Research Center	http://alzheimer.uams.edu/
	UAMS Arkansas Cancer Research Center	http://www.acrc.uams.edu/
	UAMS Arkansas Center for Birth Defects Research and Prevention	http://arbirthdefectsresearch.uams.edu/
	UAMS Arkansas Center for Health Improvement	http://www.achi.net/
	UAMS Arkansas Center for Neuroscience	http://www.uams.edu/stephensinstitute/default.html
	Arkansas Children's Nutrition Center	http://www.acnc.uams.edu/
	UAMS Biomedical Biotechnology Center	http://www.uamsbiotech.com/
	UAMS Center for Orthopaedic Research	http://www.cor.uams.edu/
	UAMS Center for Osteoporosis and Metabolic Bone Diseases	http://endocrinology.uams.edu/osteocenter.htm
	UAMS Center for Outcomes Research and Effectiveness	http://www.netoutcomes.net/
	UAMS Donald W. Reynolds Center on Aging	http://centeronaging.uams.edu/
	UAMS General Clinical Research Center	http://www.uams.edu/gcrc/
	UAMS Harvey & Bernice Jones Eye Institute	http://www.uams.edu/jei/
	UAMS Jackson T. Stephens Spine & Neurosciences Institute	http://www.uams.edu/stephensinstitute/default.html
	UAMS Myeloma Institute for Research and Therapy	http://myeloma.uams.edu/
	UAMS Pat and Willard Walker Eye Research Center	http://www.uams.edu/jei/research_center/
	UA Center for Engineering Logistics and Distribution	http://www.celdi.ineg.uark.edu/
	UA Mack-Blackwell Transportation Center	http://www.mackblackwell.org/
	UA Materials and Manufacturing Research Laboratories	http://www.engr.uark.edu/
	UA High Density Electronics Center	http://www.hidec.uark.edu/
	UA Computational Mechanics Center	http://www.cveg.uark.edu/computationalLab/
	UA Microelectronics-Photonics	http://microep.uark.edu/
	UA Membrane Separation Center	http://www.cheg.uark.edu/research.asp

	UA Arkansas Center for Technology Transfer (ACTT)	http://webdev.engr.uark.edu/ACTT/
	UA Chemical Hazards Research Center	http://www.cheg.uark.edu/research.asp
	UA Arkansas Center for Electronics-Photonic Materials Innovation (ACEMI)	http://microep.uark.edu/
	UA Arkansas Advanced Photovoltaic Research Center	http://www.ee.uark.edu/introduction/deptglance.htm
	UA Institute of Food Science and Engineering	http://www.uark.edu/depts/ifse/
	UA Center for Food Safety and Quality	http://www.uark.edu/depts/ifse/CFSQ.html
	UA Center for Food Processing and Engineering	http://www.uark.edu/depts/ifse/CFPE.HTML
	UA Center for Human Nutrition and Functional Foods	http://www.uark.edu/depts/ifse/CFHN.html
	UA Center of Excellence for Poultry Science	http://www.uark.edu/depts/posc/poultry.html
	UA Genomics Core Laboratory	http://advancement.uark.edu/pubs/Research_Frontiers/spring_2001/03_Research_Briefs.html
	UA Poultry Health Laboratory	http://www.uark.edu/depts/intagpro/poultry.html
	UA Central Analytical Laboratory	http://www.uark.edu/depts/posc/CAL/
	UA Arkansas Water Resources Center	http://www.uark.edu/depts/awrc/
	UA Center for Sensing Technologies and Research (CSTAR)	http://www.uark.edu/depts/anylchem/cstar/sens.html
	UA Center for Advanced Spatial Technologies (CAST)	http://www.cast.uark.edu/
	UA Mass Spectrometry Laboratory	http://www.uark.edu/depts/anylchem/Spec/
	UA Center for Protein Structure and Function	http://www.uark.edu/depts/cheminfo/uarkchem/protein/
	UA Arkansas-Oklahoma Center for Space and Planetary Sciences	http://www.uark.edu/misc/csaps/
	UA Center for Semiconductor Physics in Nanostructures	http://www.nhn.ou.edu/cspin/index.html
	UA Research Laboratory of Quantum and Nonlinear Optics	http://www.uark.edu/misc/quantopt/
	UA Semiconductor Fabrication and Nanoscale Characterization Facility	http://www.uark.edu/depts/physics/ research/mbe/mbestm.html
	UA Center for Business and Economic Research	http://cber.uark.edu/
	UA Center for Management and Executive Development	http://cmed.uark.edu/
	UA Center for Retailing Excellence	http://cre.uark.edu/
	UA Supply Chain Management Research Center	http://scmr.uark.edu/
	UA Information Technology Research Center	http://itrc.uark.edu/
	UA Bessie B. Moore Center for Economic Research	http://ceed.uark.edu/
	Arkansas Network of Centers for Math and Science Education	http://www.atu.edu/acad/acadcen/mscenter/Centers%20for%20Math%20and%20Science.htm
	UA Center of Leadership in Public Service	http://clintonschool.uasys.edu/center/
Office of Research and Sponsored Programs	UA Research Support and Sponsored Program	http://www.uark.edu/admin/rsspinfo/industry/fac-resources.html
	UALR Office of Research and Sponsored Program	http://www.ualr.edu/orsp/
	UAMS Office of Research and Sponsored Program	http://www.uams.edu/orsp/index.shtm

The importance of the linkage between university research and commercialization of tech products and services cannot be understated. University research centers and institutions are the source of many improvements in technology, e.g., medical research and processes research, which ultimately diffuse throughout the entire economy. This section highlights some of the critical institutions providing knowledge spillovers: Arkansas Biosciences Institute, OU-UA Center for Semiconductor Physics in Nanostructures, and the Myeloma Institute for Research and Therapy. We strongly encourage the reader to examine the section on what programs, partnerships and initiatives are present or proposed in the realm of technology development and tech transfer to get a fuller picture of how academic research can be transferred into marketable products and services.

Programs, initiatives and partnerships that translate the pursuit of knowledge through basic and applied research into economically viable technologies forming the foundation of the KBE, achieve one or more of the following goals:

- Build networks of individuals, groups or institutions that
    - Maximize the rate at which knowledge is created
    - Build knowledge into a portfolio of commercially viable intellectual property
    - Efficiently transfer that intellectual property to the commercial realm
    - Maximize the probability of successful commercial application
- Constantly monitor evolving market opportunities
- Respond rapidly to opportunities once identified
- Take advantage of centers of excellence

Key Current Programs, Initiatives and Partnerships

The following narrative highlights programs, initiatives and partnerships that promote the creation of knowledge-based industries founded on the research capacity and intellectual property of Arkansas universities.

Arkansas Biosciences Institute [43]

The Arkansas Biosciences Institute (ABI) is an agricultural and medical research consortium dedicated to improving the health of Arkansans. The ABI was created as the major research component of the Tobacco Settlement Proceeds Act of 2000, which was approved in the general election by 64 percent of Arkansas voters.

Scientists with the five member organizations—Arkansas Children's Hospital, Arkansas State University, the University of Arkansas Division of Agriculture, the University of Arkansas, Fayetteville and the University of Arkansas for Medical Sciences—focus on agriculture, and basic and clinical scientific research that will lead to health improvement, especially in the area of tobacco-related diseases. As part of its enabling legislation, ABI has five research areas:

- Agricultural research with medical implications;
- Bioengineering research that expands genetic knowledge and creates new potential applications in the agricultural-medical fields;
- Tobacco-related research that identifies and applies behavioral, diagnostic and

therapeutic knowledge to address the high level of tobacco-related illnesses in Arkansas;
- Nutrition and other research that is aimed at preventing and treating cancer, congenital and hereditary conditions or other related conditions; and
- Other areas that are related to primary ABI-supported programs.

Funding from the ABI enables research institutions to expand their research and attract additional federal and private research support. With the new seed money, and research collaborations that the ABI fosters, Arkansas will be able to attract more researchers and scientists to the state, stimulate industry partnerships for new economic development, and work faster and harder to improve the health of Arkansans.

OU-UA Center for Semiconductor Physics in Nanostructures (CSPIN)
The Center for Semiconductor Physics in Nanostructures is an interdisciplinary collaboration between the University of Arkansas (UA) and the University of Oklahoma (OU). Its mission is to grow or fabricate and characterize nanostructure in semiconductors, to study the new physics associated with the behavior of individual and arrays of nanostructures and finally explore how they can be utilized in next generation electronic, optical and chemical systems.[44]

OU and UA both perform cutting-edge research in semiconductor nanostructures, with a total of seven NSF young investigator awards among Center investigators. Both have world-class epitaxial growth facilities, and both have proven expertise in growing and characterizing traditional and novel material systems. The partnership is rooted in a common interest in nanoscience and in a need for a greater collaborative circle, or critical mass, to address the material issues important to our research. This partnership is of a scope and complexity that would not be feasible under traditional funding of individual research projects.[45]

microEP Program at the University of Arkansas
The microEP program at the University of Arkansas is closely linked with CSPIN. The microEP program is an interdisciplinary graduate program designed to expand a student's knowledge beyond the boundaries of traditional department-based graduate programs.[46] Students in the microelectronics-photonics program participate in cross-departmental research, take applications-intensive classes from multiple engineering and science departments and develop workplace productivity skills in a simulated industrial environment.

Through the UA Innovation Incubator, faculty and students in the microEP program work with client firms on research evaluation.[47] The outcome of their graduate education in this interdisciplinary environment will be a better understanding of microelectronic-photonic materials; the creation of high-performance, miniaturized devices and systems made from these materials; and an understanding of the economics that affect successful introduction of these devices and systems into industry and the community. [48]

Myeloma Institute for Research and Therapy[49]
The Myeloma Institute for Research and Therapy in the Arkansas Cancer Research Center (ACRA) at the University of Arkansas for Medical Sciences in Little Rock treats more patients with myeloma than anywhere else in the world and has one of the most active bone marrow transplantation centers for patients with numerous forms of cancer. In 1989, Dr. Bart Barlogie established the Myeloma Program at the ACRC. Numerous local and international donors facilitated his effort to build a clinical and basic research program with a strong focus on Multiple Myeloma and Bone Marrow Transplantation. In less then 10 years, the Institute has seen more than 3,000 new patients and has fundamentally changed the course of the disease through novel diagnostic procedures and therapeutic interventions.

National Center for Toxicological Research
National Center for Toxicological Research, located in Jefferson, near Pine Bluff (which is home to a chemical munitions decommissioning site) is in some sense an institution that could provide knowledge spillovers. While we primarily focus on university-based research institutions, this stand-alone federal lab could potentially provide both commercially viable technologies and an anchor for the development of synergistic enterprises. Below is a brief synopsis of the center:

"The mission of the National Center for Toxicological Research is to conduct peer-reviewed scientific research that supports and anticipates the FDA's current and future regulatory needs. This involves fundamental and applied research specifically designed to define biological mechanisms of action underlying the toxicity of products regulated by the FDA. This research is aimed at understanding critical biological events in the expression of toxicity and at developing methods to improve assessment of human exposure, susceptibility and risk."

NCTR is located on 496 acres in Jefferson, Arkansas. Physical facilities include 35 buildings owned by FDA valued at $225 million, one million square feet of floor space, and approximately $20 million in capital equipment.

The NCTR laboratory complex, accredited by the American Association for Accreditation of Laboratory Animal Care (AAALAC), houses both general purpose and high-containment laboratories, specific pathogen-free (SPF) "barrier laboratory animal breeding and holding rooms, conventional laboratory animal holding rooms, primate research facilities, diet preparation facilities, pathology laboratories and hazardous waste disposal capabilities."

"One key to FDA's success is its scientific strength, a prerequisite for all of its regulatory responsibilities. As new technologies emerge and new product applications are brought to FDA for review, state-of-the-art scientific expertise will continue to be essential for FDA to determine the safety and efficacy of the products. It is essential that the staff of the Agency keep pace with rapidly changing technology that occurs as a result of scientific advances, even in the face of budgetary constraints. One of FDA's primary goals is to insure that there is a solid science foundation underpinning all of our product standards that are used in making review decisions. NCTR is conducting fundamental research to develop strategies, methods and systems to predict toxicity and anticipate new product technology."

Conclusions

State institutions have become considerably more inventive in their thinking regarding the value of knowledge. They have also become considerably more inventive in creating structures designed to translate knowledge into intellectual property, and to making that property available to entrepreneurs.

By example, the 125-acre University of Arkansas-affiliated Arkansas Research and Technology Park (ARTP) in Fayetteville is specifically designed to provide the interface between the research and entrepreneurial communities. Essentially, the ARTP is a nursery where creators of knowledge team with creators of companies to build wealth. The UAMS Biomedical Biotechnology Center (and UAMS BioVentures, an associated technology business incubator) fulfills a similar role based on the unique research capabilities of the university. Success of the ARTP and the UAMS Biomedical Biotechnology Center depend upon their ability to generate a flow of new enterprises based on intellectual property, access to faculty and graduate students, and access to university facilities. The ultimate evidence of fulfilling the promise of each institution will be the creation of critical mass and subsequent industry cluster(s).

Institutions Providing Access to Financial Capital

The purpose of this section is to expose the reader to the programs, initiatives and partnerships that enhance knowledge-based firms' access to financial capital. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list. This section is structured as follows. First, we briefly discuss the fundamental structure of the Arkansas tax code and the state's budget. Next, we outline recent legislative initiatives that enhance knowledge-based firms' access to financial capital. Third, we highlight existing venture capital programs and angel investor networks that could provide valuable resources to knowledge-based firms. Finally, we discuss some key financial incentive programs available for knowledge-based firms.

The following table provides a list of institutions that provide access to financial capital or impact the fiscal environment in which new knowledge-based companies operate.

Institutions Providing Financial Capital

Broadly Defined Institutions	Key Institutions	Web Site
State Economic Development Agencies	Arkansas Department of Economic Development	http://www.1800arkansas.com/
	Arkansas Development Finance Authority	http://www.state.ar.us/adfa/
	Arkansas Department of Finance and Administration	http://www.state.ar.us/dfa/
	Arkansas Science and Technology Authority	http://www.accessarkansasscience.org/
Venture Capital Networks/ Investment Funds	Arkansas Venture Capital Forum	http://www.arkansasventureforum.com/
	Arkansas Capital Corporation	http://www.arcapital.com/
	Arkansas Certified Development Corporation	http://acdc.arcapital.com/
	Arkansas Capital Relending Corporation	http://acrc.arcapital.com/
	Capital Resource Corporation	http://crc.arcapital.com/
	Commerce Capital Development Company	http://ccdc.arcapital.com/
	Diamond State Ventures	http://dsv.arcapital.com/
	Venture Capital Investors, LLC	http://asbdc.ualr.edu/bizfacts/502.asp
	Heartland Renaissance Fund	http://www.cdfifund.gov/docs/nmtc/2004/states_served.pdf
	Signal Hill Venture Partners	http://www.signalhillcapital.com/contactUs.html
	Arkansas Ventures Fund	http://www.arcapital.com/accg_in_the_news/
	Council Ventures	http://www.councilventures.com/
	MB Venture Partners	http://www.mbventures.com/
	SSM Ventures	http://www.ssmventures.com/
	Delta Capital Management	http://www.deltacapital.com/
	Stephens Inc.	http://www.stephens.com/
	Advantage Capital Partners	http://www.advantagecap.com/
	Ascension Health Ventures	http://www.ascensionhealthventures.org/
	Audubon Capital	http://auduboncapital.com/
	Barry M. Corken and Company, Inc.	http://www.capitalaccessarkansas.org/dbase/allbankresult.tpl?type=Venture%20Capital%20In stitutions
	Delta Trust Investments	http://www.delta-trust.com/index.asp
	Enterprise Corporation of the Delta	http://www.ecd.org/
	Harpeth Capital	http://www.harpethcapital.com/
	Hibernia Capital Corporation	http://www.hibernia.com/Investor_Relations/Pages/IR_FrontDoor/0,2469,4162,00.html
	Massey Burch Capital	http://www.masseyburch.com/
	Morgan Keegan	http://www.morgankeegan.com/html/blue/default.asp
	Paradigm Capital Partners LLC	http://www.paradigmcp.com/
	Petra Capital Partners	http://www.petracapital.com/welcome.cfm
	Southern Financial Partners	http://www.southernfinancialpartners.org/
	Talisman Capital	http://www.talismancapital.com/
Angel Investors	Angel Investors Network	http://www.angel-investor-network.com/
	The Fund for Arkansas' Future	http://acdc.arcapital.com/
	Memphis Angels	http://www.bizjournals.com/memphis/stories/

Tax System and State Budget Position

The most important aspect of any tax system is that it not actively inhibit knowledge-based companies from locating and thriving within the state. Because knowledge-based firms are not constrained geographically, they are likely to locate in states that provide opportunities for the best total economic returns. One important factor that affects overall profitability is the tax burden that a company and its employees bear. However, companies are also concerned that the state has sufficient resources to adequately fund a quality educational system, basic health care, law enforcement and physical infrastructure needs. States are expected to provide these basic needs and knowledge-based companies will not locate in areas that have sub-par services.

In order to promote a vibrant KBE, the tax system should meet the following minimum criteria:

- Impose a total tax burden roughly equivalent to that of competitor states
- Adequately fund necessary infrastructure investments
- Minimize cost of compliance with regulations
- Avoid over-reliance on any particular tax

Key Current Issues

The following narrative highlights critical aspects of the state tax system that businesses and employees face. One of the primary variables a business examines when it is determining where to relocate or build new facilities is a state's tax code, including its corporate and personal taxes. Each year, The Tax Foundation, an independent Washington, D.C.-based think tank that conducts research on tax and budgetary policy, generates the State Business Tax Climate Index, which measures the impact on business of five major elements of the tax system: the percentage of income taken by all taxes, the individual income tax rates, the corporate income taxes, the sales tax rate, and the complexity of the tax system. On a scale of 1 being best and 50 being worst, Arkansas ranked 48th. Neighboring states ranked as follows: Tennessee (10th), Texas (13th), Missouri (23rd), Oklahoma (27th), Louisiana (41st), and Mississippi (50th). It should be noted that neither Tennessee nor Texas levies a state income tax, which contributes to their relatively high rankings.

Arkansas' corporate tax structure consists of six brackets with a top marginal rate of 6.5 percent beginning at an income level of $100,000. Among states levying corporate income taxes, Arkansas' rate ranks 32nd highest nationally. In 2001, corporate tax collections reached $69 per capita, ranking the state 36th among states that tax corporate income.[52]

The state's personal income tax consists of six brackets with a top marginal rate of 7.0 percent beginning at roughly $28,000. According to The Tax Foundation, the top marginal rate is 11th highest among states levying an income tax, and Arkansas' yearly individual income tax collections stand at $581 per capita, ranking the state 33rd nationally.[53]

With respect to the state and local tax burden, i.e., the proportion of income collected in state and local taxes, The Tax Foundation estimates Arkansas ranks 25th with a burden of 9.8 percent, compared to the national average of 10.0 percent.[54] Included in the above tax burden statistic are sales taxes and property taxes. Arkansas levies a 6 percent general sales or use tax on consumers, above the national median of 5 percent. According to The Tax Foundation, in 2001, Arkansas collected approximately $658 per capita in sales taxes, placing the state 18th nationally.[55]

Arkansas' local governments collect less in property taxes than any other state's local governments, $483,772,000 during fiscal year 2000, the latest year for which the Census Bureau has released state-by-state data. That amounted to $182 per capita, or expressed as a percentage of income, $8 per $1,000 of personal income. By either measure, Arkansas ranks 50th nationally.[56]

However, Arkansas' state government collects almost as much as local governments do, a unique situation. Nationwide, state-level property taxes are usually 10 percent of local-level collections at most. Therefore, Arkansas's combined property tax collection figure was $965,665,000 in FY 2000, which amounted to a per capita collection of $362 and $17 per $1,000 of income. It still ranked quite low nationally, 48th per capita and 46th as a percentage of income.[57]

Given Arkansas' perennially low per capita income level, it should come as little surprise that Arkansas is a net receiver from the federal government, i.e., Arkansas taxpayers receive more in federal funding per dollar than federal taxes paid. Per dollar of federal tax collected in 2002, Arkansas citizens received approximately $1.55 in the way of federal spending, a net inflow of $0.55 per dollar in federal tax collected.[58] This ranks the state 10th highest nationally and represents a rise from 1992 when Arkansas received $1.28 per dollar of taxes in federal spending (then ranked 13th nationally). Neighboring states and the amount of federal spending they received per dollar of federal taxes paid were: Texas ($0.92), Oklahoma ($1.52), Missouri ($1.34), Tennessee ($1.26), Mississippi ($1.89) and Louisiana ($1.48).[59]

Responsible citizens and firms should be interested in the status of the state budget, particularly its main sources of revenues and expenditures. In fiscal year 2003, the state of Arkansas received $4.04 billion in general revenues; 45.2 percent came from individual income taxes, 42.4 percent came from sales and use taxes and 5.6 percent came from corporate income taxes.[60] With respect to corporate income taxes, $12 million in fiscal year 2003 went into special revenues, i.e., they were not included in the above figure. These funds are allocated to the WorkForce 2000 Fund, which provides for the upgrading of the post-secondary technical colleges in Arkansas.[61]

The state allocated $3.62 billion in fiscal year 2003. Roughly half, 47.5 percent, was allocated to the public school fund; $24.9 million of the roughly $1.7 billion allocated to public schools was allocated for workforce education. Human services was allocated $718.1 million, 62.8 percent of which was allocated to Department of Health Services grants. The state allocated roughly $200 million to the Department of Corrections. Finally, the state allocated $562.2 million to institutions of higher education, with the University of Arkansas, Fayetteville receiving $96.6 million and the University Arkansas for Medical Sciences receiving $66.4 million.[62]

Conclusions

The Arkansas tax system should be designed to provide adequate funding for necessary expenditures while minimizing the total burden, both monetary and psychological, on citizens and businesses. Because the per capita income of the state is relatively low, keeping the individual burden small is an ever more difficult challenge. Moreover, improving the per capita income of the state through strategic investments in education, health care and capital projects requires dedicated funding. These investments compete with day-to-day operations for a limited pool of money. The resource allocation problem is further exacerbated when there are economic downturns because Arkansas relies heavily on sales and use taxes, which decline in recessionary periods.

A critical reevaluation of the state's tax code is necessary if Arkansas is to make the most of its limited pool of resources. The crucial investments that need to be made for Arkansas to fully participate in the KBE will continue to be delayed in the face of more immediate concerns if revenues are not used in their most efficient manner. The current tax system in Arkansas has been cobbled together from many years of legislative action. The reasoning behind the structure of Arkansas' tax code has little to do with promoting entrepreneurial activity and knowledge-based enterprise. However, by examining the tax system through the lens of promoting the KBE, several changes could be made that will have beneficial impacts on all state government programs.

First, estimates must be made of the costs of providing services and making infrastructure (both physical and human capital) investments. Next, a tax system should be designed, using income, sales, property and other taxes that can provide sufficient revenue to cover these costs. This system should be as equitable as possible to all citizens and firms operating in the state and should also be as easy to collect as possible. Finally, the design of the tax system needs to take into account the incentives that individuals and firms have to relocate to other states and to mitigate the detrimental effects of the Arkansas total tax burden.

Retooling the entire state tax code is a monumental task that would require enormous cooperation between all branches of government. Political realities make it unlikely that the system will be reformed in its entirety, but promoting the KBE should be considered when making any changes to the state's system of funding.

Financial Incentives and Recent Legislative Efforts

While the Arkansas tax code was not specifically designed to attract and retain knowledge-based industries, a whole set of economic incentives has been developed to do just that. Traditionally, business incentives have been used as the most basic industrial recruitment tool. More recently, these incentives have been rewritten to specifically target industries that use a highly skilled workforce in monetarily rewarding jobs. Because workers in knowledge industries make a higher average salary than their counterparts, these jobs are highly desirable to a state like Arkansas, with its low median income.

Financial incentives and legislation that attract and retain industries that participate in the KBE achieve one or more of the following goals:

- Provide benefits comparable to competitor states
- Are relevant to companies at all stages of development
- Recognize that knowledge-based firms hire fewer, but higher-paid employees
- Reduce the risk of investing in research and development

In this section, we discuss the financial incentives targeted at the knowledge-based industry in Arkansas that arose from The Consolidated Incentive Act of 2003. We also highlight the Venture Capital Act of 2001, Act 857 of 2003, the Arkansas Institutional Fund and the Arkansas Capital Development Company Act as notable legislative efforts in promoting the KBE. A comprehensive list of germane incentive programs and a full catalog of germane legislation can be found in the table at the end of this section.

Act 182 of 2003, better known as The Consolidated Incentive Act of 2003, as its moniker suggests, consolidated six previously existing incentives into one package and created several new incentives that encourage the growth of the knowledge-based industry in Arkansas.

As a part of the Advantage Arkansas program, the state's counties were divided into four tiers. The tiers are constructed annually by the Arkansas Department of Economic Development (ADED); rankings are computed for each county's poverty rate, population growth, per capita income and unemployment rate. The arithmetic average of the four rankings is computed for each county, and then, based on this average, counties are grouped into four tiers, with Tier 1 being the best.[63] The incentives discussed below often vary based on the county's tier.

Advantage Arkansas Income Tax Credit Program

Advantage Arkansas provides a credit on state income tax equal to between 1 percent and 4 percent of new payroll for five years, depending on the tier of the county in which the business locates. To qualify for Advantage Arkansas, the business's operations must fit one of the following descriptions continuously and throughout the project term:

- Manufacturers in NAICS codes 31–33 and businesses primarily engaged in commercial physical or biological research; or
- Eligible computer-related businesses with no retail public sales that derive at least 75 percent of their revenue from out-of-state sales;
- Businesses primarily engaged in motion picture production with no retail public sales that derive at least 75 percent of their revenue from out-of-state sales; or
- Distribution centers, including e-commerce distributors, that derive at least 75 percent of their resources from out-of-state sales; office sector businesses; corporate or regional headquarters; or trucking/distribution terminals with no retail public sales; or
- Scientific and technical services businesses that derive at least 75 percent of their revenue from out-of-state sales.

For the business to qualify for the income tax credit, employees must be Arkansas taxpayers. The credit begins in the year in which the new employees are hired. Any unused portion of the credit may be applied against income tax for the succeeding nine years.[64]

InvestArk Sales and Use Tax Credit

Advantage Arkansas participants are also eligible for a refund of sales and use taxes for building materials and taxable equipment connected with the eligible project.[65] InvestArk is a sales and use tax credit available to businesses established in Arkansas for two years or longer that invest $5 million or more in plant or equipment, new construction, expansion or modernization.[66] Eligibility requirements are similar to those for the Advantage Arkansas Income Tax Credit Program. A credit against the business's state sales and use tax liability is authorized equal to 0.5 percent above the state sales and use tax rate in effect at the time a financial incentive agreement is signed. The sales and use tax credit is a percentage of eligible project cost. The credit can be applied against the business's state sales and use tax liability. If the entire credit cannot be used in the year earned, the remainder may be carried forward for five years. Total project expenditures must be incurred within four years of the project plan approval.

Create Rebate Program

Businesses hiring specified new, full-time, permanent employees within 24 months after completion of an approved expansion and/or new location project may be eligible for the Create Rebate Program. Under terms negotiated by the ADED, this program provides businesses a financial rebate from 3.9 to 5 percent of the annual payroll of the new, full-time, permanent employees. In each tier of counties, a minimum payroll of new, full-time, permanent employees of $2 million annually is required. Incentives are available approximately 12 months after the business has fulfilled the minimum payroll requirements. Eligibility requirements are similar to those for the Advantage Arkansas Income Tax Credit Program.[67]

Targeted Business Income Tax Credit Program

These discretionary incentives are for startup companies in emerging sectors that are less than five years old, have an annual payroll between $200,000 and $1 million, and pay at least 150 percent to 180 percent of the county's current average hourly wage, depending upon the tier of the county in which the business locates. Emerging technology sectors include advanced materials and manufacturing systems; agriculture, food and environmental sciences; biotechnology, bioengineering and life sciences; information technology; transportation logistics; and bio-based products. Companies meeting these criteria are eligible for a transferable income tax credit equal to 10 percent of payroll for up to five years, a transferable income tax credit equal to 33 percent of eligible research and development costs, and sales and use tax refunds on building materials and necessary equipment.[68]

ArkPlus Income Tax Credit Program

The ArkPlus Income Tax Credit Program is negotiated by the ADED in highly competitive situations.[69] Eligibility requirements are similar to those for the Advantage Arkansas Income Tax Credit Program. The basic incentive provided by the ArkPlus program is a state income tax credit that provides tax credits of 10 percent of the total amount of the new investment. The amount of income tax credit taken during any tax year shall not exceed 50 percent of the annual Arkansas income tax liability resulting from the project.

To utilize the ArkPlus program, businesses must sign a financial agreement prior to construction outlining the terms of the incentives and including the following:

- Businesses must invest a minimum of $2 million to $5 million in a plant construction or expansion project, depending upon the tier of the county in which the business locates; and
- Businesses must have a payroll of at least $1 million to $2 million in new, full-time, permanent employees, depending upon the tier of the county in which the business locates, within 24 months of the date that the financial agreement is signed, and maintain the payroll requirements at the new project location for the duration of the incentive period. Failure to do so could result in termination of the program and reimbursement of the incentives credited plus penalty and interest.

Research and Development Incentives

Research and development incentives are intended to provide incentives for university-based research, in-house research, and research and development in startup, technology-based enterprises. An eligible business that contracts with one or more Arkansas colleges or universities in performing research may qualify for a 33 percent income tax credit for qualified research expenditures.[70]

An eligible business that conducts "in-house" research within a research facility that is operated by the eligible business may qualify for in-house research income tax credits. The credit allowed for approved in-house research is 10 percent of qualified expenditures. However, the maximum credit that can be earned by each qualified business shall not exceed $10,000 per tax year.[71]

Businesses deemed by ADED to fit within the six business sectors classified as "targeted businesses" may enter into a financial incentive agreement for income tax credits based on qualified research and development expenditures. An eligible business may be approved for an income tax credit each year equal to 33 percent of the qualified research and development expenditures incurred each year for the first five years of the financial incentive agreement. This incentive is only offered at the discretion of the Director of ADED.[72]

The Strategic Value Research and Development incentives are for qualifying businesses that invest in in-house research in an area of strategic value or a research and development project offered by the ASTA. Research in an area of strategic value is research in fields having long-term economic or commercial value to the state and that have been identified in the research and development plan approved from by the Board of Directors of ASTA. The income tax credit is equal to 33 percent of qualified research expenditures. The maximum tax credit that may be claimed by a taxpayer under this program is $50,000 per tax year. Any unused credit may be carried forward for three years beyond the tax year in which it was earned.[73]

Venture Capital Act of 2001

The Venture Capital Investment Act of 2001 authorizes the Arkansas Development Finance Authority (ADFA) to raise significant amounts of venture capital for investment within the state.

The pool of capital, raised from traditional Arkansas lenders, will guarantee principal and interest payments to the lenders and will be managed by a professional investor group under contract to the state.[74]

Act 857 of 2003
This act revises the definitions in the Arkansas tax code for computing capital gains and losses. If a taxpayer has a net capital gain from a venture capital investment in a qualified technology-based enterprise, biotech enterprise or qualified technology incubator doing business in Arkansas, 100 percent of the gain is now tax exempt.[75] This is contingent on the investments being made initially on or after January 1, 2001, and the venture capital investments being held for at least five years prior to disposition.

The Arkansas Institutional Fund
ADFA is the sponsor of the $70-million Arkansas Institutional Fund (AIF) that is underway. The AIF, directly supported by ADFA and the State of Arkansas, made its first-round commitments for investments in the spring of 2004. This fund-of-funds investment program is designed to attract professionally managed venture capital and the corresponding investing talent into Arkansas. One of the main goals of this effort is to provide more Arkansas-based sources of professionally managed venture capital that is locally accessible, can be deployed to build and grow knowledge-based industries and support Arkansas entrepreneurs.[76]

While funds targeting investments designed to build and grow companies in most areas of the state's economy will be considered, there is particular desire for funds that have specific expertise in bio-tech, bio-medical (including therapeutics, diagnostics, vaccines, ag-transgenetics and pharmaceuticals), medical (including medical devices, cancer and geriatrics), information technology, bio-informatics, communications and telecommunications, nanotechnology, micro electronics and high end services.[77]

Arkansas Capital Development Company Act
This act was a collaborative effort involving the Arkansas Capital Corporation (ACC), the Arkansas Department of Economic Development, the Arkansas Department of Finance and Administration, and the Arkansas Science and Technology Authority. The purpose of the act, passed in 2003, is to stimulate economic development, with preference given for companies or projects that meet the definition of knowledge-based industries.[78] As a result of this legislation, the Commerce Capital Development Company (CCDC), an affiliate of ACC, was formed and is now operating. The CCDC can issue a 33.3 percent state tax credit for every dollar invested in the CCDC, which in turn invests in certain targeted business in Arkansas. The legislation provides this incentive to encourage the process of providing new equity investment capital in support of new and existing knowledge-based industries and entrepreneurs. The credit is also available to funds that in turn make seed and early stage investments in Arkansas companies. This is direct support of an effort to encourage and develop a robust angel investing network. Angel investors will also be evaluating, mentoring and investing in new knowledge-based enterprises in Arkansas.[79]

Conclusions

Business incentives and legislation tailored to improve economic development efforts are important to the overall competitiveness of the state of Arkansas in attracting and retaining knowledge-based companies. Incentives are only one part of the reason industries locate in a particular area and must be examined in context. Availability of a skilled workforce, a moderate tax burden, access to capital markets, support for innovation and quality of life are aspects of the market that are likely to be just as important in the eyes of firm location decision makers.

By and large, the incentives available to firms from the state of Arkansas are adequate to compete with other states. However, Arkansas' financial incentives are disproportionately aimed at mature companies with steady profit streams. The incentives do little to encourage early-stage high-risk, high-return companies to consider relocating in Arkansas. As these companies do not have a proven track record of success, they are likely to be low-cost recruiting opportunities that could yield large future dividends.

In this same vein, economic development officials should consider actively searching out small, startup companies with products or processes that dovetail with the centers of excellence that already exist within Arkansas. Identifying and supporting "niche" industries allows for the creation of powerful economic clusters. Economic incentives and other legislation should be continually revised to make the most of comparative advantages that arise from existing industries and academic research. Cutting-edge technologies change rapidly, so the financial incentives need to be flexible enough to encourage companies working at the state-of-the-art to situate within Arkansas.

Venture Capital Programs and Angel Investor Networks

Access to venture capital is a key building block to the success of the KBE in Arkansas. Without access to capital markets, entrepreneurs are unable to realize the full market potential of their ideas and creations. Programs and initiatives undertaken to encourage a flourishing venture capital community achieve one or more of the following goals:

- Reduce the risk of investing in new technologies
- Pool diverse resources to achieve critical mass
- Educate entrepreneurs on the process of acquiring venture capital
- Bring together venture capitalists and Arkansas entrepreneurs

In this section, we highlight some important venture capital program and angel investor networks available to current and startup firms in knowledge-based industries. First, we discuss the Arkansas Science and Technology Authority's (ASTA) Investment Fund and Seed Capital Investment Program. Then, we discuss Diamond State Ventures, the Arkansas Ventures Fund, Venture Capital Investors, and The Fund for Arkansas' Future. Finally, we highlight the Arkansas Venture Capital Forum. A full catalog of germane programs and networks can be found in the table at the end of this section.

ASTA Investment Fund and Seed Capital Investment Program

ASTA administers a special Investment Fund of $2.8 million that can provide seed capital for new and developing technology-based businesses through loans, royalty agreements and limited stock purchases.[80] The purpose of ASTA's Seed Capital Investment Program (SCIP) is to foster the development of innovative technology-based businesses and projects that will stimulate economic growth and industrial competitiveness in Arkansas. SCIP, which has a $4 million revolving investment fund, can provide working capital to help support the initial capitalization or expansion of technology-based companies located in Arkansas. The program can provide working capital up to $500,000 of the company's total financing needs. Investments made by the SCIP fund can be repaid through a variety of instruments, including direct loans, participations and royalties.[81]

Diamond State Ventures and the Arkansas Ventures Fund

Diamond State Ventures (DSV) is an affiliate of the Capital Resource Corporation and operates as a federally licensed Small Business Investment Company.[82] DSV is a $56-million venture capital fund that provides financing in the knowledge-based-industry space, and was designed to provide funding for projects that could not fit within credit guidelines.[83] DSV is in the process of establishing a second venture capital fund, Arkansas Ventures, that will cover early-stage investing as well as more mature growth companies.[84]

Venture Capital Investors and The Fund for Arkansas' Future

Venture Capital Investors (VCI), LLC of Little Rock was founded in 1999 to invest in companies engaged in "technology intensive enterprises" with significant potential for capital appreciation in three to five years.[85] While the investors associated with the organization invest individually, the organization provides due diligence services. Since its founding, VCI investors have invested between $4 and $5 million in five deals. The organization is in the process of trying to close The Fund for Arkansas' Future by the end of 2004, which they hope by that time will contain between $5 and $10 million.

Arkansas Venture Forum

In 2001, the Capital Resource Corporation, a nonprofit affiliate of the Arkansas Capital Corporation Group, in cooperation with others, founded the Arkansas Venture Forum (AVF), a networking and educational event designed to increase the understanding and presence of venture capital in Arkansas.[86] AVF hosts an annual venture capital conference and, as support is generated or demand shown, additional seminars on a smaller scale.[87]

Conclusions

The availability of venture capital to businesses that make use of it has never been higher in Arkansas. Additionally, within the state, an ever-increasing number of individuals are becoming educated about the process of acquiring venture capital, thereby increasing the chances that their firms will reach their potential capitalization. Funds are being set up for specific purposes, with specific industries targeted as recipients of the capital.

There is also a concerted effort underway to encourage the development of networks of angel investors so that some businesses will grow to the point of needing venture capital. The state of Arkansas can assist this effort by continuing to institute policies to reduce or share the risk of early-stage investing in new technologies.

Institutions that Support Intellectual Property

The purpose of this section is to expose the reader to the programs, initiatives and partnerships in Arkansas that facilitate technology development and technology transfer, i.e., those programs, initiatives and partnerships that provide incentives for research and development of technology and that provide help in bringing the fruits of this research and development to market.[88] The primary source for these programs and initiatives is the Arkansas Science and Technology Authority (ASTA).

Programs and initiatives undertaken to facilitate technology development and technology transfer achieve one or more of the following goals:

- Promote a culture to make technological breakthroughs more likely
- Make strategic monetary investments in the development of new products and processes
- Extend expertise in transferring technology to the marketplace
- Educate stakeholders on the potential of commercializing breakthrough research
- Assess the commercial viability of intellectual property

Key Current Programs, Initiatives and Partnerships

The following narrative highlights critical programs and initiatives that nurture intellectual property creation and commercialization in Arkansas. While the narrative only highlights some of these programs, initiatives and partnerships, the table at the end provides an exhaustive list.

Technology Transfer Assistance Grant

The Technology Transfer Assistance Grant Program (TTAG) assists Arkansas' enterprises in developing or improving products or processes through the transfer of technical solutions to technology-based, industry-driven problems, thus enhancing that enterprise's market competitiveness.[89] These grants are used as Phase Zero SBIR awards to companies wanting to prepare SBIR proposals.

ASTA provides limited financial support for the transfer and deployment of innovative technology. ASTA will fund up to $3,750 of costs associated with transferring new or existing technology from a qualified applicant—such as a public or private enterprise, laboratory, college or university—to an enterprise based in Arkansas. Up to $5,000 of total project costs will be considered, with the first $2,500 funded by ASTA; the remaining $2,500 is cost-shared equally (50:50) between ASTA and the enterprise. The program began in state fiscal year 1995. Since its inception, 579 awards totaling $2,620,091 have been made to state enterprises. Each enterprise is eligible to receive assistance for two technology transfer projects per year.[90]

Technology Development Program

ASTA's Technology Development Program (TDP) provides assistance in development and commercialization of new technology-based products and processes through innovative technology development projects.[91] TDP provides royalty financing for qualified projects possessing a well developed, comprehensive project plan, and that utilize the benefits of science and technology to provide economic and employment growth potential in Arkansas.[92] The maximum investment is $50,000 with terms negotiated on an individual basis. These terms have a maximum 5 percent of net sales for a maximum term of 10 years. Qualified energy-related technology development projects are funded separately. Public funding of $114,000 was appropriated for each year of the 2003-2004 biennium for both the Technology Development and Technology Transfer Programs.[93]

Arkansas Manufacturing Solutions

Arkansas Manufacturing Solutions (AMS) is a program started in December 1995 by ASTA and is a partner with the U.S. Department of Commerce's National Institute of Standards and Technology Manufacturing Extension Partnership. Serving roughly 200 clients per year since its inception, AMS provides on-site project managers who offer technical and management assistance to manufacturers in Arkansas. The basic purpose of AMS is to help manufacturers increase sales and profits by cutting costs and improving manufacturing processes. While AMS serves manufacturers in the entire state, its bases of operation are in areas more heavily dependent on manufacturing; project managers are stationed in Fayetteville, Fort Smith, Jonesboro, Camden and Little Rock.[94]

Basic Research Grant Program

The Basic Research Grant Program, run by ASTA, provides incentives for Arkansas industry to participate in [basic] research.[95] The program is a competitive, matching grant effort (60 percent state: 40 percent institution) to support basic research in science and engineering. The goals of the program are to promote and support the growth and development of Arkansas scientists and to enhance the status of science and engineering in Arkansas colleges and universities.

Applied Research Grant Program

The Applied Research Grant Program, run by ASTA, provides incentives for Arkansas industry to participate in applied research.[96] The program is a (50:50) cash-matching effort to support applied research in science and engineering. (A match of $2 from the state is available for every $1 from an Arkansas business with 50 or fewer employees.) The program encourages investment by industry in the transfer of science and technology from Arkansas colleges and universities. The goal of the program is to stimulate the transfer of science and technology in Arkansas by enhancing opportunities for research partnerships between Arkansas colleges and universities and private industries.

Arkansas Research Matching Program

The purpose of the Arkansas Research Matching Fund, run by ASTA, is to encourage, establish and support basic and strategic research by providing state matching for federal agency awards for research and research equipment to Arkansas colleges and universities.[97] The goal of the Arkansas Research Matching Fund is to improve the state's federal research and development ranking by investing in Arkansas' research and research infrastructure.

With respect to the Applied Research Grant Program, the Basic Research Grant Program and the Arkansas Research Matching Fund, the budget allocation for ASTA's Research Grant Program was zero at the beginning of fiscal year 2004.[98] In light of this zero allocation, ASTA's Board of Directors decided to suspend the receipt of research proposals for the August 15, 2004 and February 15, 2005 solicitation dates. The solicitation dates normally effect both basic and applied research proposals.

The suspension effectively eliminates the receipt of all Basic Research Grant proposals; however, there is some flexibility for Applied Research Grant proposals because they can be submitted at any time during the year. The Authority was informally encouraged to accept and examine unsolicited applied research proposals with the idea that possible funding would be explored and some funding might be forthcoming later in the fiscal year. A recent letter from the Department of Finance & Administration explaining revenue shortfalls now leads us to believe that such funding for unsolicited applied proposals for FY04 is no longer feasible.

University of Arkansas Technology Development Foundation/Technology Validation Fund [99]
A partnership has been formed with the newly-created University of Arkansas Technology Development Foundation that will develop the Arkansas Research & Technology Park and direct the operations of the GENESIS Technology Incubator. The Foundation will also manage the university-built Innovation Center—a 35,000- square-foot facility to be completed in July 2004. The Foundation and the University's Office of Technology Transfer will work closely together to identify intellectual properties that meet specific criteria for validation and further development by the Foundation. The goal is to build vibrant partnerships between client companies of the GENESIS Technology Incubator, Innovation Center and throughout the Park with areas of academic excellence at the University—particularly in biotechnology and food safety, the next generation of electronic and photonic devices, transportation and logistics, materials and advanced manufacturing, database, software and telecommunications, and environmental and ecosystem analysis—in the furtherance of technology-based economic development.

In order to further this effort, the Foundation seeks to implement a Technology Validation Fund to assess and further develop intellectual property assigned to the Foundation. The intent of the Technology Validation Fund is to add value to otherwise early-stage inventions and evaluate the most appropriate commercialization path for their deployment to the marketplace. For those technologies suited to a new business startup, the Validation Fund will also support the development of a sound business plan to launch the new enterprise.

Procedurally, entrepreneurial faculty interested in pursuing the commercialization of their inventions would express their interest in assigning their intellectual property rights to the Foundation and apply to the Validation Fund. Independent technology assessment firms will subsequently review each application for both technical merit and commercial potential. If the results of both reviews are positive, the Foundation may grant funds to conduct the advanced R&D program described in the application. The Fund will be administered as a revolving grant fund, sustained by the proceeds from licensing and royalty fees. Traditional patent prosecution of assigned intellectual property will also be the responsibility of the Foundation.

Institutions Providing Intellectual Capital

Broadly Defined Institutions	Key Institutions	Web Site
Technology Incubators	GENESIS	http://www.uark.edu/~genesis/welcome.html
	Virtual Incubation Corporation	http://www.virtual-incubation.com/
	UAMS Bioventures	http://www.uamsbiotech.com/
	Innovation Incubator	http://www.innovationincubator.org/
Research Parks	University of Arkansas Technology Development Foundation	http://www.uark.edu/admin/rsspinfo/industry/index.html
	Arkansas Research and Technology Park	http://www.uark.edu/admin/rsspinfo/techtransfer/index.html
	UA Innovation Center	http://www.uark.edu/admin/rsspinfo/industry/index.html
Patent/Due Diligence Attorneys	Refer to U.S. Department of Commerce Patent and Trademark Office's Patent Attorney Directory	http://www.uspto.gov/
State Science and Technology Statutory Agencies	Arkansas Science and Technology Authority	http://www.accessarkansasscience.org/
Statewide Science and Technology Associations	Arkansas Technology Transfer Society	http://asbdc.ualr.edu/atts/
	Arkansas Biotechnology Association	http://www.uamsbiotech.com/
Private Companies	Beta Rubicon, LLC	http://www.beta-rubicon.com/
	Acxiom	http://www.acxiom.com

Conclusions

In theory, the development and commercialization of intellectual property has been embraced as a critical pathway to high-quality, high-wage economic development in Arkansas. Many support services have been put into place to promote innovation in knowledge-based companies. But, merely having the appropriate resources available for these companies has not induced a critical mass of knowledge-based firms to locate in Arkansas.

Because no intense concentration of knowledge-based industries exists in Arkansas, the programs and partnerships designed to nurture innovative firms have been underutilized. Indeed, some state programs that might have bred long-run successes have fallen victim to short-run budgetary problems. This reflects the fundamental tension within the state—Arkansas must attract more knowledge-based development in order to remain a viable competitor for the best jobs, but because this development is currently lacking, the money to make forward-looking investments is often unavailable.

Arkansas has the building blocks in place to encourage the commercialization of technologies discovered through the research process.

Institutions Supporting Quality of Life

The primary resource of a knowledge-based firm is its supply of creative workers. Revenues are more likely traced directly back to products and services coming from a worker's brain than from a set of machines. Coupled with the opportunities created by telecommunications equipment, traditional factors that companies and people look at when determining where to locate, such as access to natural resources, become less relevant. If people, companies or industries can truly locate anywhere, or at least choose from a range of places, the question of where becomes increasingly contingent on the peculiar attributes of a given location.[100] In his review of Joel Kotkin's book *The New Geography: How the Digital Revolution is Reshaping the American Landscape*, Michiko Kakutani fixes in on this point.

> In the transition to a digital economy, Mr. Kotkin [a senior research fellow with the Davenport Institute for Public Policy at Pepperdine University] argues, the ''quality of life" quotient, rather than access to raw materials or ports, will become increasingly important, turning three types of places into magnets for the technological elite, skilled workers and the upwardly mobile: cities like New York and Los Angeles, rich in "such creatively driven fields as media, fashion, advertising and design"; new high-end suburbs (or "nerdistans'" in the author's terminology) like Irvine, Calif., and Raleigh, N.C., that seek to eliminate the sorts of distractions—crime, traffic, commercial blight—"that have commonly been endemic in cities and increasingly in older suburban areas"; and upscale rural areas (or "Valhallas") like Jackson Hole, Wyo., and Park City, Utah, with "significant urban-like amenities and appealing scenery, where knowledge workers can enjoy a pastoral paradise yet remain plugged into the burgeoning information economy."[101]

"Lifestyle and amenities are the key," says Richard Florida, director of the Center for Economic Development at Carnegie Mellon University in Pittsburgh, who has studied the world's transition to a knowledge-based economy and who participated in Pittsburgh's transformation from a manufacturing city to a high-tech region. "Young knowledge workers have a lot of options. They can go wherever they want."[102] So where does Arkansas fit into this picture?

Institutions Providing Quality of Life

Broadly Defined Institutions	Key Institutions	Web Site
State Cultural and Recreation Agencies	Arkansas Department of Parks and Tourism	http://www.arkansas.com/
	Arkansas Game and Fish Commission	http://www.agfc.state.ar.us/
	Arkansas Arts Council	http://www.nasaa-arts.org/aoa/ark.shtml
Arts and Culture Organizations	Arkansas Arts Center	http://www.arkarts.com/
	Walton Arts Center	http://www.waltonartscenter.org/
	Arkansas Repertory Theatre	http://www.therep.org/
	Historic Arkansas Museum	http://tourarkansas.com/business_link.asp?id=58
	Clinton Presidential Center	http://www.clintonpresidentialcenter.org/
	Northwest Arkansas Arts Alliance	In the process of forming
Regional Planning District/Organizations	West Central Arkansas Planning and Development District	http://wcapdd.dina.org/
	Southwest Arkansas Planning and Development District	http://swapdd.dina.org/
	Western Arkansas Planning and Development District	http://www.wapdd.org/
	Northwest Arkansas Council	http://nwark.org/
	Northwest Arkansas Economic Development District	http://www.arkplan.org/NWEDD.html
Arkansas Communities		

As the state's economy attempts to transition from a primarily manufacturing and agricultural economy to an economy more heavily dependent upon high-tech firms and professional services, how can the state market itself to draw knowledge workers from other locations, and how can the state retain the knowledge workers it creates with its universities? What lifestyle options and amenities does Arkansas have that would be a draw for knowledge workers? This section highlights the most marketable recreational and cultural amenities Arkansas has to offer to knowledge workers. The table at the conclusion of the section provides a comprehensive list of programs, initiatives and partnerships that promote Arkansas' quality-of-life dimension to knowledge workers.

Arkansas: The Natural State

Staring at a computer screen for upwards of 10 to 12 hours a day can be very tedious. Opportunities for knowledge workers to decompress, especially outdoors, are vital. Fortunately, Arkansas has a climate conducive to playing outside most of the year, and the state offers a plethora of outdoor recreational opportunities for its residents and visitors.

Water sports enthusiasts will find much to do in The Natural State. The state's gem is the Buffalo River. Roughly 150 miles long, it was the country's first national river, and it has nearly 95,000 acres of public land along its corridor.[103] The river originates in the Boston Mountains in the Ozarks and travels eastward to join the White River. Along the way, it descends nearly 2,000 feet through layers of sandstone, limestone and chert; over time it has generated the highest bluffs in all the Ozarks. Hidden away, ready for discovery, are other geologic marvels—springs, caves, waterfalls, natural bridges and box-like canyons.[104]

With 600,000 acres of lakes in Arkansas, there's plenty of space for fishing, swimming, sailing, power-boating, scuba diving and more. The great lakes of Arkansas are among its most prized possessions. Constantly fed by cold-flowing springs and creeks, the mountain lakes are among the cleanest in the world. Scuba divers and underwater photographers marvel at the water clarity, while fishermen are happy with the trophy-sized lunkers they hook in the same waters.[105]

In addition to water sports, the state offers many opportunities for rock climbing, hiking and biking. Most of the quality rock climbing and bouldering in Arkansas is in the western and northern regions of the state, where the Ozark and Ouachita mountain ranges are located.[106] A recent article in *Rock and Ice* had this to say. "[M]ine has been a long battle to get something—anything—published on America's greatest unknown rock climbing, the sandstone crags of northwestern Arkansas. Here, smuggled among the hardwood Ozark hills, etched by meandering and bouldered streams lies rock of such quality and scale it is easy to dismiss without seeing first hand."[107]

Arkansas has roughly 250 trails for hikers, mountain bikers and equestrians. Outdoor enthusiasts will find trails designed for day hiking, and those preferring extended excursions will enjoy backpacking trails typically found in the Ozark Highlands and the Ouachita National Recreation areas. For underground adventures, Arkansas has 13 caves to explore [including the nationally acclaimed Blanchard Springs Cavern, run by the U.S. Forest Service, in Mountain View in north-central Arkansas].[108]

The rare natural features of Hot Springs National Park were first protected when Congress declared the area a "reservation" in 1832, some 40 years before Yellowstone became the world's first national park.[109] From prehistoric natives forward, people have been using the hot springs for therapeutic baths for millennia. The "Bathhouse Row" structures are part of a National Historic Landmark District and represent the grandest collection of such bathhouses in North America. While preserving an array of 47 hot springs and their watershed, the park provides hiking trails, scenic drives, camping and picnic areas.

The City of Hot Springs remains Arkansas's top tourist destination. Its attractions include Hot Springs National Park; live and simulcast thoroughbred racing at Oaklawn; Magic Springs/Crystal Falls theme and water parks; the 210-acre Garvan Woodland Gardens; a renowned arts community, which sponsors the premier, internationally renowned documentary film festival; and the Mid-America Science Museum. Numerous outdoor activities, including golf, horseback riding, water sports, and hiking in the Ouachita National Forest are available in the Hot Springs area.[110]

Arkansas: Cultural Amenities

Relying solely on a region's outdoor and recreational activities to attract workers is, in general, grossly shortsighted. A region needs cultural attractions and amenities to provide educational and entertainment opportunities for residents and visitors. In this subsection, we highlight the state's **major** cultural amenities and attractions in the state. The statistical evidence suggests that knowledge workers tend to cluster in larger cities, therefore we necessarily focus on Little Rock and Northwest Arkansas.

The Arkansas Arts Center is a museum of art and an active center for the visual and performing arts.[111] Located in downtown Little Rock, it is the state's largest cultural institution. Its program departments include the Arkansas Museum of Art, the Decorative Arts Museum, the Museum School, the Children's Theatre and State Services. Ongoing exhibits showcase the works of such artists and sculptors as Degas, Pissarro, Picasso, Monet, Cézanne and Moore.

With respect to theatre and the performing arts, the focus is squarely placed on The Walton Arts Center in Fayetteville and The Arkansas Repertory Theatre in Little Rock. The Walton Arts Center is the largest and busiest center for the performing arts and entertainment in Arkansas.[112] The Center opened its doors in 1992 and averages approximately 150,000 patrons a year. Through its educational programs, which include matinee performances, gallery tours, continuing education programs, and programs in the Center's studios, the Walton Arts Center serves about 40,000 students and teachers annually.

In its 27th season, the nonprofit Arkansas Repertory Theatre (The Rep) produces a diverse body of theatrical work. Since its creation in 1976, The Rep has produced more than 230 productions including 30 world premieres.[113] Last year, over 70,000 Arkansans attended productions at the Rep. In the current season, The Rep's Young Company visited 22 counties and performed for more than 12,000 students. Nationally, The Rep mounts an extensive, cross-country tour and is the most sought-after company in the Mid-America Arts Alliance roster. Over 100,000 patrons across the country enjoy Arkansas' performing arts via The Rep's national tour.

Eureka Springs, located roughly 60 miles northeast of Fayetteville, was named by the National Trust for Historic Preservation as one of its "Dozen Distinctive Destinations."[114] Indeed, the entire downtown area is on the National Register of Historic Places. The city's streets are lined with Victorian homes hugging cliff sides. The city boasts a multitude of fine art galleries, craft emporia, boutiques, spas, museums and shops. The city hosts blues, jazz, opera festivals, car shows and antique and art shows. With its location in the Ozarks near Beaver Lake and White River, the city also provides opportunity for many outdoor activities.

Arkansas also offers many opportunities for history buffs. The Historic Arkansas Museum, formerly known as The Arkansas Territorial Restoration, is a site museum of antebellum Arkansas.[115] Five pre-Civil War houses, on their original block, are completely restored. Guided tours of the historic houses feature actors portraying original residents. The museum center presents an outstanding collection of Arkansas-made decorative, mechanical and fine arts objects in six galleries. Other Civil War battlefields and places of interest are found throughout the state.

In November 2004, the Clinton Presidential Center will open its doors. The Center, located within a 30-acre city park along the south bank of the Arkansas River in Little Rock will serve as the base of operations for President Clinton's national and international public service initiatives and as a forum for the promotion of progressive ideas.[116] The site includes the residential library and museum, the renovated Rock Island Railroad Bridge, now a pedestrian bridge crossing the Arkansas

River and the Choctaw Station, built in 1899, that will house the Clinton School of Public Service and Clinton Foundation offices.[117]

Conclusions

The dominant conclusion to be drawn from an examination of institutions and other factors that influence Arkansas' quality of life is the state has the ability to market its "sense of place" to knowledge workers. While it is unlikely to attract those workers looking for amenities associated with highly urban areas, the quality of outdoor activities, particularly water sports, provides a distinct recruiting and marketing opportunity. The state also is not without a municipal area that provides a concentration of urban amenities. The River Market area of Little Rock, with art galleries, eateries, music venues, loft living space and Axciom's headquarters, all lend the area a sense of place, urban and smart.

In addition, Fayetteville boasts a college atmosphere similar to Boulder, Colorado of the 1970s or Asheville, North Carolina today. The mix of cultural amenities, arts community, academic community, growing retail and proximity to outdoor recreation are enticing lures to young professionals seeking a safe, family-oriented community.

Unfortunately, all too often Arkansas is portrayed negatively in the national media. The prejudicial opinion—poor, rural, uneducated and backward—is difficult to overcome. Most recently, the Fox Network's "The Simple Life" reinforced and played off this common perception of the state. Recent national stories concerning the Nolan Richardson discrimination case or the struggle for education reform hinder positive trends in the perception of the state brought about by positive press.

A marketing campaign based on new imagery is needed to erase deep-seated attitudes and beliefs. While a professional national ad campaign may be an appropriate step, a more immediate and effective strategy would be to examine the primary ways that people from other states learn about Arkansas. One obvious source is the state government web site. The following online services dominate the middle of the home page:

- Search for Fresh Produce
- Pay Business Taxes
- Search Criminal Background Records
- Buy Hunting Licenses
- Pay Personal Property Tax
- Register to Vote

While these services are undoubtedly useful to many constituents, they do not portray an image of the state as a vibrant, modern, sophisticated place. Knowledge firms and knowledge workers exist in a world where marketing efforts are persistent and complex. We need to "sell" Arkansas, consistently and continually.

[1] Tyson Foods corporate news release, "Tyson Foods Opens Expanded, Upgraded Lab Facility in Northwest Arkansas." This is one of 12 Tyson Foods R & D centers across North America.

[2] These centers could be based on industry sectors in which the state enjoys a comparative advantage such as transportation and logistics or in public research institutions.

[3] National Commission on Entrepreneurship, High-Growth Companies: Mapping America's Entrepreneurial Landscape, P.1. July 2001.

[4] National Academy of Engineering, Risk & Innovation: The Role and Importance of Small High-Tech Companies in the U.S. Economy, p. 39.

[5] Ziktan J. Acs, atl. High Technology Employment, Wages and University R&D Spillovers: Evidence from US Cities, 1995.

[6] Thomas Hellmann and Manju Puri, On the Fundamental Role of Venture Capital, p.20, fourth quarter, 2002 (Federal Reserve Bank of Atlanta Economic Review)

[7] David J. Skyrme, Measuring Intellectual Capital: A Plethora of Methods, 2003

[8] Joel Kotkin, The Future of the Center: The Core City in the New Economy, November, 1999.

[9] According to an article in the Hope Star in February 2004, the president of the Hempstead County Economic Development Corporation, Judy Davis, reported losing out on a development prospect due to the tenor of the legislative debate on reform of K-12 education.

[10] http://www.eastproject.org/portal/references.asp?sm=c17

[11] Recently, the Arkansas Department of Education received a grant from the National Department of education for $1.8 million to study the efficacy of the EAST Program.

[12] http://www.arkbea.org/scholars/default.html

[13] The study was commissioned by the Winthrop Rockefeller Foundation and performed by the Corporation for Enterprise Development.

[14] Currently the university center in the Sam M. Walton College at the University of Arkansas delivers entrepreneurial education content provided by the Kauffman Foundation.

[15] http://ode.homeunix.net/index.htm

[16] Mark Friedman, Arkansas Business, August 11, 2003.

[17] Arkansas Department of Higher Education, Total On-Campus Headcount 1990-2003.

[18] Cisco Academies can be found at the following url: http://cisco.netacad.net/public/index.html

[19] Hilary Hilliard, Arkansas Democrat-Gazette, October 27, 2003. Reported in the same article, "*There's 'not a chance' the school would have the system by now without the grant from the Education Department, said Mary Good, dean of the Cyber College. 'Somebody would have had to cough up some money from somewhere other than our budget,' she said.*"

[20] "University of Arkansas Receives $300 Million Gift, Largest in History of U.S. Public Higher Education." University Relations, University of Arkansas. http://advancement.uark.edu/news/NEWS_ARCHIVES/APR02/gift/300mil.html

[21] "Act 652 of 1999." http://www.work-ed.state.ar.us/LoanForgiveness/Book/ACT652of1999.pdf

[22] "Arkansas Technical Careers Student Loan Forgiveness Program Rules and Regulations." http://www.sosweb.state.ar.us/elections/elections_pdfs/register/june_03_reg/172.00.03--002.pdf

[23] Arkansas Department of Higher Education: http://www.arkansashighered.com/

[24] The A+ funding category implies that if the funds are not available in either of two distinct sources of funding for preK-12, the shortfall must be made up from the general revenue fund.

[25] Source for population figures, Census 2000: www.census.gov, state-supported institutions are per state department of higher education web sites.

[26] Arkansas Department of Higher Education: http://www.arkansashighered.com/

[27] Arkansas Department of Higher Education: http://www.arkansashighered.com/ First-time Freshmen at Arkansas

Four-year Institutions (1996 Cohort).
[28] ibid
[29] The text is taken verbatim from "What is TPAD?" Arkansas Department of Workforce Education. http://www.work-ed.state.ar.us/CTETPAD.htm
[30] Taken verbatim from "About SkillsUSA." SkillsUSA. http://www.skillsusa.org/about.html
[31] Taken from "UAEDI – Partnerships." University of Arkansas Economic Development Institute. http://uaedi.cast.uark.edu/partnerships/
[32] *P. 2, Building Entrepreneurial Networks*, National Commission on Entrepreneurship, December, 2001.
[33] "Graduate & Undergraduate Business Plan Competition, Governor's Award for Entrepreneurial Development." Capital Resource Corporation. http://crc.arcapital.com/governors_award/business_plan_competition/
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[39] "SBIR and STTR Programs and Awards." U.S. Small Business Administration, Office of Technology. http://www.sba.gov/sbir/indexsbir-sttr.html
[40] "Total STTR Awards for FY 2002." U.S. Small Business Administration, Office of Technology. http://www.sba.gov/sbir/FY2002STTRRankingbyTotalDollars.pdf
[41] "About Innovation Incubator." University of Arkansas Innovation Incubator. http://www.innovationincubator.org/about.html
[42] "About Innovation Incubator." University of Arkansas Innovation Incubator. http://www.innovationincubator.org/about.html
[43] Taken verbatim from The Arkansas Biosciences Institute. http://www.arbiosciences.org/
[44] "OU-UA CSPIN." University of Oklahoma. http://www.nhn.ou.edu/cspin/index.html
[45] "OU-UA CSPIN People." University of Oklahoma. http://www.nhn.ou.edu/cspin/people/overview.html
[46] "microEP." University of Arkansas. http://microep.uark.edu/
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[48] "microEP." University of Arkansas. http://microep.uark.edu/
[49] "Myeloma Institute for Research and Therapy." http://myeloma.uams.edu/generalinfo.asp
[50] "The Facts on Arkansas' Tax Climate." The Tax Foundation. http://www.taxfoundation.org/arkansas/index.html
[51] "State Business Tax Climate Index Ranks State Tax Systems On How Friendly They Are to Business." The Tax Foundation. http://www.taxfoundation.org/pr-businesstaxclimate.html
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[65] "Tax Back (Sales and Use Tax Refund)." Arkansas Department of Economic Development. http://www.1800arkansas.com/Incentives/tax_back.htm

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[67] "Create Rebate Program." Arkansas Department of Economic Development. http://www.1800arkansas.com/Incentives/Create_Rebate.htm

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[70] *Consolidated Incentive Act, Act 182 of 2003, Regulations.* http://www.1800arkansas.com/PDF/Final%20Regs%205-09-03.pdf

[71] *Consolidated Incentive Act, Act 182 of 2003, Regulations.* http://www.1800arkansas.com/PDF/Final%20Regs%205-09-03.pdf

[72] *Consolidated Incentive Act, Act 182 of 2003, Regulations.* http://www.1800arkansas.com/PDF/Final%20Regs%205-09-03.pdf

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[86] "Arkansas Venture Forum." Capital Resource Corporation. http://crc.arcapital.com/arkansas_venture_forum/

[87] Holly Sellers, Capital Resource Corporation.

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Best Practices

Introduction

A useful way to analyze Arkansas is by comparison with other states in the nation. Areas outside of the U.S. also provide meaningful information on experiences that Arkansas can draw upon. What are other states, regions, governments, institutions and stakeholders doing presently, or indeed what have these players done to increase their own technology and science development capabilities? In effect, who is doing what, to whom and how?

Many states are competing aggressively to create an environment that attracts and keeps technology-based businesses and their related positive spillover effects. Economically leading states are no more protected than those that are poor performers. All corners of the nation's knowledge economy landscape are facing heightened demands to go beyond the status quo. To borrow from Lewis Carroll's *Through the Looking Glass*, it takes all the running you can do just to stay in the same place.[1] Below, are best practices or world-class examples that offer instant access into the minds and actions of others that provide proven tactics and opportunity suggestions that Arkansas might consider in order to eclipse the competition, and gain technology and science strengths in the state. This section is based upon research of the factors that determine firm-location.[2]

Marketing/State Information Availability: Best Practice—Informative, navigable web site
Investment promotion represents efforts by the state of Arkansas government and other interested parties, such as the University of Arkansas Center for Business Economic Research (UACEBR) and the Arkansas Capital Corporation Group, to transfer information about the nature of the state's investment climate and to persuade and assist firms and entrepreneurs to invest, expand investment, and continue to maintain their investment(s) in the state. Research results show that state information availability is one of the top determinants of firm location.

Every state, hundreds of communities and many countries currently use "the web" to attract companies, open new markets for business and promote tourism. Success in attracting firms to expand economic development is achieved by those who manage their information best and present it to their best advantage. Timely and low-cost access to accurate information on the realities of Arkansas, are essential to decision makers contemplating value-added activities in the state. Marketing Arkansas as a "good place" to conduct business is important. Executives must be made aware of Arkansas as a possibility in their site selection decision making. As information about Arkansas is made available to these managers, awareness is increased while uncertainty and risk are reduced.

The World Association Investment Promotion Agencies (WAIPA) annual conference is considered the world's largest gathering of investment promotion agencies whose aim is to facilitate the exchange of best practices in foreign direct investment promotion. The WAIPA annual conference, which Arkansas should consider investigating or attending, brings together investment strategists, leading economists and researchers to discuss controversial issues relating to the global investment climate. WAIPA stresses the need for excellence in access, content and presentation of information as a key strategy for regions, nations and subnational entities seeking to attract foreign direct investment.

In this 21st century world of virtual reality, many investment decisions have been transformed into a virtual activity. The hard-pressed corporate executive seeking new international facilities in far-flung overseas destinations need look no further than a mouse and modem. The state of Arkansas web site must welcome and inspire investors' confidence.

But first, the web site must be found. A simple Internet search directs users to a selection of web sites. Presently, the typical user interested in Arkansas is directed to the official state site at www.state.ar.us. The user interested in economic development in the state must then find Arkansas' Department of Economic Development site http://www.1-800-arkansas.com. This site is so buried, that all but the very tenacious, will grow weary and may indeed abandon their search. Arkansas' official state site does not have a direct link to economic development. And a simple Google search directs users to many other Arkansas web sites prior to presenting the state's Department of Economic Development. It is recommended that the state government consider modifying the design of Arkansas' official government web site in terms of both presentation and content. The goal is to convey a simple, unequivocal message and provide practical, user-friendly links that will enable investors and visitors, as well as state residents and constituents, to move their plans forward. Some specific suggestions include:

1. Adjust the link priorities toward investment opportunities and away from the present site's initial impression of 'Pay Business Taxes' and 'Search Criminal Background Records.'

2. Provide a direct link to Arkansas' Department of Economic Development. Consider the web sites of Missouri, www.state.mo.us, Alabama, www.alabama.gov, and New York, www.state.ny.us. Each of these state web sites has achieved simple, yet very professional economic development web site links. An efficient link encourages business development in the state.

3. Make the 'outsider' feel like an 'insider.' It is recommended that investors and visitors to Arkansas be the target audience of the state's web site rather than constituents of the state. Refer to Ireland, www.idaireland.com; Invest in Sweden, www.isa.se; Locate in Scotland, www.lis.org.uk; and New York State, www.state.ny.us. Each of these web sites reduces user alienation and creates a welcoming atmosphere.

4. Provide a direct link to the state's schools, colleges, universities and research institutions. In this way users can quickly connect with, for example, the University of Arkansas' Center for Economic Development Institute (UAEDI). This link could be beneficial to investors and perhaps potential domestic and international students. This could also facilitate inter-institutional collaboration, an essential component of technology and science cluster development. For example, it could improve the linkages between investors and contacts for co-op programs and university/community college career centers to support student job-training. A 2002 study on innovation and the University of Utah highlights that about six new startup firms based on University of Utah[3] technology are founded each year

in the state. Their statistics show that these startups invest more than $25 million annually in the development of new products. Web site links to Arkansas' universities could provide researchers with information and funding sources for commercializing their technologies. Particular emphasis on the University's Dale Bumpers College of Agricultural, Food and Life Sciences, is recommended. The February 2003 report by the Winthrop Rockefeller Foundation titled *Entrepreneurial Arkansas: Connecting the Dots* advocates creating a pipeline of entrepreneurs in the state that could be facilitated with a link on Arkansas' official web site. The *BioVentures* initiative at the University of Arkansas for Medical Sciences (UAMS) in Little Rock, which has evolved into a clearinghouse for the state's research, commercialization and business incubation activities, is steered by an industry advisory board.[4] A link to the state's UAMS Biomedical Biotechnology Center could facilitate applied research, the associated transfer of technology to industry, and patent registration in the state of Arkansas.

5. Add links to enable user access to specific programs through which investors and entrepreneurs can obtain financial assistance in the state. It would be beneficial to the state if specific offices that facilitate private development or identify potential funds available for investment assistance were easily accessible. Individuals with potential patent possibilities could use the site as an opportunity to increase registration and development in Arkansas. "Presently, most of Arkansas' intellectual property is licensed out-of-state thus development and the resulting value-added job creation and accompanying revenues occur outside of Arkansas."[5] Local venture capital contacts, private research funding opportunities, grant sources, award applications and other funding assistance opportunities should be considered. Funding assistance examples include:
   a. the Federal Department of Agriculture, Rural Development Agency for funding to support renewable energy systems and energy improvements for agricultural producers and rural small businesses (http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.ac cess.gpo.gov/2004/04-10052.htm;
   b. Rural America Grant which provides up to $2 million in funding to foster entrepreneurship across rural regions of the country. The project, Entrepreneurship Development Systems for Rural America, provides grants to support food systems and rural development as well as new opportunities that build on existing programs http://www.eshipsystems.org/index.html.
   c. *SSTI Weekly Digest* [6] supplements (e.g. June 2004 issues) often list federal funding opportunities that Arkansas could be eligible to take advantage of to promote and develop technology and science initiatives within the state.

6. Arkansas web site users unable to find answers to their queries should be encouraged to contact the Governor's office directly. Making that information readily available will facilitate a one-stop-shopping theme so that no web site user or virtual visitor to the state, especially those with potential technology and science investment opportunities, is lost. This step will also enable continual upgrades to the site to more fully meet the needs of users and maximize the site's potential.

Incentives: Best Practice—Public utility-state government partnerships

Financial incentives directly affect a firm's profitability. They are designed to either increase the rate of return of a particular initiative or reduce its costs or risks.[7] They include subsidized job training programs, moving expense reimbursement, foreign trade and enterprise zones, tax credits and rebates, loan assistance and reduced rates for utility consumption. In addition to training, Arkansas offers tax credits and payroll rebates as incentives for economic development in the state.

All things being equal, incentives within the U.S. are designed to "tilt the scales" in favor of a particular state as host for investment. They were originally designed for, and are primarily geared toward manufacturers who could provide a community with large payrolls, and politicians with easily visible signs of development.[8] Incentives may be granted either conditionally or unconditionally. With experience, incentive packages have evolved from virtual free-for-all giveaways in some states and municipalities, to more carefully negotiated contracts with longer term phase-in periods. Audit and accountability requirements must be built into incentive packages.[9]

Efforts to influence the locational decisions of investment have led many governments to offer incentives to attract investment within their borders and often away from other geographic areas. Investment contests result when a number of sites vie to attract the location of a specific investment. Not everyone is a fan of incentives, but the trend toward more and bigger incentive packages seems to be gaining momentum. Communities react to what the competition is doing.

While investors definitely seek the location that works for them from an operational standpoint, many companies view a widening range of communities as virtually equal in terms of operational conditions. When competing sites are essentially equal in all other key location criteria, incentives can and do, make the difference between winning and losing. Incentives, as with marketing and promotion efforts (including web site attraction) become more important at the margin, especially for projects that are cost oriented and footloose.

Research studies show that generally, high energy costs are a disadvantage for manufacturing firms. Arkansas' electricity-cost comparative advantage (discussed earlier within this report) shows that Arkansas has very favorable electricity costs. Indeed the index reveals that electricity costs in Arkansas are approximately 18 percent lower than the national average. A review of comparable states reveals that electricity costs in Arkansas are below those in Mississippi, equal to the costs in Oklahoma, but higher than Tennessee, Missouri, Alabama and Kentucky, which had the lowest electricity costs in the entire country in 2001.

New Jersey's Public Service Electricity and Gas (PSE&G) is a state public utility that works closely with the state of New Jersey in business development. An example of their promotional activities is the TradeLink New Jersey program. PSE&G partnered with Prosperity New Jersey and the N.J. Department of Commerce and Economic Development, Division of International Trade, to offer foreign firms an economical way to enter the U.S. market. Their New Millennium

Economic Development Fund offers loans and loan guarantees for companies relocating to or expanding in New Jersey. PSE&G's long-term commitment to its role as a major supporter of economic development in the state of New Jersey was strengthened with the creation of an unregulated subsidiary—the Area Development Limited Liability Corporation. More information on the partnership and business promotion efforts of the utility company are available at http://www.pseg.com/media_center/pressreleases/articles/press_2000-07-12.html. It is recommended that the Arkansas Electric Cooperative Corporation and the state review the efforts of PSE&G.

To attract and retain investment in Arkansas, the state might consider specific incentives to reduce the cost burden of electricity there. The creation of state incentives to assist in attracting higher-wage Wal-Mart vendors to Arkansas would be especially significant and could further contribute to the technology and science component of the state's cluster around this flag-ship firm. Such initiatives would also begin to satisfy some of the recommendations of the recent report by the University of Arkansas 2010 Commission—*Picking up the Pace*. It is suggested that with such actions Arkansas will be in an improved strategic position to attract target firms eager to leverage Arkansas' comparative advantage.

Incentives alone must not be seen as a building block. Arkansas should use targeted incentives, at most, to jump-start the process of technology development in the state. Incentives are a means to augment a broad economic development plan, an effective tool to supplement a well-researched full industrial-based regional strategy. Incentive-driven economic development is often short-sighted, with a time horizon closely linked to election issues. It is recommended that incentives be targeted to those that upgrade the state's resource capabilities over the long-term. This will encourage the retention of established firms in Arkansas and assist in improving the competitiveness of the state in attracting future development.

Incentives also require substantial fiscal resources. Indeed, various social costs may result from these programs, ranging from administrative costs and the loss of foregone taxes, to the actual neglect of other important legislative issues. The 'quality' of foreign direct investment (FDI) matters in the cost-benefit analysis of incentives. It is therefore recommended that concerns over quality take precedence over quantity targets for Arkansas' incentive programs. There is no one-size-fits-all advice. United Nations Conference on Trade and Development (UNCTAD)[10] advocates the targeting of quality benefits through attracting export-oriented FDI that improves the comparative advantage of the host region. In order for incentive programs to be effective in improving the state's long-run goals, careful negotiations are recommended so that Arkansas not fall into a potentially counterproductive bidding war with a rival state.

Studies by the Corporation for Enterprise Development[11] conclude that investments in skill development are far more effective than traditional economic development incentives. If quality-of-life factors lure new workers, training initiatives can go far in attracting and retaining employers in Arkansas.

Some highly regarded incentives models include: the Industrial Development Agency of Ireland, www.idaireland.com, which generated a positive boost to economic development there; the practices of Unilever in Viet Nam and Toyota Motor Thailand, creating linkages to the local economy and embedding foreign affiliates; as well as the local supplier and training program incentives offered in the Czech Republic (see detailed case study below).[12]

High-Technology Communications Equipment Manufacturing

Of all the industry sectors in Arkansas, communications equipment manufacturing achieved the greatest substantial employment growth—1,893.1 percent, from just 58 employees in 1992 to 1,156 in 2002, as well as the greatest gross state product contribution growth—1,301.5 percent from $.8 million in 1992 to $11.2 million in 2002. The 2002 location quotient for communications equipment manufacturing was 0.68, indicating that there is a lower concentration of this high-tech industry in Arkansas than in the U.S. as a whole. In order to increase the production competitiveness along this industry's value chain, we recommend 'grass-roots' research, such as interviews with firms currently in this industry in Arkansas. This would assist in the state's determination of the sector's future operational needs and expansion possibilities, and in its selection of policies and resource allocations designed to meet the specific needs of the communications equipment manufacturing industry. In order to increase Arkansas' location quotient in this industry, it is recommended that the state consider fostering local development and/or attracting firms, both domestic and foreign, specifically related to high-tech communications equipment manufacturing.

Detailed Case Study -- The Czech Republic's National Supplier Development Program[13]

A strategic goal of CzechInvest is to support the country's supplier base through the attraction of foreign direct investment (FDI) with linkages to the local economy. Their 1999 Supplier Development Programme had three objectives: to promote modern industrial technology; heed environmental protection considerations; and raise the qualifications of the local labor force.

In January 2001 the Supplier Development Programme introduced a new "Twinning Programme," focused specifically on the electronics and electro-technical industry. The program consists of three elements: (1) collection and distribution of information on the products and capabilities of potential Czech component suppliers, to enable foreign manufacturers to short-list and contact potential new suppliers. (2) matchmaking, comprising: a) 'Meet-the-buyer' events between foreign investors and potential Czech suppliers. The sessions focus on identifying the type of components and services that investors are considering subcontracting. b) seminars and exhibitions organized with Czech suppliers and foreign affiliates. c) concrete proposals to potential investors, indicating potential local suppliers are presented. (3) upgrading of selected Czech suppliers. Selected firms produce an upgrading plan, tailored to their individual capacities and requirements. Progress is monitored with quantifiable performance benchmarks that compare Czech companies with their European Union (E.U.) competitors. The upgrading process usually includes consultancy and training support in such areas as the utilization of technology, general management operations, ISO certification and organizational change.

A second component is training in a wide range of areas, including finance, management, quality assurance and marketing. Assistance and advice on financial restructuring and productivity improvement are also included. As a means of providing assistance to accessing finance, results of the training program are presented to private sector bankers with the aim of promoting the financing of the trained electronics suppliers. These programs aim to improve the selected suppliers' financial, production and inventory management, as well as their capacity to undertake purchasing and quality control.

Initially, the Government of the Czech Republic financed the operational costs of the program (about $3 million for a three-year period), with co-funding from the E.U.'s Phare Program. The Government expects to qualify for the E.U.'s Structural Fund programs. The Ministry of Labour contributed funds to support the development of investment in areas with high rates of unemployment. CzechInvest periodically evaluates the progress made by the suppliers.

The economy of the Czech Republic, outpaced the average growth for the member states of the Organisation for Economic Co-operation and Development (OECD). The Czech government announced in early 2004, plans to invest $107.6 million into several tech-based economic development initiatives. CzechInvest will coordinate development of strategic components of the nation's business environment including: the development of science and technology parks, incubators and technology transfer centers; subsidies for applied research projects undertaken by companies of any size; and a wide range of support for small and medium enterprises.

Using Ireland and Spain as models, the Czech Republic's focus with the fund is to further develop its overall business infrastructure and build key sectors, including the life sciences, microelectronics and semiconductor industries. The nation is seeking to expand its R&D facilities, continue marketing to foreign investors in selected industries and create financial support for emerging enterprises.

More information is available at http://www.czechinvest.com

Education and Bridging the Digital Divide: Best Practice—Improved Competitiveness Infrastructure

The Milken Institute State Technology and Science Index shows that of the states comparable to Arkansas, Texas achieved the highest performance ranking in both 2002 and 2004. In the late 1990s, Texas established the Texas Science and Technology Council that made recommendations regarding leadership, advice and direction to the governor and the legislature on the identification, support and promotion of technology-based opportunities in the state. Specifically, the Texas Science and Technology Council:

- introduced a high-technology curriculum in each Texas community college. The Council's goal was to provide technology firms with a labor pool of well qualified students to draw upon within the state;
- implemented a statewide incentive-based advanced placement program in science and math in every Texas high school. This initiative was directed at increasing the number of skilled high school graduates; and
- adopted a franchise tax credit for research and development.

Texas ranked 23rd on the 2004 Technology and Science Index.

A strategy of the Bill & Melinda Gates Foundation is to help improve high school graduation and college readiness rates nationally. Earlier this spring, the Foundation announced a grant of more than $390,000 to help governors begin to explore options to enhance the performance of rural schools and ultimately improve graduation and college-going rates throughout the South. The project, *New Traditions: Options for Rural High School Excellence*, focuses on providing Southern state education leaders with new ways to meet the challenge of improving struggling rural schools, most notably, by identifying a range of successful schools that can be emulated and replicated. Arkansas will benefit from adapting the results of this study to its own unique state circumstances.

Good teachers are the foundation on which education is built. The Milken Family Foundation Teachers Advancement Program (TAP) is a comprehensive strategy to restructure the educational system to attract, retain and motivate the best talent to the teaching profession. It encompasses every aspect of the system—including recruitment, training, induction, professional development, compensation, performance evaluation and career advancement. TAP's framework for systemic change is centered around five key principles:

(1) Multiple career paths;
(2) Market-driven compensation;
(3) Performance-based accountability;
(4) Ongoing, applied professional growth; and
(5) Expanding the supply of high-quality teachers.

While each of these principles is powerful in its own right, the Foundation believes that all must be in place to ensure effective and lasting reform. Because each school and district is unique, TAP is designed to adapt to a wide range of instructional philosophies and geographic settings. TAP is currently in various stages of implementation in eight states: Arizona, Arkansas, Colorado, Florida, Louisiana, Minnesota, South Carolina and in Indiana by the Archdiocese of Indianapolis. Arkansas's Milken Educator is Margaret Ann Ervin. It is recommended Arkansas continue to work with the Milken Family Foundation TAP personnel or an equivalent institution to further build teacher-excellence efforts throughout the state.

President George W. Bush recently[14] pledged to bring "broadband technology to every corner of our country by the year 2007." Senator John Kerry echoed this call pledging investment "in industries of tomorrow, including broadband." So, Internet access is on the national agenda. The latest poll by the Pew Internet and American Life Project shows that as of March 1, 2004, approximately 68 million American adults log on via broadband either at home or at work with 48 million Americans having broadband connections at home. Americans live in an information society. Access to the kind of information that broadband can provide is no longer a competitive advantage, but rather, its absence is a competitive disadvantage. Arkansas must put increased Internet access on its state development agenda as a priority for educational advancement leading to economic development. Broadband support and coordination with Arkansas' Blue Ribbon Commission on Public Education will be especially helpful in moving this initiative forward.

The July 2003 Winthrop Rockefeller Foundation study *Tax Options for Arkansas: Funding Education after the Lake View Case*, presents a concise and compelling argument for quality education—the economic impact of achieving adequacy. According to federal Census and Education Department data, superior broadband access throughout the public school system in Arkansas would facilitate education improvement efforts and reduce the current trend toward re-segregation in the state. In addition, it would address issues raised in the 2002 study *Miles to Go. Arkansas. Beyond High School: Economic Imperatives for Enlarging Equity and Achievement*. [15]

Bangalore, India, the newest call-center magnet, is perhaps the world's most salient example of broadband access that effectively supports global economic gain. In the U.S., Mississippi's recent[16] Broadband Technology Development Act was designed to provide companies such as BellSouth with tax incentives for deploying broadband services throughout the state. Mississippi's goal is to further economic development and improve education. It is too early to tell whether Mississippi's efforts will prove to be a best-practice model. Indeed, value for dollar spent on this specific project may be difficult to judge. Mississippi ranked last nationally in the household-with-computers and Internet access categories on the 2004 Index. However, as a state comparable to Arkansas, Mississippi's efforts to improve its competitiveness infrastructure, merits close monitoring.

The Progressive Policy Institute's "State New Economy Index"[17] points out that states that "fully embrace the potential of networked information technologies will not only increase the quality and cut the costs of government services, but will also help foster broader use of IT among residents and businesses, leading to faster economic growth." Broadband access supports new startup companies and is essential for venture capital. Arkansas might consider a program to expand broadband access to entrepreneurs who have secured venture capital.

In 1999, 11.3 percent of Arkansas' civilians aged 25–61 had a disability or health-based work limitation, (3rd highest disability rate in the nation). Only Kentucky and West Virginia, at 12.2 percent, ranked above Arkansas.[18] IT is especially effective at maximizing the potential of disabled persons in Arkansas.

Technology Concentration and Rural Arkansas: Best Practice—Creating Linkages

Economic prosperity has not yet taken root in rural Arkansas. In 2000, almost 50 percent of Arkansas' residents lived in rural areas, more than double that of the U.S. overall. Statistics show that the percentage of residents living in rural Arkansas is declining—from 66 percent in 1980, to 53 percent in 1990, down to 48 percent in 2000, the most recent year for which data is available.

The Hubert H. Humphrey Institute of Public Affairs at the University of Minnesota produced the *Rural Knowledge Cluster: The Challenge of Rural Economic Prosperity.*[19] That report explored rural knowledge clusters as a model for rural economies. It addressed a number of special circumstances that created additional cluster challenges for rural America. The following four approaches to rural knowledge clusters identified in that report may be appropriate strategies for Arkansas to consider in developing the states' rural clusters.

1. **Understand your local knowledge base.** Analyze your economic base and understand what specialized knowledge drives your most innovative and successful firms.
2. **Foster linkages between firms and the local institutions that support them.** Active feedback loops between industry and local institutions are an important mechanism for promoting economic development.
3. **Develop strategies for promoting innovation around rural knowledge clusters.** Innovation is the most important element of rural knowledge clusters. R&D and tech transfer need to be stimulated through manufacturing extension programs and applied research centers at local universities and technical colleges.
4. **Don't go it alone; promote a regional vision to guide local strategies.** A regional vision must be established to guide local activity. This is essential in a rural setting as firms, labor and governments can be spread out over a large area and must understand the benefits of working together.

It is recommended that Arkansas work to recruit technology and science companies with the potential to augment firm assets within existing clusters. Investment in economic development clusters in Arkansas is best targeted at new assets that both seed these clusters and encourage internal collaborative interaction. As noted earlier in this report, starting a cluster from scratch is almost always a formula for failure. Mature industries are unlikely hosts for emerging industries.

Significant areas in the seven southeastern states of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Virginia face longstanding problems of poverty and inadequate economic development opportunity. Economic indicators rank this region among the most distressed in the country. In the global economy, this region is increasingly noncompetitive and has suffered jobs losses as the textile, timber and agriculture sectors restructure. The Southern Governors' Association (SGA) hopes to turn this around with support of a regional approach to economic development, a policy resolution adopted in August 2003. It is recommended that Arkansas investigate the possibility of participating in this regional initiative.

Agglomerations rise from the immobile nature of embedded knowledge. Clusters provide significant opportunities for potential intra- and inter-industry knowledge spillovers. Because of the potential transfer of technology resulting from foreign direct investment, the latter may create a social multiplier over and above what has been created by domestic projects. Arkansas' goal is to encourage cluster formation to generate externalities that will positively impact the productivity and competitiveness of domestic firms.[20] Italy's Etna Valley case[21] is a country example which demonstrates how industry-specific comparative advantages act as a catalyst for multinational enterprises, ensuring a strong enough presence to facilitate future local development.

Join Forces: Best Practice—Cooperation and Collaboration

In today's dynamic, global, fiscally-constrained environment, state governments must learn what countries have always known: in a complex, uncertain world filled with shrewd competitors, it is best not to go it alone.[22] Governments, at various levels, are more willing today to factor cooperation into their strategic planning and to selectively share their expertise. Linkages among governments and businesses exist because of the need to coordinate different or similar strategic capabilities, eliminate overlaps and reduce waste. Global competition highlights asymmetries in the skill endowments of state governments. Collaboration is the suggested path to success.[23]

In practice, intra and inter-governmental rivalry, conflict and strife abound. The creative art of matching environmental opportunities with governments' distinctive competencies and internal resources, establish its economic mission. Multidimensionality results from the very nature of globalizing capitalism: transnational enterprises cover multiple geographical markets with multiple product lines in typically multifunctional activities where societal and organizational culture combine to influence technology, R&D and work behavior. Multidimensionality means that no simple one-dimensional hierarchical solution to the issue of improving Arkansas' economic development exists. Beyond the structural indeterminacy lies the need to handle multiple stakeholders, externally and internally, and multiple perspectives on choices and decisions. Different mentalities, investment goals, and integration objectives often collide to undo the efforts of the well-intentioned. Real, measurable improvement can be negated by individuals with conflicting agendas and patronages. The objectivity of a decision-making process and the consistency of approach, are crucial to success. Issues of environmental complexity, cultural complexity and the stress of multiple markets demand that governments and businesses operate with flexibility. A cooperative economic development strategy is required for Arkansas' technology and science advancement because of the important interdependencies between competitive positions in different political areas of the state.

Collaboration, the joining of governmental and business forces, is not a tool of convenience, a fad or a fashion. It is a necessity. It is an important, even critical instrument of serving constituents in a global economy. Politicians have come to realize that they "can't be good at everything," therefore, they link up with others. And, they learn from others—other states' experiences, initiatives, goals, project failings and successes. Differences in the administrative systems that are used to manage strategies for technological growth imply different opportunities for Arkansas, and the development and application of different practices.

Individuals learn by interacting with one another; groups learn as their members cooperate, and the organization learns as it receives feedback from its environment. Three broad determinants of learning outcomes are: (1) intent, which refers to the initial propensity of stakeholders to view collaboration as an opportunity to learn; (2) openness of each participant toward a potential for learning; and (3) the receptivity to a partner's capacity for learning. Through the examples of others, the state of Arkansas can leapfrog errors and streamline its opportunity for success. Bargaining power is a function of relative dependence, therefore, it is possible to lessen dependency and improve bargaining power by out-learning one's opponents, i.e., similar states competing for limited resources, jobs, the location of foreign firms, and the birth of new entrepreneurial enterprises.

The Southern Governors' Association (SGA) promotes innovative programs and practices, and provides policy information on pressing issues to its members. Its mission is to provide a bipartisan forum to help shape and implement national policy and find solutions to state and regional problems. Three current initiatives of the SGA are especially pertinent to the state of Arkansas in its efforts to improve technology and science in the state. They relate to:

1. raising investment capital through SEBIO, the Southeastern Biotechnology Investor Forum;
2. improving education based on *New Traditions: Options for Rural High School Excellence,* a project supported by a grant from the Bill and Melinda Gates Foundation; and
3. a policy resolution adopted in August 2003, taking a regional approach to economic development.

It is recommended that the state of Arkansas leverage its participation in the SGA as it directly relates to the state's strategic plan for technology and science.

The Southeastern Biotechnology Investor Forum (SEBIO), organized by the Southeastern Life Sciences Association, is a collaborative effort of the leading life science technology and economic development organizations in the six Southeast states: Alabama, Georgia, Florida, North Carolina, South Carolina and Tennessee. Arkansas is not represented although life sciences is a high priority, technology and science initiative for the state. SEIBO represents a partnership among universities, biotech associations, economic development and research foundations and business. According to the SGA, the goals of SEIBO are to bring together national, international and regional life science investors, entrepreneurs, business executives and other stakeholders involved in building innovative life science ventures. It is recommended that Arkansas research the possibility of participating in or replicating some of SEBIO's achievements.

The Brookings Institute study, *Growth in the Heartland: Challenges and Opportunities for Missouri*, recognized the various efforts of well-meaning, albeit separate initiatives to improve performance in the state of Missouri, noting, "… these separate efforts, while impressive, fail to provide state and local leaders with the state-wide information they need to." This study clearly points out the need for cooperation and collaboration.

Evaluating Success: Best Practice—Measurement and Accountability

Progress measurement is a critical component for the success of technology and science development in the state of Arkansas. The University of Arkansas has studied criteria measurement systems that could be applied to technology and science gains in the state. The SGA recommends the establishment of long-term strategies that include measurement of state progress. The SGPB (Southern Growth Policies Board) and the Southern Technology Council have developed benchmarks. The SGPB publishes annual updates of state performance on these benchmarks as the Southern Innovation Index. Arkansas will be well served by examining this publication which offers at a glance, annual reviews of progress in technology and science, against goals. It may also serve as a vehicle for continuing to encourage regional progress and collaboration on research, development and technology issues.

Technology and science development strategies require continual review and collaborative adjustment. It is not a static process. The exit interview is an excellent means of ascertaining the reason(s) why firms may have left the state of Arkansas. Although this potentially humbling experience is not be for the faint of spirit, exit interviews with key executives of firms who have left, are leaving, or are contemplating pulling key resources out of the state, will help Arkansas adjust its economic strategies to continually reflect reality and best enable the targeting of future limited resources to essential components. Attraction to the state is great, but retention is the key to building clusters of embedded economic activity leading to long-term economic prosperity for Arkansas.

In 1989,[24] Warmack Warehouse built what was then a state-of-the-art distribution facility in Arkansas for Foot Locker. The athletic footwear retailer closed its 450-job operation in 2000. More recently, this same facility on Champs Blvd. was occupied by Keystone Internet Services, a division of Weekawken, New Jersey-based Hanover Direct, which sells home fashions, men's and women's apparel and gifts. The facility served as an e-fulfillment center for Hanover's online sales subsidiary. This 267 employee e-business closed in March 2001 after only 10 months of operation. Most recently, the building is home to Scholastic Distribution Services, a division of Scholastic Inc. The center has a three year 600-employee plan for its operations. The reasons why firms exit Arkansas will be many and varied. Often, the state has little or no control over exits (for example, mergers and acquisitions). Even so, it is recommended that the appropriate officials conduct exit interviews as a means of reducing the cost of repeat errors.

The Milken Institute State Technology & Science Index shows that Tennessee experienced the largest positive rate of change on the index in the country from 2002 to 2004, improving its ranking from 40th position up to its most recent rank of 34th in the nation. Tennessee's best practice began in 1993 with the Tennessee Technology 2020 project, one of several regional economic development strategies designed to lessen the region's dependence upon government spending and to create a strong and vibrant private-sector-driven information technology industry. The state built upon this initiative in 1998 with the creation of the Tennessee Technology Development Corporation (TTDC). In the following year, the Southeast Community Capital Corporation (SCC) was created to increase access to capital for small businesses in Tennessee. While recognizing the unique characteristics throughout the state, Tennessee's technology and science efforts appear to be inclusive and successful.

The Role of Government: Best Practice—Public Policy Initiatives

Governments can and do strongly influence business activities both indirectly through their macro-economic and macro-organizational policies, and "attitude" toward business, as well as directly through selected taxes and incentives, controls, regulation and promotion. They affect the ability of economic agents within their governance to create, sustain and efficiently utilize innovative and productive capacity, and to coordinate their domestic and international activities at least as well as their competitors.

As the factors influencing firms increasingly have more to do with created assets and less with natural factor endowments, the government of Arkansas, as the custodian of the educational system and the provider of public infrastructure (notably intermodal systems of transportation and communications) has a crucial role to play in determining its own success. Throughout this study, it is suggested that businesses select sites on the basis of the existing natural and created assets as well as the general policy attributes, i.e. the qualities of the commercial environment, of individual locations. It is the role government of Arkansas to reduce investment uncertainty, develop a strong educated workforce and promote a positive economic ethos.

India's torrid economic growth holds a valuable lesson for policy makers. According to Rodrik and Subramanian,[25] India's growth was triggered by an attitudinal shift on the part of the national government to a pro-business approach. They found that manufacturing built up in previous decades played an important role in influencing the pattern of growth across the Indian states. These researchers argue against additional layers of regulation stating that India's success demonstrates that it's usually "a question of figuring out what is the most binding constraint of growth and just alleviating it." [26]

Some public policy initiatives we recommend that Arkansas consider researching, adapting to its specific conditions and implementing in the state are:

- Oklahoma's Center for the Advancement of Science and Technology (OCAST). This center is the state's only agency focusing solely on technology—its development, transfer, commercialization and impact on Oklahoma's economy. It is designed to increase the economic well being of rural and urban Oklahoma by building bridges between companies and education.
- The Rochester Institute of Technology which has several collaborative centers heavily supported with private sector funds.
- Kentucky's comprehensive system to foster the development of the New Economy in Kentucky,[27] which came about with the passage of House Bill 572, Kentucky Innovation Act.
- Maryland's Technology Development Program (TEDCO) (see detailed case study below).
- Missouri's Certified Capital Companies program (CAPCO). Although Missouri's ranking

in the overall Milken Institute State Technology and Science Index declined from the 2002 index (rank 28th) to 2004 (31st) the state's Risk Capital and Entrepreneurial Infrastructure Compound increased substantially from 30th position in 2002 up to 25th in 2004. Indeed, Missouri achieved growth in: (1) its Total Venture Capital Investment—ranked 38th in 2002 and 32nd in 2004; (2) the Number of Companies Receiving VC Investment per 10,000 Business Establishments—ranked 24th in 2002 and 21st in 2004; (3) the Companies Receiving VC Investment Growth—ranked 32nd in 2002 and 12th in 2004; and (4) Venture Capital Investment as a Percentage of GSP—ranked 22nd in 2002 and 21st in 2004. Missouri's success in these Risk Capital and Entrepreneurial Infrastructure inputs may, in part, be attributable to its CAPCO program. (See detailed case study below).

- Oklahoma's Capital Investment Board (OCIB). Oklahoma ranks 35th in the Milken Institute State Science and Technology 2004 Index, a rise from its 37th-ranking on our previous index. This gain is due, in part, to Oklahoma's success in improving its Risk Capital and Entrepreneurial Infrastructure ranking—from 39th position nationally in the 2002 index up to 31st in 2004. Oklahoma's total venture capital investment grew, as did the state's venture capital investment as a percentage of its GSP. These improvements have been assisted by the Oklahoma Capital Investment Board (OCIB)(see detailed case study below).

While it is useful to study other state strategies for growth, many policies are place, culture, stage and time specific. This should be kept in mind when considering adoption of a course of action implemented elsewhere. Arkansas state and local governments, public policies, and the interaction between private and public sectors are crucial for the genesis, expansion and fortification phases of technology development in the state. Nonetheless, due to the unique characteristics of technology industries, government's role also is limited. Overly active government intervention and public policy may be counterproductive and even harmful to the long-term development of technology industries.[28] Arkansas can do much to upgrade its competitiveness in long-term technology and science development without increased government regulation, indeed, without mandating a thing. Well-researched strategies, stakeholder agreement and commitment, and well-managed execution are the essential components in achieving Arkansas' desired goals.

Detailed Case Study: Technology Advancement in Maryland

The Maryland Technology Development Corporation (TEDCO) was created to drive the advancement of technology industries in the state and serve as a "gateway" to Maryland's technology community (www.southerngovernors.org). In brief. TEDCO, in partnership with the Department of Business and Economic Development, the research universities, the state's regional technology councils and with the support of the governor's office and private-public leadership, developed a tech-based economic development investments plan. The plans elements for success are:

I. Make Maryland More Competitive

- Increase state pension funds investment in private equity;
- Raise investment by Maryland banks in Small Business Investment Companies;
- Restore and increase funding for investment financing programs, including the Maryland Technology Development Corporation;

- Encourage foundations in Maryland to invest in technology companies;
- Use state tax incentives to affirm the message that Maryland welcomes and encourages advanced technology investments;
- Survey chief executive officers on regulatory process; and
- Invest in the Business/Technology Case Management Program.

II. Harness Maryland's R&D Assets

- Establish a permanent State Chief Technology Officer;
- Increase utilization and effectiveness of Maryland Technology Councils;
- Encourage entrepreneurial initiatives and technology transfer;
- Support the state's incubator network with capital and operating funds for best practices;
- Allow state higher education institutions greater leeway under state personnel and procurement rules to encourage attraction of research funding;
- Increase state funding for academic research;
- Encourage Maryland research consortia to compete for large federal funding opportunities;
- Create alternative financing vehicles to create more laboratory space at Maryland's universities; and
- Promote increased coordination at University and college tech transfer offices.

III. Market Maryland

- Leverage the Office of the Governor to encourage and sustain Maryland's advanced technology enterprises;
- Develop a comprehensive marketing strategy to "brand" Maryland as a leading home for technology business and innovation;
- Create a central database of Maryland academic and federal laboratory technology resources;
- Pursue targeted international investment in Maryland;
- Create an Executive Job Corps; and
- Create a Governor's Science Advisory Board.

Detailed Case Study: CAPCO – The Missouri Example[29]

CAPCO, the Certified Capital Companies program, supports small business development utilizing private sector expertise. CAPCO was originally passed as part of a larger rewriting of the Louisiana tax code. CAPCO has been adopted in nine states, excluding Arkansas. In Missouri, the 1996 passage of the enabling legislation was supported by a broad coalition of business and community leaders.

CAPCO is a special type of venture capital fund. The program has two features that differentiate it from private sector VC funds. First, the sole objective of CAPCO is economic development which generates additional investment funds from traditional capital markets. Second, the initial seed money to establish the venture fund is provided by insurance companies. The structure of CAPCO defers the utilization of tax credits allowing for the fiscal impact of increased revenue-generating activity to actually precede any state revenue loss from the tax credits themselves. CAPCO also brings the hands-on management expertise that is essential to the development of the small firms. This aspect is relatively unique in comparison with other state incentive programs that cannot offer the day-to-day management help that is required for long-term gains.

CAPCO has been a huge success. Direct gains in Missouri, from 1997 to 2002, attributable to the program totaled over 8,000 job-years. Secondary or multiplier effects have generated an additional 6,900 job-years generating nearly $500 million in corresponding personal income gains.

The CAPCO program appears to be one of the most effective and successful economic development incentives that Missouri has implemented. In addition to the above noted gains, CAPCO has generated over $180 million of incremental state and local tax revenues. CAPCO portfolio companies have also attracted over $1.25 billion of co-investment and follow-on capital from other investors, or roughly $24 of leveraged capital for every dollar of tax incentives provided. The strongest selling point for this program is, however, its longer timer potential to attract outside capital coupled and the business expertise of its general partners.

Detailed Case Study: Venture Capital[30]

The Oklahoma Capital Investment Board (OCIB) was created to mobilize equity and near-equity capital for investment in order to create jobs and diversity and stabilize the state's economy. The strategy encourages and supports the growth of a local risk capital industry capable of financing companies from early-stage startups to later-stage expansions. Over time, full implementation of the OCIB program is expected to result in over $240 million of new capital for Oklahoma businesses.

The program is based on the principles that:

- risk capital is necessary to generate and support the growth of entrepreneurial firms, which in turn create jobs and provide economic growth;
- risk capital is best provided and managed by qualified, professional investment groups;
- the pursuit of the highest possible risk adjusted rate of return provides the best discipline for using limited resources to generate the greatest economic impact; and
- a responsive state program can demonstrate to potential investors the high level of commitment the entire state has for entrepreneurial ventures.

The OCIB is a state-beneficiary public trust. There are five trustees. Each is appointed, based on their experience and knowledge of venture investing, for staggered five-year terms. The board employs three staff. From its first commitment in 1993 through 1999, the board supported investment totaling $26 million in eight partnerships. OCIB raises capital for investment from institutional investors with the benefit of a guarantee. The capital is raised and invested through a private corporation, the Oklahoma Capital Formation Corporation. The board holds $50 million of state income and premium tax credits and is authorized to sell these credits, if necessary, to generate cash to meet a call on the board's guarantee. Public utility companies in Oklahoma have contracted to purchase the tax credits. Consequently, the board's guarantee takes on the quality of a utility guarantee.

The investment strategy and capital structures of the board were designed to deliver a number of significant benefits to the state.

- No cost. During the life of the program, the state expects to enjoy significant economic benefits at no cost (neither allocation of state funds nor loss of revenue from the use of tax credits).
- Asset Production. The program is expected to generate a cash surplus to serve as an ongoing resource for development finance activities.

- Public-Private Partnership. The funding structure and delivery system provides a variety of opportunities for meaningful collaborative participation in board programs.
- Leveraged Private Investment. The investment programs are geared to leverage private capital in the aggregate at a ration of at least 3.8 to every dollar of OCIB funds guaranteed.
- Professional Talent. A broad range of professional investment talent is being recruited and developed in the state.

The results were that, through 30 June, 1999, of the $26 million committed, approximately $18 million has been drawn with a portfolio internal rate of return exceeding 29 percent. Twelve Oklahoma companies have received equity capital of $61.6 million from these partnerships. Debt capital leveraged is estimated at $123 million. The rate of investing is accelerating through the increased understanding of seed and venture capital supported by the marketing efforts of these firms. In addition, the program supports an environment within Oklahoma, conducive to high-tech entrepreneurship.

The OCIB program has investment objectives that are clearly described and fiduciarily sound. Its strategic objectives, which are ambitious but achievable, support quality economic development in Oklahoma. The trustees and program staff have been committed and consistent in their pursuit of these objectives. In a state that started with almost no venture capital, the program attracted significant new sources of capital and investment talent. Leverage has been high. No state funds were used and no tax credits were redeemed. The program succeeded in balancing the expectations of its trustees for a diversified, financially successful portfolio with the expectations of sate officials for significant local development. And, although the program took several years to implement and its commitments cautious, results have been very positive.

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Economic Impact of Successful Creation of Knowledge-Based Industries

Background and Methodology

The method used to construct an econometric model for the state of Arkansas incorporated the structural linkages, i.e. the interrelationships, across all industries in the region. The model employed an embedded input-output (I-O) framework capable of capturing key producer and supplier relationships. From this, the impact of positive future growth in a knowledge-based industry on various dependent industries can be derived.

Arkansas' economy is comprised of construction, mining, finance, insurance, real estate, wholesale and retail trade, transportation and utilities, manufacturing, services and government. These sectors contain knowledge-based or high-tech industries that can serve a vital role in supporting some of state's key industries such as food processing, freight and general merchandise stores. Occupations in these industries usually require a higher than average skill-set. Therefore, individuals occupying these positions are normally well-trained and sufficiently knowledgeable in the latest of technological advancements. Supplying the state with this high-level of intellect and skilled labor is important in keeping up with the nation's growing educated labor pool. This paradigm serves as the foundation for defining our alternative forecast.

The model's baseline forecast is the scenario by which the state is projected to grow assuming the current industry mix and workforce within the state. The purpose of composing an alternative forecast is to determine the types of jobs, both in terms of quality and quantity, that are necessary to keep up with the growing per capita income in the nation. In so doing, we have assumed that the state must closely mimic the national industry mix and in some cases grow faster than the national average in terms of both employment and output. By expanding its knowledge-based workforce, the state would be in a better position to capitalize on its growth potential. Higher value-added industries tend to generate more wealth in a region by indirectly circulating income throughout other related sectors. This sort of economic cycle can lead to higher levels of per capita income in the state, but more importantly, it helps reduce the great disparity in income growth relative to the U.S. average.

This model is able to capture these ripple effects and their impacts on employment, output and income. It also provides a sense of time in which these impacts are likely to take place. Demographic trends, housing costs and other labor-market-based variables such as unemployment rates also influence the extent to which the economy may grow. While the bulk of the model is determined endogenously by applying the concept of simultaneous equations, the model also incorporates many exogenous factors (determined outside the model). Such is the case with U.S. based employment, wage and income categories. In addition to applying autoregressive techniques, the model consistently uses a first-differenced regression methodology to remove nonstationary bias.[1]

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Although public policy decision-making will ultimately influence the future growth of a region's industry structure, the alternative scenario can serve as basis for determining those industries that are essential to the overall health and prosperity of the state economy. While we are aware that knowledge-based or high-tech industries are where the state should focus most of its resources, they should act as a supporting cast for those key industries in which the state already has a considerable employment base (i.e., food processing, freight, etc.).

The Baseline Forecast

As stated earlier, the model's baseline forecast is the scenario by which the state is projected to grow assuming the current industry mix, workforce structure and economic condition within the state. In other words, without any significant changes to the state economy, it is likely that Arkansas would continue along its present growth path. Although that growth path shows positive signs through 2020, its growth in employment and income is underperforming relative to the U.S. average. Actually, the baseline forecast yields a widely growing disparity relative to the nation in terms of employment and per capita income growth. It suggests that if the state does not expand or create new opportunities within key industries it is likely to lag behind other competitive states even further.

Arkansas - Baseline Forecast Trends

Percent Change by 5-Year Intervals, 1990-2020

Concept	1990-95	1995-00	2000-05	2005-10	2010-15	2015-20
Total Nonfarm Employment	15.8%	8.4%	0.3%	4.4%	3.6%	4.2%
Hitech	14.2%	12.1%	-2.9%	4.9%	1.2%	0.8%
Knowledge-Based	15.0%	8.1%	-2.0%	3.3%	3.1%	2.2%
Personal Income	34.7%	28.1%	21.2%	24.8%	24.9%	29.6%
Gross State Product	40.3%	24.1%	26.6%	28.5%	31.0%	33.8%

New opportunities in high-tech or knowledge-based industries in Arkansas would be ideal. State officials must collaborate on a plan that would create more high-tech jobs in the region to reduce the gap in per capita income relative to the U.S. These jobs tend to generate higher levels of productivity and output, thus contributing towards gross state product on a much larger scale.

United States - Baseline Forecast Trends

Percent Change by 5-Year Intervals, 1990-2020

Concept	1990-95	1995-00	2000-05	2005-10	2010-15	2015-20
Total Nonfarm Employment	7.1%	12.3%	1.3%	6.4%	5.6%	5.1%
Hitech	2.1%	17.9%	-8.0%	9.8%	7.0%	8.0%
Knowledge-Based	3.2%	8.2%	-6.2%	6.8%	6.6%	7.4%
Personal Income	26.1%	37.0%	19.8%	32.3%	31.7%	33.1%
Gross Domestic Product	27.5%	32.7%	25.1%	28.8%	30.3%	32.3%

The baseline forecast predicts that by 2020, Arkansas will have a per capita income of $48,100. That level of per capita income is expected to be achieved in the nation by 2013, signifying a seven-year lag in the state. In the upcoming five-year intervals, namely, 2005–2010, 2010–2015 and 2015–2020, total U.S. personal income is expected to grow faster than the state of Arkansas, by 7.5, 6.8, and 3.5 percent, respectively. In a similar fashion, U.S. employment is expected outgrow the state by 2.0, 2.0 and 0.9 percent during each of those same time periods.

While the nation as a whole has been more sensitive to recessionary periods of the early 1990s and the recent high-tech bubble at the turn of the century, it has also exhibited faster signs of recovery. From 1995 to 2000, U.S. high-tech employment grew by 17.9 percent, while Arkansas high-tech employment grew by only 12.1 percent. Likewise, between 2005 and 2010, high-tech employment in the U.S. is expected to outgrow that of Arkansas by 4.9 percent. With a relatively small high-tech/knowledge employment base, one would expect Arkansas' growth to be much larger. Another reason for the state's lagging performance is that its high-tech mix is not as diversified relative to that of the nation's. Therefore, its high-tech growth is likely to be driven by a smaller number of industries.

Finally, the baseline forecast predicts that total nonfarm employment will increase by 13 percent between 2000 and 2020. In the U.S., that growth is expected to reach 20 percent by 2020. (see charts below)

The Alternative Forecast

In the alternative scenario, we have assumed that if Arkansas increases its high-tech and knowledge-based employment it will add more value to the state's economy, increasing total personal income, consumer spending, tax revenues, and finally, the gross state product. Most of all, it will help narrow the gap in income and employment growth relative to the U.S.

The evolution of structural change in a state economy takes time. Today's economic environment is highlighted by relentless competition for human and financial capital among regions of the globe. Lacking a formidable knowledge base in the state will make the economic transformation much more challenging. The "re-industrialization" of the Arkansas economy may take decades to complete even with effective public policy put in place today. In our alternative scenario, economic growth will not be able to match the national standard by 2020; it may take an additional decade or more to achieve economic growth and income parity between Arkansas and the nation.

There are two fundamental factors that are the underlying causes for this slow transition. First, the state's overall industry mix, which includes the nonhigh-tech/knowledge-based portion, is growing faster between 2005 to 2020, but its nontech industries are not growing up to par relative to that of the U.S. The alternative forecast is based on the assumption that the state will focus its resources primarily within its high-tech/knowledge-based sector. Although this will indirectly impact some of the nonhigh-tech categories, it does not directly impact industries such as steel, paper, textiles and agriculture. Therefore, under the current assumptions, it may take much longer than 2020 to reach the growth level of the national average. More importantly, the state will be in a better position to capture the long-term trend of the U.S. by growing faster than it would under the baseline. In the baseline forecast, long-term growth in the state seems to be stabilizing over time.

Secondly, the state's educational infrastructure is limited throughout the entire state. The state needs to build up infrastructure by attracting and retaining prospective students and human capital who will serve as the future of its high-tech and knowledge workforce. Training programs and vocational schools are also essential in building a viable workforce for the future. Additionally, a pragmatic program that links industries to educational institutions is equally critical in helping build a technology-based economy that will continue to attract and nurture high-skilled labor. Without these broad-based essentials being urgently developed in today's economy, Arkansas will be unable to keep up with a more balanced economic development across various regions and industries. Notably, certain segments of the economy such as rural counties and lower paying industries will further deteriorate. Potentially, these segments of the economy will lose employment and output to other states and regions in the globe. To sum up, a solid educational infrastructure that provides the necessary resources for future advancement and is accessible to the rural parts of state is vital to achieving the desired long-run equilibrium comparable with that of the nation.

Based on the importance of a knowledge-based sector and the role of high-tech industries in economic development, certain high-tech/knowledge-based industries were selected because of their strategic importance, i.e. high concentration in the state or high value production. By Arkansas' standards, these are areas for improvement or further expansion. These industries represent those that are essential to the state's future economy, namely, food processing, freight and general merchandise. The high-tech industries to which we added employment in the model include:

NAICS	Hi-Tech Industries
3254	Pharmaceutical and Medicine Manufacturing
3333	Commercial and Service Industry Machinery Manufacturing
3342	Communications Equipment Manufacturing
3343	Audio and Video Equipment Manufacturing
5413	Architectural, Engineering, and Related Services
5417	Scientific Research and Development Services
516	Internet Publishing and Broadcasting
517	Telecomm
518	Internet Service Providers, Web Search Portals, and Data Processing
519	Other Information Services

Similarly, the knowledge-based industries to which we added employment in the model include:

NAICS	Knowledge-Based Industries
3251	Basic Chemical Manufacturing
3259	Other Chemical Product and Preparation Manufacturing
3325	Hardware Manufacturing
3331	Agriculture, Construction, and Mining Machinery Manufacturing
3332	Industrial Machinery Manufacturing
3334	Ventilation, Heating, Air-Cond., and Comm. Refrig. Equip. Mfg.
3335	Metalworking Machinery Manufacturing
3351	Electric Lighting Equipment Manufacturing
3353	Electrical Equipment Manufacturing
4234	Professional, Commercial Equipment, & Supplies Merchant Wholesalers
4237	Hardware, Plumbing and Heating Equipment, & Supplies Merchant Wholesalers
4885	Freight Transportation Arrangement
4889	Other Support Activities for Transportation
5511	Management of Companies and Enterprises

In an attempt to seek an alternative growth path for the state of Arkansas, we added on payroll jobs and increased the productivity per workers in some of the selected or targeted industries that are deemed to be the important elements in elevating Arkansas' economic growth over time. As stated throughout our analysis, knowledge- and technology-based industries have to be the foundation for the state's future growth. We injected 27,375 jobs in industries such as professional, commercial equipment and supplies, merchant (4,234), management of companies and enterprises, electrical equipment (3,353) and basic chemical manufacturing. As a result, total additional jobs, income and gross state product would increase by 46,210, \$12.7 billion and \$11.6 billion, respectively, in 2020.

Other assumptions we introduced into this exercise include the increase of these industries' productivity measure, making them comparable to the nation's average. This assumption must be part of the scenario we perform as an exercise in changing the mix of the state's industries in both the goods- and service-producing sectors. The productivity increase is derived from introducing new technology into existing industries and bringing regional research and development centers and universities into the private sector, resulting in technology transfer and product commercialization.

Arkansas - Alternative Forecast Trends

Percent Change by 5-Year Intervals, 1990-2020

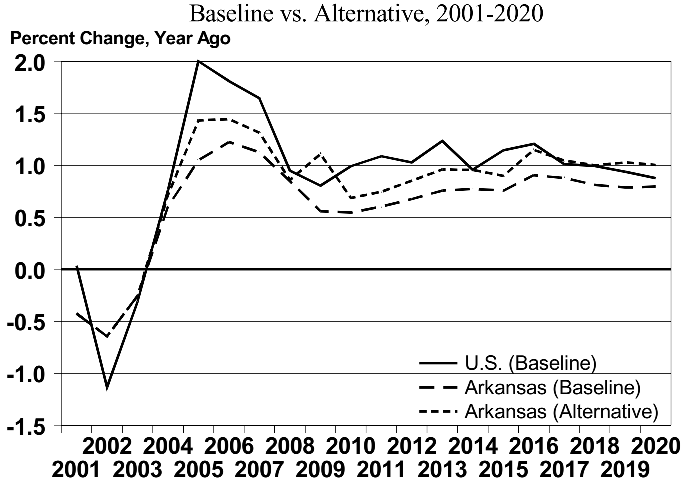
Concept	1990-95	1995-00	2000-05	2005-10	2010-15	2015-20
Total Nonfarm Employment	15.8%	8.4%	0.8%	5.5%	4.5%	5.3%
Hitech	14.2%	12.1%	-1.9%	8.5%	6.3%	6.6%
Knowledge-Based	15.0%	8.1%	-1.1%	7.4%	5.5%	6.0%
Personal Income	34.7%	28.1%	23.2%	27.1%	29.1%	31.8%
Gross State Product	40.3%	24.1%	27.5%	31.6%	32.5%	36.2%

The impact of increasing the high-tech and knowledge-based workforce is apparent from the previous table. The comparative growth differential between the baseline and alternative scenarios is quite significant. Under the alternative scenario, Arkansas high-tech industries grow by 8.5, 6.3 and 6.6 percent between 2005–2010, 2010–2015 and 2015–2020, respectfully. Employment within knowledge-based industries also rises faster in comparison to the baseline scenario. More importantly, however, both personal income and gross state product rise at a slightly faster pace than if jobs no were added.

The increases in employment with respect to the above categories generate an additional 46,200 jobs by 2020. This figure resembles the absolute change from the baseline forecast, or alternatively, a 3.5 percent increase from the baseline. Annual growth comparisons are illustrated by the graph below. In the alternative forecast scenario, employment in Arkansas grows at a faster pace than the baseline scenario (that is, no additional employment is added).

Anuual Employment Growth

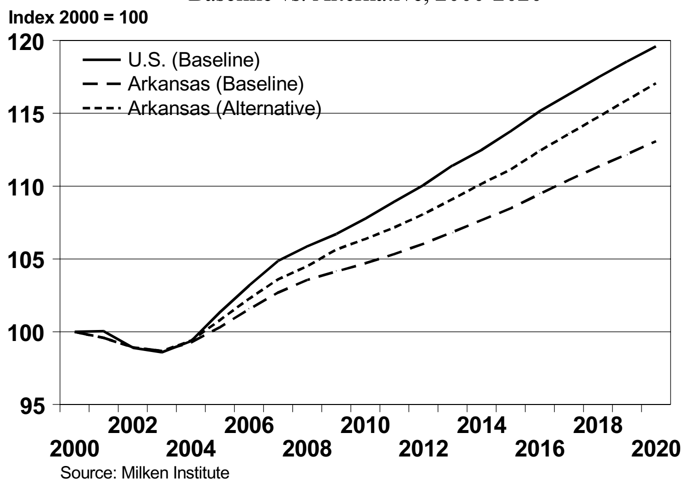
Baseline vs. Alternative, 2001-2020



Source: Milken Institute

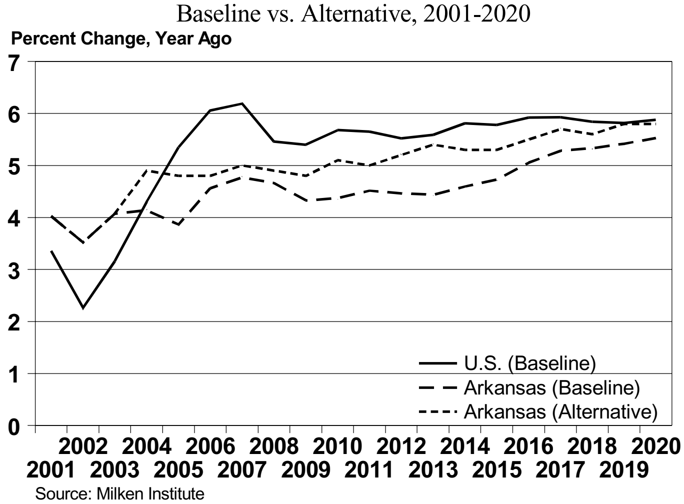
Over time, U.S. employment continues to grow faster than Arkansas; however, the disparity in growth is not as significant as it was under the Arkansas baseline forecast. The following chart portrays that growth indexed back to 2000.

Annual Employment Growth
Baseline vs. Alternative, 2000-2020

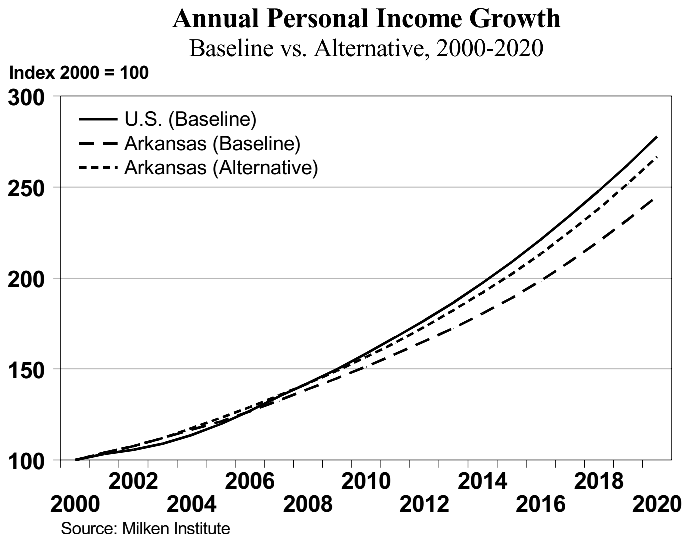


By 2020, Arkansas' employment is expected to grow by 17 percent under the alternative scenario, compared to that of 13 percent under the baseline. An even more significant trend is captured when graphing the percent change in annual personal income.

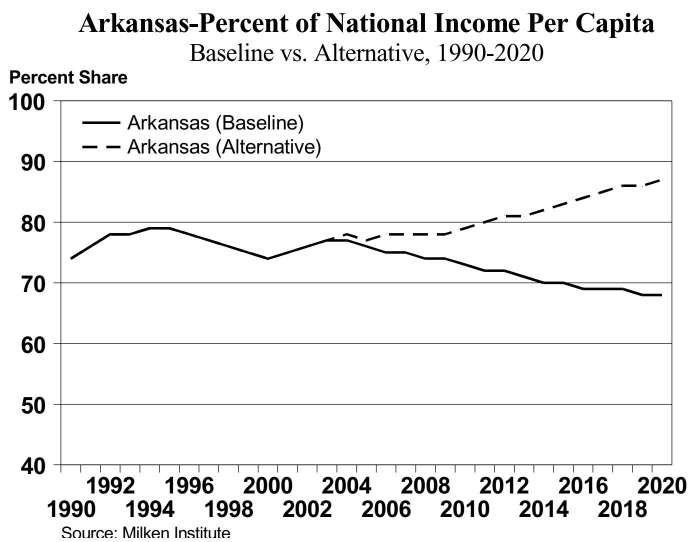
Anuual Personal Income Growth
Baseline vs. Alternative, 2001-2020



Under the alternative scenario, personal income growth nearly converges with that of the nation. When benchmarking this growth back to the year 2000, one can also note the upward shift in growth relative to that of the baseline. Under the alternative scenario, Arkansas' total personal income is expected to grow by 160 percent between 2000 and 2020, compared to only 140 percent under the baseline.



The alternative scenario also captures a higher share of national income per capita. By 2020, the difference is as large as 6 percent in comparison to the baseline.



In addition to employment and income gains, gross state product is also expected to increase by an additional $11.7 billion by 2020 under the alternative scenario. The additional employment causes the output contribution per employee to increase from $145,000 to $149,000.

From a fiscal perspective, the impact of added employment would translate into an additional $2.4 billion in tax revenue for the state by 2020. Under the alternative scenario, the additional employment increases the average tax contribution of each worker from $5,400 to $14,400 by the end of 2020.
Detailed tables containing baseline and alternative comparisons are provided in the appendix.

Summary

In short, the alternative forecast scenario explains the economic impact of adding approximately 27,000 jobs above the baseline forecast in high-tech and knowledge-based industries by the year 2020. The direct impact would generate an additional 19,000 in other sectors such as wholesale, retail trade, and manufacturing, ultimately accounting for 46,000 newly added jobs above the baseline in the state. Relative to the baseline forecast (the scenario in which Arkansas adds jobs in high-tech/knowledge-based industries at its recent historical rate), total personal income and gross state product would increase by $12.7 billion and $11.6 billion, respectively by 2020. The alternative scenario also captures a higher share of national income per capita. Finally, the change in employment would also generate an additional $2.4 billion in tax revenues.

Conclusion and Recommendations

Arkansas is faced with a fundamental choice as it determines the direction its economic development will take over the next 20 to 30 years. This choice is between the policies that have served the state for the past 50 years, and policies that will allow the state to keep pace with the rest of the country as the nation continues its transformation from a physical, manufacturing-based economy to an economy based on knowledge and technology. Many of the suggested policies and solutions offered are intended to provide improvements to the state's economy quickly, even within a few years. To make the distinction between what is readily achievable and what is achievable only through extended efforts, the recommendations here are listed by timeframe of implementation. The recommended changes for education and research are listed last not because of their lesser importance, which is certainly not the case, but because the necessary structural and planning changes that they require will take the most time and effort to implement.

Leadership

To alter the economic development paradigm toward greater focus on knowledge-based economy initiatives, it is critical for Arkansas to have a leadership group that acts as a catalyst and provides strategic vision. Leadership is the crucial element in virtually all successful regional economic transformations. In some instances, the initial leadership catalyst may have been a key individual or group of individuals from the private or public sector. Several governors have been effective catalysts for change. But enlightened governors have limited time in office making it essential to have a broader-based leadership on advocating changes required for knowledge-based economic development.

Major stakeholder groups provide the leaders to shepherd the transition to a knowledge-based economy: corporations, small and medium-sized businesses, finance, economic development officials, state and local government, elected officials, chambers of commerce, universities, workforce development groups, labor organizations and others. This group articulates and communicates why it is imperative to alter the state's economic course. There will be resistance to many proposed initiatives and strong leadership is the most effective means to overcome the forces of inertia.

Cohesive leadership facilitates coordination between the existing agencies and initiatives. In many respects, the leadership group is a network of organizations that aids information sharing and communication concerning the activities of relevant stakeholder groups. The leadership group works to convey the positive message that, despite the challenges faced by Arkansas in building a knowledge-based economy, a concerted effort can place the state on a new trajectory.

An important factor in this effort is attitude: for the state to develop a meaningful knowledge-based economy, Arkansas must accept the notion that transformation is attainable, otherwise, success is unlikely. Attitude is probably as important as the potential financial resources that can be directed toward this effort. While it should be articulated that these efforts will not transform Arkansas' position overnight, it should also be highlighted that many other states have altered their relative economic positions.

A key element in creating successful knowledge-based outcomes for Arkansas is to institutionalize the changes in attitude regarding economic development and the roles of stakeholder members. One of the ultimate goals of this leadership group should be to garner the support of institutions and turn them into advocates.

Accelerate Arkansas can position itself as the key leadership and catalyst group in promoting knowledge-based economic development among all stakeholders. It has the broad-based membership and individuals of stature to provide credible leadership. Accelerate Arkansas should consider some additional actions.

- Establish a communication outreach plan to target audiences
- Bring CEOs or senior executives of major Arkansas corporations aboard
- Identify other key stakeholder groups and individuals for membership
- Solicit personal involvement and support of Governor
- Initiate legislative education and outreach effort

Recommendations

The following 10 recommended actions are those considered most essential to the transformation of the state's economy and structure:

1. Coordinate Existing Agencies and Initiatives

In order to instigate productive change within the state's economy, it is important that the various resources both within the state government and in the private sector are encouraged to focus their efforts in a complementary fashion. The dividing lines among industry, academia and governments have become barriers to policy integration and thus hamper the process of progressive change. Economic development is a collaborative process involving government at multiple levels, educators and research institutions, foreign and domestic firms, entrepreneurs and individuals. In order to implement each of the recommendations in this section successfully, interagency cooperation and commitment, rather than rivalry, is highly important.

As discussed in the Knowledge-Based Institutions section of this report, Arkansas is already home to numerous organizations that can provide assistance to entrepreneurs and newly established companies. Many programs and partnerships designed to encourage innovation and new enterprises have either been underutilized or handicapped by budgetary limitations. Mentoring and training programs that can assist small business owners and link them to more experienced colleagues already exist in many locations throughout the state, but they cannot serve their purpose unless they can be connected to the people and businesses they are intended to serve. Coordinating and tracking existing programs will also ensure that efforts are not wasted by duplicating work that has already been put into place and by splitting scarce funds among too many parties to accomplish much of the same thing without direction.

2. Development of Coordinated Risk Capital Policy

New businesses development is a key component of the evolution of Arkansas' economy beyond its traditional base in agriculture and manufacturing. As noted in the State Technology and Science Index, venture capital and investment is on the rise in the state, as is the potential role that such investment can play. In order to promote venture capital and angel investing, and to link those investors with promising new businesses, it is strongly recommended that the state government play a leadership role in developing a coordinated system for encouraging such activities.

Efforts have already been underway in the private sector to encourage the development of networks of angel investors so that some businesses will grow to the point of needing venture capital. The state of Arkansas can assist this effort by continuing to institute policies to reduce or share the risk of early-stage investing in new technologies and startups as well as providing a central resource to match angel investors with interested companies.

Arkansas can learn a great deal about managing its risk capital infrastructure by observing successful efforts in Missouri and Oklahoma. Efforts in these two states have served to create coordinated policies on risk capital that involve working with qualified, professional investment groups and demonstrating the willingness of the state to create a beneficial climate for investment. Coordinated risk capital policies in Arkansas should not only involve investors from other states, but also key players already established locally such as Stevens Inc., and integrate them into the process of establishing the risk capital infrastructure.

3. Providing Assistance for Funding and Grant Opportunities

The ability to develop sources of funding for small businesses and entrepreneurs through networks of angel investors and venture capitalists is important, but the funding is not always available or appropriate for all interested entrepreneurs, and many others may object to the conditions that normally accompany such funding. Numerous private organizations such as the Kellogg Foundation and the Kauffman Foundation exist to offer grants to starting businesses. The federal government's Small Business Administration also has numerous resources on offer. However, without coordination by the state government or overt efforts to educate businesses about these funding opportunities, very few in Arkansas ever take advantage of the funds that are available. Given the existing constraints on state spending, providing resources and assistance to those who would be eligible for grants and awards is a cost-effective solution that aids local businesses in need of funding.

Throughout the State Technology and Science Index section, many funding opportunities are identified (for example, National Science Foundation (NSF), Small Business Technology Transfer (STTR), State Business Innovation Research (SBIR) awards, etc.) of which Arkansas has not taken full advantage. In fact, Arkansas is one of the few states in which not a single company received a

Phase II SBIR award. The quality and quantity of applications for such funding would be facilitated by improved information dissemination in the state. To explore new approaches to innovation, it is recommended that key state agencies work with the National Science Foundation and consider applying for maximum funding support through its Partnerships for Innovation program.

4. Industry Focus Initiatives and Strategy

As the state economy has matured since the 1980s, Arkansas' mix of industries has shifted toward a bi-modal system. One part of the mix centers around food processing and manufacturing and the other centers on wholesale/retail trade. Both sectors represent strong links between the state's economy and other U.S. and global markets. A well-considered and applied industry policy can further the development of these industries and their supplier network in the state allowing them to project an even stronger position in global consumer market. This will channel economic benefit back to where these industries are based in Arkansas.

Additionally, the state of Arkansas should utilize these links to the world economy to further the changes and evolution of its industries. In three distinct periods of economic transformation over the last 70 years, Arkansas' economy expanded in leaps and bounds when new elements of growth were introduced into the region. The rise of food processing, heavy recruitment of manufacturing from outside the state and the utilization of new supply chain management in global trade each provided unique footprints in Arkansas' path of economic growth.

The knowledge-based and technology-driven economy, however, requires an industry policy and subsequent recruitment effort that has to be heavily focused on directing resources to industries that create high value and are technology based. State economies with these elements tend to create higher economic value and faster per capita income growth. However, the current industry mix and structure in the state of Arkansas lags behind most other states in developing the basis for these industries.

The following is a set of recommendations to further industrial development, particularly in terms of building up the knowledge-based and technology-related employment base in the state of Arkansas. The objective of these recommendations is to establish four levels of development approaches and goals:

- Promote and link the state's well-established regional industry base to technology, focusing on technology adaptation
- Promote the extension of flagship enterprising firms to develop new product and service areas
- Promote new technology initiatives that will help existing small, but rapidly growing enterprises
- Regional cooperation and resource sharing

Policy, legislative and governing recommendations

Arkansas should form a state commission on advising and overseeing the state's industrial development. The commission, comprised of public and private stakeholders, would formulate priorities and have the stated goal of improvement in industry growth and enterprising formation. The state legislature, working with the commission, would mandate state agencies to make a concerted effort on the development cause. The state's tax code, economic development incentives and preferences, and state technology and science funding need to be designed and utilized to form a concerted core support network over a period of time for the objective to be fully materialized.

Industry-specific recommendations

A. Food Processing/Refrigeration Industry Core Group: crossing industry boundaries and exploring possibilities.

Food processing in Arkansas is not only a dominant employer in the state, but captures a large share the market for poultry and other derivative products in the United States as well. Internationally, the poultry market, particularly in Asia, provides ample room for growth. To make poultry products look and taste fresh to suit the dietary preferences among different regional markets, it is critical for Tyson and others to further explore new ways to try to capture these growing markets. Although the food processing sector demonstrates its economic importance to the state, its utilization of highly trained labor is limited. Food refrigeration on the other hand utilizes refrigeration technologies and trains workers rather extensively. Utilizing products (poultry and derivative products) to leverage technology of a supplier and promote their products (refrigeration) can prove an effective combination. This process can help build a workforce that is capable of building industrial and commercial grade refrigeration equipment.

The food processing industry is in a more mature and commoditized market. In order to compete in today's global commodity market, enterprises have to go beyond market branding. Technologies that enhance product quality and value can be the most certain way to "de-commoditize" the product. The new direction of product development in food processing industry should explore opportunities in new research areas such as bio-food, nutrition enhanced products and quality monitoring. There are many opportunities for Arkansas companies such as Safe Foods to benefit from this new direction.

B. Wholesale/Retail: packaging and product designs—beyond low cost enterprising, a creativity and design center on the horizon

Having the world's largest retailer as the driving force for economic growth in the region has provided much needed jobs in Arkansas. Having recruited many of world's premier enterprises to Arkansas, Wal-Mart has built up business service professionals in logistics, management coordination, legal and other technical support staffing. This mix of mini-cultures has yet to be tapped as a resource of product design and packaging. The presence of International Paper and George Pacific, the regional business school and Wal-Mart can be utilized to generate activities that combine business practice, product and package design, and pulp and paper research and development.

C. Transportation/Information System: building a high-tech transportation and distribution hub that provide the best logistics service to track goods and yield benefits for citizens statewide.

Arkansas' key sector, the transportation and distribution sector, can be further exploited as an engine for the region's economic growth and social development. The geographic advantage of the state's central location is probably the best naturally endowed asset that Arkansas possesses. Hence, investment in this asset should be considered an investment in the state's economic future. The development of state roadways and information infrastructures must be fully integrated. Information highway development has to be viewed as the "roadway" to the future: its benefit will help each and every citizen of this great state.

A new wireless system, while enabling major wholesalers/retailers and trucking companies to fully integrate new technologies into their operations, will also modernize state's technology base and heighten demand for a small base of rapidly growing IT industries in Arkansas. Additionally, the installation of this new technology will yield benefits far beyond the private business and transportation sector. The ultimate beneficiaries are school children and residents across the entire state—urban and rural regions included.

D. Helping other key fast-growing industries and less developed regions: "Today's gazelles, tomorrow's lion."

Building a supply network for the key industries and their suppliers will fortify state's position and help the state become more competitive. Nonetheless, it is equally critical for the state to divert resources to construct a healthy economic ecosystem: promoting industries and encouraging businesses to cooperate in key areas such as product development, quality control and exploring new markets.

Calling on industry leadership of the region's giants to help in expansion should be viewed as the priority among the state's key industry policy makers. Their leverage and reach in new and foreign markets is invaluable and powerful. Intangible corporate assets should be further utilized as a bridgehead for smaller and startup firms in new markets and new products.

A form of new "regionalism" has to be established in Arkansas to eliminate the huge difference in economic well-being among urban and rural economic regions. The current legislature's "per capita tier system" certainly sets up a more equal playing field among the regions. A more progressive, private-enterprise driven economic incentive for rapid economic development in lagging regions should be considered. A form of tax credit would probably create more jobs in rural regions than public investment dollars in the long term.

5. Identify Comparative Advantages in the State and Develop Them

To attract new business to Arkansas as well as keep those that are considering relocation, it is strongly recommended that the state make efforts to identify the key advantages it holds over potential rivals and to make the business sector aware of how important those advantages are. Arkansas is particularly well suited to attracting manufacturing and food processing companies through its low cost of living, moderate corporate tax rate and labor rates that are more competitive than most of the country. The state also benefits from a central location, a well-connected road network, navigable waterways and established freight hauling. The state has established itself as a leading food producer in several different areas and has managed to continue to develop its position in many areas of manufacturing in which the rest of the country faces a decline. The relatively inexpensive labor costs and low corporate taxes, combined with its central location and ease of transport, provide strong incentives for manufacturers wanting to relocate. In some cases, such as with the proposed factory site in Crittenden County, the proximity to nearby centers of skilled workers and resources such as Memphis can be promoted as well.

Keeping overall business costs competitive will significantly aid Arkansas in its efforts to attract entrepreneurs. However, low business costs alone are not sufficient to attract technology and science firms and industry clusters. In the modern era of outsourcing, a company simply looking to cut costs will often relocate to a location outside the United States as long as it believes the cost savings outweigh all other advantages. Arkansas must ensure that its quality-of-life standards improve even as it tries to limit its cost of doing business so as to still attract companies who wish to remain in the country and in a location in which they feel comfortable.

6. Improve the Image of the State to Lure Investment

One of the most important factors in the expansion of any economy, whether on the local, state or national level, is the ability of that location to lure investment from the outside. Despite access to grants, awards, local investment and state funding, even the largest of states such as California and Texas must look to the outside for the cash and resources to continue local development at the desired pace. As has been noted elsewhere in this report, Arkansas can benefit greatly from encouraging investment from other states, and particularly from other countries.

Promoting Arkansas so as to lure investment from other states and other countries is a practice that has been ongoing for many years in the state. The state economy has clearly benefited from being able to lure foreign companies such as Dassault Aircraft and Toyota, as well as domestic companies such as Whirlpool and Raytheon to invest locally. However, in the future, competition for major manufacturing investment will be fierce, and competitors will not only include rival states, but countries as well. Arkansas needs to be able to promote itself to smaller businesses and companies that do not fit the traditional manufacturing model in order to compete for investment and continue growth.

To promote a positive image of Arkansas as well as encourage inquiries, the state government should strongly consider reconstructing its web site. This would improve access to information for those who are curious about the state and better serve the goal of promoting Arkansas as a good place to live and work. The primary purpose of the state's website should be to cater to those both inside and outside the state's borders who are interested in investing in or traveling to Arkansas. Although links to other state governmental functions are important, the primary purpose of the website should be to facilitate commerce and tourism. The website should promote familiarity not only with the state, but also with important departments and institutions. A direct link should be on the main page to the Arkansas Department of Economic Development as well as to major schools and research institutions. The website can also serve to network companies inside the state with venture capitalists and other resources.

To further promote the state and encourage visits to the redesigned website, the state should consider using advertising and other media to raise awareness of Arkansas in other locations. A marketing campaign based on a new image is needed to promote a new view of the state in people's minds and erase any preconceptions they may have that would keep them from doing business in the state. Before launching a major national advertising campaign, a more immediate and effective strategy would be to examine the primary ways people from other states learn about Arkansas, and determine effective means for correcting any outdated views of the state they might have.

7. Upgrade Arkansas' Infrastructure

Infrastructure is one of the most important instruments a state has in facilitating economic development, particularly in knowledge-based and high technology industries. The ability to develop roads, electricity transmission, sewage lines, communications systems and encourage private technology use such as home computers, phone lines and Internet access, plays a significant role in determining the success or failure of a state's development efforts. The most important factor to understand when it comes to infrastructure development is that simply building infrastructure, particularly without an intended target, does not actually create economic growth. Instead, the lack of infrastructure, or its inadequate capacity, can prove as effective as any other cause in hindering economic development and growth. For Arkansas to continue to develop, the state should develop an organized strategy for spending its money on infrastructure where it can most effectively facilitate existing growth, rather than spending the money on projects intended to create growth on their own. Improvements in infrastructure are never an end unto itself, and money should never be spent on infrastructure improvements without connecting those improvements to other development efforts.

As Arkansas continues to develop its important role in retail and freight transportation, as well as its presence as a center of manufacturing and food processing, the state's physical infrastructure will continue to be under increasing levels of stress. Northwest Arkansas is already beginning to move toward a crisis point, as job growth in the region is fuelled by companies such as Wal-Mart and Tyson Foods. Although the two corporations have strong historical ties to the area, a failure to increase the capacity of the local infrastructure at the pace of the corporate rate of expansion runs the risk of their future economic development moving to a location that can handle their growing demands. The consequences of the overburdened local infrastructure can be seen in the ever-increasing prices of housing as demand outstrips supply and the increasing number of traffic problems that occur in the area. Completion of Interstate 540 north to Missouri and creating a direct highway link to the regional airport will assist further economic development and encourage more businesses to move into the region. As growth continues in other parts of the state, the local needs in each area should be analyzed and anticipated so as to allow growth to continue unimpeded.

To effectively fund key infrastructure projects, it is strongly recommended that the state attempt to coordinate development through multiple concerned departments. Infrastructure is not simply a matter of road or sewer building, but requires coordination of numerous agencies and businesses. Continued growth among the populace in computer and telecommunications access is also important, but may be harder to achieve in locations that lack large enough clusters of people and resources. The challenge of cluster-based, high-tech economic development in the state is magnified for rural Arkansas. Some of the rural areas do not possess the kind and sophisticated level of infrastructure necessary for many high-technology industries. Economies of scale demanded by efficiency-seeking firms may be unachievable throughout most of rural Arkansas.

8. Reform the Tax Code and Improve Incentives for Business

A well-structured and balanced tax code can be an effective means of promoting new business and encouraging the development of fledgling sectors of the state's economy. The state's tax structure on the whole is fairly competitive, but the reliance of the state on revenues derived primarily from personal income tax and sales tax has impeded the development of new knowledge-based and high-technology companies. The complexity of the tax system also makes it highly difficult for new entrepreneurs and businesses to identify potential incentives and cost savings that might help them succeed.

As is discussed in the Competitiveness section, Arkansas is hampered by higher than average personal income tax, sales tax and unemployment tax rates, and the state bureaucracy is not viewed as being as business-friendly, as it is in many other states. Although the state's tax burden is lighter than most for mid-to-large–sized corporations, the state's reliance on higher personal income tax and sales tax rates forces smaller businesses to carry a much higher relative tax burden than larger companies. Lower corporate and property tax rates do not benefit startups and small businesses at least initially, since few startups own the property on which they are located, and have not yet incorporated. These tax burdens are a clear contributor to the states consistently low ranking in the creation of new businesses. The lack of new companies being created within the state prevents the state's economy from continuing to diversify, particularly when it comes to knowledge-based and high-technology industries. Numerous incentives exist that provide encouragement to mature companies to expand or relocate into Arkansas. However, under the current tax structure, these incentives do not effectively extend to smaller businesses and startups.

To promote the growth of small companies and new knowledge-based industries, it is recommended that the tax code be restructured or at least modified so that it is friendlier toward new businesses. Simple reduction of taxes in problem areas will not serve as a solution, as the resulting budgetary shortfalls and its impact on education and infrastructure spending will cause far more harm than any benefits to small businesses. Instead, the state should simplify the tax structure, particularly for small businesses, to make it easier to understand. The time and monetary cost of compliance with regulations should be minimized. And means should be established to provide tax breaks to new and small businesses. This can include making it easier for new businesses to incorporate and shift to the corporate tax, providing exceptions to the high personal income tax rate for such businesses, and creation of incentives aimed at smaller companies rather than large corporations.

9. Improvements in Education

In the wake of the Arkansas Supreme Court's decision in the Lake View case, it has become apparent to most observers that the state's system for funding and organizing education must undergo significant change. However, what the case does not address is the fact that simply reallocating funds and combining school districts will not be enough to improve the effectiveness of the state's educational system. In order for Arkansas to continue to develop a position in knowledge-based industries, it is essential that the state's efforts in education become more focused on specific objectives. As was discussed in this report, Arkansas has made significant efforts to increase the state's capacity in higher education and to create the potential for students to earn more advanced degrees. In order to actually utilize this capacity to improve the education of the populace it will be necessary to focus the state's educational resources on specific goals, many of which will only be achievable in the long term.

As Arkansas makes efforts to transform the K-12 educational system, it is important that the state maintain a focus on what skills need to be taught to students to ensure their success both in higher education and in the workforce. As the state completes the task of providing broadband Internet access to all the schools statewide, it is essential that academic planners realize that utilization of the computers and the Internet requires an additional level of training not only for the students, but the teachers as well. If Arkansas is to provide its residents with a chance at employment in knowledge-based and high-technology industries, an improved curriculum in the sciences is essential. State leaders should consider the Texas model, in which a statewide incentive-based advanced placement program in science and math has been established in every Texas high school to help improve the students' chances of competing for jobs not only with their fellow Americans, but with overseas workers as well. Texas complemented the high school program with a high-technology curriculum in each Texas community college. However, such a program can only work if the purpose of community colleges is understood and recognized.

In order to make Arkansas more attractive for investors and business and to ensure that the state's workforce is properly trained, the state's system of two-year schools need to be connected to the vital roles of meeting the training needs of local businesses, providing professional training and educating students with the skill sets necessary to advance to better paying positions in the workforce. Two-year schools also serve an essential function in preparing students to matriculate to four-year institutions, but with 11 four-year public universities already established in the state, it is important that the two-year schools are kept from playing an overly redundant role by offering as wide a range of courses as the four-year schools. Instead, both the schools and the students might be better served by linking the two-year schools more effectively to local businesses, which can utilize the schools for funded worker training and retraining. The schools can also help establish their role in the local economy by providing more pragmatic training in entrepreneurial education and basic accounting and business courses to train the managers of new startups. As the funding of higher education is increasingly constrained by the Lake View case, instead of trying to be all things to all people, the two- and four-year schools ought to focus on how they can best serve the academic and business communities.

Arkansas lacks the necessary trained workforce to lure high-technology employers to locate in the state or avoid the extra burden of having to bring such workers into the state. Even in disciplines in which there is an established presence in the universities such as in engineering, workers find themselves lacking the economic opportunity they need to be persuaded to remain in Arkansas. To actually utilize the students educated in such programs, a critical mass must be achieved in these programs, not only to attract and retain more students, but also to establish the programs as viable partners for corporate investors. Arkansas' ability to lure a major corporation into the state can significantly benefit by connecting its efforts to programs at the universities.

10. Utilize Key Resources to Boost Research and Science

To firmly establish Arkansas as a developing center of knowledge-based industry and research, it is essential that the state harness the resources of both its existing research institutions and the industries in which it holds the highest comparative advantage. In order to achieve this end, leadership and coordination must occur over the long term to allow time for connections to be established between the state, its research institutions and the companies that can most contribute to and benefit from their research.

When linkages are properly established between research universities and industry, they serve as drivers of economic development, particularly in knowledge-based industries and high-technology fields. The ability of Arkansas to be competitive in the evolving economy not only depends upon establishing a thriving educational system, but also upon the ability to utilize the connected research institutions to stimulate economic development in the surrounding regions. Well-designed and executed strategies for utilizing the assets of such research benefit not only the universities themselves, but all industries within the state that are able to capitalize on the product of that research.

The development of research clusters is a long-term project, and involves the development of resources over a decade or more. In order to develop centers of research and innovation, the leaders of this strategy have to work with key industries that can fund and benefit from this research, and establish connections to already existing research institutions. Attempting to develop a research cluster from the ground up is both risky and expensive, which means that the three most viable candidates are the University of Arkansas in Fayetteville, the University of Arkansas Medical School in Little Rock, and the University of Arkansas-Little Rock even if other candidates such as Arkansas State University in Jonesboro might establish itself as such further in the future. The connected Arkansas Research and Technology Park (ARTP) and Biomedical Biotechnology Center represent steps in the right direction. Further utilizing the presence of the federal laboratory, the National Center for Toxicological Research (NCTR) in Jefferson, could help to further boost medical and related research in the state. If such efforts can be effectively linked to strong local industries such as electronic component manufacturing and the agricultural sciences, the industries can provide the funding to propel research in those fields that can then be turned into intellectual property that the companies can utilize to fuel economic growth. Faculty members at the research universities should also be encouraged to actually develop commercially viable ideas and to partner with those in the business community who have the time, energy and experience to turn those ideas into real businesses. Once this cycle of development reaches its fruition, Arkansas will be able to firmly establish itself in the new economy.

Goals

In order to be able to evaluate the success of implementing these recommendations, it is important to have measurable goals which can be utilized to observe improvements within Arkansas. These goals should receive wide dissemination and stakeholder groups develop an implementation plan to achieve them with responsibility and accountability assigned. Intermediate and long-range goals should be established with annual or bi-annual performance reviews to monitor progress. Frequent monitoring allows adjustments or interventions to be made on a timely basis and improves the probability of achieving stated goals. Once the state has improved to near or above the national average in these specific fields, the goals can be reasonably be considered to have been met. New goals should be established as progress is made or the initial goals fulfilled. As these various recommendations are implemented over the course of the next several years, improvement should appear in the following five categories:

1) The number of SBIR Phase II awards received per year
2) Number of business starts per 100,000 population
3) People holding bachelor's degrees or greater as a percentage of the adult population
4) Percentage of jobs in high-tech and in other knowledge-based industries
5) Per capita income relative to the national average

Conclusion

The state of Arkansas currently stands at the threshold of a knowledge-based economy. The question that faces the state's leaders should not be one of whether or not Arkansas wants to be part of this new economy, but of how the leaders can ensure that the state actively participates in it and can use this participation to benefit people across the entire state. The state can simply not afford to be left behind as the rest of the country continues to move forward. Arkansas does not have to abandon its economic legacy of manufacturing, food processing and retail in order to embrace knowledge-based industries. Instead, the state can build upon its historical strengths as it prepares itself for the economic challenges of the next 20 years.

Appendix

Arkansas Economy - Baseline Forecast

Level, 2004-2020

Concept	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Nonfarm Employment (Thous.)	1150.3	1162.3	1176.6	1189.8	1199.9	1206.6	1213.2	1220.5	1228.7	1238.0	1247.5	1257.0	1268.3	1279.5	1289.8	1300.0	1310.3
Construction	50.1	51.1	52.1	53.5	54.3	54.8	55.3	56.1	56.9	58.0	59.4	60.8	62.1	63.4	64.4	65.6	66.8
Natural Resources & Mining	6.7	6.6	6.6	6.5	6.5	6.5	6.4	6.4	6.3	6.3	6.2	6.2	6.1	6.1	6.0	6.0	6.0
Government	199.4	201.3	202.7	203.9	205.1	206.5	208.6	209.5	211.2	212.9	214.5	216.0	217.7	219.4	220.9	222.5	224.8
Manufacturing	204.6	204.3	204.0	204.3	204.0	203.0	201.9	201.3	200.1	199.1	197.7	196.2	195.1	194.1	193.0	191.9	190.7
Fabricated Metal Products	17.8	17.7	17.6	17.5	17.4	17.2	17.0	16.8	16.6	16.4	16.1	15.9	15.7	15.5	15.4	15.4	15.3
Machinery	14.3	14.2	14.0	14.0	14.1	14.2	14.2	14.2	14.2	14.2	14.3	14.3	14.3	14.2	14.1	14.0	13.9
Electrical Equip.	13.2	13.3	13.4	13.4	13.4	13.3	13.2	13.2	13.1	13.0	12.9	12.9	12.8	12.7	12.7	12.7	12.6
Food	52.4	52.3	52.4	52.4	52.4	52.4	52.5	52.5	52.5	52.5	52.5	52.6	52.6	52.6	52.6	52.6	52.6
Paper & Printing	16.9	16.7	16.7	16.8	16.7	16.7	16.7	16.6	16.5	16.4	16.2	16.1	16.0	15.9	15.8	15.7	15.6
Chemicals & Petroleum	5.8	5.8	5.8	5.8	5.8	5.7	5.7	5.7	5.6	5.6	5.6	5.6	5.5	5.5	5.5	5.5	5.5
Service Providing	689.4	699.0	711.2	721.7	729.9	735.9	741.0	747.2	754.1	761.8	769.8	777.8	787.3	796.6	805.4	814.0	822.0
Education & Health	142.6	145.5	150.0	153.2	156.6	158.6	159.4	161.2	164.3	167.6	170.9	173.7	177.5	181.3	185.0	188.4	191.5
Financial Activities	50.7	51.1	51.7	52.3	52.7	53.0	53.3	53.7	54.0	54.2	54.5	54.8	55.0	55.3	55.6	55.8	56.1
Information	20.3	20.5	20.4	20.6	21.0	21.3	21.4	21.5	21.6	21.7	21.8	21.9	22.0	22.1	22.3	22.4	22.5
Leisure & Hospitality	88.5	89.9	91.6	92.3	92.7	92.7	92.7	92.8	92.7	92.3	92.2	92.5	93.1	93.6	94.0	94.3	94.6
Professional, Scientific & Tech.	102.9	104.9	106.9	109.3	111.2	112.6	113.7	114.8	116.0	117.5	119.0	120.5	122.5	124.3	126.1	128.1	130.0
Wholesale Trade	45.0	45.7	46.3	46.8	46.9	47.1	47.5	48.0	48.4	48.9	49.5	50.2	50.7	51.2	51.6	51.9	52.2
Retail Trade	131.6	132.4	134.0	135.5	136.2	137.2	138.4	139.4	140.3	141.3	142.4	143.4	144.7	146.0	147.2	148.3	149.4
Transportation & Warehousing	60.4	61.5	62.7	63.9	64.6	65.3	66.2	67.1	68.0	68.9	69.9	70.8	71.5	72.3	73.0	73.6	74.4
Personal Income (US$, Millions)	68781	71439	74697	78259	81908	85452	89188	93214	97374	101694	106366	111395	117023	123204	129775	136808	144368
Per Capita Personal Income (US$, Thous.)	25.1	25.9	27.0	28.1	29.2	30.3	31.5	32.7	33.9	35.2	36.7	38.2	39.9	41.7	43.7	45.8	48.1
Gross State Product (US$, Millions)	80430	84579	89083	94006	98597	103285	108683	114479	120609	127347	134699	142417	150658	159676	169386	179685	190591
Tax Payments (US$, Millions)	6212	6824	7303	7749	8388	8928	9584	10291	10868	11446	12041	12635	13333	14104	14999	15978	17040

Arkansas Economy - Alternative Forecast
Absolute Change from Baseline, 2004-2020

Concept	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Nonfarm Employment (Thous.)	1.26	5.67	8.33	10.65	10.89	17.59	19.39	21.26	23.6	26.31	28.82	30.86	34.27	36.77	39.55	43.07	46.21
Construction	0.18	0.6	0.74	0.81	0.91	1.05	1.17	1.28	1.4	1.52	1.65	1.8	1.96	2.12	2.3	2.5	2.71
Natural Resources & Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacturing	0	1.81	3.72	5.42	6.44	9.07	10.1	10.99	11.92	13.41	15.07	16.35	18.25	19.48	20.8	22.63	24.19
Fabricated Metal Products	0	1.61	2.81	3.5	4.6	4.99	4.89	4.83	4.8	4.75	4.69	4.64	4.58	4.52	4.48	4.45	4.42
Machinery	0	0	0	0	0.2	0.69	1.28	1.9	2.51	3.16	3.83	4.54	5.3	6.11	7.02	7.99	8.99
Electrical Equip.	0	0	0.1	0.31	0.52	0.81	1.07	1.27	1.53	1.77	2	2.24	2.48	2.71	2.9	3.07	3.26
Food	0	0.1	0.55	1.27	0.55	1.57	1.37	1.17	0.83	1.06	1.04	0.75	1.18	0.93	0.6	0.63	0.34
Paper & Printing	0	0.1	0.15	0.17	0.2	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22
Chemicals & Petroleum	0	0	0.1	0.12	0.21	0.33	0.45	0.56	0.67	0.78	0.88	0.97	1.07	1.17	1.27	1.36	1.45
Service Providing	1.08	3.25	3.87	4.42	3.53	7.48	8.12	8.99	10.28	11.37	12.1	12.71	14.07	15.16	16.46	17.94	19.3
Education & Health	0.13	0.39	0.67	0.94	-0.65	1.74	1.99	2.2	2.47	2.79	3.11	3.23	3.3	3.5	3.65	3.8	3.83
Financial Activities	0.05	0.14	0.15	0.17	0.22	0.31	0.39	0.45	0.52	0.59	0.65	0.72	0.8	0.88	0.98	1.08	1.18
Information	0.73	0.82	0.92	0.97	1.01	1.11	1.15	1.18	1.23	1.26	1.3	1.34	1.38	1.43	1.48	1.54	1.6
Leisure & Hospitality	0.18	0.22	0.22	0.23	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.29
Professional, Scientific & Tech.	-0.02	-0.02	-0.02	0.15	0.62	1.21	1.79	2.34	2.87	3.29	3.69	4.14	4.65	5.18	5.75	6.38	7.03
Wholesale Trade	0	0	0	0.05	0.41	0.72	0.84	0.87	0.98	1.03	0.97	0.85	0.91	0.96	1.08	1.23	1.45
Retail Trade	0	1.7	1.91	1.8	1.23	1.49	1	1.04	1.18	1.34	1.36	1.3	1.63	1.54	1.48	1.52	1.5
Transportation & Warehousing	0	0	0	0.11	0.45	0.65	0.71	0.67	0.78	0.82	0.76	0.87	1.13	1.41	1.77	2.12	2.44
Personal Income (US$, Millions)	504	1171	1399	1641	1908	2387	3131	3721	4601	5788	6813	7782	8709	9694	10566	11672	12724
Per Capita Personal Income (US$, Thous.)	0.18	0.43	0.51	0.59	0.68	0.85	1.1	1.31	1.6	2.01	2.35	2.67	2.97	3.29	3.56	3.91	4.24
Gross State Product (US$, Millions)	-68	606	957	986	1714	2844	3390	3686	4292	4548	5219	6035	7295	8229	8902	10013	11627
Tax Payments (US$, Millions)	732	766	818	879	965	1046	1149	1255	1352	1450	1556	1658	1774	1905	2065	2247	2446

Arkansas Economy - Alternative Forecast

Percent Change from Baseline, 2004-2020

Concept	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total Nonfarm Employment	0.10%	0.50%	0.70%	0.90%	0.90%	1.50%	1.60%	1.70%	1.90%	2.10%	2.30%	2.50%	2.70%	2.90%	3.10%	3.30%	3.50%
Construction	0.40%	1.20%	1.40%	1.50%	1.70%	1.90%	2.10%	2.30%	2.50%	2.60%	2.80%	3.00%	3.20%	3.30%	3.60%	3.80%	4.10%
Natural Resources & Mining	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Government	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacturing	0.00%	0.90%	1.80%	2.70%	3.20%	4.50%	5.00%	5.50%	6.00%	6.70%	7.60%	8.30%	9.40%	10.00%	10.80%	11.80%	12.70%
Fabricated Metal Products	0.00%	9.10%	16.00%	20.00%	26.50%	29.00%	28.70%	28.80%	28.90%	28.90%	29.10%	29.20%	29.20%	29.20%	29.00%	28.90%	28.80%
Machinery	0.00%	0.00%	0.00%	0.00%	1.40%	4.90%	9.00%	13.40%	17.70%	22.20%	26.90%	31.80%	37.10%	42.90%	49.60%	57.00%	64.60%
Electrical Equip.	0.00%	0.00%	0.70%	2.30%	3.90%	6.10%	8.00%	9.60%	11.70%	13.60%	15.50%	17.40%	19.40%	21.30%	22.80%	24.20%	25.80%
Food	0.00%	0.20%	1.10%	2.40%	1.00%	3.00%	2.60%	2.20%	1.60%	2.00%	2.00%	1.40%	2.30%	1.80%	1.10%	1.20%	0.60%
Paper & Printing	0.00%	0.60%	0.90%	1.00%	1.20%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.30%	1.40%	1.40%	1.40%	1.40%
Chemicals & Petroleum	0.00%	0.00%	1.70%	2.00%	3.60%	5.80%	7.90%	9.90%	11.90%	13.90%	15.70%	17.50%	19.30%	21.20%	23.00%	24.80%	26.50%
Service Providing	0.20%	0.50%	0.50%	0.60%	0.50%	1.00%	1.10%	1.20%	1.40%	1.50%	1.60%	1.60%	1.80%	1.90%	2.00%	2.20%	2.30%
Education & Health	0.10%	0.30%	0.40%	0.60%	-0.40%	1.10%	1.20%	1.40%	1.50%	1.70%	1.80%	1.90%	1.90%	1.90%	2.00%	2.00%	2.00%
Financial Activities	0.10%	0.30%	0.30%	0.30%	0.40%	0.60%	0.70%	0.80%	1.00%	1.10%	1.20%	1.30%	1.50%	1.60%	1.80%	1.90%	2.10%
Information	3.60%	4.00%	4.50%	4.70%	4.80%	5.20%	5.40%	5.50%	5.70%	5.80%	6.00%	6.10%	6.30%	6.40%	6.70%	6.90%	7.10%
Leisure & Hospitality	0.20%	0.20%	0.20%	0.20%	0.20%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%	0.30%
Professional, Scientific & Tech.	0.00%	0.00%	0.00%	0.10%	0.60%	1.10%	1.60%	2.00%	2.50%	2.80%	3.10%	3.40%	3.80%	4.20%	4.60%	5.00%	5.40%
Wholesale Trade	0.00%	0.00%	0.00%	0.10%	0.90%	1.50%	1.80%	1.80%	2.00%	2.10%	2.00%	1.70%	1.80%	1.90%	2.10%	2.40%	2.80%
Retail Trade	0.00%	1.30%	1.40%	1.30%	0.90%	1.10%	0.70%	0.70%	0.80%	0.90%	1.00%	0.90%	1.10%	1.10%	1.00%	1.00%	1.00%
Transportation & Warehousing	0.00%	0.00%	0.00%	0.20%	0.70%	1.00%	1.10%	1.00%	1.10%	1.20%	1.10%	1.20%	1.60%	1.90%	2.40%	2.90%	3.30%
Personal Income	0.70%	1.60%	1.90%	2.10%	2.30%	2.80%	3.50%	4.00%	4.70%	5.70%	6.40%	7.00%	7.40%	7.90%	8.10%	8.50%	8.80%
Per Capita Personal Income	0.70%	1.60%	1.90%	2.10%	2.30%	2.80%	3.50%	4.00%	4.70%	5.70%	6.40%	7.00%	7.40%	7.90%	8.10%	8.50%	8.80%
Gross State Product	-0.10%	0.70%	1.10%	1.00%	1.70%	2.80%	3.10%	3.20%	3.60%	3.60%	3.90%	4.20%	4.80%	5.20%	5.30%	5.60%	6.10%
Tax Payments	11.80%	11.20%	11.20%	11.30%	11.50%	11.70%	12.00%	12.20%	12.40%	12.70%	12.90%	13.10%	13.30%	13.50%	13.80%	14.10%	14.40%

Arkansas Hi-Tech Summary – Tier 1*

NAICS	Hi-Tech Industries	1992 EMP (Thous)	2002 EMP (Thous)	'92-'02 Emp Growth	1992 LQ (US=1)	2002 LQ (US=1)	1992 Wage Per Employee ($,thous)	2002 Wage Per Employee ($,thous)	1992 $GSP (Mill.)	2002 $GSP (Mill.)	'92-'02 GSP Growth
3343	Audio and Video Equipment Manufacturing	0.554	0.722	30.3%	1.19	1.93	23.6	36.2	15.5	13.6	-12.2%
3333	Commercial and Service Industry Machinery Manufacturing	1.798	2.194	22.0%	1.39	1.91	27.3	30.8	79.0	159.6	102.0%
3346	Manufacturing and Reproducing Magnetic and Optical Media	1.353	0.752	-44.4%	3.50	1.46	23.9	49.7	105.7	120.4	13.9%
3344	Semiconductor and Other Electronic Component Manufacturing	3.825	4.754	24.3%	0.82	0.99	15.1	19.6	54.6	66.7	22.2%
5174	Satellite Telecommunications	0.063	0.092	46.0%	0.79	0.92	26.4	35.1	7.4	10.9	47.8%
5172	Wireless Telecommunications Carriers (except Satellite)	0.919	1.429	55.5%	0.67	0.84	31.8	43.7	118.4	194.4	64.2%
5173	Telecommunications Resellers	0.888	1.544	73.9%	0.60	0.84	33.9	43.7	122.7	211.7	72.5%
5171	Wired Telecommunications Carriers	3.327	5.138	54.4%	0.67	0.83	31.7	43.7	429.5	704.8	64.1%
3364	Aerospace Product and Parts Manufacturing	3.076	3.211	4.4%	0.49	0.78	28.6	45.9	162.9	208.3	27.9%
3342	Communications Equipment Manufacturing	0.058	1.156	1893.1%	0.03	0.68	24.4	22.5	0.8	11.2	1301.5%
5417	Scientific Research and Development Services	1.363	2.849	109.0%	0.33	0.61	27.9	22.5	47.4	84.3	77.9%
5175	Cable and Other Program Distribution	0.453	0.738	62.9%	0.69	0.61	21.4	25.9	56.7	64.6	13.8%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	2.793	2.157	-22.8%	0.57	0.55	24.5	39.7	38.5	25.9	-32.8%
5413	Architectural, Engineering, and Related Services	3.070	6.026	96.3%	0.36	0.53	35.4	31.2	211.0	276.9	31.3%
6215	Medical and Diagnostic Laboratories	0.656	0.819	24.8%	0.47	0.52	19.3	23.5	16.7	17.2	2.9%
5415	Computer Systems Design and Related Services	2.306	4.909	112.9%	0.49	0.42	28.8	63.2	108.3	202.8	87.2%
3391	Medical Equipment and Supplies Manufacturing	2.216	1.135	-48.8%	0.85	0.42	22.5	31.1	149.7	104.1	-30.5%
5112	Software Publishers	0.404	0.965	138.9%	0.41	0.40	35.6	68.8	31.2	42.5	36.2%
5121	Motion Picture and Video Industries	0.703	1.166	65.9%	0.35	0.39	8.9	20.2	19.3	16.2	-16.2%
5181	Internet Service Providers and Web Search Portals	0.466	0.597	28.1%	0.49	0.35	20.4	33.1	17.1	12.3	-28.2%
5182	Data Processing, Hosting, and Related Services	0.731	0.945	29.3%	0.49	0.35	20.6	33.2	25.6	18.7	-27.2%
5191	Other Information Services	0.105	0.112	6.7%	0.46	0.33	12.0	18.7	1.5	0.7	-52.1%
3254	Pharmaceutical and Medicine Manufacturing	0.087	0.074	-14.9%	0.04	0.03	20.9	40.2	8.6	4.3	-50.1%
5179	Other Telecommunications	0.774	0.001	-99.9%	8.12	0.02	14.6	12.3	44.9	0.9	-97.9%
3341	Computer and Peripheral Equipment Manufacturing	0.781	0.023	-97.1%	0.26	0.01	31.1	48.1	30.2	2.3	-92.5%

*Tier 1 is comprised of all high tech industries listed above.

U.S. Hi-Tech Summary – Tier 1*

NAICS	Hi-Tech Industries	1992 US EMP (Thous)	2002 US EMP (Thous)	'92-'02 US Emp Growth	1992 US-Wage Per Employee ($,thous)	2002 US-Wage Per Employee ($,thous)	1992 US $GDP (Mill.)	2002 US $GDP (Mill.)	'92-'02 US GDP Growth
3343	Audio and Video Equipment Manufacturing	52.207	41.743	-20.0%	26.8	34.4	1943.3	7259.3	273.5%
3333	Commercial and Service Industry Machinery Manufacturing	144.297	128.393	-11.0%	39.4	51.8	8582.8	12085.6	40.8%
3346	Manufacturing and Reproducing Magnetic and Optical Media	43.312	57.478	32.7%	32.4	51.1	2410.5	7019.7	191.2%
3344	Semiconductor and Other Electronic Component Manufacturing	522.358	539.193	3.2%	33.4	50.9	24218.6	137557.5	468.0%
5174	Satellite Telecommunications	8.874	11.227	26.5%	38.6	56.7	1190.2	2154.1	81.0%
5172	Wireless Telecommunications Carriers (except Satellite)	152.416	190.487	25.0%	40.9	60.0	21076.8	41692.3	97.8%
5173	Telecommunications Resellers	164.535	206.496	25.5%	40.9	59.9	22741.5	45092.7	98.3%
5171	Wired Telecommunications Carriers	552.596	690.572	25.0%	40.9	60.0	76416.1	151153.4	97.8%
3364	Aerospace Product and Parts Manufacturing	705.711	460.506	-34.7%	45.2	62.2	49122.1	43162.7	-12.1%
3342	Communications Equipment Manufacturing	211.428	189.289	-10.5%	39.8	60.4	11671.7	58497.6	401.2%
5417	Scientific Research and Development Services	466.949	521.363	11.7%	37.7	52.8	31983.4	41238.8	28.9%
5175	Cable and Other Program Distribution	73.811	135.31	83.3%	29.9	52.5	8318.9	18067.6	117.2%
3345	Navigational, Measuring, Electromedical, and Control Instruments Manufacturing	546.189	441.32	-19.2%	37.4	59.7	35950.4	24200.6	-32.7%
5413	Architectural, Engineering, and Related Services	962.659	1263.925	31.3%	41.1	54.8	71696.9	90570.1	26.3%
6215	Medical and Diagnostic Laboratories	154.696	175.833	13.7%	23.9	35.4	6586.0	7276.9	10.5%
5415	Computer Systems Design and Related Services	528.992	1300.371	145.8%	38.3	56.0	45967.1	113523.4	147.0%
3391	Medical Equipment and Supplies Manufacturing	293.125	302.054	3.0%	35.3	48.6	18067.3	14084.6	-22.0%
5112	Software Publishers	109.194	267.676	145.1%	39.0	50.3	9191.1	19714.3	114.5%
5121	Motion Picture and Video Industries	223.364	335.125	50.0%	25.4	40.9	11669.0	17425.0	49.3%
5181	Internet Service Providers and Web Search Portals	107.265	188.333	75.6%	23.0	33.5	5277.4	9386.5	77.9%
5182	Data Processing, Hosting, and Related Services	168.577	300.227	78.1%	22.8	33.4	8304.6	14955.6	80.1%
5191	Other Information Services	25.465	38.059	49.5%	25.1	31.2	952.8	1224.4	28.5%
3254	Pharmaceutical and Medicine Manufacturing	225.511	284.121	26.0%	47.5	72.6	29196.8	48609.6	66.5%
5179	Other Telecommunications	10.659	7.145	-33.0%	43.1	81.0	1553.7	2304.7	48.3%
3341	Computer and Peripheral Equipment Manufacturing	331.871	252.31	-24.0%	42.2	54.9	18326.2	32019.9	74.7%

*Tier 1 is comprised of all high tech industries listed above.

(Ranked by Arkansas rankings)

Arkansas (Non Hi-Tech) Knowledge-Based Industries Summary – Tier 2*

NAICS	Knowledge-Based Industries	1992 EMP (Thous)	2002 EMP (Thous)	'92-'02 Emp Growth	1992 LQ (US=1)	2002 LQ (US=1)	1992 Wage Per Employee ($,thous)	2002 Wage Per Employee ($,thous)	1992 $GSP (Mill.)	2002 $GSP (Mill.)	'92-'02 GSP Growth
3353	Electrical Equipment Manufacturing	6.743	6.556	-2.8%	3.64	4.18	22.5	29.4	204.9	1304.7	536.9%
3221	Pulp, Paper, and Paperboard Mills	6.860	5.665	-17.4%	3.28	3.69	34.7	49.5	496.7	312.0	-37.2%
4860**	Pipeline Transportation	1.706	1.307	-23.4%	3.37	3.08	17.6	19.1	144.7	112.7	-22.2%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	1.678	3.174	89.2%	1.22	2.96	37.0	51.4	137.8	317.2	130.1%
3312	Steel Product Manufacturing from Purchased Steel	0.901	1.699	88.6%	1.20	2.87	36.9	51.3	81.2	178.8	120.1%
3325	Hardware Manufacturing	0.725	0.993	37.0%	1.69	2.68	24.0	30.6	44.3	64.4	45.5%
3334	Ventilation, Heating, Air-Cond., and Comm. Refrig. Equip. Mfg.	3.645	3.56	-2.3%	2.48	2.35	26.7	31.6	122.5	335.0	173.4%
3359	Other Electrical Equipment and Component Manufacturing	3.656	3.206	-12.3%	2.16	2.23	23.1	31.3	130.6	576.6	341.7%
3331	Agriculture, Construction, and Mining Machinery Manufacturing	3.697	3.652	-1.2%	2.07	2.07	20.2	26.2	138.6	348.8	151.7%
3329	Other Fabricated Metal Product Manufacturing	7.014	5.289	-24.6%	2.46	2.01	25.6	33.6	329.1	308.4	-6.3%
3351	Electric Lighting Equipment Manufacturing	1.299	1.222	-5.9%	1.87	1.92	23.2	34.3	51.5	251.1	387.4%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	1.029	0.667	-35.2%	2.12	1.81	21.3	41.5	31.0	38.4	23.7%
5511	Management of Companies and Enterprises	12.19	22.318	83.1%	0.96	1.65	22.8	32.6	764.4	2456.0	221.3%
3259	Other Chemical Product and Preparation Manufacturing	0.882	1.611	82.7%	0.72	1.58	23.2	29.9	39.6	33.2	-16.2%
2212	Natural Gas Distribution	1.598	1.579	-1.2%	1.12	1.43	29.0	42.0	280.1	436.0	55.7%
5251	Insurance and Employee Benefit Funds	0.292	0.473	62.0%	0.79	1.39	38.9	70.1	18.5	19.4	5.3%
2211	Electric Power Generation, Transmission and Distribution	6.629	5.511	-16.9%	1.33	1.33	42.3	50.2	1389.5	1029.6	-25.9%
4821	Rail Transportation	1.302	0.543	-58.3%	2.84	1.33	32.9	57.7	81.3	65.3	-19.7%
3321	Forging and Stamping	0.730	1.369	87.5%	0.70	1.32	24.3	28.8	43.5	83.3	91.5%
4889	Other Support Activities for Transportation	4.335	2.529	-41.7%	1.90	1.26	39.7	56.4	285.8	232.1	-18.8%
5221	Depository Credit Intermediation	14.898	18.378	23.4%	0.94	1.19	19.6	26.2	1377.4	1488.0	8.0%
3363	Motor Vehicle Parts Manufacturing	6.547	7.516	14.8%	1.06	1.14	21.9	30.6	265.3	504.9	90.4%
5223	Activities Related to Credit Intermediation	0.415	2.097	405.3%	0.38	1.13	27.9	37.2	24.7	151.1	511.4%
3335	Metalworking Machinery Manufacturing	2.427	2.247	-7.4%	1.08	1.11	23.8	35.4	102.9	198.9	93.4%
3251	Basic Chemical Manufacturing	2.218	1.666	-24.9%	1.00	1.06	33.5	47.6	165.7	155.7	-6.0%
3362	Motor Vehicle Body and Trailer Manufacturing	1.002	1.455	45.2%	0.83	1.02	20.4	27.3	52.7	114.7	117.9%
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	0.154	0.27	75.3%	0.68	1.00	43.9	121.4	4.4	1.6	-64.5%
3361	Motor Vehicle Manufacturing	1.867	2.36	26.4%	0.88	0.98	21.2	29.3	96.8	214.6	121.8%
3339	Other General Purpose Machinery Manufacturing	2.880	2.535	-12.0%	1.08	0.98	23.8	34.3	148.2	422.5	185.0%
6211	Offices of Physicians	13.621	17.274	26.8%	0.97	0.97	33.1	46.3	804.3	769.7	-4.3%
5151	Radio and Television Broadcasting	1.745	1.933	10.8%	0.96	0.95	20.2	29.0	139.4	106.9	-23.3%
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	1.299	2.042	57.2%	0.71	0.95	26.5	41.2	89.7	230.5	157.1%
3315	Foundries	2.387	1.459	-38.9%	1.33	0.94	21.6	26.6	113.8	99.9	-12.2%
4242	Drugs and Druggists' Sundries Merchant Wholesalers	1.973	1.616	-18.1%	1.55	0.87	26.9	42.2	103.6	137.4	32.6%
2360**	Construction of Buildings	10.321	11.887	15.2%	0.98	0.83	21.0	33.8	499.5	547.1	9.5%
4246	Chemical and Allied Products Merchant Wholesalers	0.599	1.001	67.1%	0.56	0.82	31.3	52.8	44.1	126.9	188.0%
5242	Agencies, Brokerages, and Other Insurance Related Activities	5.48	5.886	7.4%	0.92	0.81	24.7	34.2	385.8	385.2	-0.2%
3241	Petroleum and Coal Products Manufacturing	1.014	0.841	-17.1%	0.75	0.79	26.0	37.8	71.3	205.2	187.9%
2131	Support Activities for Mining	1.636	1.29	-21.1%	0.90	0.78	25.5	37.0	198.4	105.7	-46.7%
5232	Securities and Commodity Exchanges	1.828	2.383	30.4%	0.86	0.74	76.4	107.9	182.6	629.2	244.6%
3255	Paint, Coating, and Adhesive Manufacturing	0.559	0.473	-15.4%	0.75	0.73	24.7	40.5	42.4	47.0	10.8%
3332	Industrial Machinery Manufacturing	0.839	0.803	-4.3%	0.67	0.70	25.9	45.1	33.1	92.1	178.0%
4885	Freight Transportation Arrangement	0.758	1.038	36.9%	0.67	0.69	26.1	34.1	48.7	52.9	8.8%
5411	Legal Services	5.033	5.917	17.6%	0.56	0.59	27.2	34.0	390.8	298.5	-23.6%
5152	Cable and Other Subscription Programming	0.295	0.484	64.1%	0.68	0.55	22.0	34.9	25.6	56.6	120.8%
4831	Deep Sea, Coastal, and Great Lakes Water Transportation	0.094	0.163	73.4%	0.34	0.52	16.7	22.8	2.2	1.1	-47.3%
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	0.472	0.44	-6.8%	0.48	0.51	24.7	36.1	19.3	55.9	189.1%
4883	Support Activities for Water Transportation	0.262	0.43	64.1%	0.31	0.50	21.9	29.3	16.3	27.8	70.6%
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg.	1.357	1.409	3.8%	0.51	0.50	21.6	31.5	61.7	121.4	96.8%
5241	Insurance Carriers	4.788	5.896	23.1%	0.39	0.46	34.5	50.2	413.9	471.0	13.8%
5222	Nondepository Credit Intermediation	2.47	2.847	15.3%	0.66	0.45	23.3	34.0	144.0	207.9	44.4%
5259	Other Investment Pools and Funds	0.218	0.211	-3.2%	0.58	0.43	29.6	59.3	2.8	1.1	-59.0%
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	2.345	2.458	4.8%	0.45	0.41	35.1	54.5	209.8	326.5	55.6%
5239	Other Financial Investment Activities	0.323	0.582	80.2%	0.42	0.39	37.5	55.6	18.5	120.4	552.5%
5416	Management, Scientific, and Technical Consulting Services	1.407	2.338	66.2%	0.35	0.34	26.8	39.2	70.8	92.6	30.7%
5611	Office Administrative Services	0.41	0.744	81.5%	0.31	0.30	44.6	87.4	35.0	58.7	67.6%
5612	Facilities Support Services	0.156	0.283	81.4%	0.31	0.30	44.6	87.4	13.3	22.3	67.6%
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.	0.212	0.276	30.2%	0.16	0.26	25.9	28.4	15.2	28.9	90.3%
5161	Internet Publishing and Broadcasting	0.003	0.003	0.0%	0.25	0.25	21.1	43.1	0.1	0.1	47.7%
5211	Monetary Authorities - Central Bank	0.045	0.05	11.1%	0.22	0.24	19.7	26.4	4.4	4.5	2.6%
5231	Securities and Commodity Contracts Intermediation and Brokerage	0.094	0.188	100.0%	0.06	0.09	65.5	94.4	2.7	11.3	320.4%

*Tier 2 is comprised of all knowledge-based industries listed above.

**Available only at the 3-digit NAICS level

Arkansas (Non Hi-Tech) Knowledge-Based Industries Summary – Tier 2*

NAICS	Knowledge-Based Industries	1992 US EMP (Thous)	2002 US EMP (Thous)	92-02 US Emp Growth	1992 US-Wage Per Employee ($,thous)	2002 US-Wage Per Employee ($,thous)	1992 US $GDP (Mill.)	2002 US $GDP (Mill.)	92-02 US GDP Growth
3353	Electrical Equipment Manufacturing	207.03	175.324	-15.3%	31.4	48.5	9045.5	42230.4	366.9%
3221	Pulp, Paper, and Paperboard Mills	233.634	171.593	-26.6%	44.1	64.2	22969.4	18217.8	-20.7%
4860**	Pipeline Transportation	57.109	48.297	-15.4%	44.5	61.1	13173.5	13000.8	-1.3%
3311	Iron and Steel Mills and Ferroalloy Manufacturing	153.512	120.043	-21.8%	39.5	56.8	10642.7	11900.2	11.8%
3312	Steel Product Manufacturing from Purchased Steel	84.287	66.165	-21.5%	39.3	56.5	5809.9	6521.3	12.2%
3325	Hardware Manufacturing	48.036	41.349	-13.9%	31.7	45.1	2705.6	2843.4	5.1%
3334	Ventilation, Heating, Air-Cond., and Comm. Refrig. Equip. Mfg.	164.539	169.524	3.0%	34.0	47.2	7640.5	17564.8	129.9%
3359	Other Electrical Equipment and Component Manufacturing	189.212	160.588	-15.1%	32.4	48.6	8941.4	33690.8	276.8%
3331	Agriculture, Construction, and Mining Machinery Manufacturing	199.709	196.837	-1.4%	34.0	46.7	8861.7	20723.9	133.9%
3329	Other Fabricated Metal Product Manufacturing	318.974	294.201	-7.8%	33.9	44.5	18195.4	22085.6	21.4%
3351	Electric Lighting Equipment Manufacturing	77.786	71.122	-8.6%	30.1	47.8	3288.9	16660.0	406.5%
3253	Pesticide, Fertilizer, and Other Agricultural Chemical Manufacturing	54.151	41.248	-23.8%	41.5	63.8	6123.0	6205.3	1.3%
5511	Management of Companies and Enterprises	1423.103	1512.055	6.3%	31.6	47.7	111170.9	159890.6	43.8%
3259	Other Chemical Product and Preparation Manufacturing	137.253	113.655	-17.2%	39.0	54.4	11715.7	11176.2	-4.6%
2212	Natural Gas Distribution	160.054	123.523	-22.8%	38.9	63.4	29176.5	27208.8	-6.7%
5251	Insurance and Employee Benefit Funds	41.433	38.137	-8.0%	36.8	53.4	3675.5	3407.6	-7.3%
2211	Electric Power Generation, Transmission and Distribution	557.561	464.311	-16.7%	41.0	64.4	107041.9	103927.2	-2.9%
4821	Rail Transportation	51.305	45.782	-10.8%	43.7	54.2	4041.9	4951.6	22.5%
3321	Forging and Stamping	117.55	116.198	-1.2%	37.3	53.7	7783.7	9554.9	22.8%
4889	Other Support Activities for Transportation	255.82	225.238	-12.0%	42.1	51.4	19655.4	22969.3	16.9%
5221	Depository Credit Intermediation	1778.299	1734.107	-2.5%	28.2	46.2	196832.6	246315.1	25.1%
3363	Motor Vehicle Parts Manufacturing	689.102	734.992	6.7%	38.0	53.8	49129.5	84785.3	72.6%
5223	Activities Related to Credit Intermediation	121.251	208.342	71.8%	39.8	47.0	12736.7	27100.7	112.8%
3335	Metalworking Machinery Manufacturing	251.616	227.209	-9.7%	37.8	55.3	12432.2	28332.7	127.9%
3251	Basic Chemical Manufacturing	249.248	175.142	-29.7%	49.2	78.4	33422.7	32235.8	-3.6%
3362	Motor Vehicle Body and Trailer Manufacturing	135.805	159.137	17.2%	39.4	53.9	10500.0	16564.1	57.8%
5331	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)	25.328	30.134	19.0%	61.9	106.5	1203.3	3142.0	161.1%
3361	Motor Vehicle Manufacturing	237.985	268.128	12.7%	42.1	59.6	20370.1	32124.4	57.7%
3339	Other General Purpose Machinery Manufacturing	297.531	288.868	-2.9%	35.8	50.6	13939.3	33009.7	136.8%
6211	Offices of Physicians	1577.191	1994.671	26.5%	41.2	58.8	116080.3	136949.9	18.0%
5151	Radio and Television Broadcasting	203.445	226.649	11.4%	41.1	56.1	28430.5	45361.5	59.6%
4237	Hardware, and Plumbing and Heating Equipment and Supplies Merchant Wholesalers	204.784	239.629	17.0%	32.8	47.1	14779.8	26708.1	80.7%
3315	Foundries	200.659	172.946	-13.8%	30.0	45.7	10575.6	13677.7	29.3%
4242	Drugs and Druggists' Sundries Merchant Wholesalers	142.188	207.825	46.2%	38.7	64.2	12067.4	31646.6	162.2%
2360**	Construction of Buildings	1178.632	1607.232	36.4%	30.3	45.5	74419.1	98480.7	32.3%
4246	Chemical and Allied Products Merchant Wholesalers	120.301	135.753	12.8%	42.2	60.0	11135.5	19302.7	73.3%
5242	Agencies, Brokerages, and Other Insurance Related Activities	666.525	814.412	22.2%	34.3	54.1	57272.1	56309.0	-1.7%
3241	Petroleum and Coal Products Manufacturing	152.224	119.126	-21.7%	47.8	65.5	19761.1	22128.9	12.0%
2131	Support Activities for Mining	204.523	184.352	-9.9%	44.3	61.7	41802.8	41795.1	0.0%
5232	Securities and Commodity Exchanges	238.314	358.85	50.6%	94.6	145.3	27573.5	121553.8	340.8%
3255	Paint, Coating, and Adhesive Manufacturing	83.512	72.789	-12.8%	39.1	59.5	8901.7	10220.0	14.8%
3332	Industrial Machinery Manufacturing	140.859	129.099	-8.3%	38.9	60.6	7161.6	17656.8	146.5%
4885	Freight Transportation Arrangement	126.13	167.633	32.9%	33.4	51.7	8872.4	15054.0	69.7%
5411	Legal Services	999.982	1121.765	12.2%	45.0	63.6	113362.5	127577.3	12.5%
5152	Cable and Other Subscription Programming	48.291	97.857	102.6%	35.9	66.5	5895.6	22733.9	285.6%
4831	Deep Sea, Coastal, and Great Lakes Water Transportation	31.531	35.013	11.0%	33.0	47.6	1804.9	2371.6	31.4%
3336	Engine, Turbine, and Power Transmission Equipment Manufacturing	111.04	97.094	-12.6%	41.6	59.2	6027.2	12943.3	114.7%
4883	Support Activities for Water Transportation	93.439	95.904	2.6%	31.7	46.8	5136.2	6478.5	26.1%
3327	Machine Shops; Turned Product; and Screw, Nut, and Bolt Mfg.	296.761	314.932	6.1%	33.5	47.7	14356.2	31183.6	117.2%
5241	Insurance Carriers	1374.981	1436.04	4.4%	36.0	56.1	113177.1	128220.3	13.3%
5222	Nondepository Credit Intermediation	417.233	713.915	71.1%	35.5	54.5	33752.2	104565.5	209.8%
5259	Other Investment Pools and Funds	42.192	54.881	30.1%	56.7	96.3	1983.3	5515.3	178.1%
4234	Professional and Commercial Equipment and Supplies Merchant Wholesalers	579.673	666.668	15.0%	43.2	60.9	54681.9	96323.5	76.2%
5239	Other Financial Investment Activities	85.457	166.318	94.6%	70.7	145.7	7694.6	54612.1	609.7%
5416	Management, Scientific, and Technical Consulting Services	451.204	777.753	72.4%	36.6	54.1	29682.8	54342.4	83.1%
5611	Office Administrative Services	146.607	279.607	90.7%	53.7	84.7	13343.2	29225.2	119.0%
5612	Facilities Support Services	55.788	106.399	90.7%	53.7	84.7	5077.5	11121.1	119.0%
3252	Resin, Synthetic Rubber, and Artificial Synthetic Fibers and Filaments Mfg.	152.327	119.514	-21.5%	46.6	66.8	19332.4	18747.9	-3.0%
5161	Internet Publishing and Broadcasting	1.269	1.463	15.3%	53.2	79.1	114.2	142.1	24.4%
5211	Monetary Authorities - Central Bank	23.379	23.109	-1.2%	28.6	47.2	2616.0	3348.8	28.0%
5231	Securities and Commodity Contracts Intermediation and Brokerage	165.539	243.45	47.1%	95.8	147.9	19229.0	84069.3	337.2%

*Tier 2 is comprised of all knowledge-based industries listed above.

**Available only at the 3-digit NAICS level

(Ranked by Arkansas rankings)

List of Hi -Tech and Knowledge-based Industries (KBI)

NAICS	Tier 1 (Hi-Tech)	NAICS	Tier 2 (Knowledge-Based)
3254	Pharmaceutical and Medicine Manufacturing	2131	Support Activities for Mining
3333	Commercial and Service Industry Machinery Mfg.	2211	Electric Power Generation Transmission and Dist
3341	Computer and Peripheral Equipment Manufacturing	2212	Natural Gas Distribution
3342	Communications Equipment Manufacturing	2360	Construction of Buildings
3343	Audio and Video Equipment Manufacturing	3221	Pulp Paper and Paperboard Mills
3344	Semiconductor and Other Electronic Component Man	3241	Petroleum and Coal Products Manufacturing
3345	Navigational Measuring Electromedical and Con	3251	Basic Chemical Manufacturing
3346	Manufacturing and Reproducing Magnetic and Optic	3252	Resin Synthetic Rubber and Artificial Synthetics
3364	Aerospace Product and Parts Manufacturing	3253	Pesticide Fertilizer and Other Agricultural Ch
3391	Medical Equipment and Supplies Manufacturing	3255	Paint Coating and Adhesive Manufacturing
5112	Software Publishers	3259	Other Chemical Product and Preparation Mfg.
5121	Motion Picture and Video Industries	3311	Iron and Steel Mills and Ferroalloy Manufacturing
5171	Wired Telecommunications Carriers	3312	Steel Product Manufacturing from Purchased Steel
5172	Wireless Telecommunications Carriers (except Sat	3315	Foundries
5173	Telecommunications Resellers	3321	Forging and Stamping
5174	Satellite Telecommunications	3325	Hardware Manufacturing
5175	Cable and Other Program Distribution	3327	Machine Shops Turned Product and Screw Nut&
5179	Other Telecommunications	3329	Other Fabricated Metal Product Manufacturing
5181	Internet Service Providers and Web Search Portal	3331	Agriculture Construction and Mining Machinery
5182	Data Processing Hosting and Related Services	3332	Industrial Machinery Manufacturing
5191	Other Information Services	3334	Ventilation Heating Air-Conditioning and Comm
5413	Architectural Engineering and Related Services	3335	Metalworking Machinery Manufacturing
5415	Computer Systems Design and Related Services	3336	Engine Turbine and Power Transmission Equipment
5417	Scientific Research and Development Services	3339	Other General Purpose Machinery Manufacturing
6215	Medical and Diagnostic Laboratories	3351	Electric Lighting Equipment Manufacturing
		3353	Electrical Equipment Manufacturing
		3359	Other Electrical Equipment and Component Mfg.
		3361	Motor Vehicle Manufacturing
		3362	Motor Vehicle Body and Trailer Manufacturing
		3363	Motor Vehicle Parts Manufacturing
		4234	Professional and Commercial Equipment and Supplies
		4237	Hardware and Plumbing and Heating Equipment
		4242	Drugs and Druggists' Sundries Merchant Wholesale
		4246	Chemical and Allied Products Merchant Wholesaler
		4821	Rail Transportation
		4831	Deep Sea Coastal and Great Lakes Water Transport
		4861	Pipeline Transportation of Crude Oil
		4862	Pipeline Transportation of Natural Gas
		4869	Other Pipeline Transportation
		4883	Support Activities for Water Transportation
		4885	Freight Transportation Arrangement
		4889	Other Support Activities for Transportation
		5151	Radio and Television Broadcasting
		5152	Cable and Other Subscription Programming
		5161	Internet Publishing and Broadcasting
		5211	Monetary Authorities - Central Bank
		5221	Depository Credit Intermediation
		5222	Nondepository Credit Intermediation
		5223	Activities Related to Credit Intermediation
		5231	Securities and Commodity Contracts Intermediation
		5232	Securities and Commodity Exchanges
		5239	Other Financial Investment Activities
		5241	Insurance Carriers

	5242	Agencies, Brokerages and Other Insurance Relate
	5251	Insurance and Employee Benefit Funds
	5259	Other Investment Pools and Funds
	5331	Lessors of Nonfinancial Intangible Assets (except
	5411	Legal Services
	5416	Management, Scientific and Technical Consulting
	5511	Management of Companies and Enterprises
	5611	Office Administrative Services
	5612	Facilities Support Services
	6211	Offices of Physicians

Programs/Initiatives/Partnerships Preparing Technologically Skilled-Workforce

Broadly –defined Programs/Initiatives/ Partnerships	Key Programs/ Initiatives/Partnerships	Leading Institution(s)	Year Started	Brief Description
Legislative Initiatives	Act 999 of 1999	NA	1999	Establishes the authority to implement Arkansas Comprehensive Testing, Assessment and Accountability Program (ACTAAP). ACTAAP is a comprehensive system that focuses on high academic standards, professional development, student assessment, and accountability for schools.
	Act 1552 of 2001	NA	2001	An Act to require the Department of Education to develop and conduct readiness testing for children who are entering kindergarten
Pre K-12 Programs	School Readiness Initiative Partnership	DHS/Division of Childcare and Early Childhood Education Arkansas Department of Education Arkansas Head Start Association Arkansas Advocates for Children and Families	2001	This partnership has defined and targeted Arkansas School Readiness Indicators consisting of Ready Children, Ready Families, Ready Schools and Ready Communities. These indicators will be tracked regularly over time at state and local levels. A Getting Ready For School data report and a Kindergarten Readiness Checklist brochure have been published identifying the indicators for the state.
	Arkansas Education Technology Plan	Governor's Task Force on Educational Technology Planning Committee	2000	This plan spells out 6 specific goals for technology improvement in Arkansas' public schools.
	Smart Start/ "K-4 Initiative"	Arkansas Department of Education	1998	Smart Start represents a comprehensive plan for student achievement. It focuses on strong accountability with an emphasis on well-defined, high educational standards in reading and mathematics.
	Smart Step/ "5-8 Initiative"	Arkansas Department of Education	2000	Smart Step focuses on improvement in reading and mathematics for students in Grades 5-8.
	Environmental and Spatial Technology (EAST) Initiative	Arkansas Department of Education	1996	The EAST program is a performance-based learning environment utilizing project-based service learning, integrated with advanced technological applications in an interdisciplinary laboratory environment where the intellectual and problem-solving growth of students is the focus.
	ExplorNet	ExplorNet's Centers for Quality Teaching and Learning™, Arkansas Department of Workforce Education, Arkansas Department of Education, Arkansas Association of Two-Year Colleges	2000	ExplorNet has been active in Arkansas since 2000, with a state office located in the capital city, Little Rock. The initial focus of ExplorNet's presence in Arkansas has been with its Information Technology programs -- Computer Engineering and then Networking. Those programs are now active in dozens of high schools across the state.
	Quality Teaching & Learning™, or QTL™	ExplorNet's Centers for Quality Teaching and Learning™, Arkansas Department of Workforce Education, Arkansas Department of Education, Arkansas Association of Two-Year Colleges	2004	The QTL™ program models the use of research-based teaching strategies to teach the core curriculum. Teachers learn ways to use technology and other tools to differentiate their instruction, address multiple intelligences in the classroom, and meet the needs of every child, every day. The program helps schools meet the demands of *No Child Left Behind* by engaging all children in learning.
	Education Task Force	Northwest Arkansas Council	2002	The Committee provided action plans to address issues identified in the "Northwest Arkansas Education Benchmarks:

				A Report Card on our Districts and Schools." One of the actions recommended was "Provide Additional Technology Resources to Assist Instruction, especially in lower performing core areas such as mathematics."
	High Schools that Work Initiative (HSTW)	Southern Regional Education Board Arkansas Department of Workforce Education	1987	HSTW is dedicated to getting at least 85 percent of career-bound high school students to complete a challenging program of study and to reach or exceed the *HSTW* performance goals in reading, mathematics and science.
	High-Tech Scholarship Program	Arkansas Department of Workforce Education	1993	The Arkansas High-Tech Scholarship Program was designed to assist Arkansas' high school graduates who demonstrate superior academic ability and leadership capabilities to attend approved high technology programs at public and private institutions of postsecondary education in Arkansas.
	Mini-Grant Program	Arkansas Science and Technology Authority	2001	The Mini-Grant program provides a $500 award to 200 Arkansas teachers in grades 5, 6, 7, and 8 to purchase consumable science materials.
	STUART Program	Arkansas Science and Technology Authority	2001	The STUART-Grant Program provides a $5,100 award to six (6) Arkansas teachers in grades 5, 6, 7, and 8 to purchase a classroom participation system, a projector and a laptop computer.
	Elementary Science Specialist Program	National Science Foundation EPSCoR, Arkansas Department of Higher Education	2003	The purpose of the grant funds is to improve the quality of science teaching and learning in Arkansas through providing an elementary science specialist at the 11 Centers for Mathematics and Science Education who will work with K-6 teachers to improve content and instructional skills in life, earth and physical science.
	Mathematics and Economics Connections for Life: 6-8	Arkansas Council on Economic Education	2001	This workshop presents curriculum created specifically for math teachers and shows how mathematics concepts and knowledge can be used to develop understanding of economics and personal finance. The twelve featured lesson plans are useful if teaching general mathematics to pre-Algebra and help reinforce math concepts and processes by using "real life" examples from economics. This workshop is sponsored by the National Council on Economic Education and 3M Foundation.
	NORMES Best Practice Study	National Office for Rural Measurement and Evaluation Systems (NORMES), National Center for Educational Accountability, Arkansas Department of Education, University of Arkansas	2003	NORMES was established in fall 2003 with a grant of nearly half a million dollars from the U.S. Department of Education to help school districts collect and analyze data necessary to meet the requirements of the federal No Child Left Behind Act of 2001.
	Cisco Academies	Arkansas Association of Two-Year Colleges	1997	A comprehensive e-learning program offers students an opportunity to pursue IT curricula through online instructor-led training and hands-on laboratory exercises.
	Arkansas Scholarship Program	Arkansas Business and Education Alliance	1997	The Arkansas Scholarship Program is designed to bring together the business and education communities to promote the importance of education. The method is based on interaction between business leaders and high school students (grades 9 - 12).
	Governor's Blue Ribbon Committee on Higher Education	Arkansas Higher Education Institutions, Arkansas Department of Higher Education	2003	The mission of this Committee is to propose specific, achievable actions that will enhance Arkansas' economy, competitiveness, quality of life and prosperity by addressing the

				importance, quality, funding and accountability of higher education.
	Status of Doctoral Education in Arkansas Report	Arkansas Department of Higher Education	2004	The purpose of the report is to provide a useful context for Arkansas Higher Education Coordinating Board members as they consider new doctoral program proposals and develop further strategies for the delivery of doctoral education in the state. The report explained the relationship between math and science education, graduate education in the sciences and engineering, and the creation of a knowledge-based economy.
Higher Education Programs/Initiatives	The Information Technology Program at the University of Arkansas, Fort Smith	National Science Foundation University of Arkansas, Fort Smith	2001	The program offers four options: networking, programming, web development and data base management. It has received 2004 Regional Innovator Award from the Southern Growth Policies Board.
	Roland S. Boreham Jr. Engineering Scholarship Program	University of Arkansas, Fort Smith	2005	$1 million gift from R.S. Boreham, Jr to fund Engineering Scholarship Program at the University of Arkansas, Fort Smith
	Workforce Training Consortium	Arkansas Association of Two-Year Colleges (AATYC)	1997-1998	The Consortium functions within the AATYC umbrella. The goal is to meet the specialized local area training needs of businesses and industries on a statewide basis through the collaboration of the 23 AATYC member institutions.
	ACCESS Arkansas Distance Education Consortium	Arkansas Association of Two-Year Colleges (AATYC)	2001	The program provides web-based distance education.
Workforce Development /Training Programs	Arkansas P-16 Partnership Taskforce	Arkansas Department of Higher Education, Arkansas Department of Education, Arkansas Department of Workforce Education	1998	The purposes of the grants are to (1) improve student achievement P-16, (2) improve the quality of teaching P-16, and (3) contribute to development of a five-year Arkansas P-16 education plan through regional partnerships among education, business, civic, and political institutions.

Programs/Initiatives/Partnerships Encouraging Entrepreneurship

Key Programs/Initiatives/Partnerships	Leading Institution(s)	Year Started	Brief Description
Mini-Society	Ewing Marion Kauffman Foundation	1996	The Mini-Society program provides students in elementary school a first-hand opportunity to learn about and experience entrepreneurship. The program train elementary teachers to implement Mini-Society in the classroom. Mini-Society's dissemination is accomplished through partnerships with university sites, the Department of Education and school districts. Since 1996, $181,200 has been awarded to University of Arkansas (Fayetteville), $124,000 to UALR and $50,000 to UAPB.
A Pilot Project for Entrepreneurship in Arkansas	Winthrop Rockefeller Foundation Arkansas Science and Technology Authority	2004	The pilot project builds on the Foundation's report, Entrepreneurial Arkansas: Connecting the Dots and examines the public policy infrastructure that supports entrepreneurs and the innovations and financial support on which they depend.
Arkansas Venture Forum (AVF) Annual Conference	Arkansas Capital Corporation Group Arkansas Venture Forum	2002	The AVF Annual Conference provides an educational and networking resource venue for entrepreneur community, the angel / accredited investor community, and the venture capital community from the region. During the conference, different panels are organized to answer questions raised by entrepreneurs. Entrepreneurs are given the opportunity to meet venture capitalists, to understand how the system work, to present their ideas and to review their business plans, etc.
Techpreneur Initiative	Capital Resource Corporation (CRC)	2004	This initiative is designed to be a networking group for technology related entrepreneurs. The hope is that Techpreneur serve as a prototype that can be replicated and expanded around the state.
Governor's Awards for Entrepreneurial Development	Capital Resource Corporation Group Arkansas Small Business Development Center Arkansas Department of Economic Development Arkansas Development Finance Authority Arkansas Science and Technology Authority	2001	The Governor's Award business plan competition is designed to encourage students of Arkansas' universities and colleges to act upon their ideas and talents to product tomorrow's businesses.
Entrepreneur Development Foundation	Public & Private Institutions in AR, TN & MS	Proposed	Arkansas, Mississippi and Tennessee are creating a foundation that would pool the three states' resources to support entrepreneurial development and create technology-based businesses in the region. The Foundation plans to provide management and early-stage

			financing, up to $250,000. The financing would be coupled with an experienced foundation mentor, to assist in the creation of a business plan, coordinate research and development and conduct market studies. The foundation has raised about half its initial budget of $100,000, with private and public institutions from the three states chipping in.
Rural Entrepreneurship Project	Capital Resource Corporation	2004	The purpose of this project is to develop communities with systems to support rural entrepreneurship.
Small Business Innovation Research Program (SBIR)	U.S Small Business Administration Arkansas Small Business Development Center	1982	SBIR is a highly competitive three-phase program that encourages small business to explore their technological potential and provides the incentive to profit from its commercialization.
Small Business Technology Transfer Program (SBTTP)	U.S. Small Business Administration Arkansas Small Business Development Center	1982	STTR is a highly competitive three-phase program that reserves a specific percentage of Federal research and development funding for award to small businesses in partnership with nonprofit research institutions to move ideas from the laboratory to the marketplace, to foster high-tech economic development and to address the technological needs of the Federal Government.
UA Satellite "HUB" Station Lab	UA College of Engineering GENESIS	2004	The installation of a large satellite "HUB" station is underway and should be completed by the end of this summer. Its purpose is to provide interactive data and video communications between the College of Engineering and remotely located student groups within the State. As a Lab of the COE, it can be used by GENESIS Client companies under the same rules that apply to existing labs, thus providing for Clients whose business relies on or is enhanced by, low cost data and video transmission.
UA Microelectronics-Photonics (microEP) Graduate Program	University of Arkansas	Fall 1998	This unique graduate program REQUIRES that each science/engineering take a minimum of 6 graduate-level credit hours in Management. Of this, a required course is MGMT 5383, Entrepreneurship of Technology.
The Stock Market Game ™	Arkansas Council on Economic Education	2001	Each semester for ten weeks, 4th-12th grade students may participate in this simulation, which introduces them to the exciting world of investing and its role in the U.S. and world economies. The object of the program is to grow their hypothetical $100,000 portfolios as much as possible.
Entrepreneur Training Partnership	Arkansas BioVentures SBDC-Little Rock	2004	This partnership is designed to create and deliver business training to entrepreneurs who want to start knowledge-based companies in Arkansas
The SEED program	UAEDI	2003	The Student Efforts in Economic Development (SEED) program is a new initiative sponsored by the University of Arkansas Economic Development Institute (UAEDI). The goal of SEED is to promote programs and breakthrough solutions that support a pipeline of student talent that extends from Arkansas communities to the University of Arkansas and then back again.

Programs/Initiatives/Partnerships Enhancing Research Universities' Capacities

Key Initiatives/Programs/Partnerships	Leading Institution(s)	Year Started	Brief Description
Legislative Initiatives			
Act 1545 of 1999	NA	1999	To encourage, establish and support basic and strategic research by providing state match for federal agency awards to Arkansas colleges and universities.
Marilyn Edwards bill	NA	2003	Provided $450K for research infrastructure at the University of Arkansas 2004 through 2006.
Programs/Initiatives			
Arkansas Research Matching Fund	Arkansas Science and Technology Authority	1999	Provides state funds to match federal awards for research and research equipment. The goal of the Arkansas Research Matching Fund is to improve the state's federal research and development ranking by investing in research and research infrastructure.
University of Arkansas 2010 Commission	University of Arkansas	2000	The 2010 Commission, consisting of 92 leaders in business, education, government, and the professions, is charged with the mission to make the case for the University of Arkansas' becoming a nationally competitive, student-centered research university serving Arkansas and the world.
Experimental Program to Stimulate Competitive Research (EPSCoR)	National Science Foundation	1979	A federal-state partnership that aids researchers and institutions in securing federal funding and develops the state's research infrastructure and advances economic growth. Arkansas has made considerable progress since the program's inception: EPSCoR funding to Arkansas has totaled about $12 million.
	Arkansas Science and Technology Authority University of Arkansas		
	UAPB		
	UALR		
Arkansas-Oklahoma Space Center	National Science Foundation	2000	The Center helps support NASA's space missions through science-based research on the ground. It brings from its two university partners a critical mass of researchers and state-of-the-art facilities to help facilitate robotic exploration of the solar system.
	University of Arkansas		
	Oklahoma State University		
Arkansas Biomedical Infrastructure Research Network (Arkansas BRIN)	University of Arkansas	2001	Founded October 2001 by 3-year $6,000,000 Grant Award from NIH NCRR's IDeA Program. The goals of this program are: 1).Expand biomedical research opportunities for undergraduate faculty and students through collaborations with graduate research institutions in Arkansas. 2). Stimulate more proposals for federal grants in the biomedical sciences from Arkansas scientists. 3).Advance statewide expertise in the rapidly developing disciplines of bioinformatics, genomics, proteomics and digital microscopy.
	UALR		
	UAMS		
COBRE Grant	University of Arkansas	2000	The Center is supported by a five-year $9.63 million grant from the National Institutes of Health Centers of Biomedical Research Excellence (COBRE) program and by matching funds from the state of Arkansas.
	UAMS		
Centers of Excellence Programs	Refer to Exhibit 2-2-2-3 for a list of Centers of Excellence		

Programs/Initiatives/Partnerships Providing Financial Incentives

Key Initiatives/Programs/Partnerships	Leading Institution(s)	Year Started	Brief Description
Legislative Initiatives			
Proposed Legislation - Expansion of the definition of the term "Manufacturing Facility	NA	2004	This is a proposed modification to the U.S. tax code and is part of the current tax bill pending in the U.S. Congress. The entire Arkansas delegation has cosponsored this proposed legislation in one form or another. The proposed definition expands to include facilities used to develop software products or processes, bio-based and bio-energy products. The new definition also changes the funding limit on related facilities, such as offices and R&D labs, from 25% to 40% of bond proceeds. Projects that fall into the description of a knowledge based industry will be given a preference in terms in terms of economic development when grading, scoring and evaluating their applications for funding. Before the limitations were placed on knowledge-based industries in 1986, ADFA completed financings for Acxiom and Arkansas Systems. Companies such as these would again be able to benefit from tax exempt IDB financing.
Venture Capital Act of 2001, The Arkansas Institutional Fund	Arkansas Development Finance Authority	2001	ADFA is the sponsor of the $70,000,000 Arkansas Institutional Fund (AIF) that is underway and the AIF made its first round commitments for investments in the Spring of 2004. This fund-of-funds investment program is designed to attract professionally managed venture capital and the corresponding investing talent into Arkansas. This program is directly supported by ADFA and the State. One of the main goals of this effort is to provide more Arkansas based sources of professionally managed venture capital that is locally accessible and can be deployed to build and grow knowledge based industries and support Arkansas entrepreneurs. Knowledge based firms of all types, especially those firms with some advantage or connection to the Arkansas economy have been identified as targeted industries that need to be assisted with financing and management talent so they will build and grow in Arkansas.
Consolidated Incentive Act of 2003 (CIA)	NA	2003	This Act created a number of new incentives to encourage the growth of knowledge based businesses in Arkansas, which are referred to as "targeted businesses." Targeted Businesses include (1) Advanced materials and manufacturing systems. (2) Agriculture, food and environmental sciences. (3) Biotechnology, bioengineering and life sciences. (4) Information technology. (5) Transportation logistics. (6) Bio-based products.

Certain Venture Capital Investments Exempt from Capital Gain (Act 857 of 2003)	NA	2003	This Act provides an income tax exemption for 100% of the net capital gain derived from a venture capital investment made in a qualified technology-based enterprise, a qualified biotechnology-based enterprise, or a qualified technology incubator client.
Arkansas Capital Development Company Act	NA	2003	The purpose of the act is to stimulate economic development, with preference given for companies or projects that meet the definition of knowledge-based industries. As a result of this legislation, Commerce Capital Development Company, an affiliate of Arkansas Capital Corporation, was formed and is now operating, awarding tax credits for qualified investments in Arkansas.
Financial Incentives			
Targeted Business Sales and Use Tax Refund Incentive	Arkansas Department of Economic Development	2003	This incentive program extends the benefits of a sales and use tax refund for new and expanding eligible businesses referred to as "targeted businesses". This incentive program grants a sales and use tax refund on the purchases of the material used in the construction of a building or buildings or any addition, modernization or improvement to a new or expanding eligible business and machinery and equipment associated with the building or project.
Targeted Business Job Creation Income Tax Credit Incentive	Arkansas Department of Economic Development	2003	The benefit for a targeted business for job creation is an income tax credit based on 10% of its annual payroll, with a cap of $100,000 per year in earned income tax credits for a business that qualifies and is approved for this incentive. The incentive may be offered for a period not to exceed five years.
University Based Research and Development Income Tax Credit Incentive	Arkansas Department of Economic Development Arkansas Science and Technology Authority Commerce Capital Development Company	2003	An eligible business that contracts with one or more Arkansas colleges or universities in performing research may qualify for a 33% income tax credit for qualified research expenditures.
In-House Research and Development Income Tax Credit Incentive	Arkansas Department of Economic Development Arkansas Science and Technology Authority Commerce Capital Development Company	2003	An eligible business that conducts "in-house" research within a research facility that is operated by the eligible business may qualify for in-house research income tax credits.
In-House Research and Development Income Tax Credit Incentive for Targeted Businesses	Arkansas Department of Economic Development Arkansas Science and Technology Authority Commerce Capital Development Company	2003	Businesses deemed by the department to fit within the six business sectors classified as "targeted businesses" may enter into a financial incentive agreement for income tax credits based on qualified research and development expenditures.

Strategic Value Research and Development Income Tax Credit Incentive	Arkansas Department of Economic Development	2003	The Strategic Value Research and Development incentives are for qualifying businesses that invest in: 1) in-house research in an area of strategic value or 2) a research and development project offered by the Arkansas Science and Technology Authority. The income tax credit is equal to 33% of qualified research expenditures.
Advantage Arkansas Income Tax Credit Program	Arkansas Department of Economic Development	2003	Advantage Arkansas provides a credit on state income tax equal to between 1 percent and 4 percent of new payroll for five years, depending on the tier of the county in which the business locates.
InvestArk Sales and Use Tax Credit	Arkansas Department of Economic Development	2003	Advantage Arkansas participants are also eligible for a refund of sales and use taxes for building materials and taxable equipment connected with the eligible project. InvestArk is a sales and use tax credit available to businesses established in Arkansas for two years or longer that invest $5 million or more in plant or equipment, new construction, expansion or modernization.
Create Rebate Program	Arkansas Department of Economic Development	2003	Businesses hiring specified new, full-time, permanent employees within 24 months after completion of an approved expansion and/or new location project may be eligible for the Create Rebate Program. Under terms negotiated by the ADED, this program provides businesses a financial rebate from 3.9 to 5 percent of the annual payroll of the new, full-time, permanent employees.
ArkPlus Income Tax Credit Program	Arkansas Department of Economic Development	2003	The basic incentive provided by the ArkPlus program is a state income tax credit that provides tax credits of 10 percent of the total amount of the new investment. The amount of income tax credit taken during any tax year shall not exceed 50 percent of the annual Arkansas income tax liability resulting from the project.
Centers for Applied Research Program	Arkansas Science and Technology Authority	1987	The Program provides an income tax credit equal to 33% of qualified research expenditures to Arkansas industry for their participation in applied technology research. A goal is to encourage investment by industry in a center to address specific projects of the private sector partner using Arkansas colleges and universities.

Programs/Initiatives/Partnerships Facilitating Technology Development and Transfer

Key Programs/Initiatives/Partnerships	Leading Institution(s)	Year Started	Brief Description
Basic Research Grant Program (Currently Unfunded)	Arkansas Science and Technology Authority	1986	This program is a competitive matching grant effort to support basic research in science and engineering. The goals of the Basic Research Grant Program are to promote and support the growth and development of Arkansas scientists and to enhance the status of science and engineering in Arkansas colleges and universities.
Applied Research Grant Program (currently unfunded)	Arkansas Science and Technology Authority	1986	This program is a (50:50) cash-matching effort to support applied research in science and engineering. (A match of $2 from the state is available for every $1 from an Arkansas business with 50 or fewer employees.) The goal of the Applied Research Grant Program is to stimulate the transfer of science and technology in Arkansas by enhancing opportunities for research partnerships between Arkansas colleges and universities and private industries.
Arkansas Research Matching Fund (currently unfunded)	Arkansas Science and Technology Authority	1999	The Arkansas Research Matching Fund provides state funds to match federal awards for research and research equipment. The goal of the Arkansas Research Matching Fund is to improve the state's federal research and development ranking by investing in research and research infrastructure.
ASTA Investment Fund	Arkansas Science and Technology Authority	1986	The Arkansas Science and Technology Authority (ASTA) administers a special Investment Fund of $2.8 million that can provide seed capital for new and developing technology-based businesses through loans, royalty agreements, and limited stock purchases.
Seed Capital Investment Program (SCIP)	Arkansas Science and Technology Authority	1986	The SCIP can provide working capital to help support the initial capitalization or expansion of technology-based companies located in Arkansas. The program can provide working capital up to $500,000 of the company's total financing needs. Investments made by the SCIP fund can be repaid through a variety of instruments, including direct loans, participations and royalties.
Technology Development Program	Arkansas Science and Technology	Early	This Program provides royalty financing for qualified projects

	Authority	1990s	possessing a well developed, comprehensive project plan, and which utilizes the benefits of science and technology to provide economic and employment growth potential in Arkansas. The maximum investment is $ 50,000 with terms negotiated on an individual basis.
Technology Transfer Assistance Grant Program (Phase Zero SBIR Program)	Arkansas Science and Technology Authority	1995	This program serves as Phase Zero SBIR awards to companies wanting to prepare SBIR proposals. The Authority will fund up to $3,750 of costs associated with transferring new or existing technology from a qualified applicant -- such as a public or private enterprise, laboratory, college or university -- to an enterprise based in Arkansas. Up to $5,000 of total project costs will be considered, with the first $2,500 funded by the Authority; the remaining $2,500 is cost-shared equally (50:50) between the Authority and the enterprise. Since 1995, 579 awards totaling $ 2,620,091.89 have been made.
Technology Incubator Certifications	Arkansas Science and Technology Authority	2003	If technology incubators meet certain criterions defined by the ASTA Board, the incubators' client investors are exempt from taxes on capital gain.
Arkansas Manufacturing Solutions (AMS)	Arkansas Science and Technology Authority National Institute of Standards and Technology (NIST) Manufacturing Extension Partnership (MEP)	1995	The AMS Program helps manufacturers increase sales and profits by cutting costs and improving manufacturing processes. AMS provides technical and management assistance that will improve the quality, productivity and global competitiveness of manufacturing business.
Technology Validation Fund	UA Technology Development Foundation	Proposed	The intent of the Technology Validation Fund is to add value to otherwise early-stage inventions and evaluate the most appropriate commercialization path for their deployment to the marketplace. For those technologies suited to a new business start-up, the Validation Fund will also support the development of a sound business plan to launch the new enterprise.
Agricultural Medicine program	Arkansas Bioventures	2004	This program is designed to foster knowledge based companies in the area of biological production of pharmaceuticals from plants.
Technology Center for the Delta, Cross	UAEDI	2003	The mission of UAEDI is to enhance the economic and social

County Coalition	Cross County Economic Development Corporation		well-being of the people of Arkansas by extending University of Arkansas programs, as appropriate, in partnership with others having similar interests. The partnership between UAEDI and CCEDC resulted in the creation of the Technology Center for the Delta to be located in Wynne (Cross County), Arkansas. The Technology Center for the Delta is envisioned as a proverbial launching pad for the programs of the University of Arkansas and others as part of a nine-county (Crittenden, Cross, Lee, Mississippi, Monroe, Phillips, Poinsett, Woodruff, St. Francis) economic development region.

Programs/Initiatives/Partnerships Promoting Arkansas' Image as a Place of Quality

Key Programs/Initiatives/Partnerships	Leading Institution(s)	Year Started	Brief Description
VISION 2010 Partners for the 21st Century	University of Arkansas, Division of Agriculture, Cooperative Extension Service Southwestern Bell CenturyTel Entergy Electric Cooperatives of Arkansas AEP Southwestern Electric Power	2003	The purpose of VISION 2010 is to build healthy, sustainable communities for the 21st Century. VISION 2010 communities sent leadership teams to seminars held from a Knowledge-Based Economy perspective then returned to develop a strategic vision and action plan for their community. VISION 2010's monthly newsletter provides a venue for community partners to share insights, resources, and tools that equip community leaders to think and act strategically – to be successful in the global, connected economy.
Breakthrough Solutions for a Connected Economy Initiative	VISION 2010 Partners for the 21st Century	2003	The VISION 2010 Partners, through its monthly e-vision newsletter, publicizes projects and initiatives that lead to major advances in partnering communities, organizations, or personal life.
Community Development Institute (CDI)	University of Central Arkansas, Conway	1987	The CDI at the University of Central Arkansas was founded in 1987, and has educated hundreds of practitioners from across the U.S. on how to build better communities.
The Arkansas Diamond Standards Study	Arkansans for Charity Excellence (A.C.E.)	2004	A.C.E. is a statewide association of charities, foundations, businesses, and individuals, with a passion for charity and a purpose to elevate the performance of the organizations that serve people. A.C.E. is developing The Arkansas Diamond Standards, which are best management practices for Mission, Money, Management, and Governance.

Abbreviations for Arkansas Institutions of Higher Education

Four-year Institutions

Arkansas State University (ASUJ)
Arkansas Tech University (ATU)
Henderson State University (HSU)
Southern Arkansas University (SAUM)
University of Arkansas, Fayetteville (UAF)
University of Arkansas at Fort Smith (UAFS)
University of Arkansas at Little Rock (UALR)
University of Arkansas for Medical Sciences (UAMS)
University of Arkansas at Monticello (UAM)
University of Arkansas at Pine Bluff (UAPB)
University of Central Arkansas (UCA)

Two-year Institutions
Arkansas Northeastern College (ANC)
Arkansas State University - Beebe (ASUB)
Arkansas State University - Newport (ASUN)
Arkansas State University - Mountain Home (ASUMH)
Black River Technical College (BRTC)
Cossatot Community College of the University of Arkansas (CCCUA)
East Arkansas Community College (EACC)
Mid-South Community College (MSCC)
National Park Community College (NPCC)
North Arkansas College (NAC)
Northwest Arkansas Community College (NWACC)
Ouachita Technical College (OTC)
Ozarka College (OZC)
Phillips Community College of the University of Arkansas (PCCUA)
Pulaski Technical College (PTC)
Rich Mountain Community College (RMCC)
South Arkansas Community College (SACC)
Southeast Arkansas College (SEAC)
Southern Arkansas University - Tech (SAUT)
University of Arkansas Community College at Batesville (UACCB)
University of Arkansas Community College at Hope (UACCH)
University of Arkansas Community College at Morrilton (UACCM)

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