Crossing the Next Regional Frontier

Information and Analytics Linking Regional Competitiveness to Investment in a Knowledge-Based Economy

October 2009

This project was supported by a grant from the U.S. Economic Development Administration

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INFORMATION AND ANALYTICS LINKING REGIONAL COMPETITIVENESS TO INVESTMENT IN A KNOWLEDGE-BASED ECONOMY

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Research conducted by

- Center for Regional Development, Purdue University
- Indiana Business Research Center, Kelley School of Business, Indiana University
- Center for Regional Competitiveness, Rural Policy Research Institute, Truman School of Public Affairs, University of Missouri
- Strategic Development Group, Inc.
- Economic Modeling Specialists, Inc.

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Executive Summary

Globalization has profoundly changed how the most successful local leaders and economic development practitioners think about economic development.

- First, the scale has changed, shifting from a local to a regional development policy level.

Metropolitan and rural areas alike now act regionally to compete globally. Individual localities collaborate as regions to gain the size or clout to compete. This may mean overcoming a history of localized competition and even distrust. Successful local leaders reach beyond their parochial interests to link assets and competitive advantages throughout their broader region. Indeed, many of today's best economic opportunities emerge only at the scale of the broader region.

- Second, economic development success is no longer achieved primarily through traditional industrial recruitment.

In a global economy, trying to compete based on cost alone will have limited success. Rather than emphasizing incentives, subsidies and low-cost, low-skill labor, the *new* race is won by regions with the capacity to innovate and with the brainpower—education and skills—needed to create and sustain a competitive advantage over the long run. Successful regions build on their own unique qualities and advantages.

Local leaders and economic development practitioners who adapt to the new economic world will:

1. Adopt a whole new approach to economic development
2. Effectively use an improved set of tools to craft a regional strategy
3. Set sound investment priorities that put a practical regional strategy into action quickly

Project Purpose

The Economic Development Administration commissioned this research project to put tools into the hands of local civic leaders and economic development practitioners so that they can more effectively compete in a global context where knowledge and innovation are vital to competitive advantage.

The result of the research is a set of practical analytical tools that regional leaders can use to assess their workforce, human capital and capacity to innovate within their region. The project is the first of its breadth and depth. But this report does more than provide tools to evaluate "where we are."

The project also has a strategic component. It presents a framework for regional leaders to collaborate to achieve mutual regional development goals. Using the results of the analytical tools, the framework helps guide the discussions of regional leaders in selecting sound strategies and in identifying the united efforts required to achieve common goals.

Regional Collaboration

A basic premise of this report is that data, tools and analysis are essential, but not enough. Regional development requires public and private leaders who collaborate, who share a strategic vision and who build enduring partnerships to achieve that vision.

To be truly useful, analytical tools should facilitate a dialogue. The tools should be integrated into the process of building trust among regional leaders.

- In regional collaboration, the process *is* the product.

This process may not be smooth at first, but with time, energy and dedication, a thriving community of economic development leaders will emerge. Leaders must have the knowledge, tools and desire to adjust their region's direction to meet the challenges of the future.

Four Tools

Four tools were designed with the economic development practitioner in mind. The tools are web-based, user-friendly and available to everyone. All data are on a county-level basis and can be used according to pre-established regional definitions, or the user can build custom regions county by county.

These tools may be especially helpful to practitioners who do not have the luxury of a sizeable staff of economic development analysts, planners and other professionals. The four tools are:

- **Industry Clusters** are regional groups of businesses that are linked in the production process and may have similar needs for technology, infrastructure, support services and a shared pool of labor. This analysis shows how the regional economy is working and where the critical linkages are to maintain or build that economy.

- Occupations are grouped according to similar knowledge and skill requirements. These **Occupation Clusters** are indispensible to link regional industries with workforce requirements, available human capital, education and training needs, and new directions.

- An **Innovation Index** presents an overall picture of a region's capacity to innovate and transform its economy. Like the industry and occupation cluster tools, this index helps assess a region's competitive advantages and weaknesses, and gauges how adept the region may be in exploiting new and emerging industries.

- A **Regional Strategy and Investment Framework** that uses the information gained from these three analytical tools to guide regional leaders toward a common regional vision, strategy and action. The process of developing a regional strategy will likely require several group discussions with a coach acting as a catalyst and guide. Using a tool for prioritizing public investment, the coach would also guide leaders through the discipline of prioritizing investments that best align with the region's development strategy.

Practitioner's Guide

Practical tips for using these tools are presented in a stand-alone practitioner's guide. In addition, an online set of over 200 downloadable maps are available to help the analyst or policy-maker gain insight into regional advantages or competitive gaps. Analytical profiles of four regions in the United States also serve as examples for regional planners, analysts and economic development practitioners.

All the data, tools, practitioner's guide and roadmap for regional strategy building can be found at: www.statsamerica.org/innovation.

The Research Partnership

Five organizations conducted this research, and each brings a unique set of expertise and capacity. Although the focus, roles and responsibilities of each partner differed, the team made special efforts to maximize the strength of its collaboration.

Purdue University's Center for Regional Development (PCRD) and Dr. Brigitte Waldorf of the Purdue College of Agriculture, with support from Economic Modeling Specialists Incorporated (EMSI), took the overall lead in constructing the occupation and skill cluster database and tools, while providing overall project coordination. In an earlier project, PCRD and the Indiana Business Research Center (IBRC) created the industry cluster database and web tools, now incorporated into the current project.

Leadership for creating the index of innovation was vested with the IBRC at Indiana University's Kelley School of Business. The framework and tool for prioritizing and aligning public investment was the responsibility of the Rural Policy Research Institute (RUPRI), with input and assistance from PCRD.

While these three tools were in the developmental stages, local stakeholders were engaged to provide feedback and make suggestions for improvement and modifications. These stakeholders included local leaders and economic development practitioners in four different regions: two in Indiana; a two-state region in Alabama and Mississippi; and a tri-state region in Illinois, Iowa and Wisconsin.

Strategic Development Group, Inc. (SDG) provided overall leadership for the field work framework and stakeholder mobilization strategy. SDG also facilitated the stakeholder focus groups, meetings and other processes for the two regions in Indiana. In the remaining two regions, RUPRI assumed this role.

Finally, IBRC took the leadership role in designing and creating the information architecture that allows the tools and data to be web-based and readily accessible by the intended audience and users.

1.Introduction

1.1 Project Background, Purpose and Goals

1.1.1 Background

Rural America needs a better approach to economic development. By most economic benchmarks, rural places are lagging behind in the economic race, and in many cases the gap is widening. [1] This problem is bad enough, but it is made worse by the fact that the majority of rural places seem unaware they are using a game plan in this economic competition that cannot succeed. *Most of rural America is still using a 20th century strategy for a 21st century economy*. This is not a recipe for success.

Globalization has profoundly changed both the scale and thrust of economic development. These changes have not been matched by corresponding shifts in economic development practice. The scale of economic development has grown bigger, shifting from a local to a regional level. Metropolitan areas and rural areas alike must now act regionally to compete globally. Global competition demands every ounce of resource to run the economic race; the only way to marshal these resources is to band together across jurisdictional lines. Yet most rural development efforts are still focused exclusively at the local level, rarely spanning the county lines and city limits drawn for a bygone economic era.

The economic "field of play" has also changed. It has shifted from recruiting businesses to places with low costs to capitalizing on new ideas quickly, a "knowledge economy." Globalization constantly opens up new markets, to buyers and sellers alike. In the process, it finds an ever widening frontier of new places where the costs of production are lower than your own—often *much* lower. Few, if any, regions in rural America will win a race founded on cost alone. The new race rewards regions that can take new ideas to market swiftly and successfully, a process otherwise known as *innovation*. The real problem is that too many rural regions are still running the old race. Far too many places in rural America still have their eye on a 20th century prize: recruiting businesses by giving away excessive financial incentives.

The shift in the economic field of play has also changed the timeline and stakes for economic development. Economic recruitment had its home in the here and now. Putting more financial incentives on the table often brought immediate results. Ribbon cuttings became *de facto* trophies of success. Innovation, on the other hand, is a long-term process that takes years of investment in knowledge and an underlying regional system to achieve results. But in what things do rural regions invest when the economic harvest is often years into the future? Answers to this investment dilemma are not easy, especially in the fiscal environment the nation is now entering. Yet regions must find ways to wean themselves off the quick fix of recruitment and enter the brave new world of investing in their emerging economic opportunities.

[1] In the current report the terms "rural" and "rurality" generally follow the definitions developed in our previous report, *Unlocking Rural Competitiveness: the Role of Regional Clusters* (2007). For that report, the team developed an Index of Relative Rurality (IRR) based on four dimensions of rurality: population, population density, extent of urbanized area, and distance to the nearest metropolitan area. These dimensions are unquestioned in terms of their contribution to rurality and are incorporated implicitly in many existing rurality definitions. The index is scaled from 0 to 1, with 0 representing the most urban place and 1 representing the most rural place. Details may be found in Section 3.2.2, pp.35-40 of the previous report at www.statsamerica.org/innovation/report_role_of_regional_clusters_2007.html.

To adapt to this new economic world, rural areas can do three things:

1. Adopt a whole new approach to economic development
2. Obtain and use effectively an improved set of tools to craft a regional strategy
3. Set sound investment priorities that put a practical strategy into action quickly

Rural areas need to shift their approach away from a concentration on business recruitment. Future prosperity will come from investments in a competitive advantage founded on regional action, education and innovation. This framework represents a whole new way of thinking about economic development, a paradigm shift that is neither natural nor easy. This report provides a roadmap to start the journey.

Although the tools and frameworks we have developed apply to both urban and rural economies, we focus on the specific needs of civic leaders and economic development practitioners in rural regions.

Urban areas are often blessed with a sizeable staff of economic development analysts, planners and other professionals. These professionals provide invaluable analytics and information to support the local leadership and help inform the civic dialogue as economic development strategies are being developed, vetted and revised. Rural areas are not typically endowed with a similar cadre of economic development professionals.

1.1.2 Purpose and Goals of the Project

The purpose of this project is to make it easier for civic leaders and economic development practitioners to understand the dynamics of their regional economy. This project also outlines how leaders can come together to develop practical strategies for investment. This report builds upon an earlier project, also sponsored by the Economic Development Administration, with the same purpose: to help leaders and practitioners understand their economy and develop strategies to strengthen it.[2]

The decision support tools created in the prior project focused on industry clusters. Specifically, industry cluster data were compiled and made available in a user-friendly format, including web-based access, for each county in the United States. These web-based tools allow economic development practitioners to combine individual counties so the industry cluster data can be compiled easily for any region.

In this project, we have developed three additional tools, along with a practitioner's guide, for local leaders and economic development practitioners:

1. The construction of occupational and skill clusters and associated data for each county in the nation. This is an analogue to the more commonly used industry clusters constructs and data that were emphasized in the earlier project.
2. An index of innovation for each county in the United States.
3. A framework and tool to enable economic development practitioners, local government officials, and other stakeholders to prioritize key public investments and ensure these investments are aligned, or consistent with, the local/regional economic development strategy.

The first two tools and the industry cluster work in the prior project help local leaders and others (a) gain a fundamental understanding of the regional economy and its unique characteristics, assets, and shortcomings;

[2] The prior project report can be found at www.statsamerica.org/innovation/report_role_of_regional_clusters_2007.html.

(b) diagnose the regional economy in a fashion that helps point the way to where comparative and competitive advantages lie; and (c) create an economic development strategy that builds upon existing and potential areas of comparative advantage.

With an economic development strategy in hand, the next question is: How well do current and planned investments support the strategy? The third tool comes into play at this point. Specifically, the public investment tool provides a framework and discipline to help ensure that public resources are prioritized, aligned and invested in a manner that is consistent with the economic development strategy that is in place.

This project is part of the EDA's Integrated Research Agenda. That agenda includes approximately 20 research and practice-related studies on such topics as regional planning and action, best practices in state and regional innovation, and various tools for regional economic development, e.g., local government fiscal analysis and industry and occupational cluster analysis. This Integrated Research Agenda has been conceptualized to link the different projects in a way that increases their usefulness much more than would otherwise be the case. EDA is also facilitating workshops and networking among the different universities and researchers to enhance synergy among projects and connectivity within the relevant scholarly community.

1.1.3 Why Emphasize Tools Linked to Skills, Innovation and Regional Strategy?

Throughout most of its history, the foundation of the U.S. economy, including the rural economy, lay in the production of various types of goods and commodities. Several decades ago, this goods- or commodity-oriented economy began to give way to an economy in which services were a major driving economic force. Economic development strategies, policies, programs and investments were reasonably well aligned to these two different stages in our economic evolution. However, today's "new economy" is about neither goods nor services per se. Instead it can be thought of as a knowledge-based innovation economy.

Recently, the World Bank noted:

> The application of knowledge is now recognized to be one of the key sources of growth in the global economy. The term Knowledge Economy (KE) has been coined to reflect this increased importance of knowledge. A knowledge economy is one where organizations and people acquire, create, disseminate and use knowledge more effectively for greater economic and social development (2009).

What is true at the global level is also true at the local level. The report of the Strengthening America's Communities Advisory Committee (2005) provides strong justification for focusing much greater attention on our transformation to a knowledge-based innovation economy and aligning public policy and investments accordingly. Among the committee's insights are the following:

> With increasing competition from across the globe, U.S. industries can no longer rely on low-cost labor, access to raw materials, and low value-added products and services to drive success. In an innovation-based economy, skilled human capital has become the most important form of capital. Knowledgeable and skilled people and their ability to apply that knowledge creatively drive the engine of successful innovation.

Two key factors now drive regional competitiveness: education and innovation (Federal Reserve Bank of Cleveland 2005). The emerging focus on education and innovation makes sense. Globalization has erased

major sources of competitive advantage. Industrial land, serviced by basic infrastructure, is widely available. The elimination of trade barriers enables technology to cross national boundaries easily. Global capital markets are tightly integrated, so low-cost financing becomes a weaker economic development tool. The physical integration of global markets has added vast new sources of unskilled labor costing pennies a day.

In today's global economy, each region's brainpower—the education and skills of a region's workforce—is unique and provides the basis for sustained competitive advantage. However, brainpower alone is not enough. Innovation translates brainpower into jobs and wealth. The region's capacity to innovate ultimately determines how well the economy performs. A region may be capable of generating workers with high levels of education and skills, but if regional businesses do not innovate enough to grow, there are not enough jobs to absorb these workers and they will leave.

Many regional economies include a significant number of small towns and open countryside. A body of research—albeit limited—suggests that rural America can be an effective player in the "new economy," although there may be certain hurdles or constraints to overcome. The research of Henderson and Abraham identified rural counties most often tied to a concentration of high-knowledge occupations; and concluded by noting that "knowledge is the new fuel powering economic growth in the 21st century… However, few rural places have tapped into this economic potential. Many are asking where to start" (2004, 88).

A more recent report (Henderson 2007) begins with the question: "Can technology adoption help invigorate rural economies?" The author concludes that "as technologies mature, patent activity in smaller communities often rises… To boost productivity and prosperity, many rural firms have adopted new technological innovations to create new products, reach new markets, and enhance production efficiencies. The size and remoteness of rural places raise the cost of knowledge sharing and information transfer, which in turn limits radical innovation. However, creating networks that support the transfer and adoption of new technologies may lay a foundation for revitalizing many rural communities."

Being an effective player in a new economy that requires new strategies built around knowledge, innovation and regional collaboration is no small task. Strong leadership and civic engagement is needed but so are analytical tools to help ground and guide the civic dialogue. Until now, we have not had the frameworks and tools available to give regional leaders much guidance on the existing skills of its workforce or on the capacity of the regional economy to innovate. The Economic Development Administration commissioned this research project to put tools into the hands of local civic leaders and economic development practitioners so that they can more effectively compete in a global context where knowledge and innovation are vital to competitive advantage. Specifically, what is needed are data and decision-support tools that (a) facilitate civic dialogue about the new economy, (b) help local leaders and other stakeholders gain an understanding of their knowledge and skill assets and gaps, and (c) show how public investments need to be aligned or realigned to be supportive of a knowledge-based innovation economy. The data and decision-support tools developed as part of this project are designed specifically for these purposes.

1.2 The Research Partnership

Five organizations conducted this research, and each brings a unique set of expertise and capacity. Although the focus, roles and responsibilities of each partner differed, the team made special efforts to maximize the strength of our collaboration. Coordinating a geographically dispersed team working on complex innovations is no easy task. Through the course of this project, some valuable lessons were learned about how to

coordinate a team across organizational and geographic boundaries. In these types of projects, leadership does not reside in any one organization. Rather, leadership emerges from a series of tasks necessary to complete the project. In our project, leadership passed from one organization to another as we passed through different stages.

The Purdue Center for Regional Development (PCRD) and Dr. Brigitte Waldorf of the Purdue College of Agriculture, with support from Economic Modeling Specialists Incorporated (EMSI), took the overall lead in constructing the occupation and skill cluster database and tools. Overall leadership for creating the index of innovation was vested with the Indiana Business Research Center (IBRC) at Indiana University's Kelley School of Business. The framework and tool for prioritizing and aligning public investment was the responsibility of the Rural Policy Research Institute (RUPRI).

While these three tools were in the developmental stages, local stakeholders were engaged to provide feedback and make suggestions for improvement and modifications. These stakeholders included local leaders and economic development practitioners in four different regions: two in Indiana; a two-state region in Alabama and Mississippi; and a tri-state region in Illinois, Iowa and Wisconsin. Strategic Development Group (SDG) provided overall leadership for the field work framework and stakeholder mobilization strategy. SDG also facilitated the stakeholder focus groups, meetings and other processes for the two regions in Indiana. In the remaining two regions, RUPRI assumed this role.

Finally, IBRC took the leadership role in designing and creating the information architecture that allows the tools and data to be web-based and readily accessible by the intended audience and users.

1.3 Organization of the Report

This report consists of seven chapters plus extensive appendices. Also delivered with this report is a digital product—an interactive database publicly accessible on the Internet at www.statsamerica.org/innovation.

Although the data and associated tools generated by the project are county-based, the most effective way to organize for economic development generally involves a regional, multi-county approach. Chapter 2 develops this argument and shows how a regional approach is not inconsistent with the economic development needs and opportunities of smaller jurisdictions within the larger region.

Chapter 3 focuses on occupation and skill clusters: the constructs, definition, methods and data used to create the various clusters; and the descriptive and analytic findings from the cluster component of the project. Chapters 4 and 5 take a similar approach in focusing on the index of innovation and the investment framework/tool, respectively.

Chapter 6 draws upon this experiential base and other sources in outlining and discussing key principles and insights around regional mobilization and governance.

Chapter 7 summarizes the main points, findings and conclusions from the project and offers suggestions for further research and applications.

The appendices include a variety of supporting materials, including cluster definitions, additional details on the innovation index, and profiles of the four pilot regions.

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2. The Emerging Importance of Regional Strategy

Investment has always been important to economic development, but it is even more critical to building competitive regions in today's economy. Through the history of economic development, the nature of these investments has shifted. We can see three distinct, overlapping eras in the past half century (Drabenstott 2005; Morrison 1986, 1987):

- *The Era of Industrial Recruiting* has its roots in the recruitment strategies that Mississippi adopted during the Great Depression and accelerated after World War II. During this period, economic development strategies emphasized financial incentives to attract factories, and focused on investments in physical infrastructure to move inputs to factories and finished goods to markets.
- *The Era of Cost Competition*, which began in the early 1980s, emphasized industry consolidation and achieving economies of scale. During this period, multinational companies began globalizing their production operations. To compete, U.S.-based economic development organizations focused on providing more aggressive, deeper incentives. The focus in this era was more diffuse and relied on creating a business and regulatory climate that encouraged private investment by reducing costs.
- *Our current Era of Regional Competitiveness*, which began in the late 1990s, emphasizes identifying each region's competitive advantages and then prioritizing public and private investments necessary to exploit those advantages. This period is seeing the blurring of lines between economic and workforce development, as innovation emerges as a key element around which economic development strategies are organizing.

The regional competitiveness approach weaves together three important findings about how regional economies work. The first has shown the importance of clusters to regional economic growth (Porter 1998). The second advocates that the clustering of economic activity gives rise to "agglomeration economies" that are critical to understanding the new economic geography of why some regions attract industrial investment and others do not (Krugman 1991). The third focuses more on the regional character of organic growth through innovation and entrepreneurship. This research notes that fresh ideas and a fertile seedbed for those ideas to take root are critical determinants to regional growth (Acs and Armington 2004).

While policy officials and economic experts increasingly agree that the competitiveness approach offers the greatest promise for sustained economic gains, in practice the first two eras still mostly guide the behavior of local practitioners. Regional leaders need new skills and tools to adopt the new paradigm of regional development. This need takes many forms, but the most pressing need is designing a strategy process and a set of analytic tools that help regional leaders reach strong consensus on sensible investment priorities.

Well-identified investment priorities carry even more urgency as our economy undergoes a fundamental transformation. Toyota's former president, Katsuaki Watanabe, characterizes the shifts this way: "The change that has hit the world economy is of a critical scale that comes once in a hundred years." In the face of these shifts, regional economies are rapidly emerging as critical factors for supporting globally competitive firms (OECD 2007).

Regions can compete globally by focusing on their unique assets. The challenge is to link and leverage these assets in new and different ways. In this general economic climate, a critical issue will be ensuring that federal and state economic development programs represent sound investments in economic growth. But what are these sound investments? A critical part of the answer must come from regions themselves. That is, the nation will reap the biggest economic dividends when each of its regions invests in those public goods that matter most to increasing and maximizing a competitive edge in global markets.

The emergence of a freshwater technology cluster in Southeast Wisconsin illustrates how regional leaders can exploit distinct assets by investing in the foundations of a more competitive regional economy. By virtue of a strong economic base in process industries that require water, such as beer making, the region has a strong slate of companies with expertise in freshwater technology. By linking these companies together in the new cluster, the region now has an opportunity to pursue a rapidly emerging opportunity as global water shortages create new markets in freshwater technology. Within the region, leaders in education, business and government are aligning their investments to support companies within the cluster.[3]

Nationally, the United States will become more competitive as regional leaders learn to link and leverage their assets in new and different ways. As they make the investments needed to support innovative, globally competitive companies, additional opportunities will emerge. Identifying and making these investments requires a new strategy process and tools to guide complex decision-making at a regional level.

To succeed, regional leaders must avoid two common traps: fragmentation and insularity. Fragmentation arises when individuals and organizations pursue their own agenda of individual projects disconnected from a broader regional strategy. Insularity arises when regional leaders pursue old strategies of recruitment and "incentive shopping" without learning that the rules guiding global competition are changing in a fundamental way.

Under a regional competitiveness approach to economic development, designing and implementing a strategy is a continuously evolving process that must adapt to the unique economic and institutional landscape of a particular region. A rich array of development experiments across the nation and around the world point to a new process that adapts well to many different types of regions (OECD 2005).

Findings from these experiments are yielding an emerging consensus that the regional development process has three key elements:

- Public and private actors who must commit to building a *collaboration* (the Who)
- The *strategic outcomes* the collaboration must achieve (the What)
- The *ongoing, strategic process* by which key outcomes are achieved (the How)

This chapter explores these critical components and outlines the key steps that lead to transformational investment decisions.

[3] See the Milwaukee 7 Water Council at www.milwaukee7-watercouncil.com.

2.1 The Who: A Regional Partnership

Every region has a set of public and private actors who represent potential partners in a regional strategy. An effective regional strategy process turns a diverse set of partners into a resilient, trusted network of leaders. These leaders become capable of executing and monitoring complex investment decisions by following some simple guidelines.

This transformation into an effective partnership or decision network does not happen easily or quickly. Analysts are just now beginning to adapt network theory to the issue of regional partnership. This theory can serve as a valuable framework for thinking about how regions can organize to design and implement sophisticated investment strategies (Cross and Parker 2004, Cross and Thomas 2009).

In building a regional strategy, overcoming political jurisdictions represents a major challenge. In most cases, a 21st century economic region will spill across county lines and often cross state lines. To develop a globally competitive region, therefore, the partners must reach across jurisdictional borders that have all too often been barriers to collaboration in the past. This challenge is especially difficult in rural areas of the United States where development is still largely practiced one county at a time. Work that has been done in rural regions elsewhere in the world strongly suggests, however, that building a strong partnership with a critical mass of globally competitive assets is an important prerequisite to development success (OECD 2006).

Another challenge comes in bringing a diverse set of partners together. Protecting institutional boundaries must give way to a new mindset: collaborating to compete. Underlying this shift is a change in perception. As an economic development strategy, recruitment tends to develop deep ruts in the mindset of local leaders. In the worst cases, economic development degenerates into a practice of poaching businesses from neighboring jurisdictions. Competing jurisdictions can get into costly competitions over incentive packages, in which the incentives no longer bear any reasonable relationship to the underlying investment.

With global competition, these practices have become hopelessly obsolete. Regional economic development is no longer a zero-sum game of winners and losers. Instead, regional economic development focuses on aligning, linking and leveraging assets to pursue new market opportunities. When done properly, this approach creates new avenues for mutual benefit; leaders are no longer preoccupied with fighting over a "fixed pie."

One can see this shift in perspective taking place in the Riverlands region, a 14-county region surrounding Dubuque, Iowa. Leadership in the region has coalesced around the need to build a stronger economic future. This region spans three states—eastern Iowa, northwestern Illinois, and southwestern Wisconsin. This region in the nation's Heartland evolved geographically as the regional development initiative gathered momentum.

The regional discussion started out with a working definition of 17 counties, but as more information became available about the common economic threads that united the region, three counties in Illinois dropped out of the project. The region has long relied on agriculture and manufacturing to sustain its economy, yet both are undergoing significant change and consolidation as a result of globalization and technological change.

As a result, regional leaders launched the Riverlands Economic Advantage Project to identify new economic opportunities that emerge for the region as a whole. The business services sector is one strong area of interest, spurred in part by the recent arrival of a large customer service center for IBM. The region has a significant constellation of higher education institutions that could sustain this initiative. Tourism is another

area where regional collaboration may bring economic gains. The area has significant scenic and historical amenities, but the state lines have resulted in fragmented initiatives in the past. With the potential for Chicago to host the 2016 Olympic Games, leaders believe they have the potential to attract many international tourists but realize they must achieve some critical mass to do that.

In the case of the Southern Minnesota Regional Competitiveness project, 38 counties have uncovered significant new bioscience opportunities that would not have been possible had each county been locked in a development battle with neighboring counties. This region has a powerful agricultural powerhouse but is also home to the Mayo Clinic. By moving to a regional scale, the region brought together agricultural groups, researchers at Mayo, and other research organizations in a new regional bioscience business roundtable. That group is developing concrete development projects, including extracting pharmaceutical inputs from specially grown crops.

To be successful, the strategy process must continuously engage leaders across the economic spectrum from public, private, and nonprofit sectors. Public actors include local government officials (such as mayors and county commissioners), as well as representatives from state and federal governments. Private actors include business leaders, financial executives, hospital administrators, utility company executives, and agricultural leaders. Nonprofit actors include leaders from regional foundations, nonprofit development organizations, and education—spanning K-12, colleges, and universities.

Effective regional partnerships do not arise from following formulas for engaging a static list of stakeholders. True region-wide partnerships emerge when regional leaders painstakingly build new habits of collaboration within the unique institutional landscape of a given region, as shown in the following examples.

- The West Alabama-East Mississippi region used a WIRED grant to focus development initiatives around a new nonprofit organization (The Montgomery Institute) working in concert with eight community colleges scattered throughout a 37-county region.[4]

- In Southern Minnesota, the partnership is emerging around two major regional philanthropies (Southwest and Southern Minnesota Initiative Foundations), a nonprofit organization (the Center for Rural Policy and Development), and a few key private sector companies (including AgStar, a large Farm Credit System association headquartered in the region).

- The Riverlands partnership was sparked by a large public utility, but has attracted strong participation from several other key regional stakeholders. These include a metropolitan development corporation, a large public university, and economic development districts.

- In 2000, the West Michigan Strategic Alliance formed across an eight-county region with a simple mission: "to serve as a catalyst for regional collaboration." The Alliance has gone on to develop a disciplined framework for thinking and acting strategically. This framework includes a document, *The Common Framework*, that explicitly outlines a framework of investment opportunities across the region.

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[4] The Workforce Innovation Regional Economic Development (WIRED) program was a new initiative of the U.S. Department of Labor to encourage an alignment between workforce development and regional economic development. More information on the program is available at www.doleta.gov/wired/about/.

- In North Central Indiana, educational institutions, including Purdue University, Indiana University and Ivy Tech are taking the lead in promoting new regional investment strategies. Financed by a WIRED grant from the Department of Labor, the core partners have focused on developing new education and training opportunities for a region lagging in educational attainment.

- In the seven-county Milwaukee 7 region of Southeast Wisconsin, the public/private partnerships of the Regional Workforce Alliance, the Milwaukee 7 and the Center for Education Innovation and Regional Economic Development are guiding innovative investment strategies.

- In Northern Idaho, the Idaho Department of Labor is both promoting and supporting the emergence of new networks focused on redesigning the region's technical education to support high-growth employers. Their first initiatives include establishing a collaborative among employers to streamline and expand apprenticeship training opportunities in the region.

- In Southeast Michigan, a network of foundations has emerged to guide regional investment strategies through the New Economy Initiative. Launched in 2008, the initiative represents a commitment of $100 million by these foundations to strengthen the regional economy.

In each of these cases, a new type of regional leadership is emerging. Leadership does not fall to any one person. Rather, regional leadership entails many different roles and responsibilities that are performed by a range of actors, each with individual strengths. Leadership passes to different individuals during the strategy process. Regional leadership is distributed among a group of people with the character, skills, resources, and commitment to move the region forward. In launching a regional effort, the leadership challenge comes in assembling this core group of leaders capable of thinking and acting regionally.

2.2 The What: Strategic Outcomes

The regional strategy process aims to produce the outcomes necessary for the region to compete most effectively and sustain its growth. Three outcomes are critical:

- An open, resilient regional partnership
- A flexible strategic action plan
- A shared set of investment priorities

2.2.1 Open, Resilient Regional Partnership

The first outcome is an open, resilient regional partnership capable of thinking and acting together. Economic development always engages local actors, but it does not always yield a region-wide partnership. Thus, the strategy process should be designed to yield a regional partnership as a critical outcome.

In some regions, the focus on the partnership comes early, when leaders set forth principles to guide their deliberations going forward. Thrive, a regional group covering eight counties in southwest Wisconsin, established regional principles of collaboration that make explicit the focus of their collaboration (Thrive

2008).[5] In West Michigan, leaders have developed detailed understandings of the scope and process of regional collaboration. They have, for example, developed a glossary to define explicitly the terms they use in building regional collaboration. In addition, their document, *The Common Framework*, clearly outlines the scope of potential regional collaborations (West Michigan Strategic Alliance 2009).

In other regions, a history of limited regional collaboration or outright distrust may prevent regional leaders from addressing their partnership initially. When that is the case, leaders may need to build the partnership more slowly by identifying mutual projects on which to work. As trust builds through project successes, a regional partnership becomes more clear and explicit. This was the path chosen by North Central Indiana, a region with two dominant metro areas—Lafayette and Kokomo. After leaders successfully implemented workforce and economic development innovations across their 14-county region, they then turned their attention to launching a regional leadership institute.

2.2.2 Flexible Strategic Action Plan

The second outcome is a strategic action plan that represents a road map for development. This strategy is founded on the region's main competitive advantages. An effective strategy links and leverages the region's assets to take advantage of emerging opportunities. Through continuous evaluation and revision, the strategy maintains the leadership's focus on a handful of transformational outcomes. In short, the plan focuses effort and funding on opportunities that unlock the region's distinct potential. The WIRED process designed by the U.S. Department of Labor focuses each region on the development of a clear, concise implementation plan to identify investment priorities. Similarly, the Comprehensive Economic Development Strategy (CEDS) process designed by the Department of Commerce calls for the development of a strategic action plan that sets forth a region's investment priorities. Some examples of individual regions creating these action plans include the following:

- The Prosperity Partnership, consisting of four counties in the Puget Sound region, represents an excellent example of a region that has set forth very clear strategic priorities. The Partnership then translates these priorities into annual action plans.

- The Metro Denver WIRED region focused on integrating education, economic development and workforce development in its key clusters: aerospace, bioscience, energy, and information technology software.

- The Southern Minnesota process will culminate in a Strategy Summit to launch a blueprint for development throughout the 38-county region, built around six strategic opportunities that were identified through extensive analysis and dialogue in the region.

- In Northern Idaho, regional leaders are accelerating the integration of education, workforce development and economic development. They are initially gearing their efforts in three focus areas: redesigning the regional system for technical education; accelerating innovation in preparing the health care workforce; and expanding the supply of sustainable, affordable housing.

[5] These principles include: competitiveness, stewardship, innovation, transparency, and servant leadership.

Strategic action plans must be flexible. Circumstances change. The core group of leaders might stumble. Setbacks are inevitable as regional leaders experiment with new ideas for coordinated action. The best strategic action plans are short and clear. They represent frameworks or maps that enable leaders to decide which way to jump when circumstances change. They are organized around a handful of focus areas (no more than seven) that represent critical transformations for the region.

Keeping focus areas limited is important for two reasons. The first is obvious. A strategy with too many focus areas cannot be focused. Equally important, strategies can only be successful if regional leaders can clearly communicate them. A strategy with too many focus areas confuses people.

Within each focus area, the regional leadership can launch a number of different initiatives. In this way, a strategy is not dependent on the success of any one initiative. With a clear framework of strategic focus series, leaders can shift resources to their most productive use.

2.2.3 Shared Investment Priorities

The third outcome is a set of priorities—a strategic investment agenda—in public goods and services that links competitive advantages to new market opportunities. The budget available to fund these economic development investments ranges widely across regions, yet every region must contend with how best to invest whatever funds are available from public, private and nonprofit sources.

Regions with shared investment priorities are in a solid position to expand their impact through leverage. Shared investment priorities encourage alignment among public, private and nonprofit investors. Very few regions currently achieve all of the opportunities that leverage provides. As a result, developing a framework for regional investment is an important focus of this research report (see Chapter 5).

2.2.4 Summary

These three outcomes provide the strongest possible regional foundation for 21st century economic development. Each reinforces the other in creating the necessary and sufficient conditions for development. Without an *open, resilient partnership*, the strategy is merely a three-ring binder, and the investment priorities are never identified. Without a *flexible strategic action plan*, the region typically devolves to the default strategy of recruiting any business it can attract, and economic development investments are not necessarily focused on what the region does best. Without *shared investment priorities*, the partnership never makes hard choices or takes focused action, and the powerful impact of leverage is lost. The strategy of regional transformation—based on a new pattern of investment—quickly falls apart.

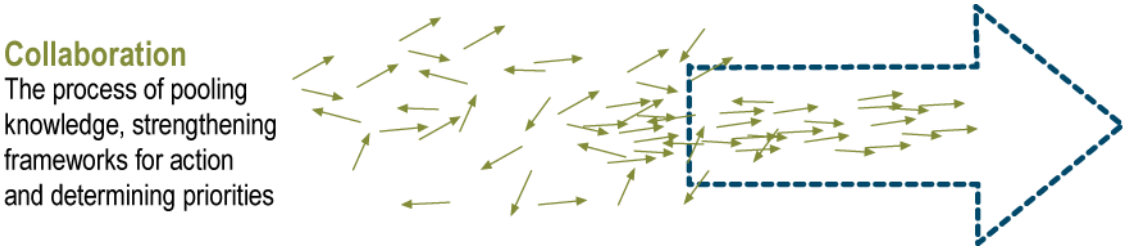
2.3 The How: Strategic Process

The three desired outcomes do not magically appear—they are the result of a regional strategy process specifically designed to achieve them. Developing an effective regional strategy requires weaving together three key component processes: collaboration, analysis and coaching. To understand how an effective strategy emerges within a region, we need to look more closely at each separate but interconnected process.

2.3.1 Collaboration

As nationally syndicated columnist Neal Pierce and urban expert Curtis Johnson have noted, "Collaboration is messy, frustrating and indispensable" (1998). Collaboration involves building the trust by which a very diverse set of regional actors become a partnership focused on the region's economic future (see Figure 1). A flexible strategic action plan emerges from purposeful conversations that build a shared framework of mutual understanding. In many regions, significant conversations do not occur. People remain "siloed" within their own organization or political jurisdiction. Without these conversations taking place on an ongoing basis, regional leaders have no opportunity to explore the diversity of perspectives, experience and assets embedded in their region. Individual organizations pursue their own mission and goals, largely disconnected from one another.

Figure 1: The Collaboration Process



Graphic developed by Drabenstott and Morrison

A sustainable economic development strategy requires regional leaders to understand and accept the legitimacy of one another's needs and goals. As this basic sense of acceptance and understanding evolves through conversation, leaders and their organizations gain new insights into how they can align themselves for their mutual benefit. Innovative ideas emerge that incorporate diverse points of view and integrate different perspectives and needs. Strategic alignments emerge. These alignments are sustained through the mutual benefits they generate.

Collaboration starts by bringing public, private, and nonprofit economic actors together in roundtable, facilitated dialogue. The dialogue should take place in a "safe" space, in which participants can feel comfortable sharing difficult issues. This sharing requires a warm and permissive atmosphere in which participants feel secure and free to air their real thoughts and feelings. Richard Lester, in his recent work on the roles universities play in regional economic development, suggests that colleges and universities are well situated to play this role of creating and maintaining the "public space" where complex conversations can take place (2005).

The first task of regional leadership is to establish this climate in which honest feelings, whether hostile or friendly, can be accepted and discussed in an objective way. The skill comes in knowing how to release the creative talents of the team drawn together (Haiman 1951). This dialogue does not take place once; it is a practice that must be ongoing, sustained, and durable; it is a process, not an event. The dialogue must be open and transparent, assuring and reminding all parties that the goal is to grow the economy of the region, not advantage one partner over another.

As habits of participation take root, the group strengthens in a number of different ways. Participants become more innovative and flexible. Individuals find themselves more willing to change and adapt to new, more inclusive perspectives. They learn how to share their early stage ideas without fear of inappropriate personal criticism. They become more skilled at listening, which enables them to discover and acknowledge diversity

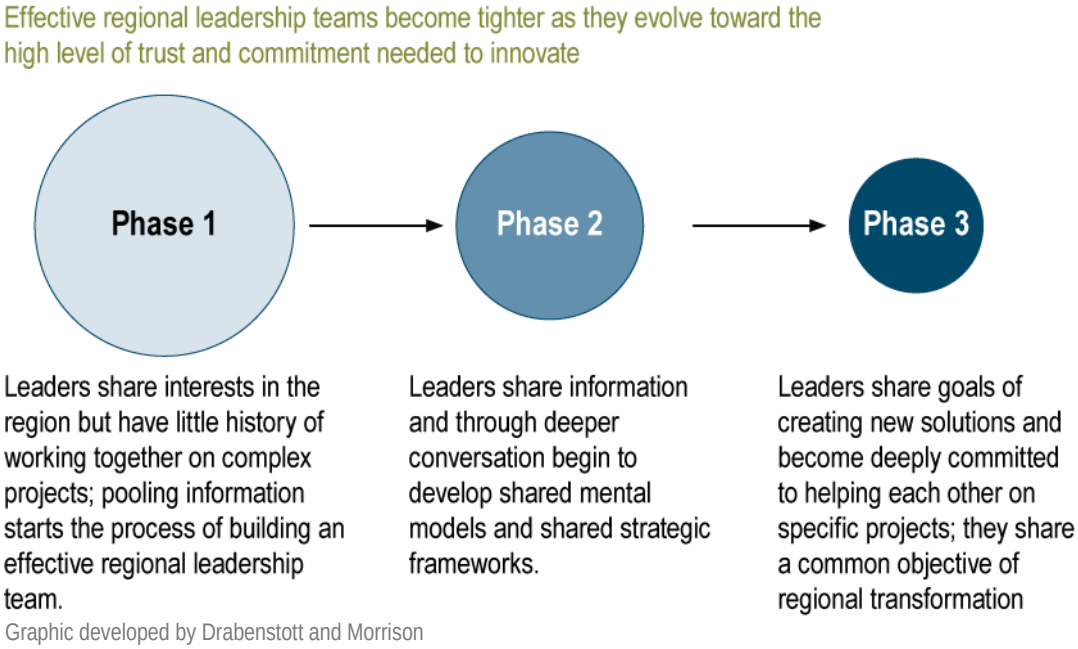
inherent in the group. As this basic sense of acceptance and understanding grows, people learn to "think together" more clearly. Solutions emerge that integrate everybody's perspectives and needs. These collective solutions have the best chance of being implemented and sustained. The reason is simple: people tend to have the strongest commitment to solutions that they have helped create.

Finally, the dialogue must be focused on translating ideas into action. Collaboration, to be sustainable, should be disciplined, pragmatic, and fast. Few people have time for idle talk. The group needs, instead, to develop the habits of generating innovative ideas, defining clear outcomes, and launching experiments to learn what works. Economic development is an inductive process in which regional leaders learn by doing. The regions with established practices of experimentation, rigorous evaluation, and replication will be more competitive in the long run. They will learn faster, spot opportunities faster, and make decisions faster.

2.3.1.1 Phases of Regional Collaboration

The regional collaboration process evolves in phases, as the partners build trust and new habits of thinking together (see Figure 2).

Figure 2: Focused Regional Collaboration Builds through Three Phases



Phase 1: Pooling Knowledge

The first phase involves pooling knowledge by mapping regional assets. During this phase, partners share what they know; by sharing information, they create a common pool of knowledge about the region's assets. These assets take many forms: colleges and universities, unique scenery, workforce skills, local ownership of companies, a large pool of local capital that can finance start-ups, a regional history of innovation, or natural resources like soils, forests, or minerals. Local actors bring significant knowledge about the extent and quality of these local assets. This knowledge has great value both in setting strategy and prioritizing investment. This knowledge transcends secondary data and cannot be deduced from an analysis of data alone. Pooling

knowledge will yield a critical map of the region's assets, and also represents the first step in crossing organizational and political boundaries (Council on Competitiveness 2007).

This knowledge pooling provides a powerful complement to the analysis and almost always uncovers opportunities that data alone cannot, as shown in the following examples.

- Tourism barely registers as a business cluster in the WAEM region, yet local roundtables uncovered powerful tourism assets, notably the rich civil rights history of the region.

- Similarly, the business services cluster is barely visible in regional data for the Riverlands region in eastern Iowa, southwestern Wisconsin, and northwestern Illinois. Yet business leaders see strong potential in this budding sector due to an outstanding constellation of higher education institutions. That inherent knowledge of the region was recently confirmed when IBM opened a new technical assistance center in Dubuque that will employ as many as 1,300 workers.

- Connecting assets in new and different ways led leaders in Southeast Wisconsin to uncover strengths in fresh water technologies. The same process led Indiana to recognize an emerging cluster in advanced energy systems.

Phase 2: Broadening Frameworks

The second phase involves broadening frameworks for regional action. Many development actions remain largely the province of local institutions. Broader frameworks are needed to coincide with the economic geography. This step involves creating new patterns of thinking—new mental models—among the partners. Typically, partners enter into regional discussions tightly tied to promoting their organizational and political agendas. They are biased toward protecting boundaries, not expanding economic frontiers.

To reach across these boundaries, the partners need to engage in new conversations explicitly designed to identify promising, mutually beneficial opportunities. In this way, the partners gradually move away from the winner/loser mindset typical of outdated economic development strategies. In the case of both the water cluster in Southeast Wisconsin and Indiana's network in advanced energy systems, workshops and retreats helped the region's leaders explore and understand their new market opportunities.

Phase 3: Making Commitments

In the last, most advanced phase of collaboration, the partners make the commitments critical to becoming a competitive region. They agree to link and leverage their assets, set joint investment priorities, and establish protocols for making complex decisions. To take this step, the partners must draw on the trust built in the first two phases of the collaboration process. The net result of this collaboration is a powerful alignment of investment decisions in the region. With Southeast Wisconsin's water cluster, private companies quickly aligned to support a new anchor investment by the University of Wisconsin–Milwaukee in a new school of Fresh Water Science (Schmitt 2009). In the case of the Indiana Energy Systems Network, private companies, through the Central Indiana Corporate Partnership, stepped forward quickly to invest in the effort (Katzenberger 2009).

By contrast, regions that fail to align their investment actions often fail to exploit the synergies bound up in their economic assets. In fact, in many regions, investments often run at cross purposes (as illustrated by the

left side of Figure 1). While each organization may be following sensible strategies, a sense of fragmentation prevails. Lack of communication leads to conflict, and these conflicts drain away time and resources. Such regions do not attain the synergies that partnership and coordinated actions bring. They cannot bring promising initiatives to scale. As a consequence, these regions cannot make or sustain the new pattern of investments needed to transform a region.

2.3.1.2 Regional Transformation

Regional economic transformation takes place through consistent, focused and coordinated short- and long-term investments by public, private and philanthropic organizations. No one organization within a region is in a position to dictate these strategies. They must emerge from focused conversations, shared insights, and coordinated actions. Two concepts are critically important to understanding this process of regional transformation:

- **Alignment:** This refers to a shared framework of thinking and acting together. When regional leaders are aligned, they share common understandings of competitive challenges and opportunities within a region. West Michigan presents the clearest case of how regional leaders create alignment by defining a common framework for thinking and acting (West Michigan Strategic Alliance 2009).

- **Linking and Leveraging**: This refers to the process of making investment commitments in a coordinated way. Linking involves a process of forming both informal and formal partnerships. Leveraging involves making investment commitments that mutually reinforce each other. Leveraged investments have the potential for higher returns than uncoordinated investments. In the case of Southeast Wisconsin, the regional leadership has adopted the phrase "linking and leveraging." To them, it emphasizes that regional transformation will take place when organizations go beyond conversation and make joint investments. So, for example, within the Southeast Wisconsin Water Council, one company operates a nationally recognized lab for cold water technology. Another company operates a similarly prominent lab for hot water technology. Both labs are not fully utilized. Through a joint commitment of the two companies, they are making these labs available to smaller companies in the region to conduct research and testing. By making these facilities available in a coordinated way, the established companies are sending a powerful signal to stimulate innovation among smaller companies.

2.3.2 Analysis

Beyond collaboration, analysis represents a second, parallel process that must support effective regional strategy. Analysis is the process by which the wide range of *the possible* becomes a focused strategy of *the most promising*. An unfortunate legacy of the recruitment era of economic development is that economic development often descends simply to "trolling"—putting out lots of financial enticements and seeing who strikes the bait. Such incentives pay diminishing returns in a globalizing economy where cheap labor and land can be found in literally thousands of locations. The practice of strategy is reduced to "targeting," which simply means compiling a list of promising candidates for relocation or expansion.

New approaches to regional strategy require a more balanced, disciplined approach. The overriding objective is focus—identifying economic niches. Within these niches, the region has a competitive edge to withstand the pressures from global markets. So, for example, rural communities may have an advantage in providing an onshore platform for technology development (Information Technology Association of America 2007).

These are four different, and at times overlapping, approaches to analysis: mapping assets, structural analysis and industry clusters, occupation clusters, and measuring innovation.

2.3.2.1 Mapping Assets

Productive regional conversations often start with an understanding of the region's economic assets. Successful strategies for community development have long focused on the importance of building communities from the "inside out" by building from the base of a community's assets (Kretzman and McKnight 1993). The same is true for regions. Competitive strategy begins with mapping regional assets. (Council on Competitiveness 2007)

Listing regional assets represent an important first step in developing a strategy, but valuable strategic insights emerge when the participants start to explore linkages among these assets. The participants begin to explore the important question, "What could we do together?" Exploring this question gives rise to more inclusive opportunities, as participants learn more about each other's assets, perspectives, and goals. As participants learn to trust each other, they become more productive at generating new ideas. They share early stage thinking, suspend judgments, and acknowledge diverse contributions.

Generating innovative ideas represents the first step in designing a regional strategy. Progressively, the participants must begin to narrow their choices. The conversation moves from "What could we do together?" to "What should we do together?" Effective regional strategies emerge from a disciplined process of comparing alternatives.

Ultimately, economic development investment decisions must face a market test. Analysis shows how investment alternatives will connect to and influence the risks and returns of a market. Each alternative will have a profile of risk and return. Without this analysis, the process of economic development can quickly degenerate into horse-trading, self-dealing or corruption. Fortunately, many emerging tools can be brought to bear on this difficult task (see Table 1).

Table 1: A Toolkit for Regional Development Analysis

Tool	Outputs	Inputs	Benefits	Limitations
Structural Economic Analysis	Industries that are specialized or concentrated in the region ("competitive advantage")	Employment data	Identifies areas of economic strength compared with the nation	Ignores income effects and which opportunities will enhance income.
Industry Cluster Analysis	Key constellations of business firms in the region	Government business data	Shows patterns of established and emerging business strength	Looks backward, not forward. More static than dynamic.

Tool	Outputs	Inputs	Benefits	Limitations
Occupation Cluster Analysis	Key constellations of workforce skills in the region	Occupational Information Network (O*NET), U.S. Department of Labor	Shows patterns of labor skills, especially valuable in charting economic transformations	Looks backward, not forward. More static than dynamic.
Innovation Indices	Measures of innovation for the region	Economic and demographic data	Benchmarks the region's ability to innovate against the nation and other regions	These are proxies for the factors that are believed to drive innovation. Innovation is difficult to capture.

2.3.2.2 Structural Analysis and Industry Clusters

Structural analysis assesses the existing industry mix in the region and notes areas of distinct specialization. Industry cluster analysis provides a picture of established and emerging constellations of businesses. These clusters represent the concentration of firms where the regional economy is currently generating its wealth. They point to market niches where business firms are signaling either established or potential areas of excellence. Development of a cluster identification and evaluation tool was the major focus of the EDA-funded Rural Competitiveness project, which is available online at www.statsamerica.org/innovation/report_role_of_regional_clusters_2007.html.

2.3.2.3 Occupation Clusters

Occupation clusters provide a similar picture, but through the lens of the skills, abilities and know-how of workers instead of businesses. This perspective is especially valuable in a region that must undergo a major economic renewal due to the dislocation of one its major industries or natural disaster. In a global economy, any region's unique strength starts with its brainpower, the skills, education and experience of its residents. Until recently, economic developers have had very limited tools to understand the brainpower embedded in their region. Occupation cluster analysis provides a powerful, promising new tool for measuring these assets, and it is an important focus of the present research report (see Chapter 3).

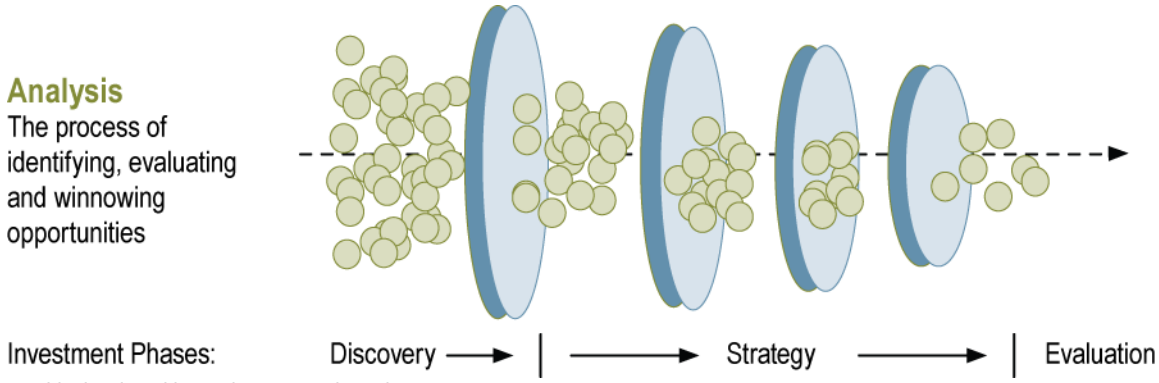
2.3.2.4 Measuring Innovation

Finally, innovation indices provide an overall picture of a region's capacity to innovate and transform its economy. Such information is especially useful in gauging how adept the region may be in exploiting new and emerging industries. Regional innovation indices are another important focus of this report (see Chapter 4).

2.3.2.5 Summary

Regional analysis is essentially a "winnowing" process (see Figure 3). A region has many economic opportunities. Analysis first identifies those opportunities that seem to match up with the region's competitive advantage. It then evaluates the potential impact of these alternatives, the critical information that allows the partnership to winnow the field to those holding the greatest promise.

Figure 3: The Analysis Process



Graphic developed by Drabenstott and Morrison

2.3.3 Coaching

Bringing a region's many public and private actors together to act in a coordinated way presents a challenge. Collaboration and analysis take a practice to master. Within most regions, they are disciplines that are not widely shared. Furthermore, few regions have an established process to forge a unified leadership team with these new habits of collaboration and analysis.

To overcome their inexperience, regions often rely on a third component of a strategic process: coaching. In the end, trust is the ultimate currency of regional action. A neutral leader (a coach) can build new bonds of trust by communicating effectively with all parties—public, private, and nonprofit alike—as the strategy process unfolds. An effective coach is also a good umpire. The coach helps mediate differences and ensures that basic rules of civility guide conversations. Effective coaches are masters of balance: promoting transparency while respecting confidences; seeing the larger patterns while focusing on next steps; accepting ambiguity while insisting on specifics; and respecting process while demanding outcomes.

The coach guides the design of an entirely new regional strategy process, coordinates that process, and connects collaboration to analysis in complementary ways. In Europe, a new metaphor has emerged of "triple helix innovation." This insight captures the process of weaving together the interests of business, government and education to promote innovation. Connecting these interests involves a continuous, dynamic process, and regions often rely on coaches to guide them.

Put another way, the coach must be comfortable with both promoting regional dialogue and conducting (or at least understanding) regional economic analysis. Effective coaches understand the power of conversation to build collaboration and the power of analytics to build understanding. To be effective, the new regional team must be capable of designing a clear strategy and implementing a complex investment action plan. In most regions, this collaboration emerges from a new process of coming together to think and act in the best interests of a newly defined region.

Coaching involves more than facilitation. The process identifies, clarifies and promotes intersections of mutual interest among the parties. The coach enables the parties to see their interests in a new frame and to see larger patterns. The task is tricky because it entails both an analytic mind and an intuitive feel. The coach

represents a new type of civic entrepreneur focused on designing this process and building the habits needed to sustain it (James Irvine Foundation 1998, 2005).[6]

As regions experiment with new forms of collaboration, the role of regional coach is emerging as a clear and distinct role—although such coaches currently seem in short supply in regions across the United States. Consultants, university groups, and public agencies are all working to fill this gap. There is no one right answer to who should be the regional coach, but the role seems critical to success in most regions.

2.3.4 Summary

The regional strategy process represents an intertwined combination of three interconnected processes: collaboration, analysis, and coaching. Today's regional development demands weaving these strands together. It is not enough to forge partners into a vibrant partnership. Without analysis, the partnership will not know which economic opportunities offer the best chance of success with the highest returns. At the same time, it is not enough to conduct analysis without developing the capability among the partners to make complex decisions. If regional leaders do not have the skills to think and act together, no amount of data can overcome this weakness. Any regional analysis will suffer if it does not tap the pooled knowledge of regional actors, and any analysis—no matter how compelling—will only be a three-ring binder without a region-wide collaboration and partnership to implement it.

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[6] For more on the steps needed to build collaboration, see David Straus, *How to Make Collaboration Work* (2002).

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3. Occupation Clusters

3.1 Introduction and Background

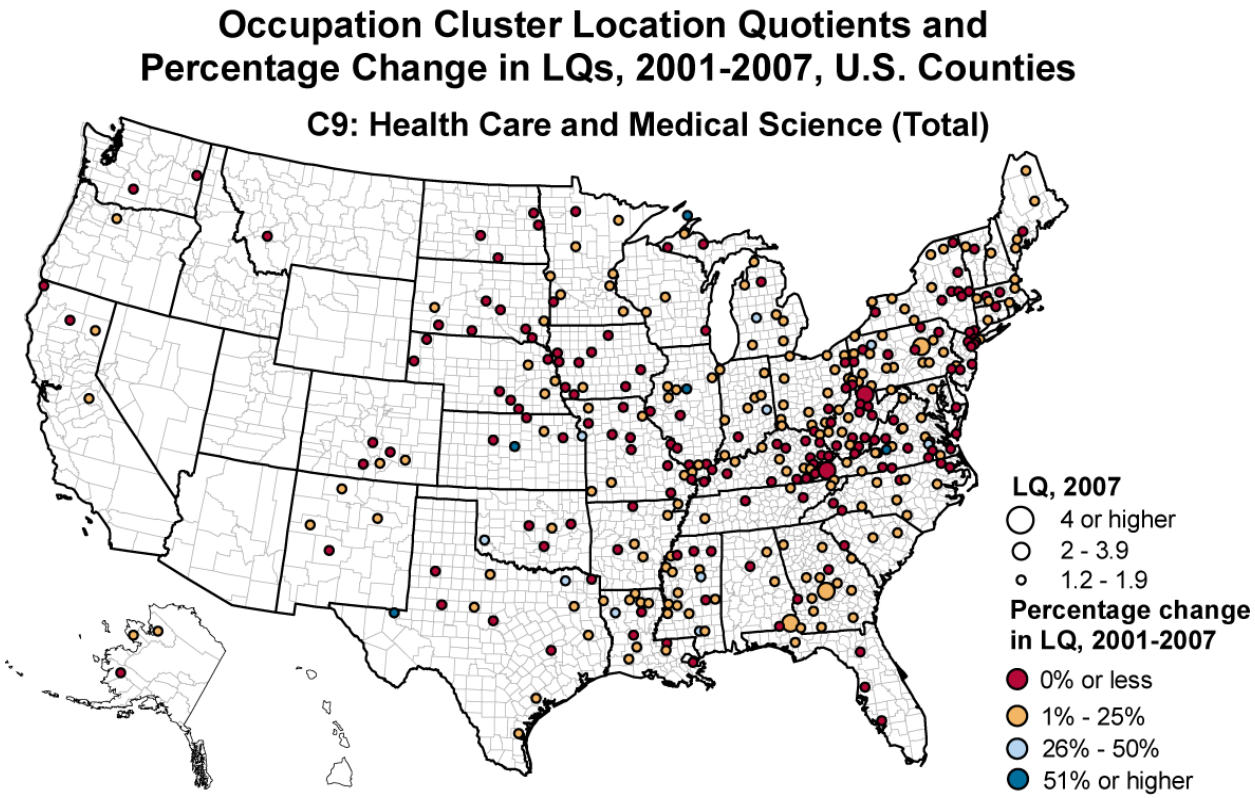
This part of the project focuses on identifying and mapping clusters of occupations for the United States as a whole and for two selected test regions in the state of Indiana, using counties as the basic unit of measurement, with an emphasis on occupations most closely associated with knowledge and innovation. We have built upon the pioneering work of Markusen and Barbour (2003, 2007) and others (for example, Feser and Koo, 2001; Feser 2003) to develop a methodology for determining the following:

- The structure and composition of regional occupation clusters
- The competitive advantage of regions in terms of occupation and knowledge specializations
- The distribution of concentrations of regional occupation clusters that seem likely to enable or encourage the production of innovative behaviors
- The distribution of concentrations of particular occupations within regional industry clusters

Research to date suggests that occupation clusters may be at least as important as industry clusters in driving regional competitive advantage. This research is discussed in Section 3.3 (literature review).

Developing a nationwide mapping of occupation clusters, with county-level data available for every U.S. county and the capability to aggregate counties to a regional level, serves as a powerful complement to an understanding of rural regional industry clusters, which was a major focus of the previous EDA-funded project conducted by partners in this research team. These GIS maps showing occupation cluster employment, cluster specialization (location quotients over 1.2) and changes in degree of specialization, by county, for the entire United States can be found at www.statsamerica.org/innovation/maps.html. An example is shown in Figure 4. The same website also displays similar maps for industry clusters throughout the nation.

Figure 4: Sample U.S. Occupation Cluster Specialization Map



Note: The location quotient compares a county's employment concentration in the occupation cluster to the nation's concentration in that cluster.

Source: Purdue Center for Regional Development

Additionally, a major product of this research effort is a web-based database and analytical framework enabling practitioners to generate occupation clusters and associated skills that will help local and regional stakeholders to

- understand their local workforce and educational situation within the broader regional economic development context,
- use this information in bridging the gap between workforce and economic development when constructing a regional economic development strategy,
- use their local and regional occupation cluster mix to diagnose how well -positioned the region and its communities are to participate effectively in a knowledge-based innovation economy, and
- determine how well occupation and skills cluster strengths align with the region's business and industry cluster strengths (Markusen and Barbour, 2003).

Finally, the team executed a special analysis of a group of technology-based knowledge clusters which are often thought to be closely associated with the production of innovations, and seeking to examine any patterns or regularities in their geographic distribution. These clusters, referred to henceforward as "tech clusters," include the following:

- Information Technology
- Engineering

- Health Care and Medical Science (Medical Practitioners and Scientists)
- Mathematics, Statistics, Data and Accounting
- Natural Sciences and Environmental Management
- Postsecondary Education and Knowledge Creation

This special analysis, which covers U.S. states and counties within four broad geographic regions, as well as an in-depth look at Indiana, where two of the project's test regions are located, can be found in Appendix D. The tech cluster analysis for the two Indiana test regions is incorporated into this report.

Of course, it is obvious that the production of innovations incorporates many other elements or characteristics of regions and places. As noted by Galloway and Robison, in a recent paper partly derived from this research project,

> Several authors have speculated on the mechanism through which innovation leads to economic growth and development (e.g., Florida 2002; Markusen and King 2003; Caves 2000; Scott 2000). The existence of universities and other higher education can certainly play a role in innovation (Goldstein 1995), as can proximity to cultural resources (Markusen et al. 2004). The mix of innovation factors is likely large, and the interplay and synergy among these factors is just beginning to be understood: The policy implications are many (2008:1).

However, in the current study part of the team's mission was to concentrate upon the role of knowledge-based occupation clusters in the production or likely production of innovations, and in fact the sub-team working on the production of the innovation index found a high correlation between the six tech clusters defined here and Florida's "creative class" variable (Florida 2004; 2005). This relationship is discussed further in Chapter 4 (page 77).

To accomplish project tasks, the team used the U.S. Department of Labor's Occupational Employment Statistics (OES) and O*NET data. The team also drew upon the expertise and proprietary databases of team partner Economic Modeling Systems, Inc. (EMSI), partly in order to avoid the spatial analytic limitations of OES and O*NET[7] but also in order to take advantage of EMSI's innovative tools for assessing regional and county-level skills sets, and the level of effort needed to transfer skill sets between occupations. The EMSI toolkit builds upon OES and O*NET providing the capacity to select clusters of knowledge, skill and ability categories and view county level labor market data for corresponding occupations.

3.2 Key Constructs

This study uses four foundational constructs, or concepts, to achieve the analysis:

- Industry clusters
- An index of relative rurality

[7]These databases do not extend to the county level, which is needed in order to analyze rural regions.

- Occupation clusters
- Occupation Cluster/Industry Cluster (OCIC) location quotients

3.2.1 Industry Clusters and the Index of Relative Rurality

The products of this grant build upon and extend previous EDA-supported work on rural regional competitiveness undertaken by the research team. This earlier study constructed 17 industry clusters and an Index of Relative Rurality (IRR). The IRR served as the basis for a typology in which all U.S. counties are classified into seven categories ranging from rural to urban. Various analytic models were used to explore and explain the spatial distribution of the industry clusters in relation to the seven different types of counties. The same approach may be used for occupation clusters. The methodology and process for defining industry clusters and the IRR may be found on the project website: www.statsamerica.org/innovation/.

3.2.2 Occupation Clusters and the OCIC

This study defines 15 knowledge-based clusters of occupations, one of which—health care and medical science—is also shown in the form of three sub-clusters for added accuracy in analysis (see Table 2). The process for forming the 15 occupation clusters was carried out using a statistical process known as Ward's algorithm (Ward's agglomerative hierarchical clustering algorithm) and is further described in Section 3.4.1.

Table 2: Occupation Clusters Defined in this Study

Occupation Cluster Name
Agribusiness and Food Technology
Arts, Entertainment, Publishing and Broadcasting
Building, Landscape and Construction Design
Engineering and Related Sciences
Health Care and Medical Science (Aggregate)
Health Care and Medical Science (Medical Practitioners and Scientists)
Health Care and Medical Science (Medical Technicians)
Health Care and Medical Science (Therapy, Counseling, Nursing and Rehabilitation)
Information Technology
Legal and Financial Services, and Real Estate
Managerial, Sales, Marketing and HR
Mathematics, Statistics, Data and Accounting
Natural Sciences and Environmental Management
Personal Services
Postsecondary Education and Knowledge Creation
Primary/Secondary and Vocational Education, Remediation & Social Services
Public Safety and Domestic Security
Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers

Source: Purdue Center for Regional Development

The OCIC (occupation cluster/industry cluster) concept was developed by the research team as a tool to assist analysts in discovering and explaining the particular configuration of staffing patterns that characterize industry clusters in their own geographic regions, thereby gaining a better understanding of their region's strengths in terms of occupational knowledge and skills embedded in its industries.

The OCIC is a location quotient (LQ)—i.e., a ratio showing the relative concentration compared to the nation—of certain types of occupations, or occupation clusters, within an industry cluster located in a certain *place*. For example, if the OCIC location quotient for managerial occupations within the chemicals and chemical products industry cluster in Region A is 1.8, that means the preponderance of managerial occupations in the chemicals cluster in Region A is 80 percent higher than the national average. Therefore, the region is not actually manufacturing chemical products so much as providing management and back-office functions for other regions that do the producing. Knowing this, the analyst or developer will be able to build upon or transition back-office strengths rather than mistakenly assuming that the occupational strengths are in chemistry.

When using location quotients for analytic purposes, an LQ of 1.2 is usually considered the base point for determining whether an occupation cluster or an industry cluster has a "concentration" in the region. If it does, then the region may have a competitive advantage in that particular industry cluster or occupation cluster. This applies equally to individual industries such as transportation vehicle manufacturing, or smaller groups of occupations such as teachers, or engineers. The analyst or economic developer can then decide whether to try and build upon that competitive advantage and in what ways.

3.3 Literature Review

The importance of studying occupations for regional analysis and planning was recognized decades ago. During the 1980s, W. R. and P.R. Thompson identified occupations as a major element in regional analysis, compared to the more common use of industry-based analysis (Koo 2005). The Thompsons proposed that local economies need to distinguish carefully between what they "make" and what they "do" (Thompson and Thompson 1987, 547), noting that occupation analysis could provide insight into what kinds of work communities or regions were doing (Thompson 1987).

Markusen and Barbour also emphasized that both industries and occupations are important for understanding complex and changing regional economies (Markusen and Barbour 2003), and suggested that economic development strategists look into occupation targeting in addition to industrial targeting. They note that whereas industry targeting includes a wish list of industries that regions want to have, occupation targeting could benefit a wide array of the industries that are built around similar occupations.

In their later work, Barbour and Markusen noted the limitations of publicly available data for occupation analysis and proposed to develop an occupation structure for state and metropolitan areas by using the national industry-by-occupation matrix. A major finding was that certain occupations in high-technology industries were distributed quite differently in some metropolitan areas (Barbour and Markusen 2007), even if the regions shared a similar industry mix. The Occupation Cluster-Industry Cluster (OCIC) construct developed for this study by the research team sheds some light on differences in occupation structure between regions specialized in similar industry clusters and provides some insights into the reasons for the differences.

Feser and Koo extended the occupation structure concept by including knowledge characteristics of the individual occupations and developing knowledge-based occupation clusters (Feser, 2003; Koo, 2005). In his study titled *What Regions Do Rather than Make: A Proposed Set of Knowledge-based Occupation Clusters*, Feser proposes that "knowledge-based occupation clusters can be used to provide descriptive profiles of local labor pools and ultimately as inputs in explanatory models of regional growth and change, particularly those concerned with the expansion of knowledge-intensive, high-technology industries" (Feser 2003, 1941).

Knowledge and skills are two important characteristics that distinguish between different occupations. By linking industries' employment data to their occupation structure and including the knowledge content of those occupations, regions could be studied in terms of knowledge specializations and differences.

Feser and Koo both used Ward's hierarchical agglomerative clustering method to construct the occupation clusters (Feser 2003; Koo 2005). As mentioned previously, the importance of studying both industries and occupations were recognized however, difficulties were encountered in attempting to construct an occupation cluster/industry cluster linkage (Feser, Markusen and Barbour). Again, in this study, the occupation cluster/industry cluster location quotient was created to assist in explaining the particular patterns of occupations in a region's industry clusters (see page 48).

Several researchers have argued the importance of knowledge and innovation in regional economic development. Polenske, for example, asserts that tangible assets (such as infrastructure) as well as intangible assets (such as skills and knowledge) are both important for regional economic development (Polenske 2008, 133). Additionally, there is a growing body of literature available on Regional Innovation Systems (RIS) that talks about social, cultural, institutional, and other broader but important aspects of innovation.

This school of thought also maintains that the "region" is a better scale for innovation-based policies. For example, Cooke mentions that regional-level analysis cannot be ignored in innovation-related studies because doing so will overlook key knowledge generation and critical actors (Cooke 2004). Furthermore, Sharpe et al. say that occupations, particularly in knowledge-based activities, are an important aspect of a regional innovation system (2007).

Several studies have attempted to link innovation, knowledge production, entrepreneurship, and economic development, with the structure of occupations playing an important role in almost every study. In a review of historical and contemporary works on "regional growth and development," Cheshire et al. assert that "systems of innovation" and "knowledge and learning" are two emerging areas of study to explain the dynamics of regional growth and development. They also assert that an important aspect of innovation is entrepreneurship with investments, in addition to research and development (Cheshire et al. 2004).

Finally, in their studies of innovation, particularly in southern metro and non-metro counties, Barkley et al. found that innovation as measured by patent counts tends to cluster over space, particularly the high-innovation clusters were spatially concentrated in metro counties (Barkley, Lee et al. 2006).

Most innovative non-metro areas were counties having major research universities, near federal research centers, and having large employment in the oil industry (ibid. 4). In another study identifying regional innovation systems in the south, Barkley, Nair et al. used industry employment and occupation indicators (such as employment in high technology and information technology industries, and managerial and business services) stating the importance of high technology industry employment and occupations in studying regional innovation and knowledge production (Barkley, Nair, et al. 2006).

In the studies reviewed here, researchers have used different methods for studying occupation clusters and linking them to industries and industry clusters. Almost all the studies reviewed recognized the limitations of available public sources of data. This study employs the EMSI commercial database in an effort to overcome some of these limitations.

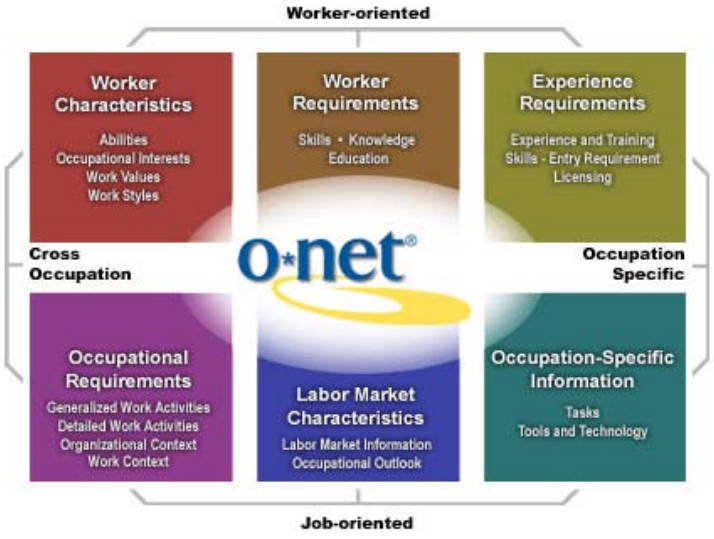
3.4 Data Sets and Methodology

Unlike the industry cluster's focus on value-chain operations (a fairly wide range of different industries and establishments linked through functions that they perform for each other such as buying inputs, providing expertise, etc.), knowledge occupation clusters are formed into groups of similar job functions and knowledge components such as bio-science, or engineering and mathematics.

However, like the industry classifications used for business and industry cluster identification (the North American Industry Classification System or NAICS codes), occupations are also classified and coded into a system: the Standard Occupation Classification System (SOC codes). This system is somewhat similar to the NAICS system. The current version of the SOC codes (2000 Version) contains 821 detailed occupations, which will increase to 840 detailed occupations in 2010 (Federal Register, Vol. 74, No. 12, 1-21-09). The detailed occupations are further classified into 449 broad occupations, 96 minor groups and 23 major groups.

Additionally, SOC occupations are classified into a system called O*Net (Occupational Information Network) which describes the "content" and attributes of each occupation.[8] O*Net classifies and describes occupations according to six major domains (see Figure 5).

Figure 5: The O*Net Content Model



Source: National Center for O*NET Development: www.onetcenter.org/content.html

[8] The Occupation Information Network (O*Net) is developed under the sponsorship of the U.S. Department of Labor/Employment and Training Administration through a grant to the North Carolina Employment Security Commission (www.onetcenter.org/overview.html).

In this study, the research team has taken the O*Net ***Worker Requirements Domain*** (which classifies SOC occupations according to the degrees of skill, knowledge and education needed to fulfill the occupation requirements) and has structured the framework for building occupation clusters based on an additional concept developed by the National O*Net Center: ***Job Zones*** (see Table 3).

A job zone is a group of occupations that are similar in these ways:

- How most people are able to enter the work
- How much overall experience people need to do the work
- How much education people need to do the work
- How much on-the-job training people need to do the work

Table 3: O*Net Job Zone Content

Job Zones	Degree of Preparation	Job Zone Examples
Job Zone 1	Occupations that need little or no preparation: the occupations may require a high school diploma or GED certificate. Some may require a formal training course to obtain a license.	These occupations involve following instructions and helping others. Examples include taxi drivers, amusement and recreation attendants, counter and rental clerks, cashiers, and waiters/waitresses.
Job Zone 2	Occupations that need some preparation: the occupations usually require a high school diploma and may require some vocational training or job-related course work. In some cases, an associate's or bachelor's degree could be needed.	These occupations often involve using your knowledge and skills to help others. Examples include sheet metal workers, forest fire fighters, customer service representatives, pharmacy technicians, salespersons (retail), and tellers.
Job Zone 3	Occupations that need medium preparation: most occupations in this zone require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.	These occupations usually involve using communication and organizational skills to coordinate, supervise, manage, or train others to accomplish goals. Examples include funeral directors, electricians, forest and conservation technicians, legal secretaries, interviewers, and insurance sales agents.
Job Zone 4	Occupations that need considerable preparation: most of these occupations require a four-year bachelor's degree, but some do not.	Many of these occupations involve coordinating, supervising, managing, or training others. Examples include accountants, human resource managers, computer programmers, teachers, chemists, and police detectives.
Job Zone 5	Occupations that need extensive preparation: A bachelor's degree is the minimum formal education required for these occupations. However, many also require graduate school. For example, they may	These occupations often involve coordinating, training, supervising, or managing the activities of others to accomplish goals. Very advanced communication and organizational skills are required. Examples include librarians,

Job Zones	Degree of Preparation	Job Zone Examples
	require a master's degree, and some require a Ph.D., M.D., or J.D. (law degree).	lawyers, aerospace engineers, physicists, school psychologists, and surgeons.

Source: http://online.onetcenter.org/help/online/zones

Within the knowledge domain for O*NET occupational descriptions, there are 33 knowledge variables, as shown in Table 4.[9]

Table 4: O*Net Occupational Knowledge Variables

Administration and management	Psychology
Clerical	Sociology and anthropology
Economics and accounting	Geography
Sales and marketing	Medicine and dentistry
Customer and personal service	Therapy and counseling
Personnel and human resources	Education and training
Production and processing	English language
Food production	Foreign language
Computers and electronics	Fine arts
Engineering and technology	History and archaeology
Design	Philosophy and theology
Building and construction	Public safety and security
Mechanical	Law, government and jurisprudence
Mathematics	Telecommunications
Physics	Communications and media
Chemistry	Transport
Biology	

Source: http://online.onetcenter.org/help/online/zones

Each variable has two measurements, namely: knowledge *level* and knowledge *importance*, which are measured on a scale of 1 to 7 and 0 to 5, respectively. In total, there are 66 knowledge measurements for each occupation (33 each for knowledge level and knowledge importance). The team found that knowledge importance scores were highly correlated with knowledge level scores; consequently, the 33 variables for knowledge importance were dropped from the analysis.

3.4.1 Methodology for Construction of Occupation Clusters

A major goal in this study was to quantifiably identify and categorize occupations into clusters based on O*NET-SOC knowledge classifications and measurements. To achieve this goal, Ward's agglomerative hierarchical clustering algorithm (henceforth, Ward's algorithm) was utilized. Though other hierarchical and K-cluster algorithms were tested, Ward's generated the best results and past research (Feser 2003) has shown

[9] The knowledge variable descriptions can be found in Appendix E.

this to be the case. Ward's algorithm uses error sum of squares to minimize within-cluster variance. A detailed technical description of the clustering process is available in Appendix G.[10]

Occupations categorized as belonging to O*Net Job Zones 3 to 5 require more specialized training, and thus demand for the associated knowledge will vary by regional specialization. Assigning these occupations to clusters with similar knowledge requirements was performed in a two-step procedure.

Using 33 variables describing occupations' knowledge levels, 19 clusters were formed on the basis of a cluster analysis using Ward's algorithm. The knowledge variables refer to the squared knowledge level scores. Squaring the knowledge level scores allowed key knowledge characteristics for each occupation to be highlighted when conducting Ward's algorithm.

The 19-cluster solution served as a baseline and was subsequently fine-tuned by scrutinizing each cluster for consistency. As a result, 90 occupations were re-allocated and some clusters were merged. Moreover, data constraints necessitated the formation of a cluster that pulls together all postsecondary educators, independent of specialization. The final result has been the identification of 15 clusters containing all occupations within O*Net Job Zones 3 to 5.

In addition, the team has provided a breakdown of the health care and medical science occupation cluster into three sub-clusters in order to facilitate greater accuracy in assessing regional strengths in this highly important occupation cluster:

- Medical Practitioners and Scientists
- Medical Technicians
- Therapy, Counseling, Nursing and Rehabilitation

Finally, in the approach used here, all occupations categorized as Job Zone 1 are assigned to one "cluster," and all occupations categorized as Job Zone 2 are assigned to a second "cluster." These clusters can also be measured, and their content can be examined for major groupings of occupations. Major characteristics of these two clusters include low-skill levels, relatively little formal education required, low wages, the likelihood of few benefits and easy transfer between jobs.

3.4.2 Using and Understanding the Occupation Cluster-Industry Cluster (OCIC) LQ Concept

The purpose of creating and using occupation clusters as well as industry clusters is to develop an additional dimension for analyzing and describing a regional economy.

In sum, what regional practitioners obtain through the OCIC calculation[11] is an aggregated version of Industry Staffing Patterns, reported as occupation cluster concentrations *within a given industry cluster* for *a*

[10] This methodology is quite different from the methods commonly used to identify and categorize industry clusters. Identification of industry clusters involves the establishment of value-chain connections between industries and businesses (that is, businesses that buy and sell things to each other that they need in order to process and produce products—machine shops that sell to auto makers are a good example), as well as supporting organizations such as local government and other service providers.

[11] The formula for the OCIC calculation is given as:

particular location. "Staffing Patterns are a list of the occupations employed within a particular industry, or a list of the industries that employ a particular occupation. Job seekers or training providers may use these lists to contact appropriate employers for job openings. And employers or economic developers may use these lists to determine the kinds of jobs they need in a particular company or business" (Employment Development Department 2009).

Industry cluster LQs describe the concentration of the defined cluster industries in a given region. Likewise, occupation cluster LQs describe concentrations of the defined occupation clusters in a given region. What if a practitioner wanted to know which groups of occupations in the occupation clusters were most highly concentrated in the region's industry clusters? In order to do this, three dimensions must be evaluated, namely: occupation cluster concentration, industry clusters, and location (i.e., by counties contained in the region). A fourth dimension could be added by considering change in the levels of concentration over time.

For example, consider a scenario where industries are allocating their production processes in different locations in order to benefit from cost and market advantages in various regions.

In this scenario, an establishment with *one* NAICS code may have an R&D facility in Southern California, a manufacturing facility in Iowa and its business headquarters in Virginia. Meanwhile, they are reporting their business functions and employment numbers under the same NAICS code. This is a problem, because the data reported by county for this NAICS code does not tell the analyst what is the main function of that industry in his/her county.

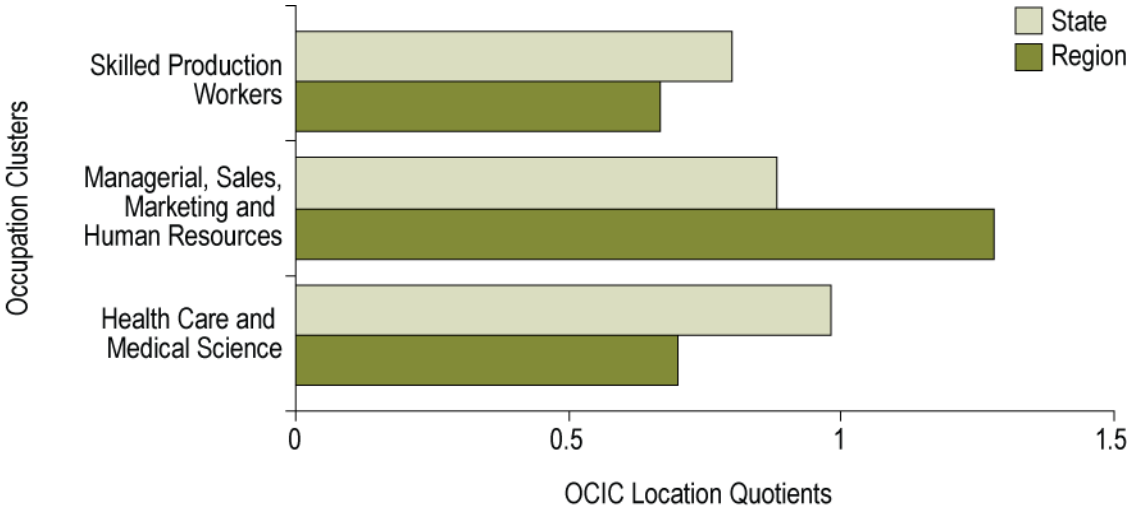
Using OCIC LQs will allow practitioners to identify not only their labor market strengths, but also identify which industries are using those strengths and how (i.e., production, R&D, business support, etc.). This will also allow practitioners to further understand the dynamics of their labor region and further leverage these industry specific occupation strengths for future development.

One way to analyze regional differences in industry-occupation structure would be to compare the structure to state levels. Figure 6 shows such a comparison.

$$\frac{OC_{iR}IC_{jR} \Big/ \sum_{i=1}^{n} OC_{iR}IC_{jR}}{OC_{iN}IC_{jN} \Big/ \sum_{i=1}^{n} OC_{iN}IC_{jN}}$$

The formula reads as follows: Occupation cluster employment for the ith occupation cluster in the jth industry cluster for region R, divided by the sum of all occupational employment in the jth industry cluster in region R. The value is divided by the occupation cluster employment for the ith occupation cluster in the jth industry cluster for the nation N, divided by the sum of employment for the jth industry cluster in the nation N.

Figure 6: Sample OCIC Cluster Analysis of a Biomedical/Biotechnical Industry Cluster



Source: PCRD

In this example, the ***regional*** occupation concentration in a biomedical/biotechnical industry cluster is focused more around management, sales, marketing and human resources. This region has a high concentration of business services or management focused in the biomedical industry when compared to the state-level concentration of occupations in the same industry cluster.

3.5 Analysis of Indiana Pilot Regions

Regional action and planning are concepts that are emerging in the state of Indiana. However, even though there are many regional entities in the state, such as regional planning councils, metropolitan planning organizations (MPOs), and state-designated economic growth regions (EGRs), quite often the actions taken are more based on a loosely grouped set of individual counties rather than an entire region without regard to boundaries. In part, this is due to local desire for independence and "home rule," but also due to a lack of legislation and tools that would enable certain types of resources and rules to be shared across a multi-jurisdiction area. This applies particularly to economic development efforts.

In 2007, the Indiana part of this research team completed a study of regional industry clusters, funded by the EDA, using Indiana Economic Growth Region 8 as a pilot region. The current research project seeks to complement the previous project, adding occupation cluster and innovation tools to the industry clusters toolbox, and the team selected two different Indiana economic growth regions (Regions 6 and 11) for detailed analysis and interaction with local stakeholders (see Figure 7 for an overview of the geography).

Figure 7: Indiana's Economic Growth Regions

Source: Indiana Business Research Center

Indiana's EGR 6 was selected largely for reasons of its extreme need for development assistance related to continued population, manufacturing, and retail loss since at least the 1970s. At least two economic development groups have been at work in parts of the region.

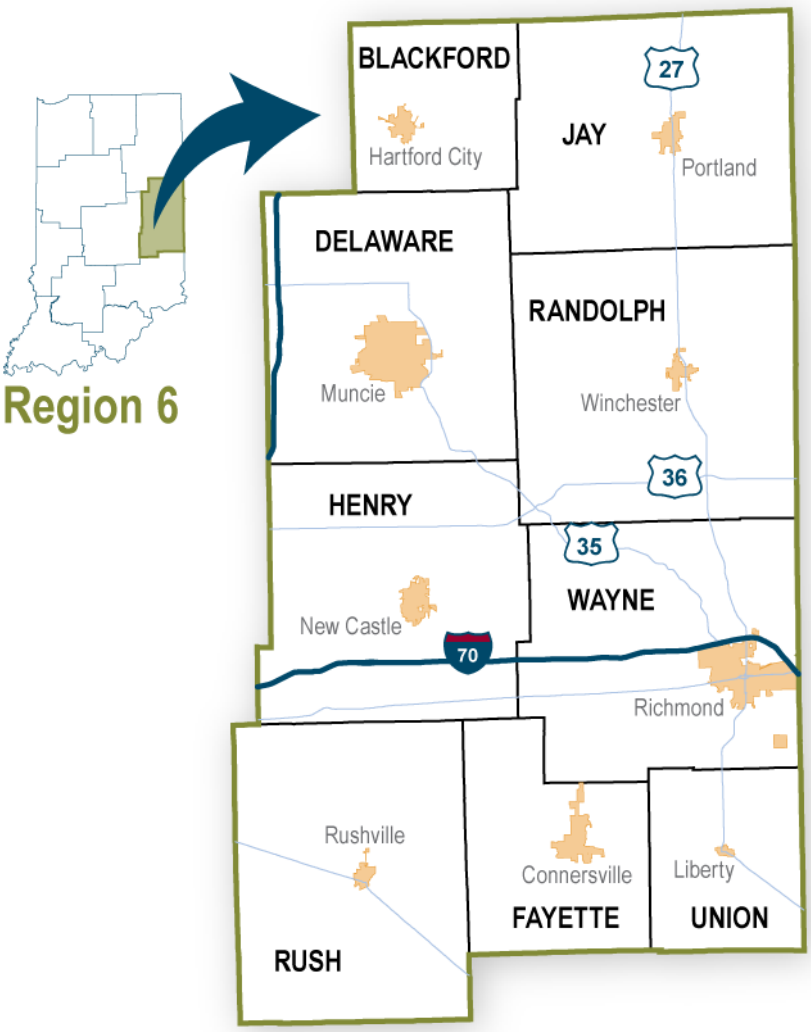
Indiana's EGR 11 was selected due to its status as a second-generation U.S. Department of Labor WIRED grantee, experiencing ongoing structural changes in important parts of its regional economy such as chemicals manufacturing and wood products, and the presence of a nascent regional planning and development group in the area.

3.5.1 Indiana Economic Growth Region 6

Economic Growth Region 6 was selected for study due to its declining economic situation and the fact that it has been losing population (albeit slowly) for some time now. Additionally, the area is served by an expanding economic development district, covering six of the nine counties in the region (the Eastern Indiana Economic Development District, in part supported by the EDA) and has another, broader, group of stakeholders actively trying to promote economic development in the region. The challenge for the research team was to try to discover what strengths in terms of knowledge and skills reside in EGR 6's occupation clusters—and how they might be used to bolster existing or emerging industry clusters.

Located in east-central Indiana with four counties sharing a border with Ohio, EGR 6 consists of nine mostly rural counties with 340,392 residents in 2007, making up 5.4 percent of the state's population (see Figure 8). Muncie, in Delaware County, is the region's largest city—home to 19.2 percent of the total regional population and to Ball State University.

Figure 8: Cities and Counties of Economic Growth Region 6



Source: Indiana Business Research Center

EGR 6 is the only economic growth region in Indiana that lost population from 1990 to 2008. The region experienced a 4.2 percent decline in total population from 1990 to 2008, while the state of Indiana experienced a 15 percent increase during the period.

EGR 6 has one of the higher unemployment rates in the state and has suffered significant losses in manufacturing as well as transportation and logistics businesses and wood products. EGR 6's emerging industry clusters include agribusiness, food processing and technology; information technology and telecommunications; and business and financial services. The region's three most specialized industry clusters are glass and ceramics, manufacturing, and forest and wood products. The concentration in glass and ceramics is a legacy of the Ball Brothers Glass Manufacturing Company, who manufactured Mason canning

jars and other glass products in Muncie from 1888 to the mid 1960s[12] and eventually gave their name to Ball State University.

In past years, the major strengths of EGR 6 have been in the areas of transportation and logistics, transportation machinery production and health care, with some counties having pockets of strength in agricultural production.

Between 2001 and 2007, EGR 6 lost just over 4,600 jobs (occupations), for a total of 177,863 jobs in 2007 (see Table 5). Most of these job losses occurred in Job Zone 2 (manufacturing and trucking occupations provided the biggest losses) and in the skilled production workers occupation cluster.

Table 5: Occupation Cluster, Percent Share, Location Quotients and Percent Change in LQs, 2001-2007, EGR 6

Occupation Cluster	2007 Cluster Jobs	Change in Cluster Jobs, 2001-2007	Percent Change in Cluster Jobs, 2001-2007	2007 Percent of Total Regional Occupations	2007 Cluster LQ	Percent Change in LQ, 2001-2007
Total Regional Jobs	177,863	-4,603	-2.5%	100.0%	1.00	0.0%
Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers	15,733	-1,204	-7.1%	8.8%	1.16	-4.9%
Health Care and Medical Science (Aggregate)	10,517	703	7.2%	5.9%	1.11	4.7%
Health Care and Medical Science (Medical Practitioners and Scientists)	2,063	99	5.0%	1.2%	0.96	4.3%
Health Care and Medical Science (Medical Technicians)	2,305	254	12.4%	1.3%	1.22	8.0%
Health Care and Medical Science (Therapy, Counseling, Nursing and Rehabilitation)	6,149	350	6.0%	3.5%	1.14	3.6%
Legal and Financial Services, and Real Estate	10,517	491	4.9%	5.9%	0.73	2.8%
Managerial, Sales, Marketing and HR	10,175	97	1.0%	5.7%	0.67	1.5%
Primary/Secondary and Vocational Education, Remediation & Social Services	8,500	558	7.0%	4.8%	0.93	8.1%

[12] See www.indianahistory.org/hbr/business_pdf/ball_corp.pdf.

Occupation Cluster	2007 Cluster Jobs	Change in Cluster Jobs, 2001-2007	Percent Change in Cluster Jobs, 2001-2007	2007 Percent of Total Regional Occupations	2007 Cluster LQ	Percent Change in LQ, 2001-2007
Agribusiness and Food Technology	6,153	-250	-3.9%	3.5%	**2.30**	5.5%
Personal Services	3,402	-192	-5.3%	1.9%	0.98	-7.5%
Postsecondary Education and Knowledge Creation	2,927	129	4.6%	1.6%	**1.33**	0.0%
Arts, Entertainment, Publishing and Broadcasting	2,545	141	5.9%	1.4%	0.72	7.5%
Mathematics, Statistics, Data and Accounting	2,234	-17	-0.8%	1.3%	0.53	3.9%
Public Safety and Domestic Security	1,900	95	5.3%	1.1%	0.94	6.8%
Information Technology	1,418	92	6.9%	0.8%	0.41	17.1%
Engineering and Related Sciences	1,031	-141	-12.0%	0.6%	0.57	-1.7%
Building, Landscape and Construction Design	474	-39	-7.6%	0.3%	0.53	-5.4%
Natural Sciences and Environmental Management	361	-8	-2.2%	0.2%	0.46	0.0%
Job Zone 1	29,052	-233	-0.8%	16.3%	1.09	3.8%
Job Zone 2	68,838	-5,524	-7.4%	38.7%	1.11	-3.5%
Subtotals, Job Zones 1 and 2	97,890	-5,757	-5.6%	55.0%	1.12	-0.9%

Note: Bold numbers indicate an LQ greater than or equal to 1.2.

Source: PCRD, using data from the EMSI Complete Employment 2008 Spring Release v. 2

The region's economy includes the two low skilled O*Net categories Job Zone 1 and Job Zone 2. Fifty-five percent of all occupations (jobs) in EGR 6 are found in Job Zones 1 and 2, whereas the six tech knowledge clusters[13] cover only about 5.7 percent of total jobs in EGR 6. For comparison, within Indiana as a whole, Job Zones 1 and 2 encompass 54.1 percent of total jobs, while the knowledge clusters account for 6.6 percent of all jobs. Between 2001 and 2007 seven occupation clusters in EGR 6 lost jobs, excluding Job Zones 1 and 2.

In EGR 6, four occupation clusters each contain 5 percent or more of total regional jobs:

- Skilled production workers
- Health care and medical science

[13] The six technology-based knowledge clusters are information technology; engineering; health care and medical science practitioners and scientists; mathematics, statistics, data and accounting; natural sciences and environmental management; and postsecondary education and knowledge creation.

- Legal and financial services and real estate
- Managerial, sales, marketing and HR

The primary/secondary/vocational education and social services cluster is approaching 5 percent.

In EGR6, four clusters have an LQ of 1.2 or more compared to the nation:

- Skilled production workers
- Agribusiness and food technology
- Postsecondary education and knowledge creation
- Medical technicians (a sub-cluster of the health care and medical science cluster)

Skilled production workers had the highest LQ (2.3) in 2007, although the information technology cluster, while not yet specialized in the region, had the highest percent growth rate in LQ (17.1 percent) between 2001 and 2007. The LQs decreased for skilled production workers; personal services; engineering; building, landscape, and construction design; and Job Zone 2 clusters from 2001 to 2007. Occupation clusters that are not yet specialized, but are increasing in specialization ("emerging clusters") include the following:

- Health care and medical science (total cluster and sub-clusters)
- Legal and financial services and real estate
- Managerial, sales, marketing and HR
- Primary/secondary and vocational education, remediation and social services
- Arts, entertainment, publishing and broadcasting
- Mathematics, statistics, data and accounting (lost jobs, however)
- Public safety and domestic security
- Information technology

3.5.1.1 EGR 6 Occupation Cluster Overview

1) **Managerial, Sales, Marketing and HR:** This cluster contained 10,175 (5.7 percent) of all jobs in EGR 6 and had an overall LQ of 0.7 in 2007. The LQ increased from 2001 to 2007. The cluster gained 97 jobs between 2001 and 2007. Major occupations that have 10 percent or more of the total jobs in the cluster are g*eneral and operations managers; first-line supervisors/managers of office and administrative support workers; sales representatives, wholesale and manufacturing, except technical and scientific products;* and *chief executives*. All the major occupations have an LQ of less than one in 2007. The occupation with the highest LQ (2.25) is *postmasters and mail superintendents*—however, this occupation provided only 54 jobs in 2007.

2) **Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers:** This cluster contains 9 percent (15,733 jobs) of total jobs in EGR 6 with an overall LQ of 1.2 in 2007. The cluster lost 1,204 jobs between 2001 and 2007 and the LQ declined. The biggest occupation categories in this cluster (10 percent or more of the total cluster jobs) are *maintenance and repair workers* and *carpenters*. Within the two major occupations only *maintenance and repair workers* had an LQ of 1.2 in 2007. Of all the 58 occupations in the cluster, 23 occupations are specialized with an LQ of 1.2 or more in 2007. The occupation category with the highest LQ is *tool and die makers* with an LQ of 5.19 (523 jobs).

3) **Health Care and Medical Science (Aggregate):** This cluster contains 6 percent (10,517 jobs) of all jobs in EGR 6, with an overall LQ of 1.1 in 2007. The location quotient is increasing and the cluster gained 703 jobs between 2001 and 2007. The two major occupations that have 10 percent or more of the total cluster jobs are *registered nurses and licensed practical nurses* and *licensed vocational nurses*.

Of the 56 occupations in the cluster, 18 occupations are specialized with an LQ of 1.2 or more in 2007. The occupation with the highest LQ—2.12 (129 jobs)—is *psychiatric technicians*. The health care and medical science cluster has been divided into three sub-clusters according to knowledge similarities and requirements of the occupations within them:

- Medical practitioners and scientists (2,063 jobs)
- Medical technicians (2,305 jobs)
- Therapy, counseling nursing and rehabilitation (6,149 jobs)

4) **Mathematics, Statistics, Data and Accounting:** This cluster contains 1.3 percent (2,234 jobs) of all jobs in EGR 6, with an overall LQ of 0.5 in 2007. The cluster declined slightly, losing 17 jobs between 2001 and 2007, while the LQ increased meaning that the cluster declined more at the national level than in EGR 6. Two major occupations that have 10 percent or more of the total cluster jobs are *accountants and auditors* and *financial managers*. Both the occupations have an LQ of less than one in 2007. Of the 17 occupations in the cluster, only one occupation, *statistical assistants*, is specialized with an LQ of 1.4 in 2007.

5) **Legal and Financial Services, and Real Estate:** This cluster contains 6 percent (10,517 jobs) of total jobs in EGR 6, with an overall and increasing LQ of 0.7 in 2007. This is a growing cluster of occupations that gained 491 jobs between 2001 and 2007. Major occupations having 10 percent or more of the total cluster jobs are *bookkeeping, accounting, and auditing clerks*; *executive secretaries and administrative assistants*; and *real estate brokers*. None of these occupations had an LQ over 1.2 in 2007. Of the 40 occupations in the cluster, only four are specialized with an LQ of 1.2 or more in 2007. The occupation with the highest LQ—2.6—is *library assistants, clerical*. This is possibly due to the presence of Ball State University in the region.

6) **Information Technology:** This cluster comprises only 1 percent (1,418 jobs) of total jobs in EGR 6, with an overall LQ of 0.4 in 2007—however, the cluster gained 92 jobs between 2001 and 2007 and the LQ grew by 17.1 percent, which is the fastest growth rate of all occupation clusters in the region. Major occupations having 10 percent or more of the total jobs in this cluster are *computer support specialists*; *computer systems analysts*; *network and computer systems administrators*; and *telecommunications equipment installers and repairers, except line installers*. However, none of the occupations in this cluster is specialized (LQ 1.2 or more); in fact, the occupation category *audio-visual collections specialist* has the highest LQ (0.8) in the entire group—again, possibly due to the presence of Ball State University in the region.

7) **Natural Sciences and Environmental Management:** This cluster of occupations is very small in EGR 6, containing 0.2 percent (361 jobs) of total jobs with an overall LQ of only 0.5 in 2007. The cluster lost eight jobs between 2001 and 2007; however, there was no change in the LQ. Major occupations having 10 percent or more of the total cluster jobs are *surveying and mapping technicians*; *compliance officers, except agriculture, construction, health and safety, and transportation*; and *natural sciences managers*. Of the 21 occupations in this cluster, only two occupations are specialized with an LQ of 1.2 or more, with *forest fire inspectors and prevention specialists* having the highest LQ of 1.5 (but only three jobs) in 2007.

8) **Agribusiness and Food Technology:** This cluster contains about 3.5 percent (6,153 jobs) of total jobs in EGR 6 with an overall LQ of 2.3 in 2007. The cluster lost 250 jobs between 2001 and 2007; however, the LQ increased. In this cluster, *farmers and ranchers* make up 75 percent (4,594 jobs) of the total cluster jobs. The other major occupation with 10 percent or more of the total cluster jobs is *farm, ranch, and other agricultural managers*. Of the 15 occupations, seven occupations are specialized with an LQ of 1.2 or more with *farmers and ranchers* having the highest LQ of 2.7 in 2007.

9) **Primary/Secondary and Vocational Education, Remediation and Social Services:** This cluster contains just under 5 percent of total jobs in EGR 6 with an overall LQ of 0.9 in 2007. The LQ is increasing and the cluster gained 558 jobs between 2001 and 2007. Major occupations having 10

percent or more jobs in the cluster are *teacher assistants*; *elementary school teachers, except special education*; and *secondary school teachers, except special and vocational education*. Of the 29 occupations, eight occupations are specialized with an LQ of 1.2 or more. The occupation with the highest LQ is *coaches and scouts* with an LQ of 1.6 (308 jobs) in 2007.

10) **Building, Landscape and Construction Design:** This cluster comprises only 0.3 percent (474 jobs) of total jobs in EGR 6 with an overall LQ of 0.5 in 2007. The cluster lost 39 jobs between 2001 and 2007. Major occupations having 10 percent or more jobs in the cluster are *surveying and mapping technicians; mechanical drafters; architects, except landscape and naval; construction and building inspectors*; and *architectural and civil drafters*. Of the 12 occupations, only two occupations are specialized with an LQ of 1.2 or more, with *model makers, wood* having an LQ of 1.4 (10 jobs) in 2007.

11) **Engineering and Related Sciences:** This cluster (one of the six tech clusters) contains 0.6 percent (1,031 jobs) of total jobs in EGR 6 in 2007. The cluster lost 141 jobs between 2001 and 2007 and the LQ decreased by almost 2 percent. Major occupations with 10 percent or more of the total cluster jobs are *industrial engineers*; *engineering managers*; and *industrial engineering technicians*. Of the 28 occupations, only three are specialized with an LQ of 1.2 or more. *Industrial engineering technicians* has the highest LQ of 1.5 (115 jobs) in 2007.

12) **Personal Services:** This cluster comprises about 2 percent (3,402 jobs) of total jobs in EGR 6 in 2007. The cluster lost 192 jobs between 2001 and 2007 and the LQ decreased by 7.5 percent—the largest decline in all the EGR 6 occupation clusters. Two major occupations having 10 percent or more of the total cluster jobs are *child care workers* and *hairdressers, hairstylists, and cosmetologists*. In fact, these two occupations together cover 69 percent of the total cluster jobs. There is only one specialized occupation, *massage therapists*, with an LQ of 1.2 (119 jobs) in 2007.

13) **Arts, Entertainment, Publishing and Broadcasting:** This cluster contains 1.4 percent (2,545 jobs) of total jobs in EGR 6 in 2007. The cluster gained 141 jobs between 2001 and 2007 and the LQ increased by 7.5 percent. Major occupations having 10 percent or more of the total cluster jobs are *photographers* and *writers and authors*. Of the 35 occupations, only three are specialized with an LQ of 1.2 or more with *choreographers* having the highest LQ of 1.8 (44 jobs) in 2007.

14) **Public Safety and Domestic Security:** This cluster contains 1.1 percent (1,900 jobs) of total jobs in EGR 6 in 2007 and is growing. The cluster gained 95 jobs between 2001 and 2007 and the LQ increased. Major occupations having 10 percent or more of the total cluster jobs are *police and sheriff's patrol officers*; *correctional officers and jailers*; and *fire fighters;* however, the first two occupations account for 67 percent of the total cluster jobs. Of the 22 occupations, only two are specialized with an LQ of 1.2 or more. *Correctional officers and jailers* has the highest LQ of 1.3 (567 jobs) in 2007.

15) **Postsecondary Education and Knowledge Creation:** This "tech" cluster is specialized in the region with an LQ of 1.3 in 2007. The LQ remained unchanged between 2001 and 2007. The cluster contains 1.7 percent (2,927 jobs) of total jobs in EGR 6 in 2007 and gained 129 jobs between 2001 and 2007—an average of about 18 jobs a year. This cluster is mostly comprised of *postsecondary teachers* covering 82 percent of the total cluster jobs. *Postsecondary teachers* and *librarians* are two specialized occupations with an LQ of 1.2 or more, and it is highly likely that the cluster's largest employer is Ball State University.

16) **Job Zone 2:** This cluster comprises 41 percent (68,838 jobs) of total jobs in EGR 6 in 2007; however, between 2001 and 2007 the cluster lost 5,524 jobs with the biggest losers being *truck drivers (heavy and tractor-trailer)* and *team assemblers*. *Retail salespersons* and *team assemblers* are the two major occupations, although both the occupations have less than 10 percent of the total cluster jobs. Of the 247 occupations in the cluster, 79 occupations are specialized with an LQ of 1.2 or more. The

occupation with the highest LQ (5.7, 389 jobs) is *lathe and turning machine tool setters, operators, and tenders, metal and plastic.*

17) **Job Zone 1:** This cluster contains16 percent (29,052 jobs) of total jobs in EGR 6 in 2007, but between 2001 and 2007, the cluster lost 233 jobs. Two major occupations having 10 percent or more of total cluster jobs are *cashiers, except gaming* and *combined food preparation and serving workers*, including fast food. Of the 51 occupations in the cluster only 13 are specialized with an LQ of 1.2 or more. The occupation with the highest LQ (3.8), but only 175 jobs, is *grinding and polishing workers, hand.*

The research team also performed an analysis of the OCIC concentrations of the six tech clusters in the regional industry clusters (see Table 6).

Although the EGR 6 economy as a whole specializes in only one of the tech occupation clusters *(postsecondary education and knowledge creation*, with an LQ of 1.3 in 2007), several important industry clusters show a strong specialization in some of the tech clusters' occupations.

Of the 10 industry clusters and sub-clusters that are specialized in EGR 6 (LQ>1.2) the primary metal industry sub-cluster specializes intensely in four of the six tech groups (IT; engineering and related sciences; mathematics, statistics, data and accounting; natural sciences and environmental management; and postsecondary education and knowledge creation. The transportation equipment industry sub-cluster specializes in engineering and postsecondary education occupations and the biomed/biotech cluster has a concentration of health care and medical sciences occupations, not surprisingly.

The machinery manufacturing industry sub-cluster specializes in the engineering, mathematics and postsecondary education occupation clusters, while the fabricated metal product industry cluster specializes in engineering, and natural sciences and environmental management occupations.

Finally, the forest and wood products industry cluster in EGR 6 has a concentration of engineering and related sciences occupations, while the legacy glass and ceramics industry cluster maintains specializations in IT, mathematics, data, statistics and accounting; and a very high concentration in engineering and related sciences.

Only one of the industry clusters that have an LQ less than 1.2 in the EGR 6 economy has a specialization in tech occupation clusters—the apparel and textiles industry cluster. However, this is a very small industry cluster.

Table 6: EGR 6 Tech Occupation Cluster OCIC Analysis, 2007

Industry Cluster Names	IT	ENG	MED	MATH	SCI	ED
Industry Cluster with LQ >1.2						
Primary Metal Manufacturing Sub-Cluster	2.28	4.18	0.27	3.21	0.27	5.17
Transportation Equipment Manufacturing Sub-Cluster	0.26	1.51	0.15	1.08	1.13	2.11
Biomedical/Biotechnical (Life Sciences)	0.30	0.09	1.16	0.60	0.16	0.21
Machinery Manufacturing Sub-Cluster	0.90	2.05	0.30	1.24	0.70	2.00
Manufacturing Supercluster	0.27	0.95	0.10	0.82	0.68	0.77
Glass & Ceramics	2.72	4.32	0.00	1.94	0.00	1.07
Fabricated Metal Product Manufacturing Sub-Cluster	0.91	1.64	0.21	1.11	1.88	0.72

Industry Cluster Names	IT	ENG	MED	MATH	SCI	ED
Advanced Materials	0.10	0.41	0.01	0.44	0.17	0.18
Chemicals & Chemical Based Products	0.34	0.62	0.01	0.52	0.17	0.14
Forest & Wood Products	1.11	**1.49**	0.00	1.15	0.36	0.89
Industry Cluster with LQ <1.2						
Agribusiness, Food Processing & Technology	0.77	0.52	0.08	1.01	0.52	0.32
Mining	0.13	0.32	0.12	0.38	0.50	0.00
Transportation & Logistics	0.39	0.39	0.22	0.45	0.27	1.54
Printing & Publishing	0.33	0.40	0.13	0.29	0.11	0.47
Computer & Electronic Product Manufacturing Sub-Cluster	0.19	0.17	0.04	0.25	0.09	0.08
Education & Knowledge Creation	0.56	0.56	0.55	0.44	0.53	0.71
Energy (Fossil & Renewable)	0.22	0.19	0.05	0.17	0.33	0.21
Apparel & Textiles	0.39	0.46	0.38	0.43	**3.47**	1.02
Arts, Entertainment, Recreation & Visitor Industries	0.26	0.52	0.46	0.17	0.67	0.73
Business & Financial Services	0.33	0.30	0.19	0.43	0.39	0.89
Electrical Equipment, Appliance & Component Manufacturing Sub-Cluster	0.25	0.58	0.00	0.53	0.00	0.01
Defense & Security	0.41	0.14	0.03	0.45	0.08	0.39
Information Technology & Telecommunications	0.33	0.22	0.04	0.37	0.10	0.34

Note: Bold numbers indicate an LQ greater than or equal to 1.2
Source: EMSI Complete Employment 2008 Spring Release v. 2

3.5.2 Indiana Economic Growth Region 11

A U.S. Department of Labor WIRED region located in the southwest corner of Indiana, Economic Growth Region 11 (EGR 11) includes some urban (the city of Evansville) but mostly rural populations among its nine counties (see Figure 9). The region's population of 422,245 (2008) ranks in the middle of the state's 11 EGRs, but it has grown by only 7 percent since 1990, half as fast as Indiana's slow-growing state average (15 percent). Highly dependent on the manufacturing sector, the region has pockets of high growth around a Toyota assembly plant and its suppliers, but it has lost some significant high-wage employers. EGR 11's emerging industry clusters include defense and security, information technology and telecommunications, and apparel and textiles (which is a small cluster, tightly associated with the forest and wood products cluster, one of the more specialized clusters in the region).

Figure 9: Cities and Counties of Economic Growth Region 11

Source: Indiana Business Research Center

Total jobs in EGR 11 increased slightly by 7,906 (3.1 percent) to 264,857 from 2001 to 2007, just below the 3.2 percent job growth rate for Indiana during the same period. In this region, Job Zones 1 and 2 cover 57 percent of total jobs, whereas the six tech clusters cover about 5.6 percent which is about the same as in EGR 6. Between 2001 and 2007, three occupation clusters lost jobs, with agribusiness and food technology having the greatest loss (143 jobs). Four occupation clusters contain 5 percent or more of total jobs in EGR 11:

- Skilled production workers
- Health care and medical science
- Legal and financial services and real estate
- Managerial, sales, marketing and HR

There are two specialized clusters that have an LQ of 1.2 or more: *skilled production workers* and *agribusiness and food technology* (see Table 7). *Skilled production workers* had the highest LQ (1.38) in 2007, and the *building, landscape, and construction design* cluster, although not specialized, had the highest percent growth in LQ (7.5

percent) between 2001 and 2007. The location quotients decreased for *legal and financial services, and real estate; personal services; managerial, sales, marketing and HR; postsecondary education and knowledge creation*; and *Job Zone 2* from 2001 to 2007. Occupation clusters that are not yet specialized, but are increasing in specialization ("emerging clusters") include the following:

- Health care and medical science (and its three sub-clusters)
- Arts, entertainment, publishing and broadcasting
- Engineering and related sciences
- Information technology
- Public safety and domestic security
- Building, landscape and construction design
- Natural sciences and environmental management

Table 7: Occupation Clusters, Percent Share, Location Quotients and Percent Change in LQs, 2001-2007, EGR 11

Occupation Cluster	2007 Cluster Jobs	Change in Cluster Jobs, 2001-2007	Percent Change in Cluster Jobs, 2001-2007	2007 Percent of Total Regional Occupations	2007 Cluster LQ	Percent Change in LQ, 2001-2007
Total Regional Jobs	264,857	7,906	3.1%	100.0%	1.00	0.0%
Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers	27,837	1,230	4.6%	10.5%	1.38	1.5%
Legal and Financial Services, and Real Estate	16,806	326	2.0%	6.4%	0.78	-6.0%
Managerial, Sales, Marketing and HR	16,291	538	3.4%	6.2%	0.72	-1.4%
Health Care and Medical Science (Aggregate)	14,604	1,856	14.6%	5.5%	1.04	6.1%
Health Care and Medical Science (Medical Practitioners and Scientists)	2,854	212	8.0%	1.1%	0.89	2.3%
Health Care and Medical Science (Medical Technicians)	3,205	409	14.6%	1.2%	1.14	4.6%
Health Care and Medical Science (Therapy, Counseling, Nursing and Rehabilitation)	8,546	1,235	16.9%	3.2%	1.06	7.1%
Primary/Secondary and Vocational Education, Remediation & Social Services	11,375	442	4.0%	4.3%	0.84	0.0%

Occupation Cluster	2007 Cluster Jobs	Change in Cluster Jobs, 2001-2007	Percent Change in Cluster Jobs, 2001-2007	2007 Percent of Total Regional Occupations	2007 Cluster LQ	Percent Change in LQ, 2001-2007
Agribusiness and Food Technology	5,335	-143	-2.6%	2.0%	**1.34**	1.5%
Personal Services	4,378	7	0.2%	1.7%	0.84	-8.7%
Mathematics, Statistics, Data and Accounting	4,000	-16	-0.4%	1.5%	0.64	0.0%
Arts, Entertainment, Publishing and Broadcasting	3,348	253	8.2%	1.3%	0.63	3.3%
Engineering and Related Sciences	2,592	-122	-4.5%	1.0%	0.96	1.1%
Information Technology	2,497	34	1.4%	0.9%	0.48	2.1%
Postsecondary Education and Knowledge Creation	2,090	124	6.3%	0.8%	0.64	-3.0%
Public Safety and Domestic Security	2,069	125	6.4%	0.8%	0.69	3.0%
Building, Landscape and Construction Design	960	94	10.9%	0.4%	0.72	7.5%
Natural Sciences and Environmental Management	917	44	5.0%	0.4%	0.78	1.3%
Job Zone 1	43,192	394	0.9%	16.3%	1.08	-0.9%
Job Zone 2	104,590	1,143	1.1%	39.5%	1.14	0.0%
Subtotals, Job Zones 1 and 2	147,782	1,537	1.1%	55.8%	1.11	-1.8%

Note: Bold numbers indicate an LQ greater than or equal to 1.2.

Source: PCRD, using data from the EMSI Complete Employment 2008 Spring Release v. 2

3.5.2.1 EGR 11 Occupation Cluster Overview

1) **Managerial, Sales, Marketing and HR**: This cluster contains 6.2 percent (16,291 jobs) of total jobs in EGR 11 with an overall LQ of 0.7 in 2007. The cluster grew by 538 jobs between 2001 and 2007; however, the LQ decreased meaning that the cluster grew at a faster pace nationally than in EGR 11. Major occupations that have a 10 percent or more share of total jobs in the cluster are: *general and operations managers; first-line supervisors/managers of office and administrative support workers;* and *sales representatives, wholesale and manufacturing, except technical and scientific products*. All the major occupations have an LQ of less than 1.0 in 2007. The occupation with the highest LQ of 1.79 (64 jobs) in 2007 is *postmasters and mail superintendent*.

2) **Skilled Production Workers—Technicians, Operators, Trades, Installers and Repairers**: This cluster contains 10.5 percent (27,837 jobs) of total jobs in EGR 11 with an overall LQ of 1.38 in 2007. The cluster gained 1,230 jobs between 2001 and 2007, and the LQ increased indicating growing specialization. One major occupation has a 10 percent or more share of total jobs in the cluster: *maintenance and repair workers*, with an LQ of 1.34 in 2007. Of the 58 occupations in the cluster, 28 have an LQ of 1.2 or more in 2007. The occupation with the highest LQ (8.6 and 463 jobs) in 2007 is *power plant operator*.

3) **Health Care and Medical Science (Aggregate):** This cluster comprises 5.5 percent (14,604 jobs) of total jobs in EGR 11 with an overall LQ of 1.04 in 2007. The cluster had a growth of 1,856 jobs between 2001 and 2007and the LQ increased. Just one major occupation has a 10 percent or more share of total jobs in the cluster: *registered nurses*, with an LQ of 1.09 in 2007. Of the 56 occupations, 13 had an LQ of 1.2 or more in 2007. The occupation with the highest LQ (4.06 and 117 jobs) in 2007 is *respiratory therapy technician*. The health care and medical science cluster has been divided into three sub-clusters according to knowledge similarities and requirements of the occupations within them:
    - Medical practitioners and scientists (2,854 jobs)
    - Medical technicians (3,205 jobs)
    - Therapy, counseling nursing and rehabilitation (8,546 jobs)

4) **Mathematics, Statistics, Data and Accounting**: This cluster contains 1.5 percent (4,000) of total jobs in EGR 11 and had an overall LQ of 0.6 in 2007. The cluster had a loss of 16 jobs between 2001 and 2007 and the LQ remained static. The four major occupations that have a 10 percent or more share of total jobs in the cluster are: *accountants and auditors; financial managers; purchasing agents, except wholesale, retail, and farm products;* and *computer programmers.* All the major occupations had an LQ of less than 1.0 in 2007. The occupation with the highest LQ of 2.40 (only 13 jobs) in 2007 is *economist.*

5) **Legal and Financial Services, and Real Estate**: This cluster contains 6.3 percent (16,806 jobs) of total jobs in EGR 11 and an overall LQ of 0.78 in 2007. The cluster had a growth of 326 jobs between 2001 and 2007. The two major occupations that have a 10 percent or more share of total jobs in the cluster are: *bookkeeping, accounting, and auditing clerks* and *executive secretaries and administrative assistants*. Of the 40 occupations, three have an LQ of 1.2 or more in 2007. The occupation with the highest LQ of 1.42 (244 jobs) in 2007 is *library assistant*.

6) **Information Technology**: This cluster contains 0.9 percent (2,497 jobs) of total jobs in EGR 11 and an overall LQ of 0.48 in 2007. The cluster had a growth of 34 jobs between 2001 and 2007. The two major occupations that have a 10 percent or more share of total jobs in the cluster are: *computer support specialists; electrical and electronic engineering technicians; telecommunications equipment installers and repairers, except line installers;* and *network and computer systems administrators*. The occupation with the highest LQ of 1.44 (377 jobs) in 2007 is *electrical and electronic engineering technician*.

7) **Natural Sciences and Environmental Management**: This smaller cluster contains 0.3 percent (917 jobs) of total jobs in EGR 11 with an overall LQ of 0.8 in 2007. The cluster grew by 44 jobs between 2001 and 2007 and the LQ increased. The three major occupations that have a 10 percent or more share of total jobs in the cluster are: *compliance officers, except agriculture, construction, health and safety, and transportation; environmental scientists and specialists, including health;* and *surveying and mapping technicians*. The occupation with the highest LQ of 1.79 (60 jobs) in 2007 is *hydrologist.*

8) **Agribusiness and Food Technology Workers**: This cluster is important in EGR 11 and contains 2.0 percent (5,335 jobs) of total jobs with an overall LQ of 1.3 in 2007. The cluster had a loss of 143 jobs between 2001 and 2007; however, the LQ increased by 1.5 percent, indicating that this cluster of occupations is declining faster at the national level than in EGR 11. The two major occupations that have a 10 percent or more share of total jobs in the cluster are: *farmers and ranchers* and *farm, ranch, and other agricultural managers*. Of the 15 occupations, five have an LQ of 1.2 or more in 2007. The occupation with the highest LQ (2.4 and 227 jobs) in 2007 is *chemical technician.*

9) **Primary/Secondary and Vocational Education, Remediation & Social Services**: This cluster contains 4.3 percent (11,375 jobs) of total jobs in EGR 11 with an overall LQ of 0.8 in 2007. The cluster grew by 442 jobs between 2001 and 2007; however, the LQ did not change. The three major occupations that have 10 percent or more share of total jobs in the cluster are: *teacher assistants;*

elementary school teachers (except special education); and *secondary school teachers (except special and vocational education)*. The occupation with the highest LQ (2.7 and 223 jobs) in 2007 is *residential advisor*.

10) **Building, Landscape and Construction Design**: This cluster contains 0.4 percent (960 jobs) of total jobs in EGR 11 with an overall LQ of 0.7 in 2007. The cluster grew by 94 jobs between 2001 and 2007, or an average of about 13 jobs per year, while the LQ increased by 7.5 percent—the largest increase of all occupation cluster LQs in EGR 11. There are five major occupations that have a 10 percent or more share of total jobs in the cluster: *surveyors; surveying and mapping technicians; mechanical drafters; construction and building inspectors;* and *architects (except landscape and naval)*. Of the five major occupations, two have an LQ of 1.2 or more in 2007. The occupation of *surveyor* has both the highest LQ (1.8) and number of jobs (171) in 2007.

11) **Engineering and Related Sciences**: This cluster contains 1.0 percent (2,592 jobs) of total jobs in EGR 11 with an overall LQ of 1.0 in 2007. The cluster had a loss of 122 jobs between 2001 and 2007 however, the LQ increased slightly. Two major occupations have a 10 percent or more share of total jobs and an LQ greater than 1.2 in the cluster: *industrial engineers* and *electrical and electronic engineering technicians*. Of the 28 occupations, 10 have an LQ of 1.2 or more in 2007. The occupation with the highest LQ of 2.6 and 46 jobs in 2007 is *mining and geological engineers, including mining safety engineers*.

12) **Personal Services Occupations**: This cluster contains 1.7 percent (4,378 jobs) of total jobs in EGR 11 with an overall LQ of 0.8 in 2007. The cluster had a growth of seven jobs between 2001 and 2007 and the LQ decreased. The two major occupations that have a 10 percent or more share of total jobs in the cluster are: *child care workers* and *hairdressers, stylists, and cosmetologists*. All major occupations have an LQ of less than 1.0 in 2007. The occupation with the highest LQ of 1.00 (18 jobs) in 2007 is *watch repairer*.

13) **Arts, Entertainment, Publishing and Broadcasting**: This cluster contains about 1.3 percent (3,348 jobs) of total jobs in EGR 11 with an overall LQ of 0.6 in 2007. The cluster grew by 253 jobs between 2001 and 2007 and the LQ increased by 3.3 percent. The two major occupations that have a 10 percent or more share of total jobs in the cluster are: *photographers* and *writers and authors*. All major occupations have an LQ of less than 1.0 in 2007. The occupation with the highest LQ of 1.7 (147 jobs) in 2007 is *radio and television announcer*.

14) **Public Safety and Domestic Security**: This cluster contains 0.8 percent (2,069 jobs) of total jobs in EGR 11 and an overall LQ of 0.7 in 2007. The cluster had a growth of 125 jobs between 2001 and 2007 and the LQ increased. Three major occupations have a 10 percent or more share of total jobs in the cluster: *police and sheriff's patrol officers; fire fighters;* and *correctional officers and jailors*. All major occupations have an LQ of less than 1.0 in 2007. Of the 22 occupations in the cluster, five have an LQ of 1.2 or more in 2007. The occupation with the highest LQ (1.7 and 29 jobs) in 2007 is *occupational health and safety technician*.

15) **Postsecondary Education and Knowledge Creation**: This cluster contains 0.8 percent (2,090 jobs) of total jobs in EGR 11 with an overall LQ of 0.6 in 2007. The cluster had a growth of 124 jobs between 2001 and 2007. Three major occupations have a 10 percent or more share of total jobs in the cluster: *postsecondary teachers; chemists;* and *education administrators (postsecondary)*. The occupation of *chemist* (225 jobs) has the highest LQ—1.8 in 2007—and is the only occupation in the cluster with an LQ greater than 1.0 in 2007.

16) **Job Zone 2** in EGR 11 contained 39.5 percent of all jobs in the region, and gained 1,143 jobs between 2001 and 2007. The largest numbers of occupations in Job Zone 2 include *retail salespersons* (lost 238 jobs), *team assemblers* (gained 583 jobs), *hand laborers and freight, stock and material movers* (lost

172 jobs) and *heavy truck and tractor trailer drivers* (gained 413 jobs). The first three of these occupation categories had a 5 percent or more share of the total cluster jobs. Many occupations in EGR 11's Job Zone 2 cluster had LQs higher (even much higher!) than 1.2. The highest was *boilermakers*, with an LQ of 18.3 in 2007.

17) **Job Zone 1** in EGR 11 contained 16.3 percent of all occupation cluster jobs in the region. This group of occupations experienced a net gain of only 394 (0.9 percent) jobs between 2001 and 2007. Seven occupations in Job Zone 1 covered 5 percent of more of total occupations in this group: *cashiers, except gaming; combined food preparation and serving workers, including fast food; janitors and cleaners, except maids and housekeeping cleaners; waiters and waitresses; maids and housekeeping cleaners; helpers–production workers;* and *stock clerks and order fillers.* As in Job Zone 2, many occupations in Job Zone 1 had LQs higher than 1.2. The occupation with the highest level of specialization, with an LQ of 8.9 was *furniture finishers*, which is not such a surprise considering the region's industry cluster specialization in forest and wood products.

Like the state of Indiana, EGR 11's economy as a whole is not specialized in any of the tech clusters, yet several important industry clusters show a strong specialization in some of the tech clusters' occupations (see Table 8).

Of the 10 industry clusters and sub-clusters that are specialized in EGR 11 (LQ>1.2), the primary metal industry sub-cluster specializes intensely in all six tech knowledge occupation clusters.[14] The chemicals and chemical-based products industry cluster specializes intensely in all but the health care and medical science occupation cluster.

In this region, the forest and wood products industry cluster has been extremely important for many years, and the cluster contains concentrations of IT, engineering, mathematics, and postsecondary education and knowledge creation occupations.

The electrical equipment sub-cluster and the glass and ceramics industry clusters both contain concentrations of IT, engineering and mathematics occupations, while the transportation and logistics industry cluster contains a concentration of natural sciences and environmental management occupations.

Two of the industry clusters that have an LQ less than 1.2 in the EGR 11 economy have a specialization in tech occupation clusters—the energy industry cluster, which is specialized in natural sciences and environmental management occupations; and the arts, entertainment, recreation and visitor industries cluster, which contains a concentration of health care and medical science occupations as well as natural science and environmental management occupations. While not the largest industry clusters in the region, both energy and arts and entertainment employ fairly large numbers of people (6,000+).

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[14] Data used in the occupation cluster analysis were derived from five-digit standard occupation classification (SOC) codes. This is to be differentiated from the O*NET-SOC codes that contain several additional occupation titles that are sub-groups of the detailed five-digit SOC codes. These sub-groups are denoted by a decimal point and two-digit number. To develop knowledge occupation clusters, the team used the detailed O*NET-SOC codes. As a result, some of the sub-groups were categorized in different clusters. However, employment data is only available for the SOC codes, which can result in minor overlap for a few occupations. This overlap can become more apparent when looking at OCIC LQ data. For example, in Table 8, primary metal manufacturing has an OCIC LQ of 13.65 in both the medical and science occupation clusters. This is the result of O*NET-SOC codes existing in two clusters and the ability to only report five-digit SOC data. These numbers are the same because no other occupational data in the cluster was reported.

Table 8: EGR 11 Tech Occupation Cluster OCIC Analysis, 2007

Industry Cluster Names	IT	ENG	MED	MATH	SCI	ED
Industry Cluster with LQ >1.2						
Primary Metal Manufacturing Sub-Cluster	**6.20**	**4.48**	**13.65**	**3.40**	**13.65**	**3.41**
Electrical Equipment, Appliance & Component Sub-Cluster Manufacturing	**1.90**	**2.78**	0.00	**2.72**	0.00	0.68
Biomedical/Biotechnical (Life Sciences)	0.62	0.89	1.13	1.06	0.90	1.18
Chemicals & Chemical Based Products	**1.93**	**2.99**	0.73	**2.37**	**2.03**	**3.24**
Forest & Wood Products	**2.51**	**5.25**	0.00	**2.79**	0.11	**5.30**
Transportation Equipment Manufacturing Sub-Cluster	0.18	0.79	0.07	0.54	0.19	0.62
Advanced Materials	0.47	1.11	0.26	0.92	0.89	1.42
Manufacturing Supercluster	0.39	0.86	0.37	0.61	0.39	0.44
Glass & Ceramics	**3.70**	**2.84**	0.00	**1.75**	0.00	0.61
Transportation & Logistics	0.68	0.84	0.63	0.86	**1.24**	0.66
Industry Cluster with LQ <1.2						
Agribusiness, Food Processing & Technology	0.98	0.99	0.51	1.16	0.49	0.58
Apparel & Textiles	0.31	0.54	0.00	0.43	0.14	0.00
Fabricated Metal Product Manufacturing Sub-Cluster	0.54	0.57	0.47	0.54	0.18	0.65
Energy (Fossil & Renewable)	0.63	0.85	0.23	0.66	**1.27**	0.46
Arts, Entertainment, Recreation & Visitor Industries	0.72	1.13	**1.22**	0.69	**1.79**	0.24
Machinery Manufacturing Sub-Cluster	0.44	0.56	0.79	0.44	0.93	0.00
Printing & Publishing	0.43	0.61	0.59	0.44	0.82	0.42
Computer & Electronic Product Manufacturing Sub-Cluster	0.32	0.63	0.08	0.29	0.10	0.05
Business & Financial Services	0.25	0.55	0.32	0.44	0.79	0.50
Defense & Security	0.25	0.17	0.09	0.44	0.34	0.20
Information Technology & Telecommunications	0.34	0.73	0.13	0.41	0.34	0.17
Education & Knowledge Creation	0.60	0.78	0.64	0.67	0.91	0.66
Mining	0.42	0.54	0.35	0.77	0.42	0.00

Note: Bold numbers indicate an LQ greater than or equal to 1.2.
Source: EMSI Complete Employment 2008 Spring Release v. 2

3.6 Major Findings and Achievements Concerning Occupation Clusters

In general, the research team considers the development of the 15 occupation clusters and the associated OCIC location quotient linking occupation clusters to industry clusters "on the ground" in actual geographic regions to be a major achievement of this project. This information and associated data will be helpful in multiple ways to workforce development analysts and economic development professionals throughout the

United States. In fact, the team has already made the cluster definitions available to a group working on an occupational skills gap analysis for the Iowa Workforce Development Department.

In Indiana, the research team aimed to provide tools, data and analysis to assist economic development groups in finding new directions for the test regions' array of skills and knowledge embedded in their occupation clusters. This concluding section provides some examples of how these tools and accompanying insights could be used to guide consideration of economic development strategies in a region, and even expand the range of activities that would normally be considered—usually the largest clusters—by looking in more detail at some of the faster-growing, but smaller, occupation clusters.

In Economic Growth Region 6, job growth occurred in eight of the 15 occupation clusters between 2001 and 2007, with health care and medical science having the highest growth rate as shown in Table 9. This cluster is also the second largest in the region (tied with legal and financial services and real estate) and its location quotient is approaching 1.2, suggesting that a regional specialization is developing in these occupations. One of the cluster's components (medical technicians) is already specialized (LQ=1.22). The largest group of occupations in the health care and medical science cluster is comprised of registered nurses, licensed practical and licensed vocational nurses, followed by physicians and surgeons, and medical assistants. Finally, the biomedical/biotechnical industry cluster in EGR 6 shows a clear concentration compared with the nation, with a location quotient of 3.7 in 2007.

With this kind of a concentration in medical skills and establishments, the region could, for example, seek opportunities to grow its medical research capacities or to aim for a specialization in geriatrics and nursing homes, or other specialized nursing facilities—leveraging proximity to the large biomedical industry cluster in the Indianapolis metropolitan area.

Alternatively, the region could try to develop a capacity for physical therapy and the kind of skilled nursing required in rehabilitating patients who need prosthetics. Such potential strategies should obviously be worked out by the economic development stakeholders in tandem with medical and related professionals in the region—in other words, those who would be in the front lines of moving such strategies forward.

Table 9: Occupation Clusters of Opportunity in EGR 6

Cluster	Employment Growth (%), 2001-2007	2007 LQ	% Growth of LQ
Health Care and Medical Science	7.2%	1.11	4.7%
Primary/Secondary and Vocation Education & Social Services	7.0%	0.93	8.1%
Information Technology	6.9%	0.41	17.1%
Arts, Entertainment, Publishing and Broadcasting	5.9%	0.72	7.5%
Public Safety and Domestic Security	5.3%	0.94	6.8%
Legal and Financial Services, and Real Estate	4.9%	0.73	2.8%
Postsecondary Education and Knowledge Creation	4.6%	1.33	0.0%
Managerial, Sales, Marketing and HR	1.0%	0.67	1.5%

Source: EMSI Complete Employment 2008 Spring Release v. 2

A surprising finding is that the information technology occupation cluster (IT) has the third highest growth rate in EGR 6. Even more strikingly, the location quotient (while well below 1.2 in 2007) has grown by over 17 percent during the period. A look into the occupational structure of this cluster (see Table 10) reveals that the major occupations within the cluster are largely composed of computer software engineers, systems and data communications analysts, network and computer systems administrators, and support specialists.

Table 10: Fast Growing Occupations in the Information Technology Cluster in EGR 6

Information Technology Cluster Fastest Growing Occupations	2001 Cluster Jobs	2007 Cluster Jobs	Change, 2001-2007	Percent Change, 2001-2007
Total Information Technology Cluster	1,326	1,418	92	6.9%
Computer software engineers, applications	90	113	23	25.6%
Network systems and data communications analysts	82	99	17	20.7%
Computer systems analysts	160	186	26	16.3%
Computer software engineers, systems software	55	62	7	12.7%
Computer support specialists	309	347	38	12.3%
Network and computer systems administrators	160	177	17	10.6%

Source: EMSI Complete Employment 2008 Spring Release v. 2

It is possible that this emerging occupation cluster is related to the presence of Ball State University (postsecondary education and knowledge creation cluster) in the region, although the team's special study of "tech" knowledge clusters (see Appendix D) has found that the information technology cluster tends to co-locate with the engineering and mathematics, statistics, data analysis and accounting occupation clusters. However, these two clusters are both smaller, unspecialized and declining in the region, while the IT cluster, though currently small, is growing and increasing in degree of specialization compared to the nation. Clearly, given this kind of information, economic development stakeholders in EGR 6 will want to explore ways to support the further expansion of this important cluster of occupational skills in EGR 6.

Not all of the higher-growth clusters provide direct regional opportunities for twenty-first century global or even national competitiveness. For example, the 7 percent job growth in primary/secondary and vocational education and social services occupations and an increasing level of concentration of such jobs is beneficial inasmuch as good professional jobs are provided, and the region's education resources are increased; however, this cluster is more of a "pipeline" for *future* competitiveness, and this is where its importance lies.

In EGR 11, six clusters showed job growth of 5 percent or more between 2001 and 2007 (see Table 11). In fact, all the occupation clusters in the region grew except for three: engineering, math and data, and agribusiness and food processing. As in EGR 6, the health care and medical science cluster showed the largest percentage gain in jobs, with a concomitant rise in the size of the location quotient, and a similar internal occupational structure to the EGR 6 cluster (concentration of physicians and surgeons, nurses and medical assistants). However, the next two highest growth rates occur in very different occupation clusters—building, landscape and construction design followed by arts, entertainment, publishing and broadcasting.

Table 11: Occupation Clusters of Opportunity in EGR 11

Occupation Cluster	Employment Growth (%), 2001-2007	2007 LQ	% Growth of LQ
Health Care and Medical Science	14.6%	1.04	6.1%
Building, Landscape and Construction Design	10.9%	0.72	7.5%
Arts, Entertainment, Publishing and Broadcasting	8.2%	0.63	3.3%
Public Safety and Domestic Security	6.4%	0.69	3.0%
Postsecondary Education and Knowledge Creation	6.3%	0.64	-3.0%
Natural Sciences and Environmental Management	5.0%	0.78	1.3%
Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers	4.6%	1.38	1.5%
Primary/Secondary and Vocational Education, Remediation & Social Services	4.0%	0.84	0.0%
Managerial, Sales, Marketing and HR	3.4%	0.72	-1.4%
Legal and Financial Services, and Real Estate	2.0%	0.78	-6.0%
Information Technology	1.4%	0.48	2.1%
Personal Services	0.2%	0.84	-8.7%

Source: EMSI Complete Employment 2008 Spring Release v. 2

As shown in Table 12, the building, landscape and construction design occupation cluster in EGR 11 is not a large cluster (960 jobs in 2007), nor is it the type of cluster that focuses on exportable products. However, it is an important cluster from the point of view of maintaining and increasing "quality of life" factors for the region and can increase the value of the arts, entertainment, visitor industries and recreation industry cluster if the region becomes known for exceptional design and physical attractiveness.

Table 12: Fast Growing Occupations in the Building, Landscape and Construction Design Cluster in EGR 11

Building, Landscape and Construction Design Cluster Fastest Growing Occupations	2001 Cluster Jobs	2007 Cluster Jobs	Change, 2001-2007	Percent Change, 2001-2007
Total Building, Landscape and Construction Design Cluster	866	960	94	10.9%
Landscape architects	38	47	9	23.7%
Architects, except landscape and naval	84	99	15	17.9%
Surveyors	147	171	24	16.3%
Surveying and mapping technicians	138	159	21	15.2%
Construction and building inspectors	100	111	11	11.0%
Architectural and civil drafters	71	76	5	7.0%
Mechanical drafters	132	139	7	5.3%

Building, Landscape and Construction Design Cluster Fastest Growing Occupations	2001 Cluster Jobs	2007 Cluster Jobs	Change, 2001-2007	Percent Change, 2001-2007
Urban and regional planners	38	40	2	5.3%

Source: EMSI Complete Employment 2008 Spring Release v. 2

Perhaps by coincidence (a statistical connection has not been explored in this study), the third fastest growing occupation cluster in EGR 11 is the arts, entertainment, publishing and broadcasting cluster.

The southwest region of Indiana, where EGR 11 is located, is bounded on the west by the scenic Wabash River and to the south by the Ohio River. Several nearby counties are home to historic structures, including hotels and spas, and Evansville, the region's largest city, is host to a large riverboat casino (Casino Aztar) and related entertainment facilities. The Evansville metropolitan area also includes several counties on the Kentucky side of the Ohio River. Much of the regional terrain is limestone, hilly, wooded, and riddled with caves, providing many opportunities for outdoor recreation and tourism.

However, the fastest growing occupations in the arts and entertainment cluster in EGR 11 appear to be concentrated around casino-style entertainment, photography, graphic design and publishing (see Table 13). It might be worthwhile for regional planners and economic developers to explore the potential synergies of outdoor recreational opportunities with this cluster.

Table 13: Fast-Growing Occupations in the Arts, Entertainment, Publishing and Broadcasting Cluster in EGR 11

Arts, Entertainment, Publishing and Broadcasting Cluster Fastest Growing Occupations	2001 Cluster Jobs	2007 Cluster Jobs	Change, 2001-2007	Percent Change, 2001-2007
Total Arts and Entertainment Cluster	3,095	3,348	253	8.2%
Agents and business managers of artists, performers, and athletes	19	25	6	31.6%
Writers and authors	272	346	74	27.2%
Multi-media artists and animators	76	95	19	25.0%
Set and exhibit designers	28	35	7	25.0%
Choreographers	12	15	3	25.0%
Radio operators	4	5	1	25.0%
Fine artists, including painters, sculptors, and illustrators	71	88	17	23.9%
Fashion designers	28	34	6	21.4%
Interior designers	51	61	10	19.6%
Music directors and composers	137	163	26	19.0%
Art directors	84	99	15	17.9%
Jewelers and precious stone and metal workers	28	33	5	17.9%
Photographers	606	705	99	16.3%

Arts, Entertainment, Publishing and Broadcasting Cluster Fastest Growing Occupations	2001 Cluster Jobs	2007 Cluster Jobs	Change, 2001-2007	Percent Change, 2001-2007
Musicians and singers	225	249	24	10.7%
Camera operators, television, video, and motion picture	10	11	1	10.0%
Interpreters and translators	95	104	9	9.5%
Camera and photographic equipment repairers	11	12	1	9.1%
Graphic designers	274	295	21	7.7%
Editors	118	127	9	7.6%
Desktop publishers	73	78	5	6.8%
Musical instrument repairers and tuners	15	16	1	6.7%

Source: EMSI Complete Employment 2008 Spring Release v. 2

Finally, in both EGR 6 and EGR 11 the skilled production workers occupation cluster is the largest in the region. While this cluster has been growing in EGR 11 (at least through 2007), the cluster has been shrinking in EGR 6 for many years. In EGR 11, the occupational structure of this cluster concentrates most heavily on carpenters, cabinet makers and bench carpenters, transportation equipment and industrial machinery makers, plumbers, pipe-fitters, steamfitters, and electricians.

In EGR 6, the concentration is on carpenters, first-line supervisors of the various trades, machinists, electricians, and tool and die makers. In both regions, the second largest industry clusters are the manufacturing clusters. However, EGR 11 (being endowed with exceptional hardwood forests) also has a large forest and wood products industry cluster which accounts for the need for furniture-making occupations and skills. This legacy cluster has been declining due to competition from the Far East and China.

Such trends in industry and occupation clusters—pose both challenges and opportunities for economic development practitioners and public officials in each region as they seek to transition the more traditional manufacturing workers to high-tech occupations that can become competitive in the future. The occupation cluster and industry cluster databases developed in the course of this and previous EDA-funded research can help guide these important decisions.

Next steps for this project should include the preparation of more detailed analysis of the data for the pilot regions, and workshops/strategic planning sessions for regional stakeholders to consider their strategic directions for economic development in the light of what these data show.

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4. The Innovation Index

4.1 What Is Innovation and Why Index It?

According to the United States Department of Commerce, innovation is "the design, invention, development and/or implementation of new or altered products, services, processes, systems, organizational structures, or business models for the purpose of creating new value for customers and financial returns for the firm" (DOC 2008, i). Other entities offer similar definitions, including the Federal Reserve (2007), which defines innovation as "taking something established and introducing a new idea, method or device that creates a new dimension of performance" and adding value.

For the purposes of this research and report, innovation is defined similarly, but more broadly.

Innovation puts ideas into action with the result of increasing firms' compensation and profits.[15] Innovation can result in the introduction of new or better goods and services and is manifest in adopting new technologies and processes that increase productivity or lower costs. Adopting a new technology makes production more efficient. Adopting new business models and organizational structures improve how firms meet consumer needs, process information or make decisions. As a result, innovation reduces costs and increases profitability. Innovation can be incremental (e.g., reducing breakage during shipping) or radical (e.g., using computers for business applications). On a more macro-level, innovation is evident in an economy that is adaptable and that can readily move resources from lower value-added activities to higher value-added activities.[16]

The body of innovation literature has focused largely on patent activity (Audretsch and Feldman 2006; Barkley et al. 2006; Jaffe et al. 1993) and occupational groupings (Henderson and Abraham 2004; Koo 2005b). Researchers tend to operationalize innovation in terms of an element of the definition of innovation or some proxy, but fall short of capturing innovation's primary goal—economic growth.

Efforts to compare innovative activities at a county-level unit of analysis have occurred sporadically in recent years. Most efforts have focused on a state or country level of analysis due to greater data availability. The most comprehensive county-level analysis is from Lee (2006) who examined select counties in the southern United States in a series of descriptive models.

The index in this report is not typical for two reasons. First, the index includes both inputs and outputs together as a composite indicator of innovation capacity and output potential. Second, it places greater emphasis on increased economic productivity. The combination of multiple variables into a composite index gives local and regional development practitioners a single, high-level snapshot to evaluate innovative capacity, innovation outcomes and economic progress. This approach is similar to the annual European Innovation Scorecard (ETCI 2005, Pro Inno Europe 2006). Second, whereas most other innovation indices

[15] The vast majority of value added is comprised of compensation and profits. In economics, value added refers to the returns to the factors of production—primarily labor and capital—that increase the value of a product and corresponds to the incomes received by labor and the owners of capital.

[16] The definition of innovation for this study is focused on economic outcomes. Innovation can also occur in the social sphere. In such a case, innovation would result in improved social outcomes and a higher quality of life.

are developed on an annual basis, the index developed here spans an entire decade. The advantage of a long-term index approach is that the impact on the overall score of short-term variations resulting from exogenous factors, such as natural disasters, is minimized. The index is also less subject to political manipulation that divides regions into winners and losers based on short-term changes in ranks and scores. The disadvantage of this approach is that counties that have made systematic changes during the middle of the study period may be under-represented with regard to their innovative potential and capacity in the final results.

This index is intended to serve as a tool for regional economic development practitioners. It should be understood, however, that each region of the country will have a different mix of qualities that can boost its overall innovation score. No two counties or regions will be exactly alike and there is no single path toward an innovative and growing economy. Interpretation of this index should be done with caution as the collection of multiple data points into a single composite estimate may obscure important information that could help explain a particular region's underlying innovative capacity and performance.

The following section describes the variables selected for the broad portfolio of innovation-related activities that comprise the "Portfolio Innovation Index." Then, there is a brief discussion of an empirical approach that attempts to link innovation outcomes—namely economic growth—with innovation inputs. The research team's efforts suggest that the portfolio and empirical approaches are modestly correlated. This statistical relationship suggests a broad portfolio can and does capture much of the effect sought through an empirical approach that identifies the independent variables, e.g., human capital, that have the strongest explanatory power on the dependent variable, namely the growth of gross domestic product per worker. The advantage of the portfolio approach is that the relative importance of any one factor is diminished by a wide array of other factors that may influence innovation, whereas the empirical index concentrates innovation scores on far fewer variables.

4.2 Portfolio Innovation Index

The Portfolio Innovation Index (PII) builds on past research and analysis that used higher-order geographic units of analysis such as states and countries (ETCI 2005; Pro Inno Europe 2006; Porter and Stern 1999; Atkinson and Correa 2007). The approach is based on the assumption that innovative capacity, or inputs, can be combined with outputs to create a single, composite index value.

The process of developing the portfolio of variables to index began by identifying possible indicators used in previous analyses (Barkley et al. 2006; Drabenstott and Henderson 2006; ETCI 2005; Pro Inno Europe 2006; Lee 2006; Atkinson and Correa 2007). Several additional variables were identified as theoretically important and investigated for possible inclusion. The final list of variables was restricted to those for which county-level data were available, or that could be developed on the county level with relatively little imputation.

The remaining variables were then classified as either an input to innovative activity or a result or output of innovation. Each variable was classified into one of the following four categories: human capital, economic dynamics, productivity and employment, and economic well-being. Each of the four preceding categories has its own sub-index and is discussed in greater detail below.

A fifth category, state context, seeks to capture data that are theoretically important but available only at the state level. The state context category, which is not discussed in depth below, is composed of science and engineering graduates from state institutions per 1,000 residents of the state and research and development

spending per capita.[17] In the future, the state context could expand in scope to mimic several of the state-level indicators reported by Atkinson and Correa (2007), for example, the export of high-tech goods and foreign direct investment flows. The state context category is given relatively scant attention because it is not used for the PII calculation and because the context indicator becomes diluted if a region crosses state boundaries—that is, the index calculation aggregates across all applicable states. In addition, the state context category is not highlighted because the focus of this study is to develop county-level indicators so that users are able to define their geographic unit of analysis based on distinct economic boundaries that, frequently, are not confined by state lines.

As noted above, the innovation index is a tool for regional economic development practitioners to identify the knowledge-based and innovation-based strengths and weaknesses of a regional economy. Many of the measures used for the index gauge the foundational elements that are currently in place in the region for future, innovation-driven economic growth. Some of the measures gauge the degree to which the region is attractive to new talent and firms that may also enhance the regional economy, but those same measures of attractiveness are also measures for retaining current talent and firms. Certain characteristics, in other words, work like gravity, keeping objects on the ground and pulling objects to the ground. It is hoped, therefore, that the innovation index is not primarily used to try to attract outside firms, resources and talent, but primarily used to identify indigenous sources of innovation and ways to fortify those sources. Encouraging home-grown entrepreneurs with personal commitments to the region, for example, is preferred to attracting talent with minimal personal investment in the region.

4.2.1 Inputs

Inputs are those factors, influences or conditions that promote innovation and create knowledge. Inputs are combined into two categories: human capital and economic dynamics.

4.2.1.1 Human Capital Sub-Index

Variables included in the human capital sub-index suggest the extent to which a county's population and labor force are able to engage in innovative activities. Counties with high levels of human capital are those with enhanced knowledge that can be measured by high educational attainment, growth in younger age brackets of the workforce (signifying attractiveness to younger generations of workers), and a sizeable number of innovation-related occupations and jobs relative to the overall labor force.

Education

Educational attainment measures the skills and knowledge that contribute to a population's capacity to innovate. The research team was particularly interested in individuals in the labor force with tertiary degrees. Thus, educational attainment was divided into two categories: (1) some college or an associate's degree and (2) bachelor's degree or higher. The distinction is made to capture the relative importance of a knowledge differential, together with regional distinctions in the types of degrees earned. In many states, educational funding mechanisms favor four-year universities whereas elsewhere state policy tends to favor two-year community colleges and vocational schools (Kolesnikova and Shimek 2008; Rouse 1998).

[17] Please refer to Appendix C for more information on the state context indicator.

An important educational differential is also present within states and counties where higher concentrations of bachelor's degrees tend to surround metropolitan areas, whereas associate degree concentrations tend to be elevated in more rural counties where fewer residents have the resources or ability to travel to distant four-year institutions (Dougherty 1994). Community colleges and vocational schools are more widely dispersed and proximate to rural residents. They also tend to provide education at a lower cost, with easier access, and tend to offer more flexible course schedules, such as evening or weekend courses (Dougherty 1994; Rouse 1998; Kolesnikova and Shimek 2008). Community colleges are also more likely to cater to a region's economic development needs than larger universities (Rosenfeld and Sheaff 2002).

Population Growth Rate

A growing population is desirable. But growth in the number of newborns or retirees does little to suggest whether those persons most likely to engage in innovative activities are present in the community. For this reason, population growth rates are confined in this study to ages 25 to 44. The lower bound ensures transient college students typically aged 18 to 21 become less of a factor in influencing the overall rate of growth, whereas the upper bound signifies a point at which a professional's geographic location would likely remain more stable. The 25-to-44 age bracket is likely to be less risk averse and more entrepreneurial. Moreover, population growth in this age bracket suggests the possibility that new residents are likely to augment the innovative and entrepreneurial characteristics of the base community.

Occupational Mix

Richard Florida (2004; 2005) developed the notion of the "Creative Class," a social concept that describes a region's population by identifying the types of occupations in the workforce. According to Florida, areas with large creative class populations have a more socially tolerant populace and experience greater economic growth. Ultimately Florida concludes that the creative class drives economic expansion in the United States. The creative class is based on occupational data from the decennial census. While Florida's concept is bolstered by research, more recent critiques call into question the validity and reliability of his argument (see Donegan et al. 2008). In fact, the research team's empirical analysis suggests that when combined with other important factors that describe growth in economic productivity, higher proportions of creative class occupations bear a negative relationship.[18]

Like Florida, the research team hypothesized that there is a certain occupational mix that favors innovative behaviors. Rather than relying on Florida's intuitive definitions of the desirable occupational mixes, the research team substituted six technology-based knowledge occupation clusters that were based on statistical analysis.[19] These clusters are similar in composition to those used by Henderson and Abraham (2004), who sought to explain the agglomeration effect of knowledge occupations at the county-level. They defined knowledge occupations as managerial, professional, and technical. Henderson and Abraham's (2004) model found that higher concentrations of knowledge occupations could be explained by the presence of college graduates and colleges, and in areas surrounded by high-knowledge occupations.

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[18] This analysis is not shown. Originally the creative class was used as an "innovation occupations" proxy, prior to the inclusion of O*NET-based occupation cluster data.

[19] Our cluster is highly correlated with creative class (ϱ=0.67). IT and mathematics, statistics, data and accounting are highly correlated with the creative class variable with coefficients greater than 0.7. The natural sciences and environmental management component exhibited the lowest correlation of the component clusters with the creative class (ϱ= 0.02).

The six technology-based knowledge occupation clusters, as described in Chapter 3, include (1) information technology, (2) engineering, (3) health care and medical science practitioners and scientists, (4) mathematics, statistics, data and accounting, (5) natural sciences and environmental management, and (6) postsecondary education and knowledge creation. Occupations in these clusters each hold Occupational Information Network (O*NET) scores of three or higher.[20] O*NET's seven-point Likert-like scale accounts for the degree to which knowledge is required to satisfactorily perform the duties of the occupation. The use of scores of three or higher removes low-scoring occupations. Following the theories of Florida, in conjunction with the occupation cluster analysis reported in Chapter 3 of this report, these six technology-based clusters were also hypothesized to have a higher probability of developing new and innovative ideas, products and processes that drive economic growth. Collectively these clusters comprise 8 percent of national employment.

High-Technology Employment

In addition to knowledge occupations, there are other occupations linked to high-technology firms and activities that either retain opportunities for the home-grown, skilled and specialized labor force or attract similar workers that are complementary to technology-based knowledge occupations. According to Kolko (1999), high-tech firm employment and growth is overwhelmingly found in urban centers, producing a rural-urban technology gap. High-tech employment uses industry-level data. The high-tech sector is defined by Moody's as comprised of such industries as telecommunications, Internet providers, computer manufacturing, and scientific laboratories, to name a few.

Together, the high-tech industry employment and technology-based knowledge occupational data provide a reasonable understanding of the extent to which a county's occupational and industry mix provide either the existing capacity to generate innovative products and processes or the ability to augment local innovative capacity by attracting new firms and new talent.

4.2.1.2 Economic Dynamics Sub-Index

The economic dynamics sub-index measures local business conditions and resources available to entrepreneurs and businesses. Targeted resources such as research and development funds are input flows that encourage innovation close to home, or that, if not present, can limit innovative activity.

R&D Investment

Inputs to innovation can come in the form of fund or knowledge transfers that may originate outside a region but benefit firms and individuals inside a region.

Investments targeted to a region provide capital to aid the economic dynamics of a region. In particular, direct research and development (R&D) investments in a given county are indicative of overall levels of research being conducted. While research itself may not always result in a marketable innovation, it is a vital precursor. R&D expenditures are thus an indicator of innovation—even if the funds go toward unsuccessful products. It is generally understood, however, that those spending more will have the greatest innovative results or outcomes. R&D also has a well-documented spillover effect where R&D can provide crucial knowledge and resources for third-party firms to further innovate (Audretsch and Feldman 2006).

[20] The methodology is based on the approach advocated by Feser (2003) and Koo (2005b).

Unfortunately, private R&D data is coded in a manner based on the location of company headquarters and not the research sites. Thus, the data may not reveal the true location of the R&D activity. Be that as it may, the R&D concept was operationalized in this study for each county by dividing total R&D expenditures by total worker compensation. In this way, the volume of R&D expenditures is adjusted for the level of productive activity in the county (as opposed to high personal income values that may be due to a large presence of retirees) and, to some degree, the local cost of living or doing business.

Venture Capital Investment

Venture capital (VC) funds are used to launch new ideas or expand innovative companies. In the United States, VC may be responsible for up to 14 percent of all innovative output activity (Kortum and Lerner 2000). Rin and Penas (2007) note that VC investment firms are highly selective with their investments to maximize the probability of high returns. The return on VC, and possibly the importance of VC, is diminished somewhat by the fact that the VC investments are typically management-intensive. Looking for VC funding may consume a considerable level of effort by the seeking firm's management, just as VC firms exert considerable effort seeking suitable projects to invest in (Timmons and Bygrave 1986).

Broadband Density

Several state-level studies have attempted to capture the effect of adding broadband capacity to a region's infrastructure. These studies suggest that broadband capacity has an overwhelmingly positive impact on economic performance (Lehr et al. 2005, 2005b; Crandall et al. 2007). Broadband provides high-speed Internet connections to businesses and consumers. Thus, high-speed Internet access ensures that businesses and individuals can access and share new ideas from virtually any location. An increase in broadband density would indicate an improvement in capacity over time.

Unfortunately, broadband density or penetration is not directly tracked at the county level by the Federal Communications Commission (FCC). The FCC does collect data on the number of broadband providers, not users or broadband lines, at a ZIP code level. The number of broadband lines is available only at the more aggregated state level of analysis. To create a measure—that is, a broadband density proxy at the county level—broadband penetration was estimated by using population densities of both counties and ZIP codes to transform the FCC ZIP code data into county-level data. In other words, the number of broadband holding companies per ZIP code were assigned to a county using weighted averages of populations and ZIP code population centroids.[21]

This measure of broadband penetration does not state how many individuals in a region have access to broadband. Broadband density could be driven by two starkly different factors. Either (1) the increased number of providers is related to total employment and demand for access or (2) the number of providers is

[21] One of the limitations of these data is the assumption that postal service ZIP code data from the FCC was directly comparable to ZIP code tabulation areas (ZCTAs) available from the U.S. Census Bureau. This assumption was necessary in order to weight the ZIP code data accordingly to develop a county-level dataset. To assess the reliability of this measure, the county-level density data were aggregated to a state level which showed a weak correlation (r=0.3) with the actual number of broadband lines per capita among states. The correlation was marginally stronger (r=0.4) with the actual number of lines irrespective of a state's population. Perhaps a greater limitation is that service providers can be, or more likely are, frequently double-counted because a service provider may service multiple ZIP codes within the same county.

a function of geographic size. The number of broadband providers tends to increase with employment and decrease with land area.

The extent to which a county has broadband access differs conceptually from the rate at which counties opt to add broadband access. A county that had high density and a slow rate of change was likely an early adopter of the technology whereas a county with a low density and a low rate of change never really engaged in full adoption of broadband technology. But, of particular interest are the counties with low initial densities that exhibit high rates of change in adding broadband access. These are the counties that presumably recognized the importance of access and sought to add it between 2000 and 2007.[22]

Given the limitations of the data, but acknowledging the theoretical importance of the concept, the index uses two broadband indicators. The first is a measure of current density, that is, density in 2007, and the second is the rate of density change from 2000, the first year of available data.

Churn

Competition is crucial to innovation. Market structures can influence the degree to which innovation is even possible (Jadlow 1981). Specifically, markets with high rates of firm entry have been linked to increased levels of innovation (Geroski 1995). Conversely, the rate at which businesses shut their doors or reduce their workforce indicates a decrease in economic deadwood. Together the growth and contractions along with births and deaths produce the notion of economic churn, which serves as an indicator of the extent to which innovative and efficient companies replace outdated firms unable to modernize techniques and processes. Churn has been linked to positive employment growth (Spletzer 2000) and is not subject to agglomeration effects that often distinguish urban and rural economic structures (Plummer and Head 2008).

The average churn variable is defined as the total establishment births and deaths, and expansions and contractions, relative to the total number of firms in county *j* for all years available, 1999 through 2004. More specifically,

$$average\ churn_j = \frac{\sum_{t_0}^{t_n}(Births + Deaths + Expansions + Contractions)_t}{\sum_{t_0}^{t_n}(Deaths + Expansions + Contractions + Constant)_t}$$

where *constant* is the number of establishments that neither expanded or contracted in year *t*.

Business Sizes

While churn measures the creative destruction in a region, it provides relatively little information about the structural composition of a region. Small firms, it is thought, are highly adaptable and can easily change their processes to incorporate new ideas. In recent years, high merger rates between small and large firms have coincided with increased technological influence of small firms. Some evidence, however, suggests these acquisitions may not be significant sources of innovation for large firms (Acs and Audretsch 1990; CHI Research 2004).

[22] Broadband density is measured using the same data in two ways: the average number of broadband service providers available per county and the change in average number of broadband service providers available per county.

Theoretically, a higher proportion of large businesses would positively contribute to innovation through the increased availability of funds for research and development, as well as the resources to directly employ scientists rather than hire out research services. Available data, however, do not identify whether, or the degree to which, an establishment is engaged in innovation activities. It may be that one *establishment* has a large, low-skilled operation while innovative activities for the same firm occur at a different location.

Moreover, using data on large establishments, defined as establishments with 500 or more employees,[23] may be of limited utility for explaining innovative capacities in rural counties with small economies. Not many large establishments exist in rural counties. This could explain the reason that the large establishment variable did not yield statistically significant results in the empirical model. Just the same, because the variable has some theoretical merit, the number of large establishments per 10,000 workers remains in the portfolio index.

4.2.2 Outputs

Outputs are the direct outcomes and economic improvements that result from inputs. Typically outputs are lagged where possible to reflect a cause-and-effect element or presented as a decade-long rate of change to capture the degree to which improvements were realized. Outputs are divided into two categories or sub-indices: productivity and employment, and economic well-being.

4.2.2.1 Productivity and Employment Sub-Index

The productivity and employment sub-index describes economic growth, regional desirability, or direct outcomes of innovative activity. Variables in this index suggest the extent to which local and regional economies are moving up the value chain and attracting workers seeking particular jobs.

High-Tech Employment Share Growth

Just as the share of high-tech employment in a county was an important input, the extent to which that share is increasing relative to total employment is an important performance measure. Firms requiring a highly skilled and specialized workforce are drawn to innovative areas. In a similar way, this measure also registers the degree to which home-grown, high-tech firms have expanded their presence. Growth in the share of high-tech employment suggests the increasing presence of innovative activity and signifies that high-tech firms are growing in the county or region both in relative as well as absolute terms.

Job Growth-to-Population Growth Ratio

Even as high-tech employment increases, other sectors may decline or grow. High employment growth relative to population growth suggests jobs are being created faster than people are moving to a region. Even though the ratio measures the change in level between jobs and population and, therefore, can't be used to compare rates of growth, it can rank order counties or regions in terms of employment performance. A high ratio between these two variables indicates strong employment growth. The ratio for the United States is 0.73, meaning that ratios above this value would imply job creation performance above the national average. (On a national level, it would be unusual for employment growth to exceed population growth.) This ratio can vary dramatically county to county. A negative value signifies that population is growing while employment is

[23] The definition (size) of a large establishment follows Barkley et al. 2006.

declining or vice versa. In cases for which population is declining while employment is increasing, the absolute value of the ratio is used as that would be considered favorable employment performance.

Patent Activity

New patented technologies provide an indicator of individuals' and firms' abilities to develop new technologies and remain competitive. The number of patents produced is a commonly used output measure for innovative activities, but the data can mislead. Patent data are coded to distinguish between the residence of the filer and the recorded location of the employer (if the applicant is not a private inventor), but the recorded location of the employer may or may not correspond to the location of the work that produced the patent, especially if the employer is a large, diversified company with many locations. In addition, the available patent data do not cover the universe of all patent types (Barkley et al. 2006). Patent data are recoded from the raw data provided by the U.S. Patent Office and awards patents to any county from which one of the filers reported as their location. This means that for any single patent with more than one filer, a patent may be counted multiple times if filers are located in different counties. As far as the type of patent, only utility patents are considered. Utility patents are items intended to serve a function, in contrast to design patents, which are nonfunctional in nature and include such things as new computer fonts (USPTO 2008). Patents can also be an inaccurate indicator of innovation outcomes, particularly in areas where a single firm overwhelms the total patent count, such as Eli Lilly in Indianapolis (White 2008).

Gross Domestic Product

The final component of the productivity and employment sub-index is the single most important measure of productivity available—gross domestic product (GDP). The index incorporates both the level of a county's current-dollar GDP per worker today, and also growth in the value over the past decade. A high rate of growth signifies substantial improvement from 1997 to 2006.

4.2.2.2 Economic Well-Being Sub-Index

Innovative economies improve economic well-being because residents earn more and have a higher standard of living. Decreasing poverty rates, increasing employment, in-migration of new residents and improvements in personal income signal a more desirable location to live and point to an increase in economic well-being.

Net Migration

Migration measures the extent to which a county or region is broadly appealing and excludes other elements of population dynamics such as fertility rates. While people may migrate into a region for a host of reasons, from employment opportunities to environmental amenities, migration out of a region almost certainly signals declining economic conditions and the inability to keep the innovative talent that will spawn economic growth in the future.

Compensation

Compensation data convey how much workers make based on their place of work. Likewise, proprietors' income is also based on place of work. Compensation and proprietor's income, therefore, probably provide a strong relationship between the activities of innovation and the rewards of innovation based on the location of innovation.

As an alternative to measuring remuneration based on place of work, per capita personal income (PCPI) measure incomes by place of residence. Because PCPI includes other forms of income in addition to wages, salaries and fringe benefits, it is a more comprehensive measure of well-being. That said, the linkage between where innovation occurs (county of work) and the financial rewards of innovation (county of residence) is less direct.

4.2.3 Calculating the Sub-Indices

Each sub-index (X_s) for human capital, economic dynamics, productivity and employment, and economic well-being is calculated by summing weighted ratios that divide the county-level metric by the U.S.-level metric:

$$X_{sj} = 100 * \left[\sum_{i=1}^{n} \alpha_i \left(\frac{x_{ij}}{x_{iU}}\right) \ldots \alpha_n \left(\frac{x_{nj}}{x_{nU}}\right)\right] \qquad \text{(Equation 1)}$$

where x_{ij} denotes data for county *j* for innovation factor (or variable) *i* , where x_{iU} denotes the U.S. average for innovation factor *i* and where α_i is the weighting for factor *i* for the particular sub-index *s*. Equation 1 provides a general sense of how each X_s is calculated.[24] In instances where the factor could have a negative range (e.g., growth variables), the entire range was shifted upward by adding the absolute value of the minimum value in the range. This shift prevents any single variable from subtracting points from the overall index as a result of its negative range and maintains necessary rank order of continuous variables.

Additional adjustments may also be warranted. If the ratio of the county value to the U.S. value exceeds two standard deviations above or below the U.S. mean, the value of that datum for that particular county is constrained to within two standard deviations. This procedure limits the amount of influence any single variable can have in the overall index. Even with this constraint on extreme outliers, this procedure was insufficient to modify the extremes of three variables with broad ranges, namely patents, venture capital and R&D. As a result, before calculating the standard deviation for constraining extreme values for these three variables, extreme outliers[25] were removed prior to calculating the standard deviations used for the 2σ constrained data range.

Strictly speaking, innovation factors were not weighted equally as some factors were broken down into two measures in a sub-index. That said, each concept was weighted equally.[26] A concept is defined here as an umbrella under which a factor may be measured in multiple ways. For instance, GDP per worker is a concept and the concept is included as a level that measures a county's relative performance today as well as a rate of change to suggest the extent to which an economy has grown over the last decade. Together the measures are one concept and each receives half of the concept's overall weight. The weighting of a concept within a sub-index is dependent on the number of concepts included in each sub-index (four to five).

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[24] See full algorithm and discussion in Appendix C.

[25] Extreme outliers are here defined to be greater than four standard deviations, as calculated from the complete dataset. The extreme outliers, therefore, were not used to calculate the standard deviation for the 2σ constrained data.

[26] This is the same approach utilized in the European Innovation studies due largely to disagreement on the precise weighting metrics and an inability to derive anything on a more empirical basis. See the Empirical Innovation Index (EII) section for further discussion of the research team's attempts to move beyond the simple weighting scheme.

A similar weighting approach is used in several other innovation indexes (Atkinson and Correa 2007; Pro Inno Europe 2006). An alternative approach would be a weighting scheme based on which factors (or variables) have the greatest explanatory power for the changes in innovation. The alternative approach is early in its genesis. For one reason, the approach requires that researchers declare their dependent variable, that is, declare their single measure for changes in innovation (see Empirical Index discussion in Section 4.3; Porter and Stern 1999).

4.2.4 Calculating the Portfolio Index

The Portfolio Innovation Index (PII) combines the four sub-indices presented above. Each component is weighted relatively equally. Economic well-being has a less direct relationship to innovation activities, and receives one-third the weight of the other three sub-indices. In addition, the index values for economic well-being across counties also tend to be higher than the other sub-indices, largely because there is less dispersion in measures such as poverty rate and average unemployment than there is among measures such as high-tech employment or R&D expenditures among counties.

The final calculation for the portfolio index is as follows:

$$PII_j = \sum_{s=1}^{4} A_s X_{sj} \qquad \text{(Equation 2)}$$

where PII_j is the portfolio index for county *j*, A_s is the weight for the sub-index *s* component of the portfolio index and X_{sj} is a given sub-index value for county *j*.[27]

See Table 14 for a presentation of all the indices used for the PII and summary statistics for each component.

Table 14: Summary Statistics for Innovation Indices and Data Series

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
Overall	Portfolio Index			100.0	80.5	79.0	9.2	60.3	127.4
	Human Capital Sub-Index			100.0	77.8	75.0	16.1	50.1	146.0
	Economic Dynamics Sub-Index			100.0	78.4	76.8	11.2	51.7	132.2
	Productivity and Employment Sub-Index			100.0	79.7	79.1	9.8	47.8	128.7
	Economic Well-Being Sub-Index			100.0	97.1	96.7	7.3	70.6	126.2

[27] j is introduced to the X_i variable to reflect that in addition to calculating a sub-index for each county, there are also multiple indexes for each county.

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
Human Capital Sub-Index	Mid-Aged Population Growth Rate, 1997 to 2006	popgroma	20%	-0.2%	-0.7%	-0.7%	2.1%	-22.2%	9.4%
	Percent of Population Ages 25-64 with Some College or an Associate's Degree, 2000	Perassoc	20%	29.5%	29.1%	29.1%	6.2%	11.3%	47.2%
	Percent of Population Ages 25-64 with a Bachelor's Degree, 2000	Perbach	20%	26.5%	18.0%	16.2%	8.2%	4.9%	64.0%
	Average High-Tech Employment Share, 1997 to 2006	avghtshare	20%	4.8%	2.9%	2.3%	2.5%	0.1%	51.2%
	Technology-Based Knowledge Occupations Share, 2007	KOC	20%	1.0	0.6	0.6	0.3	0.1	3.9
Economic Dynamics Sub-Index	Average Venture Capital Investment per $10,000 GDP, 2000 to 2006	avgVCGDP	20%	35.2	4.2	0.0	25.2	0.0	648.5
	Average Private Research & Development per $1,000 Compensation, 1997 to 2006	avgRDpCOMP	20%	2.3	3.0	0.0	28.2	0.0	1081.7
	Broadband Density, 2007	Bb_lya	10%	10.6	7.7	7.5	2.6	0.0	19.0
	Change in Broadband Density, 2000 to 2007	bbd	10%	16%	21%	21%	6%	0%	88%

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
	Average Establishment Churn, 1999 to 2004	avgchurn	20%	0.80	0.74	0.74	0.06	0.42	0.96
	Average Small Establishments per 10,000 Workers, 1997 to 2006	smestpw	10%	364	412	400	101	36	1,176
	Average Large Establishments per 10,000 Workers, 1997 to 2006	lgestpw	10%	1.07	0.67	0.58	0.70	0.0	7.27
Productivity & Employment Sub-Index	Job Growth to Population Growth Ratio, 1997 to 2006	jobpop	25%	0.7	1.0	0.5	30.4	-909.0	1200.3
	Change in High-Tech Employment Share, 1997 to 2006	HTESd	25%	-0.7%	0.0%	-0.2%	4.0%	-21.7%	33.1%
	Average Annual Rate of Change in GDP ($ Current) per Worker, 1997 to 2006	GDPWcod	12.5%	3.6%	3.4%	3.4%	1.9%	-25.2%	13.9%
	Gross Domestic Product ($ Current) per Worker, 2006	cuGDPW	12.5%	73,989	58,976	57,119	20,831	3,314	622,632
	Average Patents per 1,000 Workers, 1997 to 2006	avgPatpw	25%	18.8	4.0	1.8	7.3	0.0	101.2

Index	Variable	Variable Label	Percent of Sub-Index	U.S. Value	All Counties				
					Mean	Median	Std	Min	Max
Economic Well-Being Sub-Index	Average Poverty Rate, 2003 to 2005, inverse	avgpovR	20%	12.8%	14.1%	13.2%	5.5%	3.0%	41.2%
	Average Unemployment Rate, 2005 to 2007, inverse	avgunempR	20%	4.8%	5.1%	4.8%	1.7%	1.7%	20.6%
	Average Net Internal Migration Rate, 2000 to 2006	netmigR	20%	0.0%	0.0%	-0.1%	1.1%	-11.1%	7.3%
	Change in Per Capita Personal Income, 1997 to 2006	PCPId	20%	4.1%	3.8%	3.7%	1.1%	-1.7%	15.7%
	Change in Wage and Salary Compensation per Worker, 1997 to 2006	wspWd	10%	3.8%	3.5%	3.5%	0.8%	-4.8%	9.8%
	Change in Proprietors Income per Proprietor, 1997 to 2006	propincd	10%	3.0%	0.7%	0.5%	3.8%	-18.1%	20.0%

Source: Indiana Business Research Center

4.2.5 What Does the Portfolio Innovation Index Mean?

Interpreting the PII is not as simple as an initial glance may suggest. The PII rates a county's performance relative to the United States on a continuous scale. Comparisons between counties are similarly relative to the U.S. average. Additionally, the PII composite index has no simple definition as there is no single dependent variable. Rather, the PII is a collection of measures baked into one at-a-glance number, not unlike the leading economic index of the Conference Board[28] (except the PII components have a more equal weighting). As a "portfolio," the index is an aggregation of many disparate parts that may or may not move in tandem with each other.

The PII is an aggregation of underlying sub-indices for innovation inputs and outputs. Traditionally these two components—inputs and outputs—would not be combined into a single figure. The higher scoring counties will tend to exhibit high levels of inputs and outputs, whereas the lowest-scoring counties will have low levels

[28] See www.conference-board.org/economics/indicators.cfm.

of inputs and outputs. The murky analytical area is for counties that may have a high overall score but only due to a relative advantage in either inputs or outputs, but not both concepts simultaneously.

Overall, there are 100 counties (out of 3,111 counties) that have high output results (defined as greater than 100, the U.S. average) in both economic well-being and productivity and employment. Of those counties, only 40 also have high inputs (>100) in human capital and economic dynamics (see Table 15). These 40 counties are, in essence, the innovation leaders where high inputs are linked to high outputs.

For the remaining 60 counties with high outputs, 31 have high levels of inputs in at least one category, as well as relatively high levels in the other (85<x<100). The remaining 29 counties are more challenging to interpret as their outputs are high but neither input component is high. For these counties, their high output levels could be related to other input factors not included in the index (e.g. natural resource extraction). Conversely, the counties with high levels of inputs but marginal outputs may signify a delayed or lagged effect in realizing the economic benefits from improved human capital and economic dynamism. Testing such a relationship was beyond the scope of this study, but the notion merits further research.

There is no perfect combination of factors that define an innovative region, but an innovative county could be expected to perform at or better than the nation in at least one category. A total of 1,165 counties (37 percent) score greater than 100 in at least one input or output sub-index. Many of those (774 counties) are bolstered by the economic well-being sub-index. The other 1,946 counties (63 percent) do not have any sub-index value greater than the national average, thereby showing how a relatively few large population, high-output counties pull up the national average.

Figure 10 presents mean scores from three of the groupings presented in Table 15. The high-input/high-output grouping is, on average, as good as it gets for counties, whereas the low-input/low-output is the average of the counties that did not ever score higher than 100 on any single sub-index. As Figure 10 indicates, the averages vary substantially between these groups in both input categories, with the greatest disparity in human capital.

Table 15 and Figure 10 present alternate approaches to describing the input-output leaders. As illustrated in Figure 10, the economic well-being sub-index tends to measure highly for all types of counties.

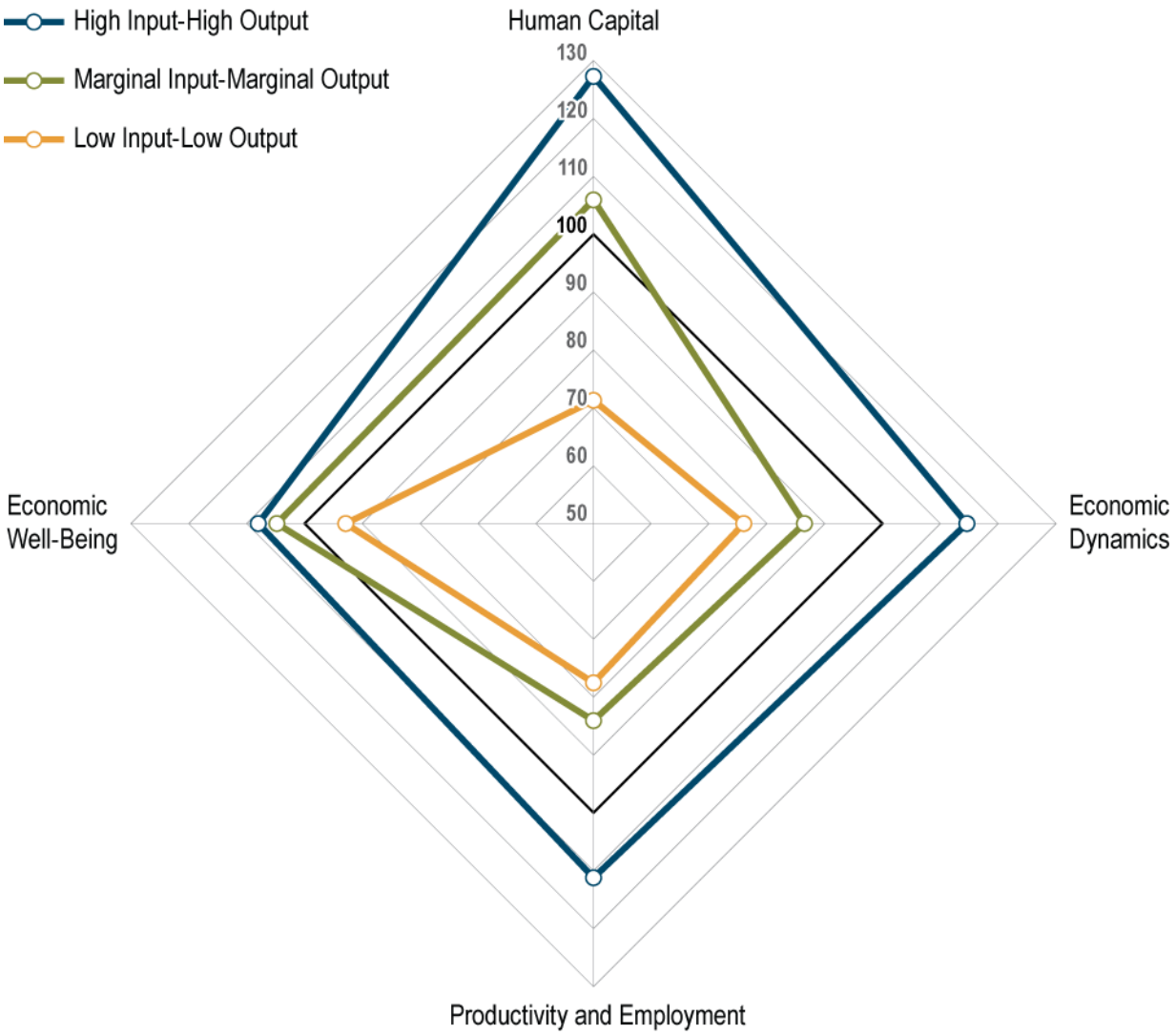
Table 15: Innovation Categorization Based on Performance in Input and Output Sub-Indices

No. of Input Sub-Indices over 100	No. of Output Sub-Indices over 100	Mean Portfolio Index	No. of Counties	Innovation Category
2	2	116.7	40	High-Input/High-Output
2	1	107.6	45	High-Input/Marginal-Output
2	0	102.9	12	High-Input/Low-Output
1	2	104.0	31	Marginal-Input/High-Output
1	1	93.4	137	Marginal-Input/Marginal-Output
1	0	90.1	97	Marginal-Input/Low-Output
0	2	93.3	29	Low-Input/High-Output
0	1	81.2	774	Low-Input/Marginal-Output

No. of Input Sub-Indices over 100	No. of Output Sub-Indices over 100	Mean Portfolio Index	No. of Counties	Innovation Category
0	0	76.7	1,941	Low-Input/Low-Output

Note: Counties do not sum to 3,111 as five counties were omitted due to null values.
Source: Indiana Business Research Center

Figure 10: Sub-Index Dimensions of the Portfolio Innovation Index



Note: United States = 100
Source: Indiana Business Research Center

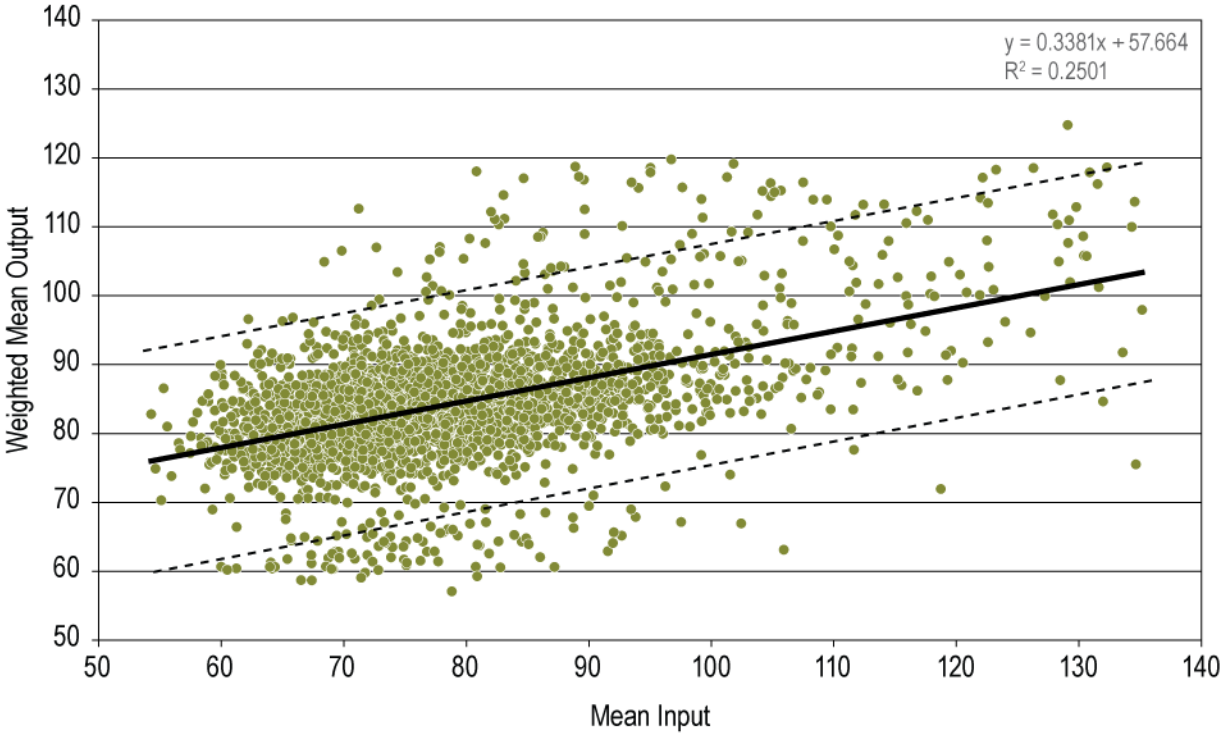
4.2.6 The Relationship between Innovation Inputs and Outputs

The measures for inputs and outputs in the portfolio index are theoretically linked, as discussed in the introduction to this section of the report. The manner by which the concept of innovation was operationalized shows that there is a clear relation between the results of innovation and factors that describe

innovation capacity and activity.[29] The fact that the variables that measure innovation inputs and outputs tend to move together offers statistical support for joining the two concepts into a single composite index.

Figure 11 highlights the range of capacity and performance. The graph also shows that some counties may have relatively high innovative capacity or inputs coupled with low innovation output, at least for the time frame for which there are data. Conversely, high output measures can be realized with low input capacity, suggesting that there are unexplained exogenous factors influencing performance.

Figure 11: Weighted Average Input/Output (proportional)



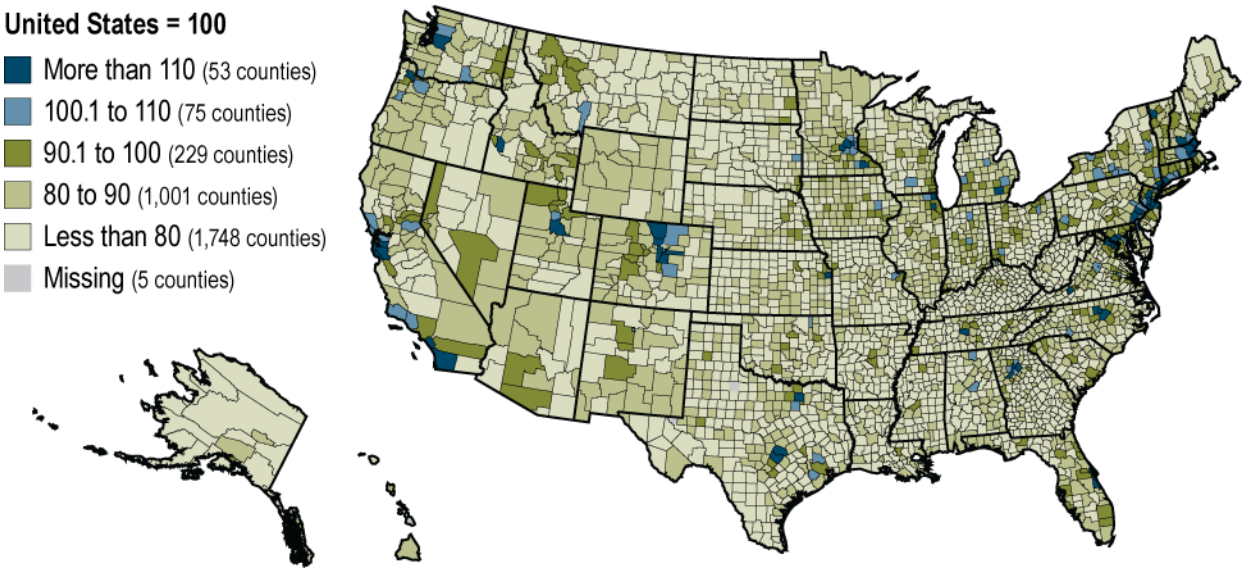
Source: Indiana Business Research Center

4.2.7 Spatial Considerations

Spatially, high-innovation counties tend to be proximate to metropolitan areas (see Figure 12). For instance, some of the greatest concentrations of high PII are clustered in the New England states, Silicon Valley, the District of Columbia, St. Paul-Minneapolis, and along the central corridor of Colorado. The highest innovation scores are not, however, always confined to the central portions of major cities. Take, for instance, Kansas City, Mo., where the composite indicator is marginal, but in suburban Johnson County, Kan., the composite indicator is among the highest in the country.

[29] The research team, however, cannot be certain about the direction of causality based on this approach.

Figure 12: County-Level Portfolio Index for the United States



Note: A missing value for any one data series results in a missing value for a sub-index, which results in a missing value for the PII.
Source: Indiana Business Research Center

4.2.8 Can Rural Regions Be Innovative?

The idea that innovation occurs only in large metropolitan areas is spurious. While rural regions may lack certain agglomerative effects for innovation capacity, the ability of a rural area to become an innovation leader should not be dismissed.

There are a number of rural counties (defined as 0.4 or greater on the Index of Relative Rurality[30]) that score above average in the portfolio index and also score above average in three or four of the sub-indices. Each of these rural counties has specific traits that lead to its strong performance, but no two counties have identical traits.

Here are a few examples:

- **Midland County, Mich.**, located 40 miles northwest of Flint, Mich., is an example of a rural county that fares quite well within the PII. Three sub-indices were greater than the U.S. average including two inputs and one output. Only economic well-being was below the U.S. average, and not by much. So what characteristics describe this rural county's relatively high performance in the PII? There are a few things that clearly set this county aside from other more rural areas, including large research and development expenditures by Dow Chemical, above average educational attainment, and high broadband density and growth. But the entire story is not positive. The county's GDP per worker is lower than the U.S. average, as is GDP-per-worker growth, migration, per capita personal income growth, and tech-based knowledge occupation share. The key to Midland's higher innovation score is that the strong positives outweigh the

[30] The IRR was briefly discussed in Chapter 3. It is comprised, by county, using four measures: population, population density, extent of urbanized area, and distance to the nearest metropolitan area. For more information, please see Section 3.2.2 of the prior report: www.statsamerica.org/innovation/report_role_of_regional_clusters_2007.html.

relative negatives. For instance, Midland's reported relative R&D expenditures are among the highest in the county.

- **Dodge County, Minn.**, directly west of Olmsted County, home to the Mayo Clinic, portrays a slightly different picture. Dodge County is located in the Rochester MSA due to commuter flow patterns into that city. Dodge County scores above the U.S. average in one sub-index input category and both sub-index output categories. Despite an absence of both R&D and venture capital investment in the county, the variables that set Dodge apart from the rest of the country include combinations of growth in the mid-aged populations, high growth in per capita personal income, low unemployment, and a low poverty rate.
- **Gallatin County, Mont.**, home of Montana State University in Bozeman, benefits from the presence of a major university. The two input categories are high, as is one output category. The presence of highly educated individuals, as well as R&D and VC investments, explains the above-average input sub-indices.
- **Los Alamos County, N.M.**, is home to Los Alamos National Laboratory where the Manhattan Project research was conducted. Except for the economic dynamics category, the county performs well in all other indices. In the other input measures, particularly educational attainment, the county performs very well. Los Alamos has the nation's greatest concentration of bachelor's or higher degrees in its population. This model to promote innovation, however, would be difficult, if not impossible, for other counties to replicate.
- **Steuben County, N.Y.**, has the Corning Glass Museum as its claim to fame. Corning, a glass and ceramic manufacturer, contributes significantly to Steuben's high output indices by providing a substantial amount of private R&D to the county on the order of $4.1 billion between 1998 and 2006. The county performs marginally well in the human capital area, but above average in every other sub-index.
- **Tioga County, N.Y.**, is located in the Binghamton MSA due to its commuter patterns. The county is home to Biolife Solutions, a large biosciences research firm. Tioga is an example of a county that performed above average in only one output sub-index and one input sub-index. In terms of economic dynamics, the county performs poorly with a low degree of establishment churn and low broadband density. However, the county performs very well in terms of human capital with a high location quotient for technology-based knowledge occupations.

While the precise sources of innovation in several of these counties would prove difficult to replicate elsewhere, such as the case of Los Alamos County, others could more easily be modeled. For instance, Steuben and Tioga counties mostly benefit from the presence of firms investing in major R&D ventures. These firms attract a certain type of worker capable of performing specified tasks, which in turn leads to increases in desired innovative outputs and improvements in the quality of life in the areas. Neither of these two counties performed above average in every sub-index, but still performed well overall on the PII.

4.3 Empirically Based Innovation Index

The Portfolio Innovation Index discussed above weights each incorporated measure relatively equally. To assess the validity of this broad approach, the research team also derived an empirically based Innovation Index (EII). The EII departs from previous attempts to index innovative activities by identifying those specific factors with the greatest influence on economic growth, while controlling for some non-innovation

factors. Interpreting this index is simpler than the portfolio approach because there is only one output measure—economic growth.[31]

The empirical scheme was developed with weights based on a descriptive cross-sectional regression model using the variables that most influence growth in GDP per worker.[32] The inputs, or independent variables, considered in this index are weighted according to their statistical relationship to the main measure of economic output. Instead of using the weights based on the beta coefficients from the regression model, the research team re-weighted the statistically significant and positive independent variables so that the weights, or coefficients, of the set of indicators summed to one. As a result, this empirical index diverges from a purely theoretical or empirical approach because factors that, theoretically, should contribute to innovation but showed a negative relationship to innovation were removed from the index.

Further discussion of the regression models and data used is available in Appendix C.

4.3.1 Comparing EII and PII

The empirical index uses the same equations presented for calculating PII's sub-indices, although only a single iteration is necessary due to the limited number of positively significant variables: mid-age population growth, two measures of educational attainment, growth in high-tech employment, average small establishments per 10,000 workers, average VC investment per GDP dollar and change in broadband density.

Estimates for the empirical index are positively correlated with the portfolio index (r=0.46) indicating a somewhat modest relationship between the two approaches. The indices, however, represent distinctively different approaches to measuring innovation performance. The PII takes a broad, multi-metric approach to gauge performance. The EII, however, posits that the rate of economic growth is partially determined by innovation and that the rate of economic growth is the most direct measure to gauge innovation performance.

4.4 Conclusion

Developing an innovation index relies on a relatively small pool of literature regarding indices and their applications in the social sciences. The data and method pursued by the research team for designing and building an innovation index attempted to appeal to two audiences: academic and policy-related researchers as well as economic development practitioners in the field.

This index is, to the research team's knowledge, the first attempt to create a comprehensive innovation measure at the county-level unit of analysis in the United States, and the measure is admittedly not perfect. The Europeans have noted that their own effort to create national measures for innovation has been fraught with difficulties. For example, using indices can result in a loss of variability and explanatory power through the grouping of data. It also implies that more data are always better. Finally, using all available data ignores

[31] Y=GDP-per-worker growth from 1997 to 2006

[32] Ideally a time-series regression model would be utilized; however, several key variables had only limited time frames available that were not conducive to this approach. The research team did run a time series analysis including as many of the independent variables as possible, but the results were weaker than the simple descriptive model that could incorporate a broader array of variables.

multicollinearity between variables and that some data are redundant (Hollanders and van Cruysen 2008). The Portfolio Innovation Index shares several of these flaws.

In order to address the issue of potentially spurious grouping of data and the loss of variability, a web-enabled database and tool was created as a part of this research project. The database and tool will allow a user to see the effects a particular measure (or data series) has on a county or region's overall index. Of potentially greater concern may be the degree to which concepts or measures are related conceptually and statistically. The research team minimized correlations between factors of the PII by carefully selecting data series, calculations and measures.

Imperfections aside, this index presents a state-of-the-art measure of county and regional innovation performance and capacity. This index can serve as a valuable tool for policymakers and practitioners to quickly evaluate innovative capacity and potential. As with all indices, however, the overall estimate is not as important as the sum of its parts. Economic development practitioners not only get a quick snapshot of how their region is doing in terms of innovation with the portfolio index, but they also have the ability to drill down into the highly granular data to gain a better understanding about their region's strengths and weaknesses.

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4.6 Data Sources

The Innovation Index used data from both official government statistical agencies and several private, proprietary sources.

The research and database team accessed the following websites between May and August 2008. In all cases, the latest year available (lya) of each data series was used. In the majority of cases, 2006 was the latest year available. The initial year for a majority of the economic statistics on employment and output was 1997, the first year of the major revision in industrial classification, i.e., the NAICS. For data series that did not begin in 1997, the series extended as far back as possible. In several cases—notably educational attainment and migration—the data were anchored in 2000, the year of the last decennial Census.

Economic Modeling Specialists Inc. (EMSI), Spring 2008 Release v. 2, www.economicmodeling.com, (data series: EMSI Complete Employment).

Used for:

Number of Technology-Based Knowledge Occupation Employment, **Technology-Based Knowledge Occupation Cluster**, Human Capital Sub-Index

Total Employment (EMSI Definition), **Technology-Based Knowledge Occupation Cluster**, Human Capital Sub-Index

Federal Communications Commission, Local Telephone Competition and Broadband Deployment, www.fcc.gov/wcb/iatd/comp.html, (data series: ZIP Codes by Number of High-Speed Service Providers).

Used for:

Broadband Weighting Factor, **Broadband Density and Penetration**, Economic Dynamics Sub-Index

Innovation Economy 360, Decision Data Resources, www.ie360.net, (data series: Venture Capital Investment).

Used for:

Total Venture Capital, **Average Venture Capital**, Economic Dynamics Sub-Index

Innovation Economy 360, Decision Data Resources, www.ie360.net, (data series: Private Research and Development).

Used for:

Total Research & Development Funds, **Average Private R&D**, Economic Dynamics Sub-Index

Innovation Economy 360, Decision Data Resources, www.ie360.net, (data series: Patents).

Used for:

Total Patents, **Average Patents per 1,000 Workers**, Productivity & Employment Sub-Index

Moody's economy.com, www.economy.com/databuffet/pro/beta/ , (data series: FEZTECA, High tech industries employment in thousands, seasonally adjusted).

Used for:

High Tech Employment, **High-Tech Employment Share**, Human Capital Sub-Index

High Tech Employment, **Change in Share of High-Tech Employment**, Productivity & Employment Sub-Index

Moody's economy.com, www.economy.com/databuffet/pro/beta/, (data series: FETA, Total non-farm employment in thousands, seasonally adjusted).

Used for:

Moody's Estimated Total Employment, **High-Tech Employment Share**, Human Capital Sub-Index

Moody's Estimated Total Employment, **Change in Share of High-Tech Employment**, Productivity & Employment Sub-Index

Moody's economy.com, www.economy.com/databuffet/pro/beta/, (data series: RGDPA, Total Gross Product, in millions).

Used for:

Current-Dollar County GDP, **Average Venture Capital**, Economic Dynamics Sub-Index

Current-Dollar County GDP, **Change in Gross Domestic Product per Worker**, Productivity & Employment Sub-Index

Current-Dollar County GDP, **Gross Domestic Product per Worker**, Productivity & Employment Sub-Index

National Science Foundation, IPEDS Completions Survey, webcaspar.nsf.gov, (data series: Degrees/Awards Conferred [NSF population of institutions]).

Used for:

Number of Sciences and Engineering Graduates – Bachelor's and Advanced Degrees, **S&E Graduations from State Institutions**, State Context Sub-Index

National Science Foundation, Division of Science Resources Statistics, www.nsf.gov/statistics/nsf08318/, National Patterns of R&D Resources, (data series: U.S. R&D Expenditures by state, sector, and source of funds).

Used for:

Research and Development Expenditures by University and Private Firms, **R&D Spending per Capita**, State Context Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts, Compensation by Industry, www.bea.gov/regional/reis/default.cfm?catable=CA06.

Used for:

Total Worker Compensation, **Average Private R & D**, Economic Dynamics Sub-Index

BEA Wage and Salary Earnings, **Compensation – Annual Wage and Salary Earnings per Worker,** Economic Well-Being Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts – Total Wages, Wage Employment, Average Wage Per Job, www.bea.gov/regional/reis/default.cfm?catable=CA34&section=2.

Used for:

BEA Wage and Salary Employees, **Compensation – Annual Wage and Salary Earnings per Worker,** Economic Well-Being Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts, Personal Income and Detailed Earnings by Industry, www.bea.gov/regional/reis/default.cfm?catable=CA05N&series=NAICS.

Used for:

BEA Nonfarm Proprietors Income, **Compensation – Proprietor's Income per Proprietor**, Economic Well-Being Sub-Index

BEA Personal Income, **Per Capita Personal Income Growth**, Economic Well-Being Sub-Index

BEA Population Estimate, **Per Capita Personal Income Growth**, Economic Well-Being Sub-Index

U.S. Bureau of Economic Analysis, Regional Economic Accounts, Total Employment by Industry, www.bea.gov/regional/reis/default.cfm?catable=CA25.

Used for:

BEA Total Employment, **Gross Domestic Product per Worker**, Productivity and Employment Sub-Index

BEA Total Employment, **Change in Gross Domestic Product per Worker**, Productivity and Employment Sub-Index

BEA Total Employment, **Average Small Establishments per 10,000 Workers**, Economic Dynamics Sub-Index

BEA Total Employment, **Average Large Establishments per 10,000 Workers**, Economic Dynamics Sub-Index

BEA Total Employment in Thousands, **Average Patents per 1,000 Workers**, Productivity and Employment Sub-Index

BEA Total Employment, **Job Growth – Change in BEA Employment Divided by the Change in Population**, Productivity and Employment Sub-Index

Nonfarm Proprietor's Employment, **Compensation – Proprietor's Income per Proprietor**, Economic Well-Being Sub-Index

U.S. Bureau of Labor Statistics, Local Area Unemployment Statistics, www.bls.gov/lau/.

Used for:

Number of Unemployed Persons, **Average Unemployment Rates**, Economic Well-Being Sub-Index

Number of Persons in Labor Force, **Average Unemployment Rates**, Economic Well-Being Sub-Index

U.S. Census Bureau, Company Statistics Division, www.census.gov/csd/susb/susbdyn.htm, Statistics of U.S. Businesses, (data series: Dynamic Data, County, Sectors).

Used for:

Establishment Births, Deaths, Expansions, Contractions and Constants, **Establishment Churn**, Economic Dynamics Sub-Index

U.S. Census Bureau, Census Bureau Economic Programs, County Business Patterns, www.census.gov/epcd/cbp/download/cbpdownload.html.

Used for:

Small Establishments with Less than 20 Employees, **Establishment Sizes – Average Small Establishments per 10,000 Workers**, Economic Dynamics Sub-Index

Large Establishments with More than 500 Employees, **Establishment Sizes – Average Large Establishments per 10,000 Workers**, Economic Dynamics Sub-Index

U.S. Census Bureau, Population Estimates Program, County Estimates By Demographic Characteristics – Age, Sex, Race, and Hispanic Origin, www.census.gov/popest/datasets.html.

Used for:

Mid-Aged Population (Ages 25-44), **Average Annual Population Growth Rate for Ages 25-44**, Human Capital Sub-Index

Population Estimate**, Broadband Density and Penetration – Average Number of Broadband Service Providers per County Translated from Population-Weighted ZIP Code Data**, Economic Dynamics Sub-Index

Population for Year, **Job Growth – Change in BEA Employment Divided by the Change in Population**, Productivity and Employment Sub-Index

Total Population, **R&D Spending Per Capita**, State Context Sub-Index

Total Population in Thousands, **S&E Graduates from State Institutions per 1000**, State Context Sub-Index

Total Population, **Average Net Migration**, Economic Well-Being Sub-Index

U.S. Census Bureau, Population Estimates Program, County Population, Population Change and Estimated Components of Population Change: April 1, 2000 to July 1, 2007 www.census.gov/popest/datasets.html.

Used for:

Total Net Internal Migration, **Average Net Migration**, Economic Well-Being Sub-Index

U.S. Census Bureau, Small Area Income and Poverty Estimates, www.census.gov/did/www/saipe/data/statecounty/data/index.html.

Used for:

Total Impoverished Persons, **Average in Poverty Rate**, Economic Well-Being Sub-Index

U.S. Census Bureau, Small Area Income and Poverty Estimates, Model Input Data, www.census.gov/did/www/saipe/data/model/tables.html.

Used for:

Poverty Universe, **Average in Poverty Rate**, Economic Well-Being Sub-Index

5. Investing for Competitive Regions: New Tools for the 21st Century

5.1 Investing in Competitive Regions

Investment represents the most critical decision made by every region trying to grow its economy, but it also represents a very complex task. At this stage, it is helpful to take a step back and understand the role that economic development investment plays in stimulating the growth of a regional economy.

The regional strategy process outlined in Chapter 2 is a crucial prerequisite to the investment decision process. It identifies the strategic opportunities that ultimately define the investment alternatives. It creates the framework within which investment decisions can be reached. And by operating at the regional level, it potentially assembles a critical mass of investment funding. Today, it is still common to find economic development in rural America operating at the level of a single community or county. One of the major limitations of this approach is that it fails to achieve the investment scale necessary to fund many of the public goods required in today's innovation-driven economy.

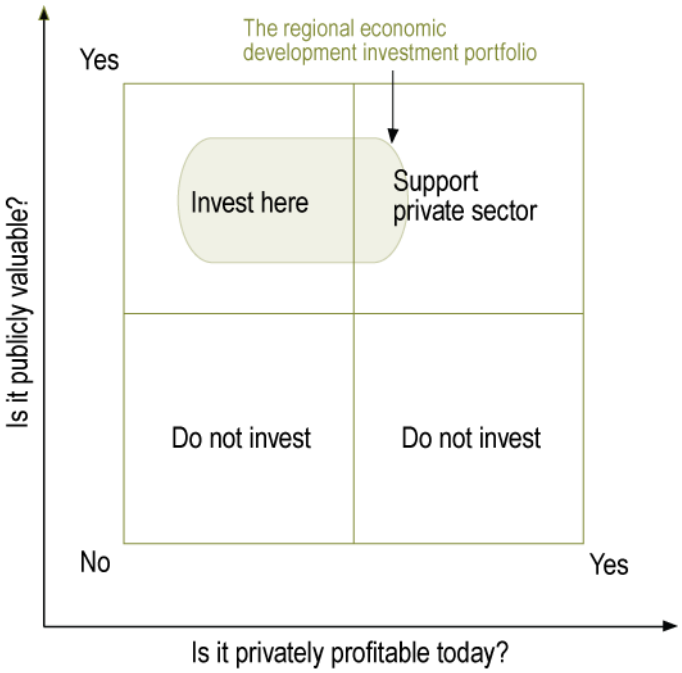
Successful investment for regional development involves making commitments today to attract private investment tomorrow. Indeed, we often measure the success of our public investment in economic development by the number of private dollars each public dollar attracts. The most effective economic development investment often takes place on the leading edge of the regional economy, where innovation stretches the region's economy in new directions. Typically, many economic development investments involve public/private partnerships, because these investments often come at the leading edge of an existing regional economy. At this edge, profits are rarely high enough to generate private commitments alone. Still, investments on this economic frontier can generate significant public returns over time.

Because the long-term payoff outweighs the short-term risks, regional investment strategy should focus on this frontier. Often this frontier is defined by public investments that unlock the economic value of a region's distinct economic strengths. More specifically, the process should identify investments with significant public value, but which are not sufficiently profitable for the private sector to undertake on its own (see Figure 13). These investments generally fall into two broad categories:

- **Publicly led, privately supported investments:** These typically involve large public goods projects that must be championed by public officials. Public dollars represent more than half of the total project investment. Large-scale infrastructure projects fall into this category.

- **Privately led, publicly supported investments:** These projects are typically led by the private sector, but the public sector provides a critical supporting role. Many workforce training programs, small business financing programs, and technology-based economic development initiatives fall into this category.

Figure 13: Effective Economic Development Investments Are Publicly Valuable, but Generate Relatively Weak Private Returns



Graphic developed by Morrison

In practice, successful economic development investments take on many forms. A useful way to frame the alternatives is to imagine five strategic focus areas in which a region can make strategic investments, as shown in Figure 14: brainpower (investments in people); entrepreneur and innovation networks (investments in business development); quality, connected places (investments in places); effective branding (investments in marketing); and civic collaboration (investments in leadership). These categories broadly correspond to the building blocks of 21st century regional economies and are discussed in more detail in section 5.2.1.

Figure 14: Regional Prosperity Depends on a Portfolio of Investments in Five Key Areas

Graphic developed by Morrison

The real challenge facing every region is to allocate investment across these five strategic focus areas in an optimal way. Optimal means the mix that best exploits a region's competitive advantages at the lowest possible risk. Achieving this outcome is tricky and represents a complex set of decisions. It requires that the region have the necessary prerequisites before it can even begin to invest: a Regional Partnership (the Who); a set of Strategic Outcomes (the What); and a Strategic Process (the How), as described in Chapter 2.

We are now prepared to take the discussion of Chapter 2 one step further. This chapter explores how a region can make informed investment decisions, ones that weigh potential returns against perceived risks. This chapter also explores how regional leaders can choose investments that provide the greatest degree of leverage, triggering additional investments from other funders, whether public or private.

5.2 Three Critical Phases of the Investment Process

A sound regional investment process has three critical phases, which roughly align with the phases of the regional strategy process discussed in Chapter 2. The first is discovery: understanding in what broad categories of investment the region currently invests. Ironically, this initial allocation of funding is not always obvious to regional leaders. It is essential to know where the region is before it can chart a course to where it wants to go.

The discovery phase also involves identifying opportunities for the region to combine its assets in new and different ways. Regional asset mapping is often a first step in designing a regional investment strategy. However, as we indicated in Chapter 2, this exercise involves more than simply listing the current assets that form the foundation of a region's current competitive position. The real value of regional asset mapping comes in exploring new connections among these assets. This amounts to an exercise in connecting

economic dots in creative ways, connections that ultimately transform the economic landscape of the region. So, for example, how could a community college work with a nearby four-year university to create new networks to support entrepreneurs with an incubator and angel investors? By pooling local knowledge and creating a forum for creative conversations about what is possible, regional leaders begin assembling investment options from which to craft a strategy.

The second phase uses the region's strategic plan to assemble an investment portfolio in tune with the region's overall competitive strengths. Typically, this strategy phase involves a portfolio of investments that include safe, commonsense initiatives, as well as investments that are riskier but offer higher potential returns.

In every case, the key is developing a list of potential investments directly linked to the region's development strategy. A safe, commonsense investment might be to create a common database of firms within the region, so that economic developer professionals can share information about how these firms might be able to collaborate with one another to establish stronger inherent clusters. Establishing a research foundation to attract nationally recognized researchers to a local university is an example of a higher risk, higher reward investment.

This general approach has been followed in many regions throughout the nation. The West Alabama-East Mississippi WIRED region developed a set of investment projects that aligned with its overall strategy that emphasized advanced manufacturing, tourism, entrepreneurship, health care, and warehousing and distribution. After evaluating the alternative returns from public action, the region put its first priority on creating a region-wide certification program on advanced manufacturing skills at its eight community colleges.

The third phase of regional investment is evaluation: constantly monitoring the region's investments and evaluating how to update the investment portfolio as conditions change. Monitoring can be effective, however, only if regional leaders embrace metrics that provide a dashboard of investment returns. During the strategy phase, leaders must craft clear outcomes for each investment initiative. They must clearly define the measurable dimensions of success. Clear metrics help ensure focus and alignment. They also provide an objective means of measuring progress against benchmarks. Follow through is no simple matter; it requires discipline and determination to adjust course in the face of disappointment or failure.

During the evaluation phase, a subtle but important shift occurs in the way metrics are used. Traditionally, we think of metrics as a mechanism of control. Within hierarchical organizations, metrics alert managers to deviations in predicted performance. In today's economy, metrics are also an important learning tool. Many economic development investments are experiments. Metrics provide the tool to discover what works.

This section explores these three phases and discusses some new tools that help regions achieve sound investment decisions.

5.2.1 The Investment Discovery Phase

Regions are competing in a dynamic global economy. New technologies emerge continuously. Capital now flies around the globe at the click of a mouse, transcending borders and opening markets. Low-cost labor undercuts the competitive position of established businesses. The Internet, the first interactive mass medium, opens the door to entirely new organizational forms across traditional market boundaries.

All of these factors create a complex economic environment in which to make economic development investments. Regional success depends on combining knowledge, skills and creativity in new ways. Global

competition expands the range of potential economic development investments dramatically. New advances in brain science, for example, underscore the importance of early childhood education for later cognitive development. In a global economy that runs on brainpower, therefore, investments and early childhood education now fall within the realm of economic development (Committee for Economic Development 2006).

At the same time, community colleges and research universities are emerging as important actors within regional economies. Collaborative investments geared toward unlocking the innovation potential of these institutions are accelerating. Leading-edge regions also are recognizing the importance of innovation in secondary education to fill the talent pipeline needed to support high-growth companies. Accordingly, they are investing in initiatives to build science, technology, engineering and math (STEM) skills among high school students.

Keeping track of these investments without a strategic framework can be confusing—and confusion undercuts consensus. To overcome this confusion, we have developed a framework that identifies five categories of strategic investment (refer again to Figure 14). These categories correspond to the critical ingredients for competitive regions in today's global economy:

- **Brainpower:** Regional competitiveness begins with brainpower. Thus, regions need to develop systems that equip public and private leaders with 21st-century skills—along with continued support of the human capital of workers and entrepreneurs throughout the region.

- **Innovation and entrepreneurship networks:** Successful regions are capable of converting this brainpower into wealth through effective innovation and entrepreneurship networks. Innovation is increasingly a regional phenomenon, and competitive regions are building effective innovation systems that create the climate in which new ideas sprout at rapid rates. Innovation provides the process and entrepreneurship provides the temperament and skills to translate ideas into wealth through new products, new services, and new markets. A region's networks also define the support systems that underpin entrepreneurial success.

- **Quality, connected places:** Regions must also invest in the planning and infrastructure to create quality, connected places. Smart people and high-growth companies are mobile. They can locate virtually anywhere. They will choose to locate in regions that value connected, safe, convenient and healthy places to live and work. Connectivity requires infrastructure to facilitate internal and external communications: strategic transportation links and information technology connections. Connectivity extends beyond these physical connections to activities that explicitly focus on building networks among people (United Kingdom 2004).

- **Branding and story-telling:** Successful regions tell their story through powerful experiences and effective marketing. Branding not only creates value for the region's products for international buyers, it also creates the sense of identity necessary to spur collaboration throughout the region. Tuscany serves as a powerful example of successful branding that has given wine, olive oil, and tourist destinations distinct market cache that has translated into a much stronger regional economy over time. International branding expert Simon Anholt has coined the term "competitive identity" to more clearly represent the importance of place-branding in the global arena (2007). By developing a competitive identity a region does much more for itself than simply "marketing." The process of branding requires many of the same

steps needed for region-building, strategic planning and regional investment alignment—developing common goals, creating a common vision (e.g., "who we are" and "what we represent to the world"), discovering regional strengths and so on. Successful project positive images to both residents and outsiders; they create a "buzz" that retains and attracts brainpower. A region's brand represents the stories that citizens of a region tell about themselves. The stories create a shared understanding of the region's distinct identity and its economic potential. Increasingly, regional leadership requires the skills of telling engaging stories and compelling narratives linking a region's past strengths to its future opportunities (Denning 2005).

- **Collaborative leadership:** Economic development involves designing and implementing complex investment partnerships. These partnerships form in the civic space that exists outside the walls of any one organization. Civic spaces represent places in a community or region in which focused conversations about complex issues can take place. These civic spaces include forums, conferences, and regular informal events. Many regions have ignored the civic spaces; now they must rebuild them. This step requires building new civic habits of dialogue and inclusion.

This strategy framework can be used throughout the regional strategy process. Initially, it provides a convenient way to group regional actors according to their strategic focus. So, for example, school superintendents, teachers, workforce development professionals, and librarians fall into the brainpower quadrant, while small business development professionals, angel capital investors, university technology transfer professionals, and many economic developers focus on entrepreneurship in innovation networks. Physical planners focus on issues of developing quality, connected places. Tourism professionals concentrate on packaging powerful experiences, detailing regional stories, and promoting an effective brand. Food and agriculture leaders are also looking at ways to create branded food products in the same way that Napa Valley and Tuscany have done. Local and regional leadership programs concentrate on strengthening collaborative skills. The strategy mapping tool helps to organize regional assets into sensible strategic categories.

Notice that the strategy framework broadly defines economic development to include areas that are typically considered workforce development, community development, urban and regional planning, and tourism development. Successful regional development strategies require the consideration, involvement and coordination of the full range of available developmental activities rather than the compartmentalization that typically occurred in the past.

The strategy framework also provides a good vehicle to categorize public, private and nonprofit investments in economic development across the region. For example, the framework makes it easy to identify all of the regional chambers of commerce and their respective investments in brainpower development, or, alternatively, to provide a quick overview of how much the region is investing to promote entrepreneurship and encourage start-up companies. The framework provides a convenient, easy-to-understand accounting of a region's investments in economic development.

By defining and mapping regional goals onto the strategy framework, regional leaders can gain some insights into whether their current level and pattern of economic development investments appropriately reflect their goals.

Here's one example of a mismatch. The Charleston, S.C., region suffers from particularly low educational attainment. High school dropouts are high, and relatively few young people move on to postsecondary

education. Employers are quick to notice, complaining of the chronic shortage of skilled employees. In this region, the private sector makes its economic development investments through two channels: local chambers of commerce and a regional economic development alliance. Mapping these private-sector investments on to the strategy framework reveals that the region invests six times as much in marketing and branding initiatives as it does in educational initiatives to improve the workforce. Clearly, the region's investment initiatives are not aligned with the region's strategic priorities to improve per capita income.

5.2.2 The Investment Strategy Decision Phase

Investment dollars are finite, and not all investments yield the same public or private returns. As a result, strategy matters. Making investment decisions across different types of investment presents a particularly difficult challenge. How do you evaluate the choice between an investment in early childhood education versus an investment in a new business incubator? Of course, the choice is seldom as stark as that. Public investment dollars typically come with strings attached. Local, state and federal laws often restrict how economic development dollars are used.

In general, though, a region's development strategy is becoming ever more crucial in making investment decisions. Federal policies are shifting toward more flexibility in regional investments. In effect, this means that public agencies recognize that investments must align with a region's competitive advantages, and regions themselves must play a major role in identifying those advantages since that is where the greatest knowledge of the region lies. Flexibility has become a critical principle simply because governments understand that in a globalizing economy, one-size-fits-all policies do not work.

Two trends illustrate how flexibility in federal guidelines puts more onus on the region to rigorously identify investment priorities.

First, the federal government is encouraging regions to collaborate. As a consequence, we can expect more flexibility with federal funds in the future. The Workforce Innovation in Regional Economic Development (WIRED) initiative from the U.S. Department of Labor exemplifies this trend. For the 39 regions selected to participate, the WIRED initiative provided more flexible federal funding to encourage collaborations across traditional lines of education, economic development, and workforce development.

The leaders of these WIRED regions have faced a wide array of potential investment choices. In the cases of Southeast Wisconsin and North Central Indiana, regional leaders established flexible opportunity funds. In these regions, the WIRED leadership solicited innovative investment ideas to implement their strategies. Florida's Great Northwest, a 16-county region from Pensacola through Tallahassee, followed a similar path with its Innovation II initiative.

Second, private foundations are becoming more actively involved with direct investments in regional economic development. For example, in Southeast Michigan, 10 foundations have combined to form the New Economy Initiative for Southeast Michigan (NEI). An eight-year, $100 million effort, the NEI hopes to accelerate the region's transition to a more innovative economy. In Northeast Ohio, a large number of foundations came together to form a $60 million fund to make investments in that region.

As leaders move toward a regional scale, it becomes increasingly important to align the resources of the public, private and nonprofit actors. Regional scale expands the pool of investable funds, but as the pool expands, more actors are involved and decision-making can become more complex. Disciplined strategic discussions resolve this complexity in favor of explicit, clear and logical measures to evaluate alternatives.

Without consensus as to how investment alternatives are evaluated, regional leaders run the risk of making ad hoc, haphazard investment decisions. In the worst case, these decisions are made in secret without the transparency needed to build confidence in broader regional alignments.

Explicit regional investment strategies carry four distinct benefits. First, a good strategy documents how regional leaders will evaluate different regional economic development investments. By following a rigorous, analytical approach to setting investment priorities, regional leaders squeeze out speculation that investment decisions are based on ad hoc criteria or inappropriate considerations.

Second, an explicit strategy frames regional dialogue in a constructive way. By agreeing on what aspects of investments are the most important to consider and then considering these different aspects for each investment, regional leaders learn to focus their attention on the factors that matter.

Third, an explicit investment strategy establishes a record that documents how each investment decision is made. As such, it provides a vehicle for learning. After the results of an investment emerge, regional leaders can revisit their decisions and trace the logic that led them to invest. They can more easily learn from their mistakes and replicate their successes.

Finally, the investment strategy builds trust in the process of making complex civic decisions. To be sustainable, regional investment strategies must transcend the personalities of individual civic leaders engaged at the moment. A commitment to an explicit strategy lends stability and focus to these decisions over time.

5.2.2.1 The Regional Investment Portfolio Tool

A critical phase of a region's investment decision is figuring out which areas of investment will best align with its competitive advantages. This means the investment decision must be linked to the analysis of the region's competitive niches. An analogy helps frame the challenge and unlock the solution. A 21st century region faces essentially the same investment decision that a mutual fund manager does. Unless they manage a sector fund, most fund managers must make two critical decisions in investing their dollars. The first decision is to allocate investment funds across sectors. The second is to pick stocks within each sector. In both cases, projections of risk and reward will guide the decision. But there is a natural sequence to follow. The first major allocation decision involves picking sectors that hold the greatest promise. In exactly the same way, each region must pick those sectors where it believes it has the greatest economic advantage or those in which it has a good chance of building competitive advantage.

The regional allocation decision can be addressed with a strategic investment portfolio tool. This tool has two key elements and a goal for each:

- The first element is gathering together key pieces of information that flow from and link to the competitive advantage analysis described above. The first goal is to develop a matrix of critical information on alternative investments to inform an optimal allocation of the region's public investment funds.

- The second element is facilitating a dialogue among key leaders in the region to weigh the alternatives and assign priority to those that point to the best economic outcomes for the region. The second goal is to frame the alternatives, inform discussion, and lead it to a decision.

The Regional Investment Portfolio Tool (RIPT) is designed to help a region identify the public investments most critical to carrying out its economic development strategy. The tool is based on the same decision measures that investment managers use in allocating a pool of financial capital across a range of possible investments. In this case, the investment pool is public funds (federal, state, and local) that could be invested in public goods critical to the region's development strategy. Thus, the regional development strategy is a critical starting point for developing and using the investment tool.

Developing the tool can usefully be divided into two phases: preparation and implementation. The preparation phase involves gathering extensive background information that provides the information base on which regional leaders can base their investment decision. The implementation phase involves a facilitated roundtable dialogue where regional leaders reach express preferences and reach consensus on top investment priorities.

Preparation phase

The goal of the preparation phase is to gather the information necessary for the region to make a sound investment decision.

- **A regional development strategy** that outlines the region's plan to seize its competitive advantage is the essential starting point. This strategy will be the result of an extensive process whose aim is to diagnose the region's competitive advantage and build consensus around it. Thus, the strategy will already have identified the handful of industries in which the region believes it has a competitive edge in both the near term (three to five years) and long term (five to 10 years). For the purposes of this tool, these industries need to be identifiable by NAICS codes. An example of the strategy for the West Alabama-East Mississippi (WAEM) 37-county region can be found at http://waem.tmi.ms/research.html.

- **National growth projections for the target industries** provide an important context for the investment decision and allow a side-by-side comparison of potential returns for alternative investments. While the projects are available only at the national level, they nonetheless provide a useful benchmark for comparison. The Bureau of Labor Statistics projections for growth in employment and production by industry are a good baseline for comparison. These are publicly available at www.bls.gov/emp/.

- **Impact estimates for target industries** provide a comparative analysis of investments in alternative industries. The analysis focuses on three different impacts: production, employment, and income. The production measure serves as a proxy[33] for gross regional product (similar to GDP). Together, the impact measures provide a starting point for comparing investments in alternative industries. The measures are essentially multipliers that compare the impact of an equal investment in each target industry. They are only a starting point, though, in that they view the future through the lens of the region's existing economic landscape. They do not, for

[33] In the language of economics, a "proxy" is a substitute measure for something that cannot be measured easily, or for which little or no information is available. This is the case with Gross Regional Product.

example, capture the full impact of investments that widen the scope of an industry cluster. Thus, the impact analysis is indicative, not conclusive.[34]

- **Fiscal measures** provide an important sense of the budget constraint facing the region. Fiscal capacity provides a general measure of the region's available tax base, while fiscal effort provides a measure of how intensively that base is currently taxed. By comparing the two measures, regional leaders gain an indication of how deep their public funds may be. Regions with high capacity and low effort have a comparatively large budget to spend while regions with low capacity and high effort face a much tighter constraint.[35]

- **A list of alternative investment projects under consideration** provides detail on the timeline and scope of funding alternatives. These projects are ones regional leaders have under serious consideration within each strategic opportunity. Specifically, information is gathered on the timeline and dollar amounts of each project.

All of the above information is combined in an investment decision matrix—the centerpiece of the RIPT. This matrix provides a full comparison of alternative investment opportunities, allowing regional leaders to weigh alternative impacts, prospects, and timelines. The fiscal measures circumscribe the comparisons, giving a sense of the budgetary freedom the region has in selecting its overall investment plan. Figure 15 provides a sample investment decision matrix for a selected region, in this case the West Alabama-East Mississippi WIRED region.

The investment decision process actually unfolds in two key steps. The first step is to allocate investments across the key strategic opportunities. This is shown in Figure 15. This decision corresponds to an investment manager allocating investments across key sectors. In this case, the rows represent the strategic opportunities that were identified through a regional strategy process in the WAEM region. For each opportunity, a comparison is made of the regional economic impact, payback horizon, anticipated national rates of growth, leverage, and risk.

The second step is to allocate investment to individual projects within a given strategic opportunity. This step necessarily requires greater care in specifying individual investment projects that can advance the overall regional strategy. This second round of analysis corresponds to an investment manager picking individual stocks within each sector. In the case of the Alabama-Mississippi region, these are shown in the second portion of Figure 15 as subcategories within each major sector for which projects were identified. In ranking each project, it is helpful for the region to understand whether the project is building basic infrastructure, what might be called an "essential public good," or whether it is aimed at unlocking the unique potential in

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[34] The impact measures flow from input-output analysis, a technique well-suited to comparing the impacts of alternative industries. This regional economic analysis tool is widely available. IMPLAN is a widely used input-output model; the Socio-Economic Benefit Assessment System (SEBAS) model is another approach. This model has been adopted by the U.S. Department of Agriculture to evaluate the impacts of several of its programs. A user's guide for the SEBAS model can be found at www.cpac.missouri.edu/projects/national_programs/sebas_guide.pdf.

[35] The RIPT uses county-level measures of fiscal capacity and effort based on an extension of the state-level methodology of the U.S. Advisory Commission on Intergovernmental Relations (1982) applied to counties. Due to varying state tax structures, a generic template for this analysis is not available. Hoyt (2001) provides an excellent starting point for developing a state-specific methodology.

that strategic sector, what might be called a "competitiveness public good."[36] In the more detailed assessment, it is also helpful to understand the overall scale of the project and thus understand how much of the region's investment pool it may require. However, a mitigating factor may be the ability to leverage public investment with other sources, which is reflected in the leverage column.

The sections in Figure 15 provide the critical factors to be considered in weighing the alternative sector investments.

- The impact multiplier section shows the expected impact of investing a representative $1 million in that sector. Each column shows in turn the impact on jobs, income, and output. These estimates are developed through a regional economic model, such as IMPLAN or the Socio-Economic Benefit Assessment System.

- The payback horizon section indicates the time horizon over which the investment will pay off—short (one to three years), medium (three to seven years), or long (more than seven years). These timelines are developed in consultation with regional leaders and reflect the amount of time required for the investment to reach its full economic potential.

- The U.S. production and employment sections indicate how much growth in output and employment, respectively, is anticipated in each particular sector. These projections are national estimates, not regional ones. They come from the U.S. Bureau of Labor Statistics Employment Projection Program.

- The funding leverage section indicates the degree (low, medium, and high) to which investment in the sector can be leveraged with additional funding from national, state, or local sources. These sources would include funds from other state and federal programs, foundations, and other private sources.

- The success probability section indicates the risk associated with investing in the particular sector. This assessment of risk (low, medium, and high) is based on consultation with regional officials who are knowledgeable about the respective investment.

The predetermined and participant-determined inputs to the RIPT matrix, shown in Figure 15, are described below.

Predetermined Inputs

- ***Principal investments*** are the strategic areas of investment opportunity that flow out of the strategy development process. The underlying foundation for this whole matrix is a regional strategy that has already identified the region's competitive advantages. While these are already "predetermined" in a sense, they are the result of significant knowledge and analysis by leaders in the region.
- ***Investment subcomponents*** provide detail on the types of sub-projects that make up the principal investment.

[36] This distinction between essential and competitiveness public goods is gaining favor at the OECD as a means of highlighting those investments that are directly linked to a region's competitive advantage. Such a distinction is particularly helpful because of the powerful inertia behind a more generalist focus on infrastructure that persists from the era of business recruitment.

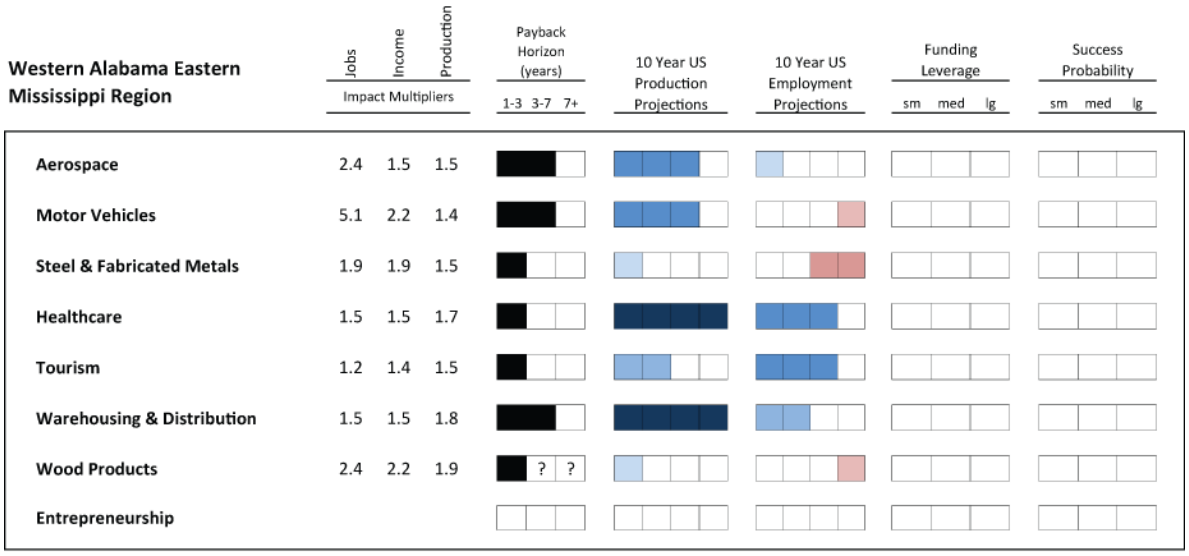
- ***Essential public good*** indicates that the project will involve investments in foundational elements that all regions need to compete (e.g., roads, water, sewer, primary/secondary education).
- ***Competitiveness public good*** indicates that the project will involve specific investments targeted at unlocking one of the region's distinct competitive advantages.
- **Production and employment projections** are for the nation as a whole from the U.S. Bureau of Labor Statistics Employment Projections Program, www.bls.gov/emp/home.htm.

Participant-Determined Factors

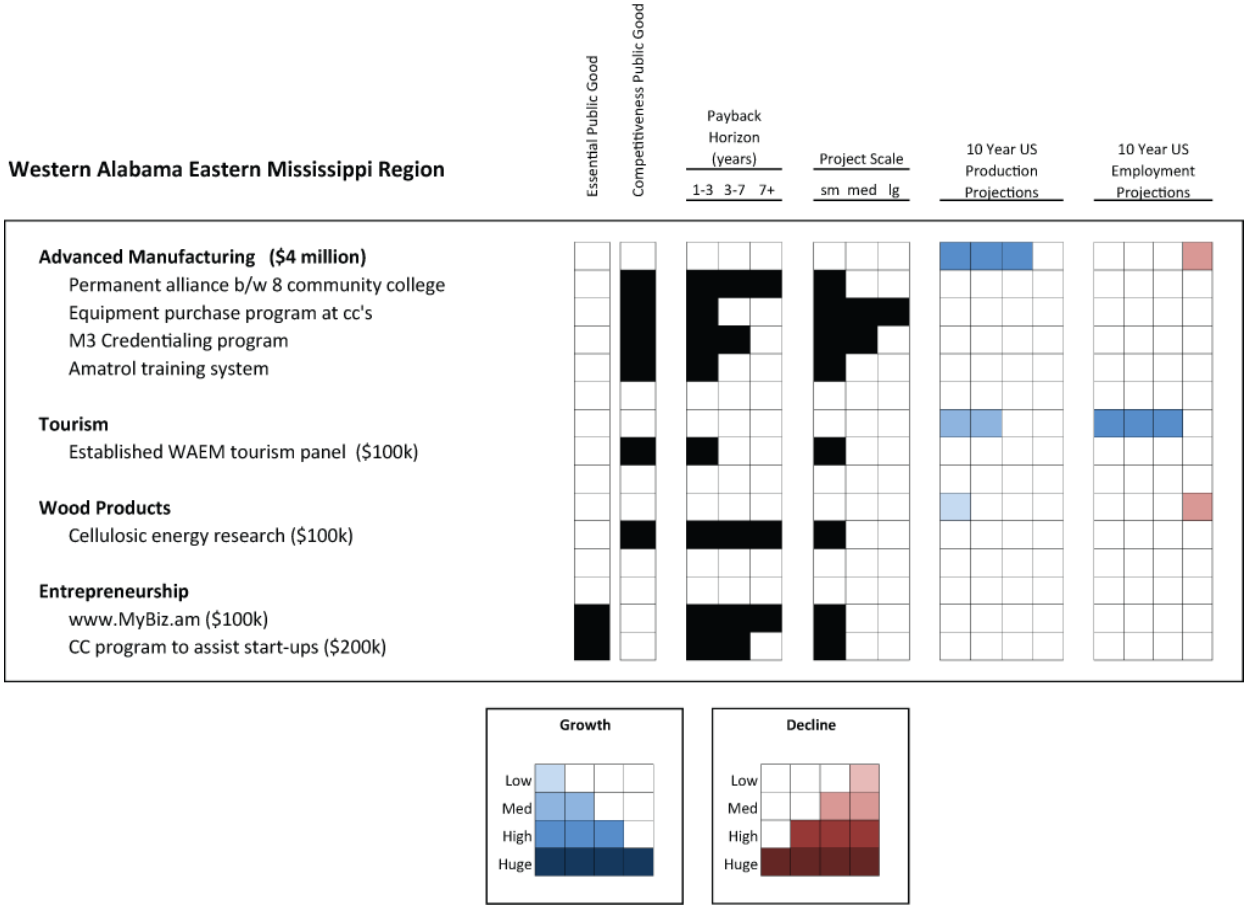
- ***Payback horizon*** is the period of time necessary for the project to realize its full economic impact (e.g., short-term, intermediate-term, or long-term).
- ***Project scale*** refers to the relative size of the project investment, with special focus on amounts that must be funded by the region itself.
- **Funding leverage** refers to the degree to which matching funds are available from outside sources.
- **Success probability** is an estimate of the likelihood the project will achieve its objectives.

Figure 15: Components of the Regional Investment Portfolio Tool

Investment Allocation Matrix (Principal Investments)



Investment Prioritization Matrix (Subcomponent Detail)



Graphic developed by Drabenstott

Implementation phase

While all of this information is helpful, it is useful only if it informs a sound regional decision. Turning information into decision is the whole purpose of holding an investment roundtable. The dialogue is facilitated by the coach described in Section 2.3.3. To be effective, the regional coach must be fully schooled in the regional analysis and all the information that went in to the decision matrix (ideally, this person or group would have developed the RIPT matrix).

The goal of the implementation phase is to reach consensus among regional leaders on public investment priorities. Key steps to this goal include revealing initial investment preferences across the spectrum of leaders, facilitating an exchange of opinions on critical factors in the region's investment decision, and creating an objective forum where differences in opinion can be mediated.

Implementing the public investment decision tool successfully requires bringing together the right group of regional leaders and having a process that elicits an engaged dialogue on the alternative investments facing the region.

The roundtable process has three key steps. The first is to present the information on the alternative sectors under consideration. The second is to pose a series of questions aimed at revealing preferences on which sectors offer the highest risk-adjusted reward. The final step is to identify the range of opinions, close gaps, and move to a consensus decision if possible.

The outcome of this exercise can be very powerful. Most investment analysts believe that the most important investment decision that any investor makes is the allocation across investment categories. This is the same desired outcome of the strategic investment allocation tool.

The investment matrix is a powerful device, but it has tangible value only when it becomes the focus of deliberation by the partnership that is implementing the region's strategic development. The investment tool, therefore, becomes valuable through a process of facilitated discussion among the partners. Who should be involved in this discussion and how can the investment decision best be discussed?

The Who. By the time a region begins an in-depth discussion of public investment priorities, it should already be well-advanced in sustaining an effective form of regional partnership—a group of leaders who provide oversight and governance structure to the region's economic development strategy. This regional partnership group becomes the critical forum for implementing the tool. As in forming a regional strategy, it is critical that this group of leaders represent the region's diverse landscape of sectors and geography. In terms of sectors, it is important that public, private, philanthropic, and civic groups all be part of the discussion. In terms of geography, the region's rich array of local landscapes must all be represented. The strategy process likely provides the impetus for the regional partnership and encouraged it to galvanize. That said, the investment prioritization process can be an important means of further strengthening the partnership and extending its role to a decision framework. All available evidence suggests that prosperous regions are characterized by strong regional partnerships that can act decisively.

Implementing the public investment priority tool requires in-depth discussion among key stakeholders. Thus, a group that is 25 to 30 in number is a good target, since it is difficult to facilitate in-depth discussion in a larger group.

The How. The public investment tool is implemented in a roundtable meeting facilitated by an external expert who has been actively engaged in preparing the investment decision matrix. It is also helpful if this expert has in-depth knowledge of the region's economic development strategy, or was actively involved in its development. The strategy forms the critical backdrop for implementing the tool.

There are three critical phases of the roundtable meeting:

- **Information sharing:** The starting point is to share objective information to all roundtable participants on the region's strategy, its investment alternatives, and the funding situation it faces. This involves re-capping the strategy and then walking through the investment decision matrix. This provides the foundation for the investment dialogue to follow.

- **Revealing individual investment priorities:** The next step is to identify the range of individual priorities. This can be done through individual forms, where participants rank investment priorities, or by electronic device where these priorities are registered. A quick compilation of these priorities is then gathered and shared with the group. The range of priorities then forms the basis for group discussion and moving to consensus.

- **Mediating differences and building consensus:** The facilitator reminds the group of its general budget constraint and then tries to find avenues of agreement that could lead to a consensus on investment priorities. The goal is to build consensus on one set of priorities. At the end of the story, however, it must be emphasized that the priorities belong to the region itself. Thus one outcome may be a bi-polar or multi-polar set of top priorities. This represents an impasse that could be addressed by an additional roundtable. If that course is desired, then additional clarification of project scope and timing would be sought to further refine the investment decision matrix.

An important outcome of the roundtable is to produce a report that describes the region's investment priorities. This report would be likely be five to 10 pages in length and contain the following information:

- Concise summary of the region's development strategy.
- Discussion of the region's public investment alternatives, drawing on the information contained in the investment decision matrix.
- Re-cap of the roundtable discussion, highlighting the points of consensus and describing the range of views presented.
- A list of top investment priorities and the implications for future action by regional leaders.
- Discussion of the funding and tax implications for the region.
- Discussion of the steps the region will take to implement the investment plan and evaluate its ongoing impact.

The report would be written by the roundtable facilitator and then reviewed by participants before publication.

5.2.3 The Evaluation Phase

We have introduced a suite of new tools to help regional leaders identify strategic investment priorities. These tools are founded on the importance of linking regional strategy and investment. Once an investment is made, however, the challenge shifts from selecting an investment portfolio to managing one.

Evaluating strategic investments after they take place poses some tricky challenges. First of all, by definition, economic development investments generate public returns that are not always captured by market returns alone. With a private investment, an investor can quickly evaluate among different investments by both the rate of return (projected returns as a percent of the initial investment) and risk (the variability of those returns). If the investor's expectations are not met, it's easy to reallocate investment within the portfolio. With economic development investments, however, the comparisons are not so easy. How do we capture the public returns? How do we monitor both the spectrum of public returns generated and the risks attached?

Two techniques help fill this gap in measurement: cost-benefit analysis and economic impact analysis. Cost-benefit analysis leads to a simple decision rule: Make an investment if the benefits (however estimated) outweigh the costs. Economic impact analysis takes a different look. Using an economic model, this approach estimates the total economic impact of a given investment by estimating economic flows. Economic impacts include both direct and indirect effects, reflecting what economists call "the multiplier."

While sensible, both of these approaches have significant practical limitations as evaluation tools for an economic development investment portfolio. First of all, they are cumbersome and costly to use. Accurately estimating the benefits for an economic development investment often requires extensive surveys to estimate public benefits and whether the benefits, once realized, meet expectations. Economic impact analysis relies on an underlying model of an economy, often constructed from detailed input-output tables. Neither of these approaches works easily as management tools after investment funds have been committed.

A second weakness appears in the form of measurement bias, which is often hidden in the analysis. Critics of economic impact analysis often point out that an analysis can easily be distorted by simply "manipulating the multiplier." By using an inflated multiplier, an analyst can quickly make a sour investment appear sweet. Indeed, there is good evidence to suggest that economic impact studies of large scale public investments, such as convention centers, routinely reflect a bias that overestimates the economic impact of these investments (Sanders 2005).

Given these shortcomings, it is not surprising that analysts have adopted another tool—a simple productivity measure—to evaluate economic development investments. Under this approach, economic benefit is defined narrowly to include only the employment impacts of an investment. The productivity measure estimates the level of investment that generates one job. So, for example, an investment of $10 million that generates 400 jobs yields a productivity measure of four jobs per $100,000 invested. An economic development investment that yielded 10 jobs per $100,000 invested would be more effective, since it would produce a higher level of employment for a given level of investment.

This simple measure suffers from two core weaknesses. First, it equates economic benefit with jobs— a narrow view of economic development. There is no allowance in the measure for the types of jobs generated by the investment—low-paying versus high-paying, for example. Other factors outside employment are excluded from the evaluation. Second, like the other methods of investment evaluation, this approach is vulnerable to hidden bias. Proponents of a particular investment can easily inflate the number of jobs

generated from an investment. Not surprisingly, economic development investments are often criticized for failing to deliver the promised employment from the investment (Miller and Associates 2009).

A model adopted by the U.S. Department of Agriculture is a very promising way of overcoming this challenge. The Socio-Economic Benefits Assessment System is an impact model that explicitly adjusts for the quality of jobs being created (Johnson et al. 2007). This model appears to be one of the few that is gaining traction in Washington to evaluate federal investments in economic development.

Another promising approach looks at the investment leverage generated by the economic development investment: For every dollar of economic development investment, how many dollars of private investment are generated? The logic of this measure is straightforward. Effective economic development investment operates on the boundaries of existing markets; it "stretches" these boundaries and, in so doing, induces new private investment. By this measure, a public economic development investment is more effective if it triggers higher levels of private sector leverage. Indeed, the concept of leverage moves to the core of what economic development investments are designed to accomplish.

Nevertheless, none of these approaches to investment evaluation deals with the central challenge of measuring the "strategic fit" of a proposed investment: How well is the investment aligned with the region's development strategy? How does it exploit the region's competitive advantages?

To address this challenge of evaluating strategic investments, regional leaders in North Central Indiana, a WIRED region, designed their own approach with a mix of tools. The leadership placed $5 million of its $15 million grant into an Opportunity Fund to finance innovations in four strategic focus areas: talent development; entrepreneurship development; cluster development; and leadership development. Within each focus area, the leadership articulated a clear strategic outcome. They then solicited outside proposals for innovative investments to reach these outcomes.

The evaluation system includes these components.

1. **Metrics aligned to strategic outcomes.** Each investment option is characterized by output and outcome metrics.[37] These metrics serve two purposes. During the proposal phase, the metrics assist the evaluators in drawing logical links between the investment and strategic outcomes. Closely aligned metrics are concise, and the linkage is easy to understand. After an investment is made, the metrics help evaluators track how well the investment is working. Here is an example: Regional leaders made a commitment of funds to provide tuition vouchers to adults who had attended college but who had not completed a degree. Within a few months of launching the program, leaders recognized that adults who had attended Indiana University–Kokomo were significantly more willing to use these vouchers than adults who had attended other universities in the region. Leaders quickly shifted investment dollars to expand the tuition assistance program at Indiana University–Kokomo.

2. **A phased or "stage gate" investment program to promote leverage.** Not all strategic investments are at the same stage of development. Some are in an exploratory phase. Other investment proposals are more developed. They may be designing and evaluating a pilot program. Or, they may be expanding an existing pilot initiative to a wider deployment across the region. North

[37] For a good discussion of different types of metrics, see Committee on Metrics for Global Change Research, Climate Research Committee, National Research Council, *Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Science Program* (2005).

Central Indiana uses three phases—exploratory, development, and deployment—to evaluate investments. As the size of the proposed investment increases and the development phase advances, co-investors must expand their participation. So, for example, a small exploratory investment requires no leverage. As the size of the investment increases and moves toward full scale deployment, the requirement for leverage increases. North Central Indiana uses this sliding scale to evaluate the quality and effectiveness of strategic investments as they develop.

3. **A decision matrix to create a record for ongoing evaluation.** Economic development investment decisions engages both quantitative and qualitative factors, both strategic analysis and strategic intuition. Subjective factors inherently play a part in all economic development investments. To maintain the integrity of the investment process, these subjective factors need to be made explicit. The leadership in North Central Indiana uses a decision matrix, similar to the Regional Investment Portfolio Tool, discussed in Section 5.2.2.1, to make subjective factors more quantitative and transparent. The tool used in North Central Indiana consists of a set of weighted criteria to evaluate potential options for a strategic investment. Evaluators rank potential options by giving them a score for each criterion. So, for example, in North Central Indiana, evaluators scored proposed strategic investments according to factors such as replication (Is this investment easily replicated?); scalability (Can this investment, if successful, be brought to scale across the region?); and sustainability (Are there clearly identified co-investors willing to continue this investment, if it proves successful?). The total score from the weighted criteria produces an easy way to rank investments to find the best set of strategic investments. After the investment commitment is made, the decision matrix provides a framework for evaluating the investment and determining whether expectations have been met. A decision matrix converts subjective factors—often unarticulated, often hidden—into clear and concise measures. This approach promotes transparency in the process of economic development investment. In turn, transparency is critical to building and maintaining the public confidence needed to sustain a strategic investment program and to learning what works.

This Indiana approach actually comports with a program authorized in the recent federal farm bill. The Rural Collaborative Investment Program (RCIP) would provide public support and technical assistance to help regions craft a development strategy, and at the same time set aside an investment pool available only after the region has set its investment priorities. This creates a strong incentive for the region to develop those priorities.

In this chapter, we have reviewed tools that both identify strategic investments and evaluate potential strategic investment to find the best fit with a particular strategy. Identifying and evaluating strategic investments blends science and art, analysis and intuition. As our tools advance, we will learn more about how to integrate them into effective regional strategies.

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6. Principles for Regional Governance in Economic Development

6.1 Introduction

This study uncovered a number of issues related to regional governance. An assumption that the study team held at the outset was that by presenting new tools for regional economic development—especially in rural areas—these instruments would naturally find a welcome among leaders throughout the region. However, while certain segments of the regional leadership have welcomed the tools and are looking forward to using them, other groups of leaders in the region have been less interested.

We have come to see that the extent to which leaders partner and think regionally is critical to how a region is able to understand knowledge-based development tools and, more importantly, forge a development strategy for the region as a whole. Regional governance is the term that experts typically apply to a partnership of public, private, and nonprofit leaders who come together to forge and implement a regional development strategy. However, across many parts of rural America, the term governance is still frequently confused with "government." While in concept the same, partnership is a term that often elicits more engagement from rural leaders.

This chapter looks at some fundamental principles of regional governance, examines these principles in action in three regions in rural America, and suggests possible approaches in future work with regions, especially rural regions.

6.2 The Concept of Regional Governance

The topic of regional governance has received considerable attention among regional policy experts and practitioners over the past 10 years. One definition of regional governance comes from the 2006 RUPRI white paper, *Eight Principles for Effective Rural Governance and How Communities Put Them into Practice*:

> Governance is the process of making and carrying out decisions. In its most common use, governance refers to the management practices of govern*ments*…
>
> Govern*ment* is the most recognized form of gover*nance*, but it is not the whole story. Effective governance incorporates a variety of decision-making and implementation practices by a wide range of people, organizations and institutions *beyond government* … Moreover, effective governance incorporates *community building* processes that develop leadership, enhance social capital and personal networks, and strengthen a community's capacity for improvement (Dabson 2006, 5).

Miller, in his 2002 study of regional governing for metropolitan regions notes that the United States has been moving from "a paradigm centered on Government to one centered on governing, or governance. Governing is the act of public decision-making and is no longer the exclusive domain of governments" (Miller 2002, 99).

Another definition comes from several OECD reviews of emerging regional development experience in many countries around the world. Regional governance is a collective term (OECD 2005). "Regional" refers to the functional economic geography that shares a common economic future. "Governance" refers to how public, private, and nonprofit leaders come together and organize the region's competitiveness strategy and implement it.

6.3 The State of Governance in Four Regions

Comprehensive regional governance is not a common phenomenon throughout much of America, although there are encouraging signs of change. County lines and limited public/private collaboration remain barriers to progress in facilitating sustained regional governance mechanisms. A critical issue for public policy is how to create the right conditions in which regional governance can form and thrive. The recent experiences of four regions offer some useful lessons in this regard.

Indiana Economic Growth Regions 6 (east-central Indiana) and 11 (southwestern Indiana) were in different stages of developing an effective system of governance when this study began. The regions were chosen for the pilot study because each contained characteristics that the study team was seeking. An important feature for the team was that each region was predominantly rural but contained a significant urban area.

The two regions are part of the state of Indiana's regional system for workforce development. Thus each region was created by state government in order to help deliver economic and workforce development services rather than having been created from within by local leaders banding together. Accordingly, neither region exhibits a high degree of comprehensive governance.

Economic development is the one subject where substantial progress toward regional governance has been achieved. In Region 6, all of the counties in the region with dedicated, full-time economic development organizations have formed a regional group. The group is incorporated as Energize ECI. This organization focuses primarily upon new basic-employer recruitment for the region, so Energize ECI's main activity is marketing to prospective businesses.

Region 11 also has a growing regional approach to economic development. However, this region is in transition. All of the counties in the region were part of the Southwest Indiana Development Council. This organization has recently reduced the geographic area that it serves. The counties centered around Evansville, the third most populous city in the state, were in the process of creating a new, four-county economic development organization during the study.

Perhaps the most significant stimulus toward regional governance for Region 11 is the fact that it is a second-generation WIRED grant recipient. This grant has resulted in a number of regional projects and collaborations.

A series of meetings were held with Indiana regional stakeholders. These included meetings with selected "early adopters" who reviewed preliminary data and indices and suggested ways to make the analysis and investment tools more accessible. Additional meetings involved stakeholders who were not familiar with the project. From these meetings, some broad observations can be made:

- While there is discussion about regional cooperation in Indiana and even some regional projects, most cooperation occurs on an ad hoc basis, is mandated by the state, or has a specific focus such as

solid waste. Otherwise, there is not a lot of funding, governance or structure to address regional issues.

- Many local leaders lack the skills needed to utilize the tools without further assistance. "It was way over their heads," one early adopter said after a presentation made to a more general audience of elected officials and representatives from nonprofit agencies. This person further noted that many elected officials do not have or do not use e-mail or the Internet. Clearly, the lesson here is that these tools need to be targeted more toward professionals such as urban and regional planners as well as economic development officials, who were more familiar with the concepts of this project and in using those new tools.

- The early adopter meetings explained how the tools could be used for regional analysis, and thus as a basis for regional cooperation. Many participants were interested in the concepts, and suggestions for additions to the data were freely made. Not all of these suggestions are implementable—for example, economic development professionals would like to have the names and addresses of companies added to the industry and occupation cluster data. This level of detail would be very difficult to obtain without the use of expensive commercial databases. Expectations must be managed when introducing sophisticated new analytical tools to the development community.

- It will take some time to educate stakeholders about the use of the tools. Ideally, this process should take place after the tools are completely developed and in working order. Additionally, some of these tools and concepts are so new that case studies and success stories that help to obtain project buy-in are still needed.

- It would be worth considering some pilot projects in carefully selected regions throughout the country to test the tools that the team has developed, to train potential users, and to document a set of success stories to use in promulgating the future adoption and practice of regional cooperation.

The West Alabama-East Mississippi (WAEM) region is another WIRED grant recipient that offers useful lessons in regional partnership. The region has 37 counties, roughly evenly divided between the two states. The state line was perceived as a major hurdle from the outset, so a critical starting point was strong, visible support from both governors. Leadership from eight community college presidents was another critical early foundation for building a stronger spirit of collaboration throughout the region. To provide formal oversight for the initiative, a WAEM Commission was formed, with members reflecting important economic stakeholders throughout the region. The Montgomery Institute, a nonprofit based in Meridian, Miss., provides operational support for ongoing project initiatives.[38]

The Southern Minnesota Regional Competitiveness Project represents a different perspective on regional governance. This 38-county region has no unifying governmental organization, nor does it coincide with the geographic boundaries of any public or private organizations. That said, the region did come together to sponsor a 12-month project to craft a region-wide competitiveness strategy in collaboration with RUPRI. A critical outcome of the project is the formation of the Southern Minnesota Opportunity Roundtable. This will

[38] The history of the WAEM region's partnership is described at http://waem.tmi.ms/about.html. The region's economic strategy and the context for that strategy are summarized at http://waem.tmi.ms/docs/wired%20report/combined.pdf.

be a new nonprofit organization that will champion the region's comprehensive strategy, coordinate development activities, steer public initiatives, and help brand the region.

The Southern Minnesota experience holds many lessons for creating regional governance in other regions in rural America.

- Understanding and duly recognizing the existing landscape of development partnerships in the region was a critical foundation for the new governance mechanism. The region had a deep history of collaboration, but this had not developed to the geographic scale that corresponded with its economic opportunities. Linking the two was a critical step in creating conducive conditions for the final mechanism.

- Language was extremely important in achieving buy-in for the strategy. Many leaders in the region equated "governance" with "government." Thus, focusing the discussion on public-private partnership was much more effective in achieving a good result.

- Creating a "home" for the regional governance mechanism is critical to long-term success. The Southern Minnesota project had a clear lifespan that resulted in a well-articulated regional competitiveness strategy.[39] Creating a sense of permanence (that is, giving a home) to the Southern Minnesota Opportunity Roundtable was a crucial step in lending a sense of life and ongoing vitality to the strategy.

6.4 Developing Principles for Regional Governance

Regional governance as an academic subject is relatively new. Over the past 10 years, there has been a growing body of discussion by scholars, policy experts, and practitioners. A number of articles have attempted to list basic principles that are common to effective regional governance.

In 2008, the Public Policy Research Institute at the University of Montana (2008) listed nine principles to help people think and act regionally:

1. Focus on a compelling purpose or interest (catalyst)
2. Organize around collaborative leaders (leadership)
3. Mobilize and engage the right people (representation)
4. Define the region to match people's interest (regional fit)
5. Assemble the necessary resources (capacity)
6. Jointly determine where you want to go and how you want to get there (strategy of action)
7. Move from vision to action (implementation)
8. Learn as you go and adapt as needed (evaluation)
9. Sustain a regional initiative (governance)

[39] Key project findings, recommendations, and Southern Minnesota's economic game plan are available at www.mnsu.edu/ruralmn/images/SMRCP%20Report.pdf.

In 2003, the Alliance for Regional Stewardship published "Principles of Regional Stewardship." This article focused on four elements that comprised a framework for regional stewardship:

1. Livable places
2. Innovative economy
3. Social inclusion
4. Collaborative governance

RUPRI, in the article mentioned earlier, states that effective governance has three general components: collaboration, sustained citizen engagement, and leveraging regional resources. Supporting those three components are eight principles for governance, as shown in Table 16 (Dabson 2006).

Table 16: Components and Principles for Effective Governance

Three General Components	Eight Principles
Collaboration	Crossing sectors (public, private, nonprofit)
	Crossing political boundaries, recognizing regions
Sustained Citizen Engagement	Welcoming new voices (especially under-represented individuals and youth)
	Visioning a different future (bottom-up process)
Leveraging Regional Resources	Analyzing region's competitive advantages (focus on strengths, identify clusters)
	Strengthening competencies of local elected officials
	Engaging key intermediaries
	Investing local capital

Source: Dabson 2006

Discussions of regional governance have not been limited to the United States. Indeed, regional governance has been a lively focus of regional policy attention throughout the globe. There are many models of regional governance emerging around the world. This vibrant spectrum of experience is framed by two extremes. On one end, the driving force for the region-wide partnership comes from the public sector. Under this model, public officials organize a sort of "consultation" of local private associations and companies.[40] In most cases, the consultation is largely advisory, with the information flow benefiting government decisions. On the other end, regional dialogue and strategy is driven mainly by private sector leaders. In some cases, this reflects a lack of strong public sector leadership; in others, it reflects the influence of the private sector in local government.[41] In reality, evidence throughout the world shows that the catalyst for regional governance can come from many different sources, including nonprofit organizations.

[40] France's "Conseil regional economique et social" is a prime example of this model. These regional councils have no governmental authority, but do provide a roundtable for experts to meet with regional business leaders (OECD Territorial Review of France, www.sourceoecd.org/9789264022652.

[41] An example of the latter can be found in Mexico's "Yucatán Infrastructure Councils." See OECD Regional Review of Yucatán, www.sourceoecd.org/9789264037021.

The key is finding a means of bringing together a diverse collection of leaders in a way that engenders trust and a frank sharing of economic information. Pooling knowledge is a critical function of the collaboration, and this can only happen when there is a high level of trust. What is more, a regional strategy can only take shape when all parties agree that it will "grow the pie" for everyone, not represent a zero-sum game in which one part of the region wins at the expense of another.

The European Union has also issued a number of white papers on the topic. The following statement from the Mayor of London's European Forum (2003) illustrates this.

> We would wish to see the principles of governance stated in the Constitution as the operating principles of the EU institutions. This should include those outlined in the European Commission's White Paper on Governance (**openness**, **participation**, **accountability**, **effectiveness** and **coherence**) with the addition of **consultation** and **partnership**.

The United Kingdom's experience in sustainable, regional development is a source of ideas on regional governance. Similarly, this excerpt from the province of Ontario presents another set of principles:

> All the principles of good government—sustainability, democracy, decentralization, efficiency—call for local power. A sustainable community has to have responsible government, and a devolution of power to local or regional authorities is the way to accomplish this (Atkins 2007).

There are merits in all of the principles listed above, whether one considers the four-element framework of the Alliance for Regional Stewardship, the three components/eight principles from RUPRI, or the nine principles from the Public Policy Research Institute. Nonetheless, the study team's experience in the Indiana and Minnesota regions suggests a different approach to creating regional governance principles.

Indiana, for example, has limited experience in regional collaboration on a broad base of issues. Approximately half the state is covered by regional planning commissions and economic development districts. The most common regional collaboration that has lasted over a period of years is the regional solid waste district. This program, which was created by state legislation, enables multiple counties to work together in the disposition of solid waste.

Beyond those programs mentioned above, there are few vehicles for formal intergovernmental cooperation. The difficulty of regional governance is increased when one considers the fact that individual counties (and the cities and towns within them) in Indiana have at best limited fiscal home rule. The ability to raise taxes is controlled by the state's general assembly. These obstacles do not make regional governance impossible, but Indiana counties and communities find it more difficult to work together.

A fundamental issue that is central to sustained regional governance is trust. In order for leaders to collectively govern a region effectively, each leader must have confidence that his or her colleagues will work in the best interest of the region. One way to begin to establish that trust is to have a series of early successes that establish the effectiveness of the regional approach.

Here are some guidelines that may be useful in moving a region toward a working regional partnership:

1. Acknowledge the need for change

2. Understand that regional action is needed to seize new economic opportunities
3. Have a clear sense of the region's economic opportunities
4. Map the region's assets, including the existing landscape of collaboration.
5. Include representatives from the public and private (for-profit and nonprofit) sectors
6. Use initial external funding as the catalyst to bring regional actors together to forge a new strategy
7. Work with an economic development "coach" from outside the region to help create the initial plan
8. Have an open and transparent planning process:
    a. accessible by all residents of the region
    b. with a planning structure that is completely clear
9. Create as part of the planning process a regional partnership mechanism that will provide ongoing oversight for the plan
10. Keep the plan simple, have relatively few goals and objectives
11. Make the plan's budget realistic—funding sources should be ready to access
12. Specify measurements by which the plan's outcomes will be judged

Collectively the concepts above suggest a model for helping regions—especially rural areas—move to collaboration in economic development. These principles are compatible with all of the standards from the organizations mentioned above, and also align with the regional development strategy process discussed in Chapter 2.

6.5 Government, Governance, and the Responsibility of Elected Officials

An important issue related to the principles of effective governance for economic development is the role of local elected officials for the process. Despite the fact, as mentioned in the introduction, that *governance* is not the same as *government*, there is a direct connection. Regional development depends critically on investing in public goods that unlock the full potential of a region's competitive advantages. As noted in Chapter 2, identifying these public investment priorities is one of the most important outcomes of the regional development strategy process. Such priorities can only be developed when there is consensus among public and private leaders. Once those priorities are clear, however, in a democratic society it is the responsibility of public officials to oversee public projects that use public funds. In monitoring these projects, public officials can provide powerful information to shape the strategy over time. Thus, regions that master the art of regional governance create a virtuous cycle in which local officials play a valuable supporting role in selecting, overseeing, and monitoring the public investments that the region agrees are critical to its economic prosperity. For this role to emerge, however, a strong region-wide partnership must exist that spans jurisdictional lines—and those separating the public and private sectors. Today, such partnerships are too rare, and thus too many decisions default to government officials alone.

6.6 Conclusion

The general lack of region-wide partnerships throughout much of this country raises important questions about regional development generally and how the tools developed in this project may be used more specifically. It is highly likely that the economic development professionals will use some or all of the tools on both a local and regional basis. In Region 6, where the local economic development organizations have a

dynamic regional organization, Energize ECI will probably serve as an implementing regional agency. It is also likely that the WIRED project in Region 11 will help that area grow an effective governance system for the region. The Southern Minnesota project suggests a hearty appetite for regional analysis.

However, the experience in Indiana underscores the conclusion that development tools lack real vigor when not paired with a robust region-wide mechanism for ongoing partnership. Tools may be necessary to crafting an effective regional strategy, but partnership is the necessary condition. This fact points to two important conclusions surrounding future work on regional development. The first is understanding the best timing and conditions in which to introduce knowledge-based tools in a region. The second is the ongoing need to develop the best possible guidelines for building regional governance, especially where it does not naturally occur. This remains a huge challenge not just in rural areas, but in most regions around the world. And because success depends on understanding the unique social and institutional landscape of every region, this policy frontier promises to be a hard one to claim.

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7. Conclusions, Lessons Learned and Future Directions

7.1 General Background

This project was undertaken to develop new decision support tools and conceptual frameworks to help in shaping economic development strategy for regions throughout the United States, especially rural regions which often lack both the decision framework and the leadership capacity to yield effective development strategies. These tools and frameworks were designed for use by local leaders and economic development practitioners working not only in individual counties but, more importantly, in multi-county regions.

The project extended previous research, which developed related economic development data and tools analyzing industry clusters, by adding three new dimensions: occupation and skill clusters, measures and a new index of innovation, and a framework to help regional stakeholders prioritize public investments in support of a regional economic development strategy. The first two dimensions are captured in a web-enabled national database tool that provides access to detailed county-level data and lets users aggregate data across counties to understand the economic environment of multi-county regions.[42]

Insights gained from these tools and analyses can help regional leaders and economic development practitioners focus their strategies in ways that reflect a region's comparative advantages and disadvantages, especially those related to its potential to cultivate a knowledge-based innovation economy. Highlights from each component of this study are summarized in the following sections.

7.2 Regional Strategy Process

The economic development field has evolved over the past half century through traditional incentives-based industrial recruiting to competition based on reducing business costs to today's regional competitiveness era. Regional competitiveness emphasizes identifying each region's competitive advantages and then prioritizing public and private investments necessary to exploit those advantages.

Although authorities agree that the regional competitiveness approach offers the greatest promise for sustained economic gains, many local practitioners still cling to the older approaches. Regional leaders need new tools and new skills to understand and capitalize on the regional competitiveness concept. Accustomed to thinking in terms of their own local areas, these leaders must reach beyond their parochial interests to link assets and competitive advantages throughout their broader region, thereby increasing their competitive edge in global markets. Indeed, many of today's best economic opportunities only emerge at the scale of the broader region.

Three important elements are proposed as essential to the regional development process, represented by the "who," the "what," and the "how." The "who" element refers to identifying and bringing together the right mix of partners from the region's public, private and nonprofit sectors, reaching across jurisdictional

[42] See www.statsamerica.org/innovation/data.html.

boundaries to achieve the shared mindset of collaborating to compete. Few regions, achieve a solid strategic partnership at the outset; most must first overcome a history of competition or even distrust among the region's players.

The "what" element refers to the strategic outcomes necessary for the region to compete effectively and to sustain its growth. Critical outcomes include development of an open, resilient regional partnership, a strategic action plan, and a set of investment priorities to support the plan. The plan's goal is to identify opportunities likely to unlock the region's distinct potential to leverage its assets in ways that will transform its economy. A strategic investment agenda is then required to focus public effort and funding (in alignment with private priorities) on the most promising strategic alternatives. All three of these outcomes are essential to a strong regional foundation for a competitive economy.

The "how" element refers to the collaborative process through which the three desired outcomes come about. A three-component process is proposed, weaving together processes of collaboration, analysis and coaching. Collaboration involves building the trust by which a diverse set of regional actors become a partnership focused on a common mission, sharing a common understanding of competitive challenges and opportunities facing the region.

Analysis is a process of winnowing the wide range of possible targets for regional investment down to a small set that offer the most promise for increasing the region's competitive advantage. It is grounded on detailed information about the region's economy, its assets and liabilities; the tools developed for this study support such analysis. Finally, through the coaching process a neutral leader (coach) works with the strategic partners to engender trust and to facilitate both dialogue and analysis, helping the partners reach a point where they can make complex decisions as a unified group.

7.3 Occupation Clusters

The development of a new set of 15 occupation clusters and detailed, county-level data for them, coupled with industry cluster data at the same level, is a major contribution of this study. Analysis of this database offers regional planners valuable insight into their workforce dynamics, the ability to examine how well the kinds of jobs that are in increasing demand match the mix of industries found in the region. This helps planners understand the opportunities and challenges they face in charting a strategic path for their region's development.

Analysis and application of these data was tested in two pilot regions, leading to a number of observations about those regions' competitive strengths and weaknesses. These test cases illustrate the practical value of such analysis for "on the ground" planning efforts. Coupled with insights and guidance found in other sections of this report concerning assessment of innovation potential, identifying promising investment opportunities, and facilitating collaboration among regional players, the study has produced a potentially powerful set of tools to support economic and workforce development efforts in regions throughout the nation.

7.4 Innovation Index

Innovation is a key ingredient in an economy's ability to shift from lower to higher value-added activities, which in turn improve firm profits, compensation and the standard of living for the region's residents. Building on past research, this study developed a new index of innovation derived from a number of individual indicators, some reflecting inputs that enhance a region's potential for innovation, and others reflecting outputs of innovative activity. Based on data representing a 10-year period, the resulting Portfolio Innovation Index (PII) is less influenced by year-to-year fluctuations in component indicators than are innovation indexes based on changes in the annual figures.

Individual county-level indicators were grouped into four categories. Two categories represent innovation inputs (factors, influences or conditions that promote innovation and create knowledge), and a sub-index was derived for each. The human capital sub-index reflects the extent to which a county's population and labor force are able to engage in innovative activities, while the economic dynamics sub-index measures business conditions and resources available to entrepreneurs and businesses. The other two indicator categories represent outputs of innovation. The productivity and employment sub-index suggests the extent to which local and regional economies are benefiting from innovation, generating growth in jobs and output. The economic well-being sub-index reflects the overall attractiveness of the region and growth in compensation. Each of these four sub-indexes was based on from five to seven separate measures.

Data were also compiled for a fifth category, state context, capturing data that are theoretically important but available only at the state level. These data are included in the study's online database tool, but they were not included in the PII itself.

Analysis of the county data for the PII and its sub-indexes revealed just over 1 percent of U.S. counties to be true innovation leaders, scoring above the national average on all four sub-indexes. At the other end of the spectrum, five of every eight counties scored below the national average on all four sub-indexes. The remaining counties demonstrated a wide range of combinations of input and output performance. In general, sub-index scores for innovation inputs were moderately correlated with those of innovation outputs, providing support for joining the two concepts into a single composite index such as the PII.

Finally, spatial analysis revealed that most high-innovation counties were located in or near metropolitan areas. Nonetheless, a number of rural counties were found to score above average in most or all of the innovation sub-indexes. The underlying causes for such strong rural innovation performance appear to derive from a variety of sources rather than one common characteristic across these counties.

7.5 Investment Framework

The process of identifying and selecting strategic economic development investments with good prospects for stimulating a region's prosperity represents a balancing act between their value to the public and their potential to attract private investment. The challenge lies in allocating investment across a portfolio of different kinds of investment opportunities that minimize investment risk while exploiting the region's competitive advantages.

This study presents a three-phase process to guide investment strategy. The process begins with the investment discovery phase, identifying opportunities for the region to combine its assets in new and

different ways. Next comes the phase of setting investment priorities, weighing the potential returns and risks across the investment opportunities previously identified and choosing a mix of investments that balances these factors appropriately. The third phase is evaluation, monitoring the region's investments through a well selected set of metrics that will track progress toward the investment goals and providing guidance for future revisions to the region's investment portfolio.

Strategic investments can be classified into five categories representing critical ingredients for competitive regions. These categories are brainpower (the skills needed for today's workers and leaders to compete globally); innovation and entrepreneurship networks (creating a climate fostering new ideas and their commercialization); quality, connected places to live and work; branding (creating and conveying the region's competitive identity); and collaborative leadership (reinforced by regular, inclusive forums for dialog about the region's strategic opportunities and direction). Organizing current and potential economic development investments into these categories and then mapping onto that structure the region's strategic goals makes this framework a valuable tool for assessing the alignment of investments and the region's strategic priorities.

As investment decisions increasingly are being made by regions rather than individual communities, it becomes increasingly important to align the resources of the public, private, and nonprofit actors. As the pool of investable funds expands, more actors are involved and decision making can become more complex.

To facilitate regional investment decision making, this study introduces a Regional Investment Portfolio Tool (RIPT). The RIPT places into a decision matrix information on the region's inherent competitive advantages, the national outlook for growth in targeted sectors, the relative economic impact that investment in each sector would create, the region's fiscal capacity to fund projects, and a list of alternative projects under consideration. This decision matrix helps regional leaders compare different projects in terms of their impacts, prospects, and payback timelines. Guidelines are also offered regarding effective implementation of the RIPT to lead to consensus on the region's investment priorities.

After considering various alternative measures for evaluating the outcomes of public investments, an approach is suggested that takes into account the alignment of each investment with the region's strategic priorities, the stage of development of the investment project (coupled with the extent of private investment leverage), and other characteristics of the investment project such as scalability, replicability, and sustainability. The performance of projects in which public investments have been made may be compared by explicitly rating each investment on the above dimensions.

7.6 Regional Governance

The nature and level of region-wide governance exhibited in a region are a key factor in regional leaders' ability to understand and take advantage of the knowledge-based tools for economic development developed in this study. The presence of an established regional partnership with a history of effective collaboration and strategic planning greatly enhances the prospects to leverage these tools and concepts effectively.

The lack of regional partnership in the two Indiana regions examined in this study is typical of many regions' limited experience with regional collaboration; however, both of these regions have shown some promising beginnings towards such collaboration. The West Alabama-East Mississippi region, as well as a region in southern Minnesota, had somewhat more experience, and were able to move to an effective regional competitive strategy with some additional focused guidance. Communities throughout the nation could

benefit from an organized approach to collaborating for economic development. The following guidelines are proposed to facilitate such efforts:

- Acknowledge the need for change
- Understand that regional action is needed to seize new economic opportunities
- Have a clear sense of the region's economic opportunities
- Map the region's assets, including the existing landscape of collaboration.
- Include representatives from the public and private (for-profit and nonprofit) sectors
- Use initial external funding as the catalyst to bring regional actors together to forge a new strategy
- Work with an economic development "coach" from outside the region to help create the initial plan
- Have an open and transparent planning process, accessible by all residents of the region and with a planning structure that is completely clear
- Create as part of the planning process a regional partnership mechanism that will provide ongoing oversight for the plan
- Keep the plan simple, have relatively few goals and objectives
- Make the plan's budget realistic—funding sources should be ready to access
- Specify measurements by which the plan's outcomes will be judged

The general lack of region-wide partnerships throughout much of the nation raises important questions about regional development generally and how the tools developed in this project may be used more specifically. The experience in Indiana underscores the conclusion that development tools lack real vigor when not paired with a robust region-wide mechanism for ongoing partnership. Tools may be necessary to crafting an effective regional strategy, but partnership is the necessary condition. This fact points to two important conclusions surrounding future work on regional development. The first is understanding the best timing and conditions in which to introduce knowledge-based tools in a region. The second is the ongoing need to develop the best possible guidelines for building regional governance, especially where it does not naturally occur. This remains a huge challenge not just in rural areas, but in most regions around the world. And because success depends on understanding the unique social and institutional landscape of every region, this policy frontier promises to be a hard one to claim.

7.7 Future Research and Application

The tools, methods and guidelines developed in this study show promising potential for helping guide analysis and strategic planning for the development of knowledge-based regional economies. Ongoing work with stakeholders in the pilot regions studied in this project will further test the usefulness of the study's products and concepts for facilitating regional collaboration and strategic planning. Similar application in other regions around the country will provide valuable feedback to guide future development of these tools and practices.

The research team plans to conduct further, more detailed analyses of occupation cluster data for the study's pilot regions to explore additional opportunities that may be evident. In addition, research designed to refine and extend the innovation index could enhance the value and power of this tool. Potentially productive innovation index research directions might focus on the following:

- Augmenting the set of innovation indicators
- Exploring whether some indicators such as establishment churn or knowledge-based technology occupations should be broken down further into their component parts
- Determining empirically which indicator has the greatest influence on an output measure for innovation, such as growth in GDP per worker
- Exploring the influence of county characteristics—e.g., size, proximity to a metro area, broadband connectivity—on economic growth or rates of entrepreneurship
- Updating the indexes to reflect more current data as it's released from the American Community Survey (all counties should be covered by ACS data by 2010)

Integrating the tools developed in this study into the emerging practices of regional leadership also presents some promising new directions. Learning how to use these tools effectively could be accelerated through a community of practice of leading regional leaders and practitioners. This learning network can develop practical tips for applying these tools and can offer continued suggestions for further development.

This community of practice could emerge in a number of different ways. The EDA is currently expanding a curriculum on regional leadership across the country. Through its network of university centers, EDA has another platform to deploy these tools. Finally, ETA is expanding its collaboration with the Employment and Training Administration at the Department of Labor. Recently, the Atlanta regions of both EDA and ETA held a joint forum on the challenges facing regional economies in the Southeast. These types of forums present excellent opportunities to expand the use of these tools and models. By partnering with ETA, EDA can help workforce development professionals gain new insights into their transforming regional economies.

Appendix A: List of Contributors

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Appendix B: Regional Profiles

Comparison between the Study Regions

An inherent strength of this study was the inclusion of regions among different states in the Midwest and the South. Each of the regions faces its own unique set of challenges and each region has its own "profile" within these pages.

However, we do provide a head-on comparison of these regions to provide the reader with an overview of the relative wealth, education, population and job growth (among other things) for each region in an apples-to-apples fashion (see Table 17).

Table 17: Key Indicators for the Four Study Regions

Variables	EGR 6	EGR 11	Riverlands	WAEM
Population (2008)	338,667	422,245	543,435	1,080,155
Population (2000)	352,474	415,068	541,800	1,085,304
Growth (%) 2000 to 2008	-3.9%	1.7%	0.3%	-0.5%
Net Domestic Migration (2007-08)	-1,767	-1,024	-1,055	-2,885
Net International Migration (2007-08)	164	204	305	595
Per Capita Personal Income (2006)	$27,363	$31,911	$28,737	$24,070
Avg. Median Household Income (2007)	$40,893	$48,197	$45,624	$31,417
Poverty Rate (2007)	12.8	10.7	10.2	23.7
Average Wage Per Job (2007)	$30,443	$36,577	$30,139	$30,057
Unemployment Rate (February 2009)	11.8	8.8	9.3	11.9
% Adults 25+ with B.A. (2000)	11.7	14.2	14.8	12.0

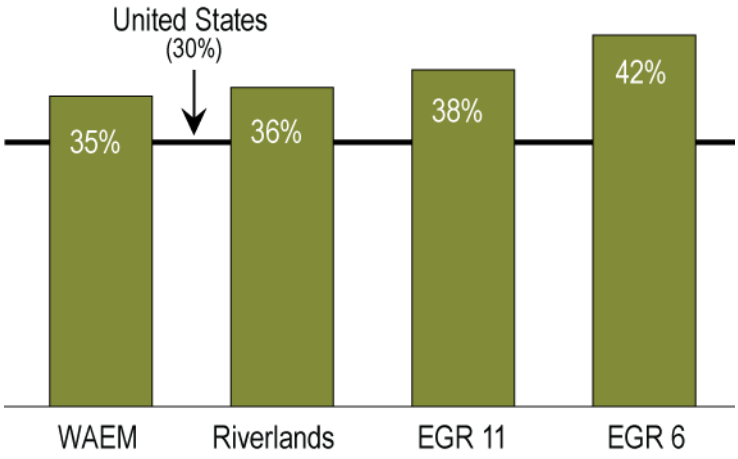
Source: Indiana Business Research Center

Similarities

Based on the demographic profiles created by Strategic Development Group Inc. (SDG) and the RUPRI Center for Regional Competitiveness, there are few similarities between each region based on the data selected by each group. Statistics in education and degrees of rurality define the most common ground between the four study areas.

Of the population age 25 or older, less than half of the population in each region has a high school diploma. Compared to the United States in 2000, all of the regions posted higher percentages of high school graduates by at least 5 points (see Figure 16).

Figure 16: Percent with High School Diploma, 2000



The index of relative rurality is based on a scale from 0 to 1, with 0 being the most urban place and 1 being the most rural place. The numbers between 0 and 1 indicate the degree of rurality. Each region in the study area is composed of mostly rural areas, but no region has an index of relative rurality rating higher than 0.7.

Table 18 shows the similarities and differences in availability of different types of infrastructure for the four regions.

Table 18: Infrastructure by Region

Variables	EGR 6	EGR 11	Riverlands	WAEM
Area (mi²)	2,986	3,630	10,077	24,699
Interstate (centerline miles)	60	95	100	291
U.S. Highway (centerline miles)	220	136	696	1,325
Railway (miles)	633	632	1,437	2,307
Amtrak Station (numbers)	1	0	0	3
Intermodal Terminal (numbers)	4	17	8	6
Water port, harbors, and docks (numbers)	0	37	42	64
Navigable Waterway (miles)	0	276	123	644
Transit System (miles)	0	0	0	0
Airport (total)	33	38	89	62
Public	8	6	18	41
Private	25	32	71	21
National Park (properties)	0	2	2	1
Area (mi²)	0	0.31	0.95	2.41
Area (acres)	0	197	610	1543
Military Reservation	0	0	1	2

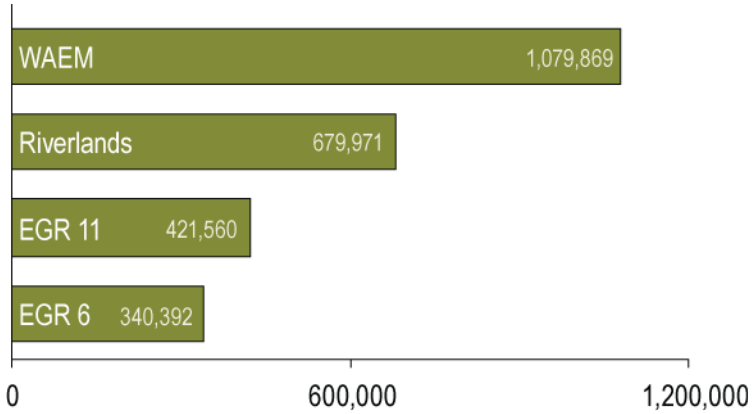
Source: PCRD

Differences

As for differences in each region, they vary mostly in terms of overall population, percent of college graduates, dominant industry clusters and unemployment rates.

The EGRs in Indiana are smaller in area and population than the WAEM and Riverlands regions. For example, EGR 6 has a 68 percent smaller regional population than the WAEM region (see Figure 17).

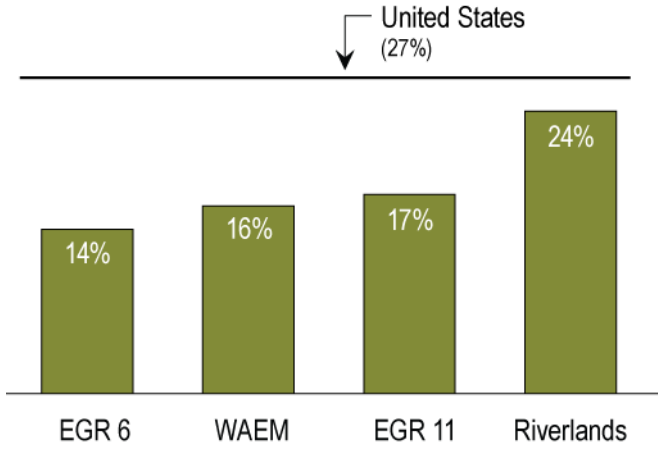
Figure 17: Region Population, 2007



Source: U.S. Census Bureau

Each region has moderate rates of college graduates with bachelor's degrees or higher in the 25 and older population, with the exception of the Riverlands region where 24 percent of the adult population has a bachelor's degree. Compared to the U.S. average in 2000, all regions posted lower rates of college graduates with a bachelor's degree or higher (see Figure 18).

Figure 18: Percent Bachelor's Degree or Higher, 2000



Source: U.S. Census Bureau

The regions have varied primary industry clusters (see Table 19). EGR 6 and the Riverlands region's largest industry is manufacturing, while the primary industry cluster in EGR 11 is biomedical/biotechnical (life sciences) and in WAEM, it is forest and wood products.

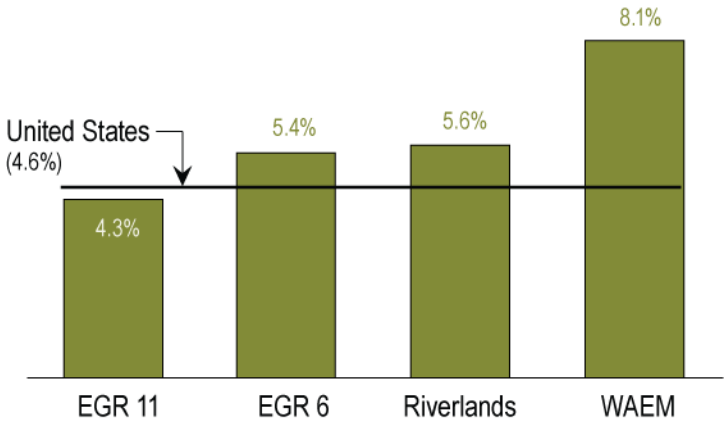
Table 19: Largest Industry Clusters, 2007

Region	Cluster	Establishments	Employment	Wages
EGR 6	Biomedical/Biotechnical (Life Sciences)	296	15,793	$494,102,413
EGR 11	Biomedical/Biotechnical (Life Sciences)	347	22,504	818,127,226
WAEM	Forest & Wood Products	1,153	18,790	699,498,303
RiverLands	Manufacturing Supercluster	386	17,453	808,077,558

Source: IBRC, using Indiana Department of Workforce Development and U.S. Bureau of Labor Statistics data. Cluster definitions developed by PCRD.

The regions had similar unemployment rates with the exception of the WAEM region, which had an average 8.1 percent unemployment rate in 2007, 2.5 percentage points higher than the next highest rate in the Riverlands region (see Figure 19).

Figure 19: Unemployment Rates, 2007

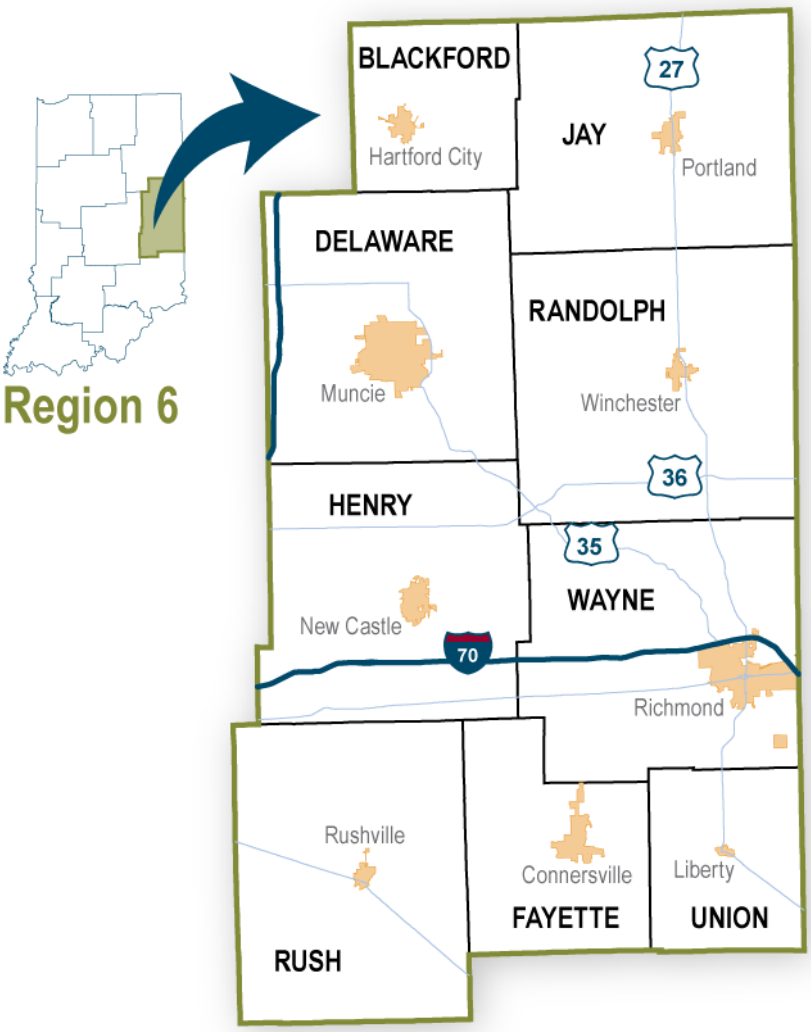


Source: U.S. Bureau of Labor Statistics

Profile of Indiana Economic Growth Region 6

Economic Growth Region (EGR) 6 is located in eastern Indiana and is comprised of nine counties: Blackford, Delaware, Fayette, Henry, Jay, Randolph, Rush, Union and Wayne counties (see Figure 20). EGR 6 covers 2,976 square miles and has a population density of 114.4 persons per square mile. Muncie (in Delaware County) is the largest city in the region with a 2006 population of 65,287 people.

Figure 20: Counties in EGR 6

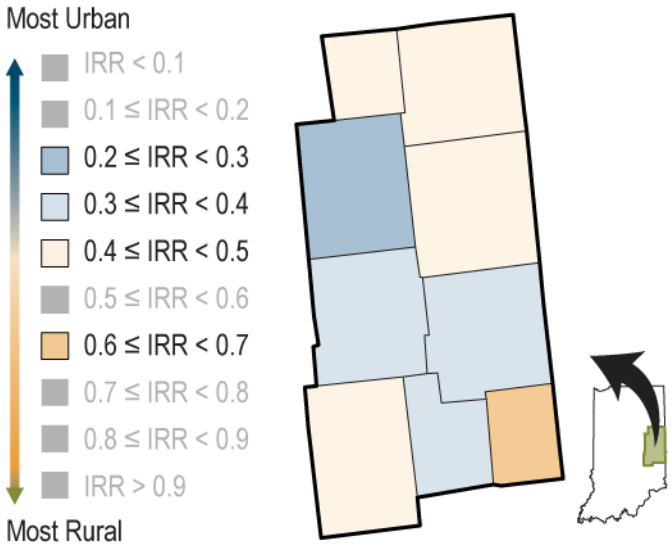


Source: IBRC

Urban/Rural Hierarchy

The Index of Relative Rurality (IRR) is a tool created by Brigitte Waldorf, professor with the Department of Agricultural Economics at Purdue University. It is used to determine a county's degree of rurality (see Figure 21).

Figure 21: Index of Relative Rurality, EGR 6, 2000

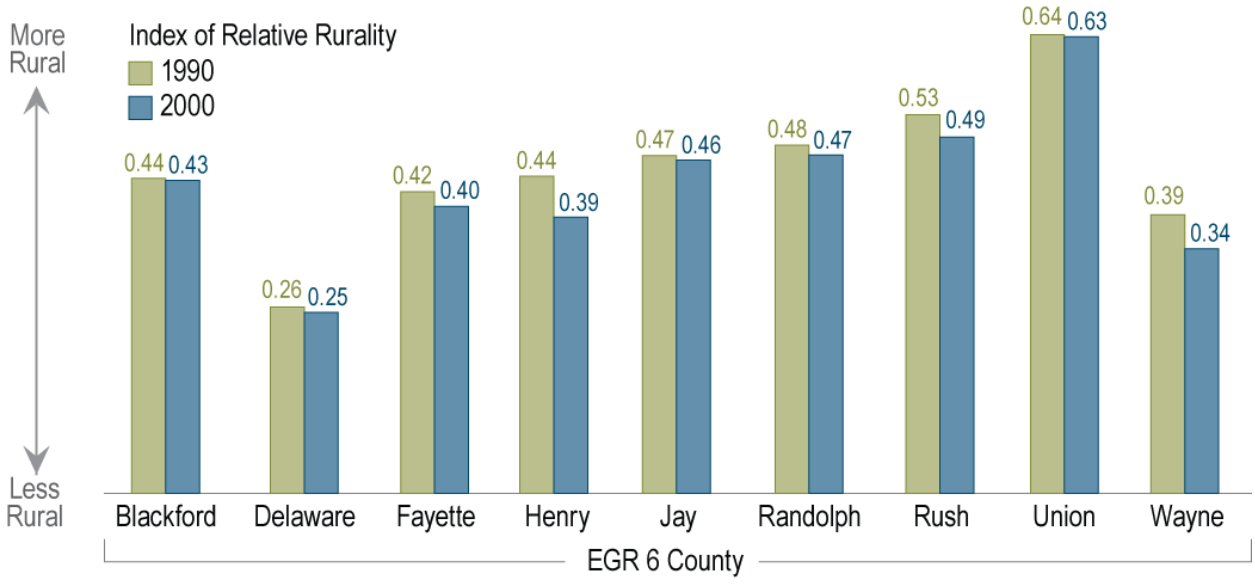


Source: Indiana Business Research Center

The index is based on a scale from 0 to 1, with 0 being the most urban place and 1 being the most rural place. The numbers between 0 and 1 indicate the degree of rurality. The IRR is based on four dimensions of rurality: population, population density, extent of urbanized area, and the distance to the nearest metro area.

According to Figure 22, Union County is this region's most rural county, while Delaware County is its most urban.

Figure 22: Index of Relative Rurality, EGR 6, 1990-2000

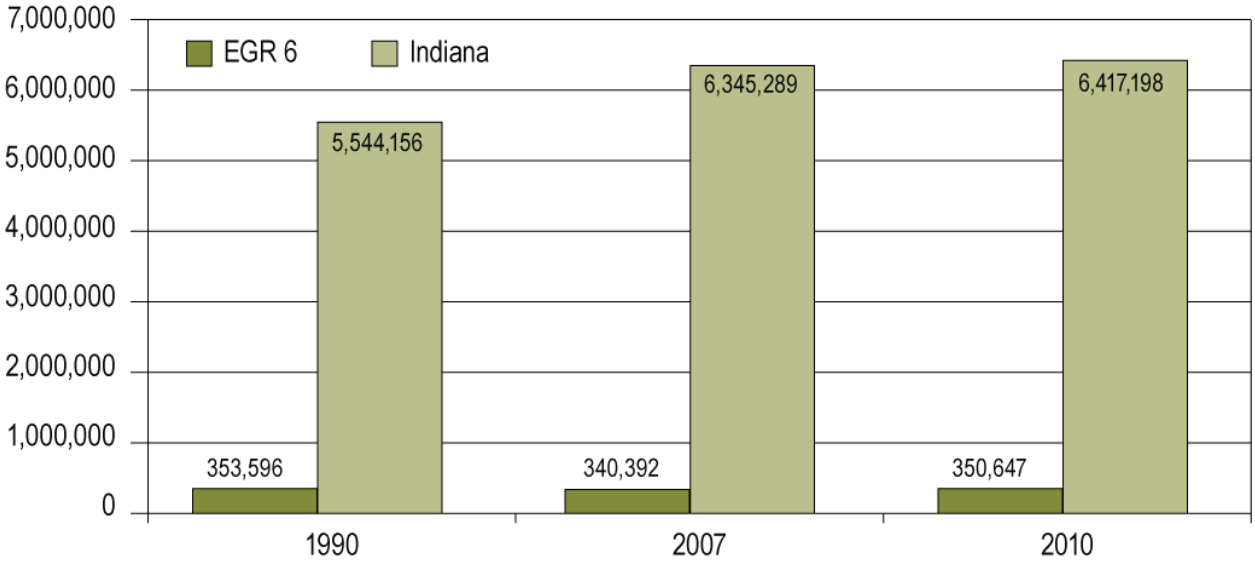


Source: Indiana Business Research Center

Population

EGR 6 had a total population of 340,392 residents in 2007, which correlates to 5.4 percent of the total 2007 Indiana population (see Figure 23). The region experienced a 0.2 percent decline in total population from 1990 to 2000. The state of Indiana experienced a 9.7 percent increase in total population during this same period.

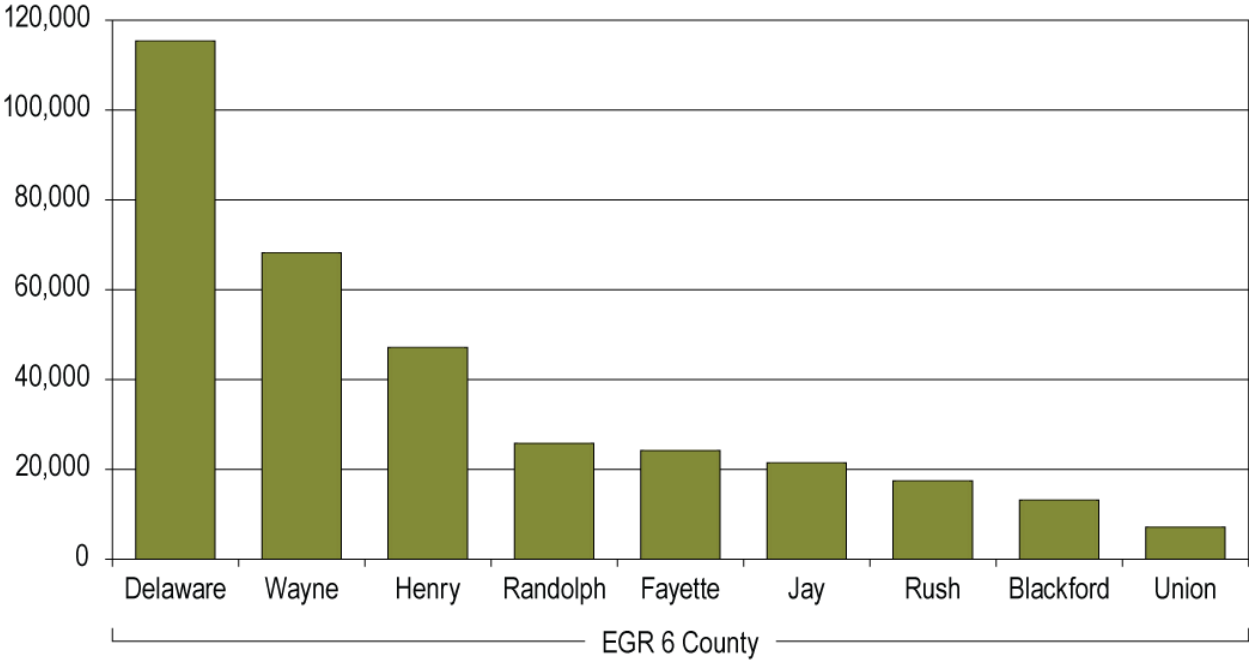
Figure 23: Regional Population, EGR 6, 1990-2010



Source: STATS Indiana, using U.S. Census Bureau and IBRC data

Delaware County has the highest population total in EGR 6, with a 34 percent share of the region. Wayne County has the second highest population with 68,260 residents, noted in Figure 24 and Table 20.

Figure 24: Population by County, EGR 6, 2007



Source: STATS Indiana, using U.S. Census Bureau data

Table 20: County Populations, EGR 6, 2007

County	2007 Population	Percent of Region	Percent of State
Blackford	13,189	4	0.2
Delaware	115,419	34	1.8
Fayette	24,273	7	0.4
Henry	47,181	14	0.7
Jay	21,514	6	0.3
Randolph	25,859	8	0.4
Rush	17,494	5	0.3
Union	7,203	2	0.1
Wayne	68,260	20	1.1
EGR 6 Total	340,392	100	5.4

Source: STATS Indiana, using U.S. Census Bureau data

The majority of the population in EGR 6 is between the ages of 45 and 64 (see Table 21). The age distribution of EGR 6 residents is similar to the age distribution in Indiana. The region experienced a 3.1 percent decline in the 18-to-24 age group and a 1.3 percent decline in the 25-to-44 age group in 2006, as compared to 2005.

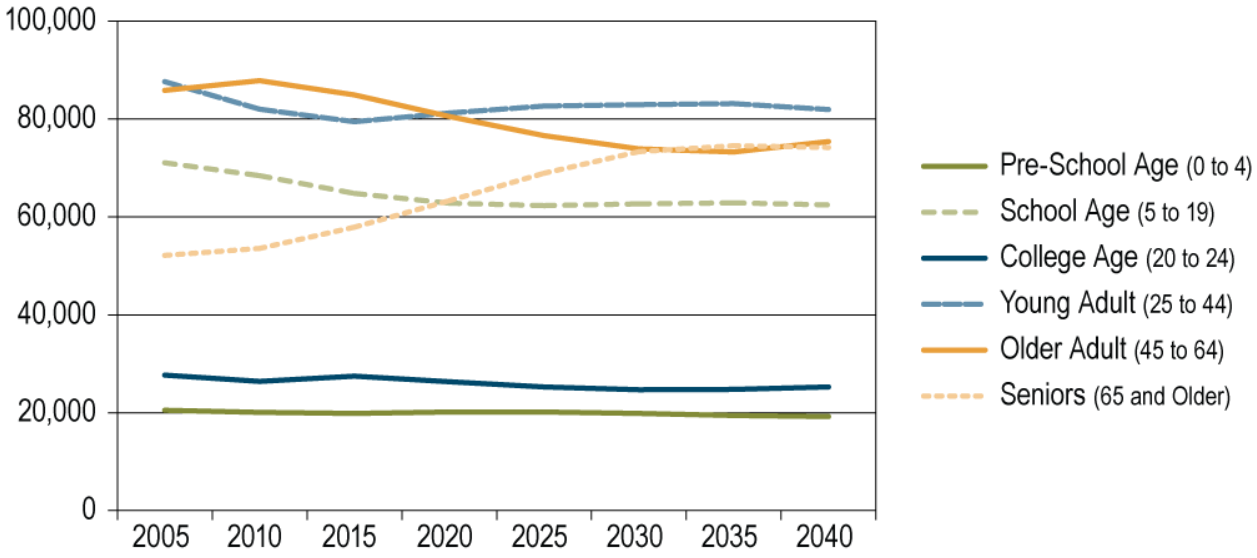
Table 21: Population Estimates by Age, EGR 6, 2006

Age Group	Number	% Distribution EGR 6	% Distribution Indiana
Preschool (0 to 4)	20,280	6	7
School Age (5 to 17)	57,600	17	18
College Age (18 to 24)	37,234	11	10
Young Adult (25 to 44)	86,772	25	28
Older Adult (45 to 64)	87,723	26	25
Older (65 Plus)	52,475	15	12

Source: STATS Indiana, using U.S. Census Bureau data

Population projections for EGR 6 indicate that the age 65 and older population is expected to increase by more than 40 percent by the year 2040. Projections for all of the other age categories have varying degrees of change over the next several decades, as shown in Figure 25.

Figure 25: Population Projections, EGR 6, 2005-2040

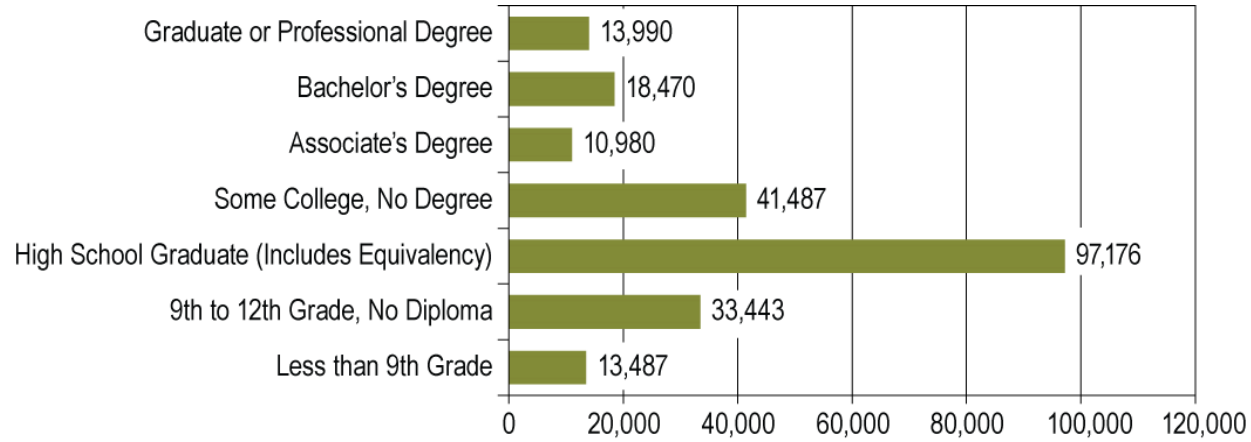


Source: STATS Indiana, using U.S. Census Bureau and IBRC data

Educational Attainment

According to the U.S. Census Bureau, EGR 6 had a population of 229,033 persons over the age of 25 in 2000. Of this total, 42.4 percent were high school graduates, 4.8 percent had an associate's degree and another 8.1 percent had a bachelor's degree. Figure 26 displays the educational attainment of people over the age of 25 in EGR 6.

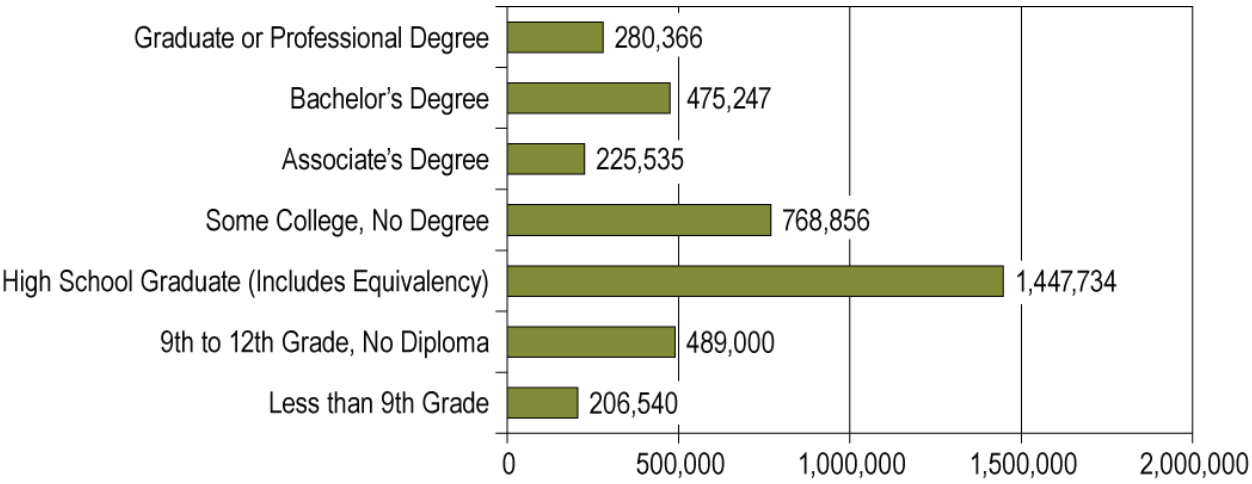
Figure 26: Educational Attainment, EGR 6, 2000



Source: STATS Indiana, using U.S. Census Bureau data

In 2000, EGR 6 had a higher percentage of high school graduates as compared to the state; however, the region had lower percentages of residents with associate's and bachelor's degrees (see Figure 27).

Figure 27: Indiana's Educational Attainment, EGR 6, 2000



Source: STATS Indiana, using U.S. Census Bureau data

The Indiana Department of Education finds that the majority of high school graduates in EGR 6 intend to go on to higher education. As noted in Table 22, 56 percent of high school students intend to enroll in a four-year institution, while 18 percent intend to enroll in a two-year institution.

Table 22: High School Graduates Higher Education Intent, EGR 6, 2006

	EGR 6 Percent Distribution	Indiana Percent Distribution
Graduates	100	100
Total Going on to Higher Education	84	8
Four-Year Institution	56	62

	EGR 6 Percent Distribution	Indiana Percent Distribution
Two-Year Institution	18	14
Vocational and Tech.	9	8
Military	3	3

Source: STATS Indiana, using Indiana Department of Education data

Income

EGR 6 had nearly $9.4 billion in personal income in 2006, with $5.9 billion in total earnings by place of work (see Table 23). Per capita personal income for EGR 6 was $27,462 in 2006, as shown in Figure 28.

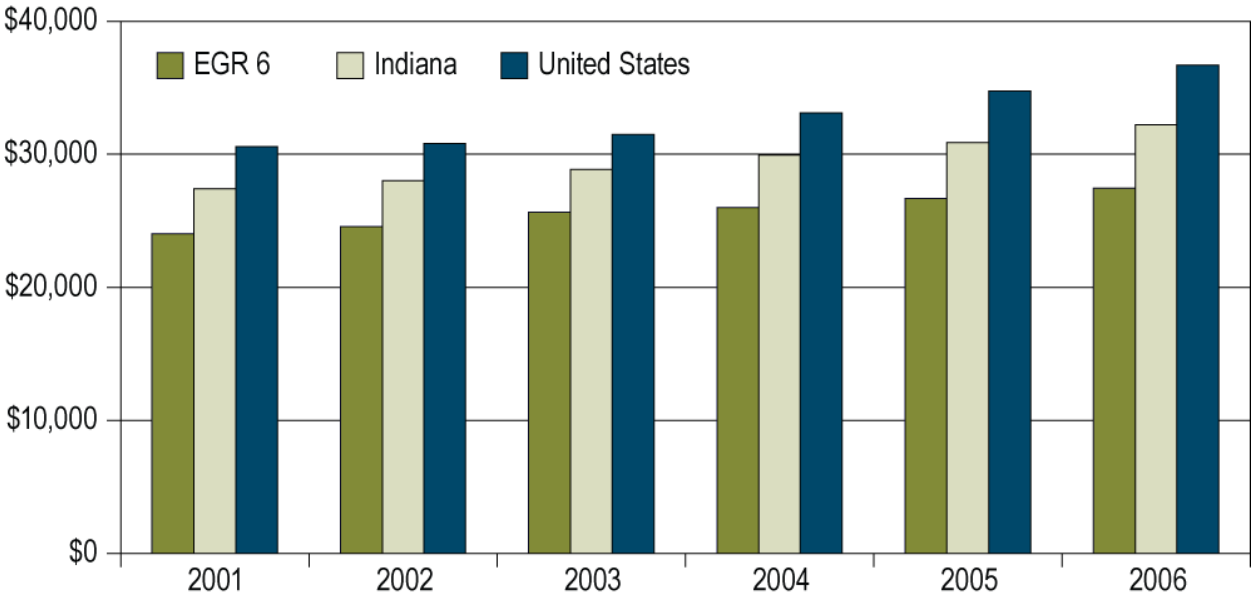
Table 23: Personal Income, EGR 6, 2006

	Number ($000)	EGR 6 Five-Year Percent Change (adj*)	Indiana Five-Year Percent Change (adj*)
Total Earnings by Place of Work	$5,897,143	-6.3	6.8
Minus: Contributions for government social insurance	$691,528	-3.3	7.2
Personal contributions for government social insurance	$375,941	-1.0	7.6
Employer contributions for government social insurance	$315,587	-5.9	6.8
Plus: Adjustment for residence	$766,590	25.9	8.4
Equals: Net Earnings by Place of Residence	$5,972,205	-3.4	6.8
Plus: Dividends, rent, interest	$1,291,469	-21.6	-6.3
Plus: Transfer payments	$2,120,028	17.6	20.4
Equals: Personal Income by Place of Residence	$9,383,702	-2.6	6.5

*adj = Adjusted for Inflation

Source: STATS Indiana, using U.S. Bureau of Economic Analysis data

Figure 28: Per Capita Personal Income, EGR 6, 2001-2006



Source: STATS Indiana, using U.S. Bureau of Economic Analysis data

Table 24 displays median values for homes, gross rents, household incomes and earnings for each county in EGR 6 plus the state of Indiana. In 2000, Henry County had the highest median home value at $84,100, while Fayette County had the highest median family income at $46,111. In each category listed, Indiana posted higher median values than each individual county in EGR 6.

Table 24: Census Medians, EGR 6, 2000

County	Median Home Value ($)	Rank[1]	Median Gross Rent ($)	Rank	Median Household Income ($)	Rank	Median Family Income ($)	Rank	Median Earnings: Men ($)	Rank	Median Earnings: Women ($)	Rank
Indiana	94,300	NA	521	NA	41,567	NA	50,261	NA	37,055	NA	25,252	NA
Blackford	58,900	91	396	79	34,760	80	41,758	79	30,172	90	21,386	74
Delaware	75,400	67	465	44	34,659	82	45,394	60	36,155	31	23,268	41
Fayette	78,500	61	442	62	38,840	56	46,111	55	34,493	45	23,082	43
Henry	84,100	52	464	45	38,150	61	45,470	59	36,439	28	22,432	51
Jay	62,500	88	387	83	35,700	76	41,850	76	31,031	79	21,015	84
Randolph	64,600	83	392	81	34,544	84	40,855	87	30,951	81	20,634	90
Rush	82,300	55	446	58	38,152	60	42,633	71	32,491	61	22,101	57
Union	82,600	53	450	56	36,672	68	41,752	80	31,859	72	21,617	71
Wayne	80,300	59	446	58	34,885	78	42,811	70	32,298	66	21,901	63

[1] Rank indicates position of county in state; Indiana has a total of 92 counties.

Note: Median earnings are for year-round, full-time workers.

Source: STATS Indiana, using U.S. Census Bureau data

Jobs and Unemployment Rates

The manufacturing sector has the most jobs in EGR 6 with 26,075 jobs, followed by the health care and social assistance sector with 17,043 jobs (see Table 25). The highest wages for EGR 6 are in the utilities and management sectors, although it had fewer than 500 jobs.

Table 25: Employment and Wages by Sector, EGR 6, 2006

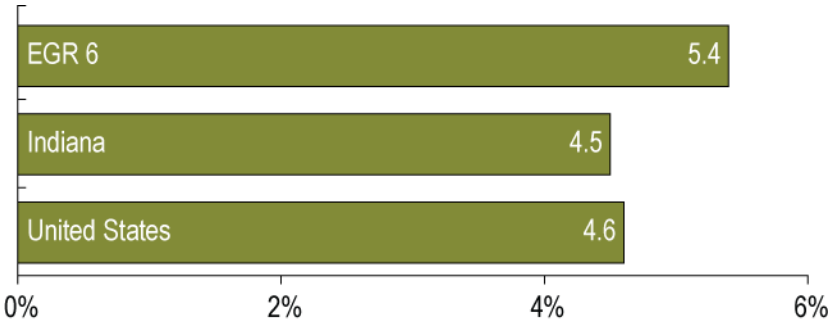
Sector	Estab.	Jobs	OTY[1] Job Chg.	OTY % Chg.	Avg. Wage	OTY Avg. Wage Chg.	OTY Avg. Wage % Chg
Total Employment	7,095	129,532	1,744	1.4	29,603	317	1.1
Total Private Employment	6,668	105,572	2,148	2.1	30,052	224	0.8
Agriculture, Forestry, Fishing, Hunting	78	144	22	18.0	22,211	-1,282	-5.5
Mining	15	26	1	3.2	44,163	1,262	2.9
Construction	715	4,902	289	6.3	30,673	534	1.8
Manufacturing	517	26,075	-1,848	-6.6	42,234	1,045	2.5
Wholesale Trade	356	3,169	-54	-1.7	36,889	766	2.1
Retail Trade	1,172	16,110	-104	-0.6	18,275	311	1.7
Transport. and Warehousing	264	3,381	30	0.9	36,800	2,470	7.2
Utilities	37	445	1	0.2	54,501	-241	-0.4
Information	110	1,528	-25	-1.6	26,644	1,174	4.6
Finance and Insurance	461	3,474	26	0.7	32,636	2,253	7.4
Real Estate, Rental, Leasing	258	1,180	109	10.2	18,200	-969	-5.1
Professional And Tech. Servs.	436	2,279	-345	-13.1	29,690	1,790	6.4
Mgmt. of Companies	41	443	-286	-39.2	44,812	-5,589	-11.1
Admin. and Waste Services	277	7,119	3,487	96.0	24,389	1,524	6.7
Educational Services	135	5,861	-21	-0.4	22,472	-1,213	-5.1
Health Care And Social Assistance	628	17,043	267	1.6	28,927	-1,006	-3.4
Arts, Entertain., and Recreation	125	1,077	-34	-3.0	13,320	1,336	11.2
Accommodation and Food Service	575	11,114	11	0.1	10,148	138	1.4
Other Services	658	3,428	-110	-3.1	17,017	632	3.9
Federal, State, & Local Govt.	250	5,088	-281	-5.2	27,187	217	0.8

[1] OTY: Over-the-Year

Source: STATS Indiana, using U.S. Bureau of Labor Statistics data

Unemployment figures for 2007 show that the EGR 6 unemployment rate of 5.4 was greater than the state of Indiana and the United States during the same time period (see Figure 29).

Figure 29: Unemployment Rates, EGR 6, 2007

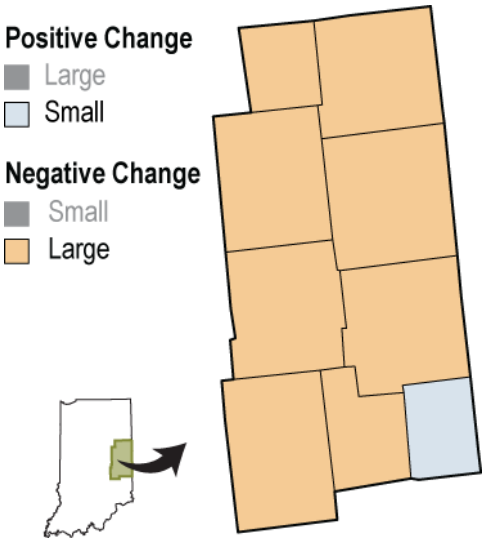


Source: STATS Indiana, using U.S. Bureau of Labor Statistics and Indiana Department of Workforce Development data

Competiveness Standing

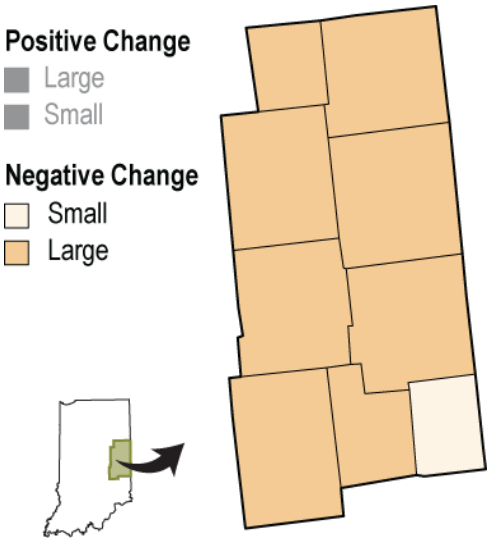
Figure 30 and Figure 31 show the region's competitiveness standing over the last decade as indicated by each county's change in the share of U.S. jobs and income. This measure approaches regional competiveness from the perspective that counties that see their "slice" of the U.S. economy grow are more competitive than those with declining shares. By this measure much of EGR 6 has seen its share of the expanding U.S. economy decline on a relative basis for both jobs and income.

Figure 30: Change in Share of U.S. Jobs, EGR 6, 1996-2006



Source: Center for Regional Competiveness and the Indiana Business Research Center, using U.S. Bureau of Economic Analysis, REIS data

Figure 31: Change in Share of U.S. Income, EGR 6, 1996-2006



Source: Center for Regional Competiveness and the Indiana Business Research Center, using U.S. Bureau of Economic Analysis, REIS data

Industry Cluster and Occupational Profile

EGR 6 has 17 industry clusters, with six manufacturing sub-clusters. The business and financial services cluster has the most establishments in EGR 6, with 738 entities. The biomedical/biotechnical (life sciences) cluster employs the most people, with 15,793 employees, closely followed by the manufacturing supercluster (see Table 26).

Table 26: Industry Clusters, EGR 6, 2007

Cluster Type	Establishments	Employment	Wages
Total All Industries	7,326	128,136	$4,022,920,372
Advanced Materials	217	9,213	383,602,490
Agribusiness, Food Processing & Technology	199	3,080	98,111,954
Apparel & Textiles	39	459	14,753,601
Arts, Entertainment, Recreation & Visitor Industries	206	2,017	27,731,562
Biomedical/Biotechnical (Life Sciences)	296	15,793	494,102,413
Business & Financial Services	738	4,071	162,460,991
Chemicals & Chemical Based Products	77	3,603	165,609,558
Defense & Security	154	2,211	87,193,167
Education & Knowledge Creation	93	6,453	224,368,149
Energy (Fossil & Renewable)	304	3,759	125,479,970
Forest & Wood Products	83	3,113	128,133,772
Glass & Ceramics	21	1,292	76,016,360
Information Technology & Telecommunications	101	1,987	86,488,681
Transportation & Logistics	248	2,645	92,259,476
Manufacturing Supercluster	260	15,623	723,366,262

Cluster Type	Establishments	Employment	Wages
Primary Metal Mfg	19	2,251	116,083,215
Fabricated Metal Product Mfg	108	3,192	126,144,788
Machinery Mfg	78	3,188	151,360,536
Computer & Electronic Product Mfg	9	719	27,153,943
Electrical Equipment, Appliance & Component Mfg	4	147	5,480,940
Transportation Equipment Mfg	42	6,126	297,142,840
Mining	15	142	6,858,107
Printing & Publishing	102	1,647	51,719,983

Source: IBRC, using Indiana Department of Workforce Development data. Cluster definitions developed by PCRD.

Long-term occupation projections cite health care practitioner and technical positions; education, training and library positions; and food preparation and serving related positions as the fastest growing occupations in EGR 6. As shown in Table 27, available positions in each of these occupation categories are expected to increase by 1,360, 1,350 and 1,220 positions, respectively. The health care practitioner and technical positions offer the highest wages in the top three fastest growing occupations, with a 2006 annual wage of $42,540.

Table 27: Long-Term Job Projections by Occupation, EGR 6

Occupational Title[1]	2004	2014	Total Growth	Percent Change	2006 Annual Wage[2]	Education Requirement[3]
Total, All Occupations	128,870	133,250	4,380	3	$27,858	n/a
Health Care Practitioners and Technical	7,760	9,120	1,360	18	$42,540	Associate's degree
Education, Training, and Library	9,330	10,670	1,350	14	$34,602	Bachelor's degree
Food Preparation and Serving Related	12,090	13,310	1,220	10	$14,621	Short-term on-the-job training
Health care Support	4,070	4,960	890	22	$20,931	Short-term on the job training
Personal Care and Service	3,380	4,120	730	22	$19,236	Short-term on-the-job training
Building and Grounds Cleaning and Maintenance	3,430	3,830	400	12	$19,928	Short-term on-the-job training
Management	4,680	4,990	310	7	$66,018	Bachelor's or higher degree, plus work experience
Community and Social Services	1,840	2,150	300	16	$30,276	Master's degree
Business and Financial Operations	2,570	2,850	280	11	$43,902	Bachelor's degree
Construction and Extraction	4,950	5,140	190	4	$31,710	Long-term on-the-job training

Occupational Title[1]	2004	2014	Total Growth	Percent Change	2006 Annual Wage[2]	Education Requirement[3]
Computer and Mathematical	810	990	180	22	$45,023	Bachelor's degree
Arts, Design, Entertainment, Sports, and Media	1,300	1,440	140	11	$26,937	Bachelor's degree
Protective Service	2,230	2,350	130	6	$30,640	Moderate-term on-the-job training
Farming, Fishing, and Forestry	510	590	80	16	$16,748	Short-term on-the-job training
Legal	260	300	40	15	$40,580	First professional degree [4]
Life, Physical, and Social Science	370	410	40	11	$40,220	Master's degree
Installation, Maintenance, and Repair	5,580	5,600	20	0	$32,048	Moderate-term on-the-job training
Transportation and Material Moving	10,220	10,190	-30	0	$25,289	Short-term on-the-job training
Architecture and Engineering	1,230	1,190	-40	-3	$52,472	Bachelor's degree
Office and Administrative Support	19,090	18,920	-170	-1	$23,705	Short-term on-the-job training
Sales and Related	12,740	12,570	-180	-1	$18,790	Short-term on-the-job training
Production	20,430	17,570	-2,860	-14	$28,634	Moderate-term on-the-job training

1) Self-employed and unpaid family workers excluded.

2) 2006 Annual Wage is the regional median wage for the occupation from the Occupational Employment Statistics program, conducted by the Indiana Workforce Development Agency for the U.S. Bureau of Labor Statistics.

3) The most prevalent education requirement within each occupational group was assigned to the respective summary group.

4) First professional degree. Completion of the academic program usually requires at least six years of full-time equivalent academic study, including college study prior to entering the professional degree program.

Source: Indiana Department of Workforce Development

The Indiana Department of Workforce Development provides job rankings based on projected employment growth, total job openings, and wage factors. Table 28 displays the top 25 jobs for EGR 6.

Table 28: Top 25 Regional Jobs, EGR 6

Rank	Job Title	2004	2014	New Jobs	Growth %	Area Wage
1	Postsecondary Teachers	2,310	2,870	560	24	$51,042
2	Registered Nurses	2,480	3,110	630	25	$51,314
3	Elementary and Kindergarten School Teachers	1,800	2,000	200	11	$48,720

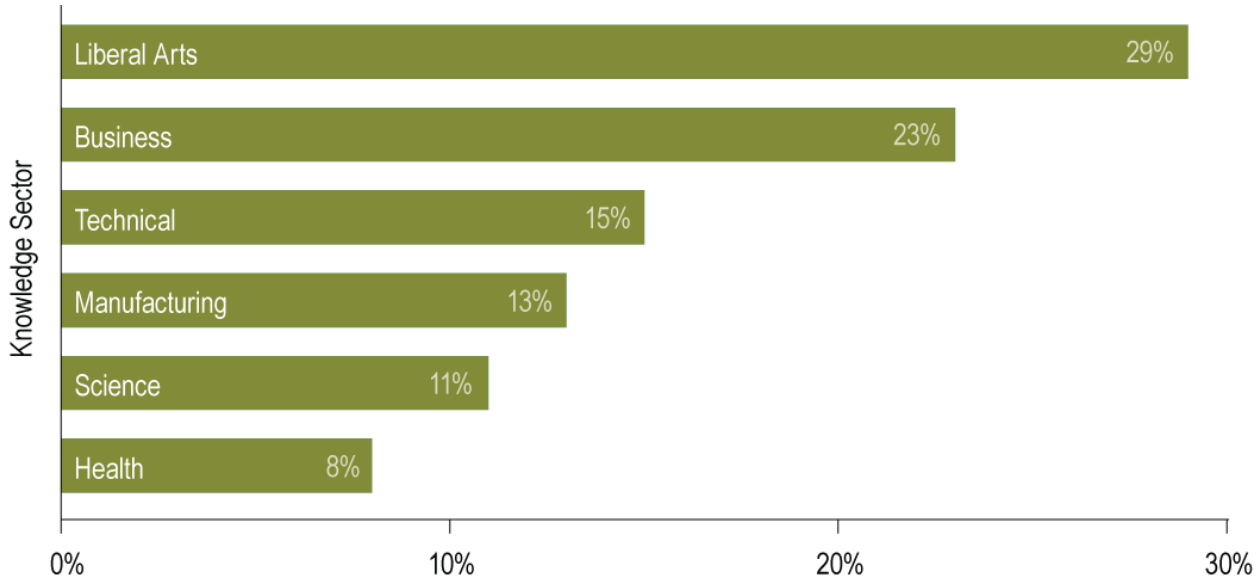
Rank	Job Title	2004	2014	New Jobs	Growth %	Area Wage
4	Computer Systems Analysts	190	250	60	33	$50,080
5	Network and Computer Systems Administrators	120	170	40	35	$47,561
6	Accountants and Auditors	610	700	90	15	$49,929
7	Farm, Ranch, and Other Agricultural Managers	110	150	40	35	$40,181
8	Loan Officers	310	380	70	21	$40,391
9	Pharmacists	250	290	40	16	$90,402
10	Medical and Health Services Managers	250	300	50	19	$67,039
11	Secondary School Teachers	1,530	1,650	120	8	$47,017
12	Medical and Clinical Laboratory Technologists	290	340	50	19	$46,389
13	Educational, Vocational, and School Counselors	300	340	50	16	$40,603
14	Licensed Practical and Licensed Vocational Nurses	1,150	1,250	100	9	$34,809
15	First-Line Supervisors/Managers of Personal Service Workers	150	190	40	25	$29,468
16	General and Operations Managers	1,230	1,300	70	6	$72,508
17	Radiologic Technologists and Technicians	170	210	30	19	$43,030
18	Surgical Technologists	120	150	30	25	$35,529
19	Mental Health and Substance Abuse Social Workers	140	170	30	24	$29,413
20	Computer Support Specialists	230	260	40	16	$36,901
21	Fire Fighters	260	300	40	14	$39,354
22	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	180	210	30	19	$30,094
23	Child, Family, and School Social Workers	450	500	50	12	$30,018
24	Medical and Clinical Laboratory Technicians	190	220	30	17	$32,176
25	Operating Engineers and Other Construction Equipment Operators	410	450	50	11	$30,121

Source: Indiana Department of Workforce Development

Knowledge Sectors and Skills in Demand

Knowledge sector information shows how regional occupations require different categories of knowledge such as business, technical, manufacturing and other categories of knowledge. The percentage of all knowledge associated with each category is calculated by adding up each competency's required level in each occupation multiplied by the regional employment in that occupation. Knowledge sectors allow for viewing a regional workforce in terms of its competencies, rather than its occupations (see Figure 32).

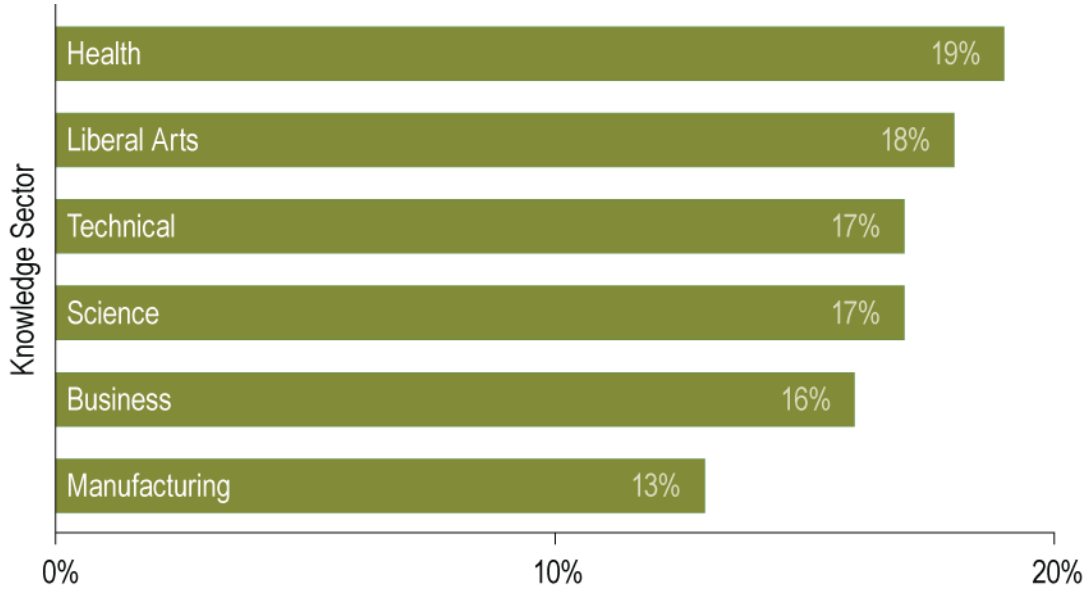
Figure 32: Knowledge Sectors, EGR 6, 2004



Source: EMSI, using the O*NET database and Indiana Department of Workforce Development data

The health knowledge sector is projected to have the most growth, with a 19 percent increase expected from 2004 to 2014 (see Figure 33). The liberal arts knowledge sector is expected to grow 18 percent in the same time period.

Figure 33: Knowledge Sector Growth, EGR 6, 2004-2014



Source: EMSI, using the O*NET database and Indiana Department of Workforce Development data

The Indiana Department of Workforce Development performs matches between job applicants looking for work and employers looking for new employees. Table 29 provides a ranking of the top job skills most often required by employers in EGR 6.

Table 29: Skills in Demand, EGR 6

Rank	Skill
1	Manage time effectively
2	Adhere to safety procedures
3	Apply good listening skills
4	Use computer
5	Organize and work with detailed office or warehouse records
6	Work as a team member
7	Acquire and evaluate information
8	Perform more than one task at the same time
9	Use computer keyboard
10	Follow detailed instructions
11	Follow and give instructions
12	Make decisions
13	Operate precision measuring tools and equipment in industrial production, manufacturing
14	Receive payments and make change
15	Use computers to enter, access and retrieve client data
16	Apply health/sanitation standards
17	Serve customers/clients
18	Use Microsoft word processing software
19	Use Excel spreadsheet software
20	Use Microsoft Office suite software

Source: Indiana Department of Workforce Development

Profile of Indiana Economic Growth Region 11

Economic Growth Region (EGR) 11 is located in southwestern Indiana and is comprised of nine counties: Dubois, Gibson, Knox, Perry, Pike, Posey, Spencer, Vanderburgh, and Warrick (see Figure 34). EGR 11 covers 3,578 square miles and has a population density of 117.8 persons per square mile. Evansville, in Vanderburgh County, is the largest city in the region with a 2007 population of 116,253 persons, according to the Census Bureau's population estimates.

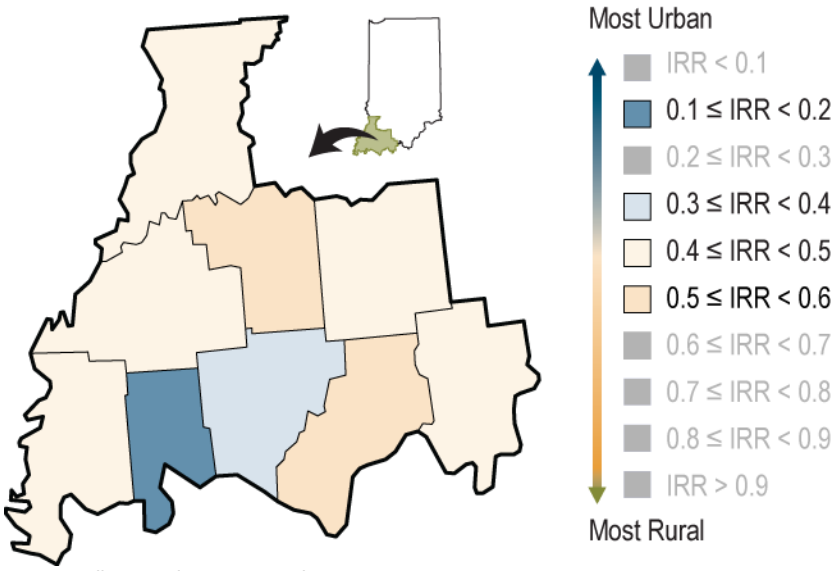
Figure 34: Counties in EGR 11

Source: IBRC

Urban/Rural Hierarchy

The Index of Relative Rurality (IRR) is a tool created by Brigitte Waldorf, a professor with the Department of Agricultural Economics at Purdue University. It is used to determine a county's degree of rurality (see Figure 35).

Figure 35: Index of Relative Rurality, EGR 11, 2000

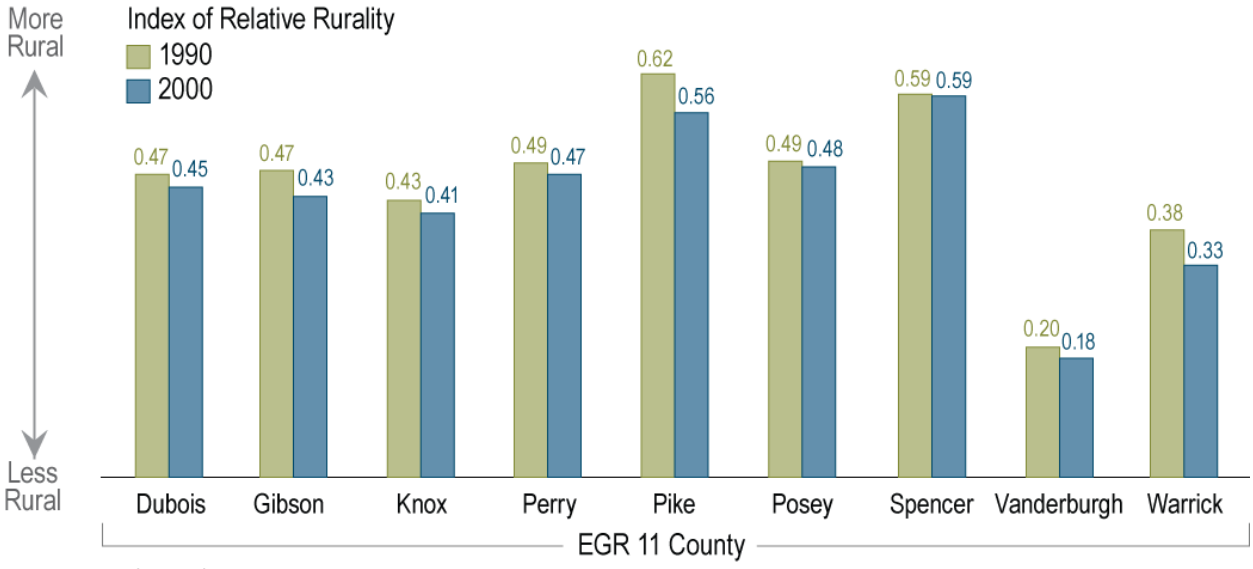


Source: Indiana Business Research Center

The index is based on a scale from 0 to 1, with 0 being the most urban place and 1 being the most rural place. The numbers between 0 and 1 indicate the degree of rurality. The IRR is based on four dimensions of rurality: population, population density, extent of urbanized area and distance to the nearest metro area.

According to Figure 36, Spencer County is this region's most rural county while Vanderburgh County is the most urban.

Figure 36: Index of Relative Rurality, EGR 11, 1990-2000

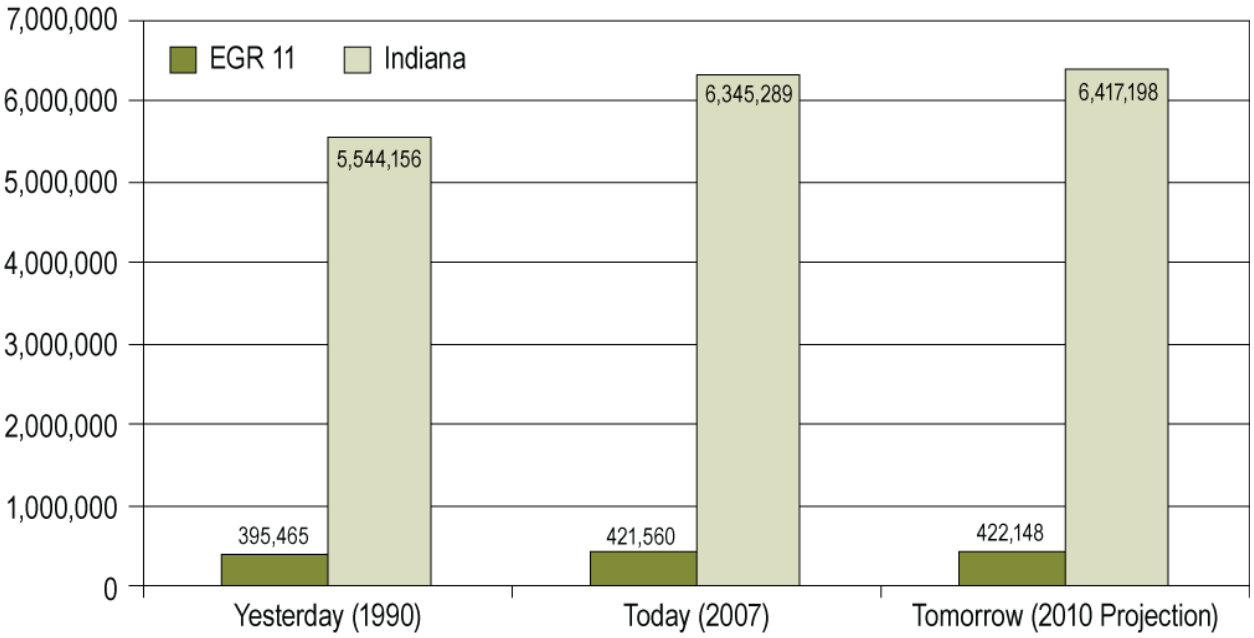


Source: Strategic Development Group

Population

EGR 11 had a total population of 421,560 residents in 2007, which correlates to 6.6 percent of the total 2007 Indiana population (see Figure 37). The region experienced a 4.9 percent increase in total population from 1990 to 2000. The state of Indiana experienced a 9.7 percent increase in total population during this same period.

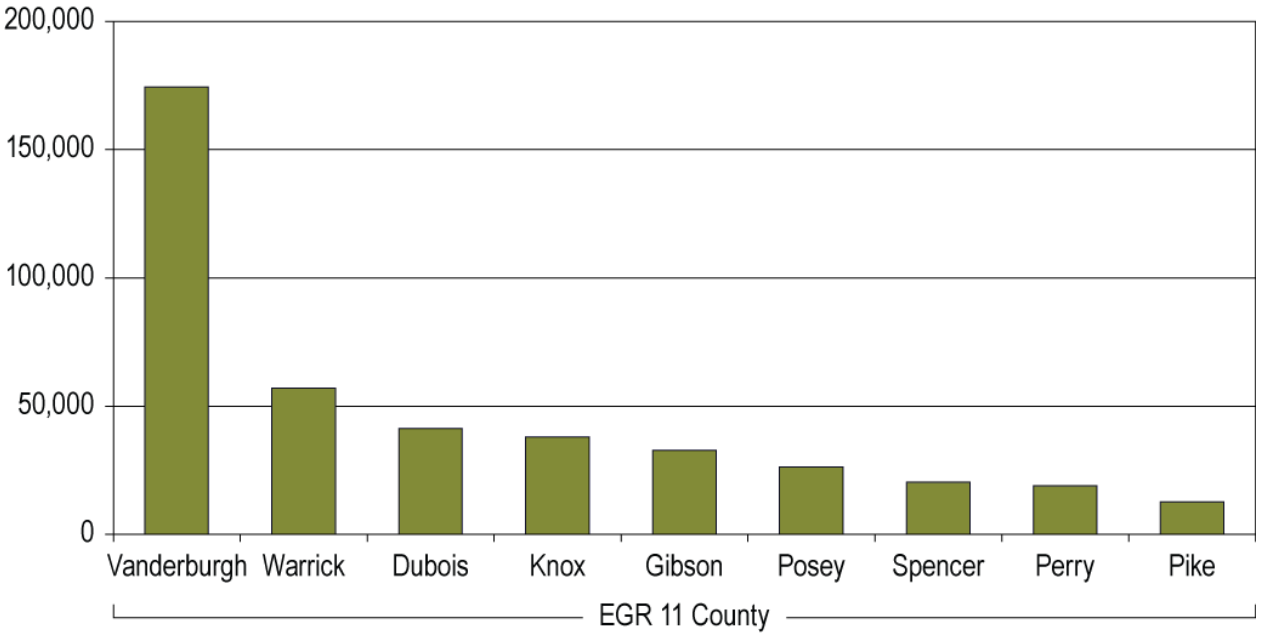
Figure 37: Population, EGR 11, 1990-2010



Source: STATS Indiana, using U.S. Census Bureau and IBRC data

Vanderburgh County has the highest population total in EGR 11, with a 41 percent share of the region (see Figure 38 and Table 30). Warrick County has the second highest population with 57,090 residents.

Figure 38: Regional Population by County, EGR 11, 2007



Source: STATS Indiana, using U.S. Census Bureau data

Table 30: County Populations, EGR 11, 2007

County	2007 Population	Percent of Region	Percent of State
Dubois	41,225	10	0.6
Gibson	32,754	8	0.5
Knox	37,949	9	0.6
Perry	18,916	4	0.3
Pike	12,605	3	0.2
Posey	26,262	6	0.4
Spencer	20,334	5	0.3
Vanderburgh	174,425	41	2.7
Warrick	57,090	14	0.9
EGR 11	421,560	100	6.6

Source: STATS Indiana, using U.S. Census Bureau data

The majority of the population in EGR 11 is between the ages of 45 and 64 (see Table 31). The second largest population segment is young adults from 25 to 44, with 26 percent of the distribution. The age distribution of residents in EGR 11 is similar to that of Indiana.

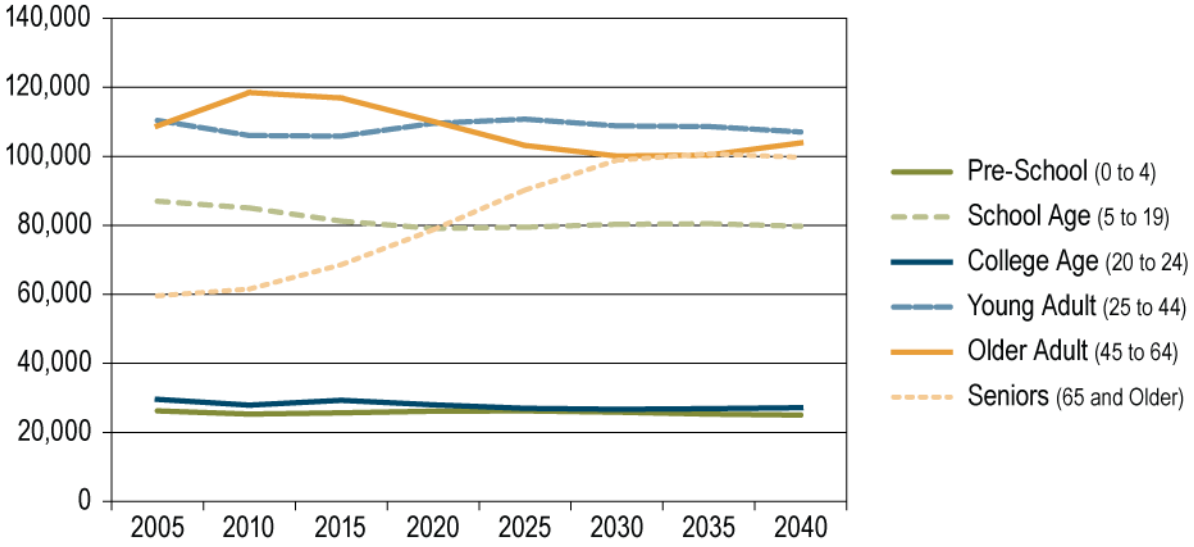
Table 31: Population Estimates by Age, EGR 11, 2006

Age Group	Number	EGR 11 % Distribution	Indiana % Distribution
Preschool (0 to 4)	26,352	6	7
School Age (5 to 17)	71,832	17	18
College Age (18 to 24)	42,773	10	10
Young Adult (25 to 44)	109,944	26	28
Older Adult (45 to 64)	111,801	27	25
Older (65 Plus)	59,652	14	12

Source: STATS Indiana, using U.S. Census Bureau data

Population projections for EGR 11 indicate that the 65 and older population is expected to increase by more than 60 percent by the year 2040. Projections for all of the other age categories have varying degrees of change over the next several decades, as shown in Figure 39.

Figure 39: Population Projections, EGR 11, 2005-2040

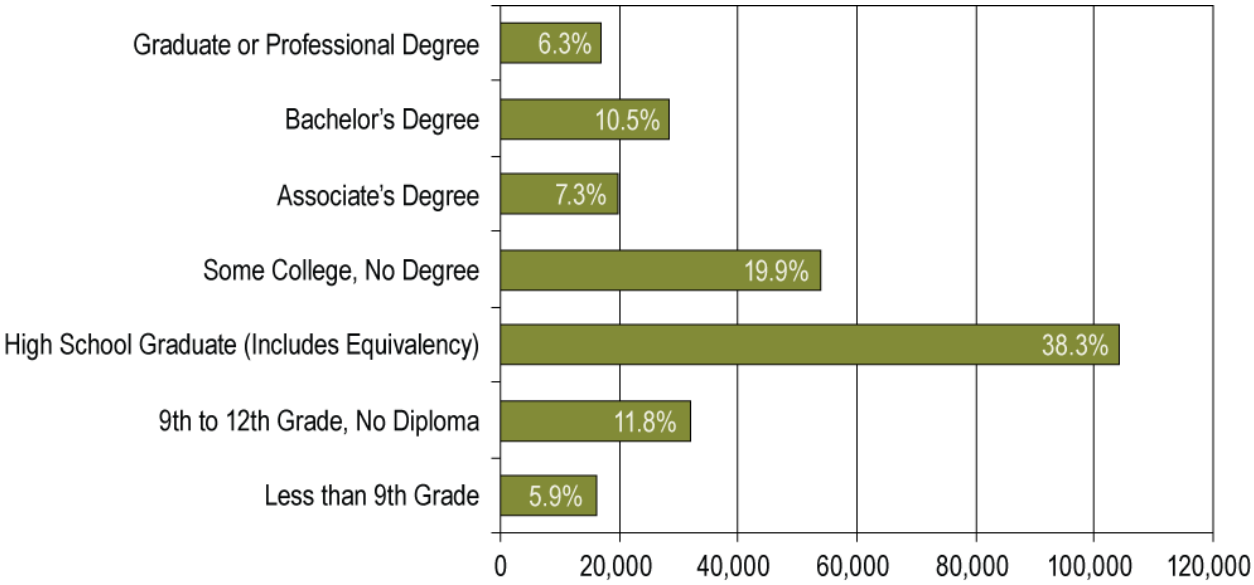


Source: STATS Indiana, using U.S. Census Bureau and IBRC data

Educational Attainment

According to the U.S. Census Bureau, EGR 11 had a population of 271,690 people over the age of 25 in 2000. Of this total, 104,169 were high school graduates; 19,898 had an associate's degree; and another 28,518 had a bachelor's degree. Figure 40 displays the educational attainment of people over the age of 25 in EGR 11.

Figure 40: Educational Attainment, EGR 11, 2000



Source: STATS Indiana, using U.S. Census Bureau data

In 2000, EGR 11 had a higher percentage of high school graduates and those with associate's degrees as compared to the state of Indiana; however, the region had a lower percentage of residents with bachelor's and graduate degrees.

The Indiana Department of Education finds that the majority of high school graduates in EGR 11 intend to go on to higher education. As noted in Table 32, 59 percent of high school students intend to enroll in a four-year institution, while 20 percent intend to enroll in a two-year institution.

Table 32: High School Graduates Higher Education Intent, EGR 11, 2006

	EGR 11 % Distribution	Indiana % Distribution
Graduates	100	100
Total Going on to Higher Education	85	83
Four-Year Institution	59	62
Two-Year Institution	20	14
Vocational and Tech.	6	8
Military	3	3

Source: STATS Indiana, using Indiana Department of Education data

Income

EGR 11 had $14.4 billion in personal income in 2006, with $11 billion in total earnings by place of work (see Table 33). Per capita personal income for EGR 11 was $34,159 in 2006, as shown in Figure 41.

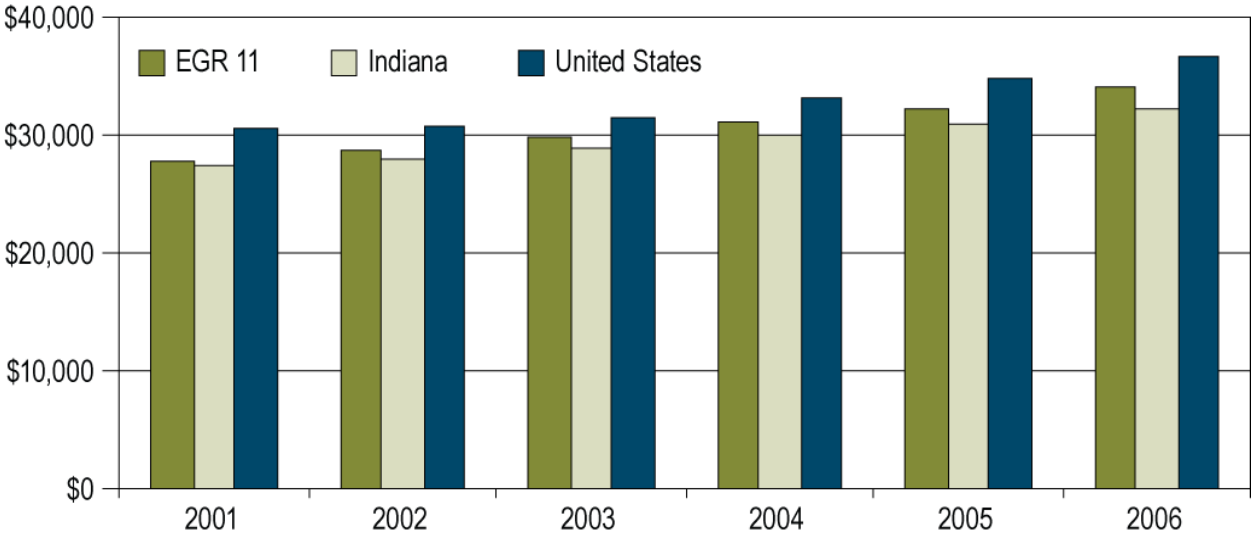
Table 33: Personal Income, EGR 11, 2006

	EGR 11 ($000)	EGR 11 Five-Year % Change (adj*)	Indiana Five-Year % Change (adj*)
Total Earnings By Place Of Work	$11,055,254	10.8	6.8
Minus: Contributions For Government Social Insurance	1,248,814	10.3	7.2
Personal Contributions For Government Social Insurance	656,765	11.0	7.6
Employer Contributions For Government Social Insurance	592,049	9.5	6.8
Plus: Adjustment For Residence	-412,920	9.3	8.4
Equals: Net Earnings By Place Of Residence	9,393,520	10.9	6.8
Plus: Dividends, Rent, Interest	2,573,266	-0.7	-6.3
Plus: Transfer Payments	2,397,357	18.3	20.4
Equals: Personal Income By Place Of Residence	$14,364,143	9.8	6.5

*adj = Adjusted for Inflation

Source: STATS Indiana, using U.S. Bureau of Economic Analysis data

Figure 41: Per Capita Income, EGR 11, 2001-2006



Source: STATS Indiana, using U.S. Bureau of Economic Analysis data

Table 34 displays median values for homes, gross rents, household incomes and earnings for each county in EGR 11, plus the state of Indiana. In 2000, Warrick County had the highest median values as compared to the other counties in EGR 11.

Table 34: Census Medians, EGR 11, 2000

County	Median Home Value ($)	Rank[1]	Median Gross Rent ($)	Rank	Median Household Income ($)	Rank	Median Family Income ($)	Rank	Median Earnings: Men ($)	Rank	Median Earnings: Women ($)	Rank
Indiana	94,300	na	521	na	41,567	na	50,261	na	37,055	na	25,252	na
Dubois	92,700	30	440	63	44,169	16	52,342	16	32,484	62	23,526	37
Gibson	74,700	70	427	68	37,515	63	44,839	63	35,511	36	21,284	78
Knox	63,600	86	403	77	31,362	92	41,273	85	30,536	86	20,916	87
Perry	71,200	76	370	89	36,246	73	43,743	65	31,554	76	22,123	56
Pike	59,300	90	339	92	34,759	81	41,420	82	31,967	71	20,970	85
Posey	89,800	32	419	71	44,209	14	53,737	10	39,084	13	23,996	31
Spencer	85,100	49	423	70	42,451	32	49,123	34	35,125	40	22,787	46
Vanderburgh	82,400	54	458	49	36,823	67	47,416	43	34,162	47	22,869	45
Warrick	104,400	15	478	37	48,814	8	55,497	8	40,491	9	24,334	25

[1] Rank indicates position of county in state; Indiana has a total of 92 counties.

Note: Median earnings are for year-round, full-time workers.

Source: STATS Indiana, using U.S. Census Bureau data

Jobs and Unemployment Rates

The manufacturing sector has the most jobs in EGR 11 with 44,941 jobs, followed by the health care and social assistance sector with 24,129 jobs (see Table 35). The highest wages for EGR 11 are in the management of companies and mining sectors, although they had fewer than 200 jobs.

Table 35: Employment and Wages by Sector, EGR 11, 2006

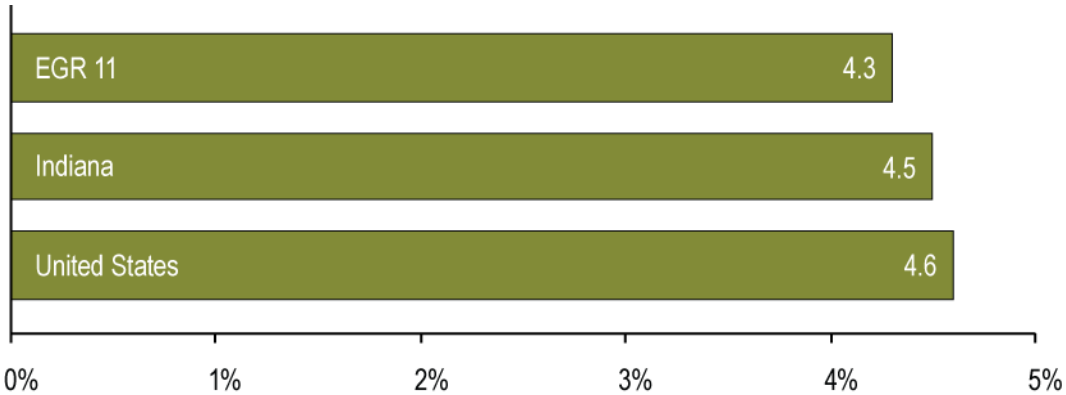
Sector	Estab.	Jobs	OTY Job Chg.	OTY % Chg.	Avg. Wage	OTY Avg. Wage Change	OTY Avg. Wage % Change
Total Employment	10,478	208,782	930	0.5	$35,969	$1,190	3.4
Total Private Employment	10,038	185,255	762	0.4	36,710	1,195	3.4
Agriculture, Forestry, Fishing, Hunt	159	1,040	17	1.6	24,790	-924	-3.6
Mining	77	1,850	37	2.0	59,231	4,478	8.2
Construction	1,257	11,825	86	0.7	34,661	1,987	6.1
Manufacturing	585	44,941	-154	-0.3	49,977	1,941	4.0
Wholesale Trade	696	8,171	101	1.3	37,151	946	2.6
Retail Trade	1,532	22,930	-593	-2.5	20,094	629	3.2

Sector	Estab.	Jobs	OTY Job Chg.	OTY % Chg.	Avg. Wage	OTY Avg. Wage Change	OTY Avg. Wage % Change
Transport and Warehousing	452	9,781	517	5.6	35,767	1,507	4.4
Utilities	61	2,312	360	18.4	58,010	4,221	7.9
Information	164	3,264	-167	-4.9	29,978	202	0.7
Finance and Insurance	597	4,715	-53	-1.1	35,446	386	1.1
Real Estate, Rental, Leasing	355	2,147	13	0.6	19,926	-189	-0.9
Professional and Tech. Services	820	5,430	137	2.6	38,366	2,429	6.8
Mgmt. of Companies	83	4,271	128	3.1	64,559	9,309	16.9
Admin. and Waste Services	450	7,197	-356	-4.7	24,052	1,660	7.4
Educational Services	198	5,958	72	1.2	27,548	1,515	5.8
Health Care and Social Assistance	890	24,129	568	2.4	31,725	2,257	7.7
Arts, Entertain., and Recreation	118	2,660	-101	-3.7	17,463	1,716	10.9
Accommodation and Food Service	808	15,660	168	1.1	10,333	243	2.4
Other Services	907	6,345	3	0.1	23,169	695	3.1
Federal, State, & Local Govt.	282	4,843	-29	-0.6	28,173	683	2.5

Source: STATS Indiana, using U.S. Bureau of Labor Statistics data

EGR 11 had a 2007 unemployment rate of 4.3 percent, lower than the state of Indiana and the United States during the same time period (see Figure 42).

Figure 42: Unemployment Rates, EGR 11, 2007

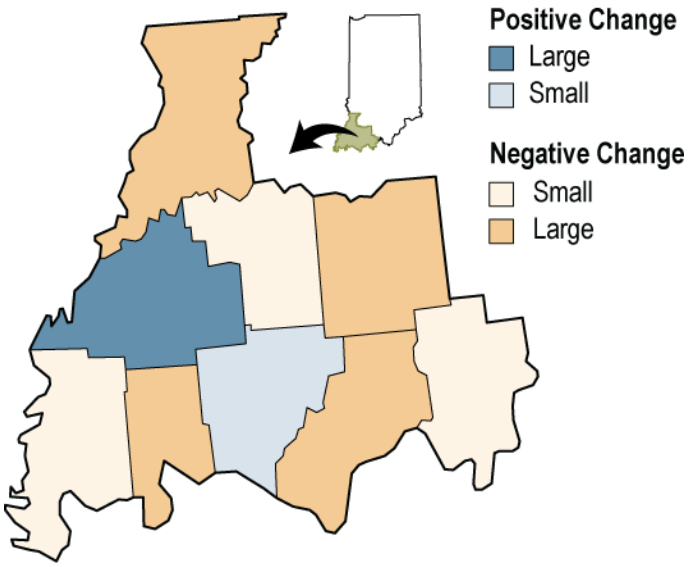


Source: STATS Indiana, using U.S. Bureau of Labor Statistics and Indiana Department of Workforce Development data

Competiveness Standing

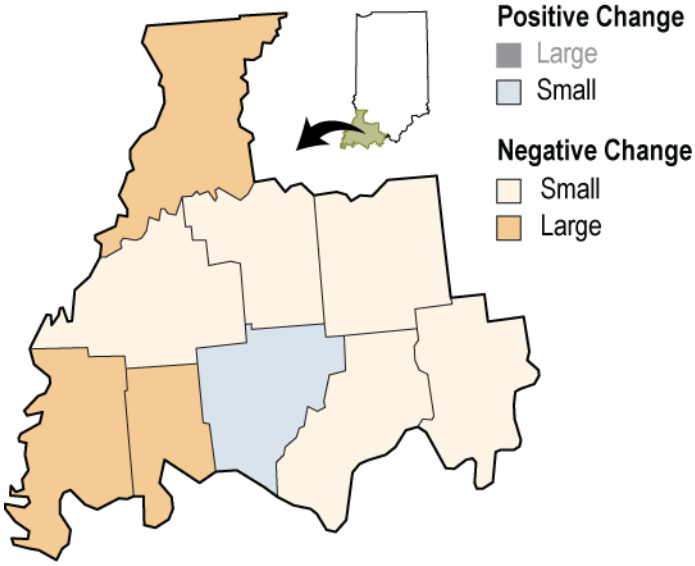
Figure 43 and Figure 44 show the region's competitiveness standing over the last decade as indicated by each county's change in share of U.S. jobs and income. This measure approaches regional competiveness from the perspective that counties that see their "slice" of the U.S. economy grow are more competitive than those with declining shares. By this measure much of EGR 11 has seen its share of the expanding U.S. economy decline on a relative basis for income, and to a lesser extent for jobs.

Figure 43: Change in Share of U.S. Jobs, EGR 11, 1996-2006



Source: Center for Regional Competiveness, using U.S. Bureau of Economic Analysis, REIS data

Figure 44: Change in Share of U.S. Income, EGR 11, 1996-2006



Source: Center for Regional Competiveness, using U.S. Bureau of Economic Analysis, REIS data

Industry Cluster and Occupational Profile

EGR 11 has 17 industry clusters, with six manufacturing sub-clusters. The business and financial services cluster has the most establishments in EGR 11, with 1,201 entities. The biomedical/biotechnical (life sciences) sector employs the most people, with 22,504 workers (see Table 36).

Table 36: Industry Clusters, EGR 11, 2007

Cluster	Estab.	Empl.	Wages
Total All Industries	10,709	208,130	$7,514,096,454
Advanced Materials	234	14,952	773,641,197
Agribusiness, Food Processing & Technology	266	5,472	174,569,545
Apparel & Textiles	64	1,754	57,052,395
Arts, Entertainment, Recreation & Visitor	266	5,814	118,734,441
Biomedical/Biotechnical (Life Sciences)	347	22,504	818,127,226
Business & Financial Services	1,201	7,375	345,400,505
Chemicals & Chemical Based Products	148	10,892	599,509,229
Defense & Security	235	3,701	148,424,319
Education & Knowledge Creation	129	5,852	186,445,102
Energy (Fossil & Renewable)	539	9,583	517,778,726
Forest & Wood Products	201	11,847	437,227,028
Glass & Ceramics	22	1,268	49,599,466
Information Technology & Telecommunications	180	3,383	166,487,955
Transportation & Logistics	400	8,312	317,851,499
Manufacturing Supercluster	201	17,309	980,295,422
Primary Metal Mfg	12	3,774	243,358,346
Fabricated Metal Product Mfg	92	1,989	77,320,671
Machinery Mfg	57	1,114	54,573,236
Computer & Electronic Product Mfg	9	855	31,630,123
Electrical Equipment, Appliance & Component Mfg	8	2,256	119,765,519
Transportation Equipment Mfg	23	7,321	453,647,527
Mining	14	85	3,482,782
Printing & Publishing	174	2,437	85,226,959

Source: IBRC, using Indiana Department of Workforce Development data. Cluster definitions developed by PCRD.

Long-term occupation projections cite health care practitioner and technical positions; food preparation and serving related positions; and construction and extraction occupation positions as the fastest growing occupations in EGR 11. As shown in Table 37, available positions in each of these occupation categories are expected to increase by 2,520, 1,510, and 1,420 positions, respectively. The health care practitioner and technical positions will require an associate's degree, while the food preparation and serving related positions and construction and extraction occupation will require on-the-job training. The health care practitioner and

technical positions offer the highest wages in the top three fastest growing occupations, with a 2006 annual wage of $43,161.

Table 37: Long-Term Job Projections by Occupation, EGR 11

Occupational Title[1]	2004	2014	Total Growth	Percent Change	2006 Annual Wage[2]	Education requirement[3]
Total, All Occupations	206,140	222,720	16,580	8	$28,616	n/a
Health Care Practitioners and Technical Occupations	10,920	13,430	2,520	23	$43,161	Associate degree
Food Preparation and Serving Related Occupations	17,460	18,970	1,510	9	$14,943	Short-term on-the-job training
Construction and Extraction Occupations	12,060	13,480	1,420	12	$38,240	Long-term on-the-job training
Health Care Support Occupations	4,910	6,320	1,410	29	$22,051	Short-term on-the-job training
Education, Training, and Library Occupations	9,330	10,680	1,350	14	$36,244	Bachelor's degree
Building and Grounds Cleaning and Maintenance Occupations	6,200	7,400	1,200	19	$19,529	Short-term on-the-job training
Transportation and Material Moving Occupations	19,340	20,530	1,200	6	$25,401	Short-term on-the-job training
Management Occupations	7,740	8,730	990	13	$70,192	Bachelor's or higher degree, plus work experience
Personal Care and Service Occupations	3,990	4,920	930	23	$17,797	Short-term on-the-job training
Business and Financial Operations Occupations	5,300	6,130	840	16	$45,245	Bachelor's degree
Installation, Maintenance, and Repair Occupations	11,320	12,130	810	7	$35,956	Long-term on-the-job training
Computer and Mathematical Occupations	1,920	2,350	430	22	$47,799	Bachelor's degree
Sales and Related Occupations	19,400	19,800	390	2	$20,930	Short-term on-the-job training
Community and Social Services Occupations	2,060	2,440	380	18	$33,163	Master's degree
Protective Service Occupations	2,860	3,140	280	10	$30,479	Short-term on-the-job training
Architecture and Engineering Occupations	2,870	3,120	240	8	$52,859	Bachelor's degree

Occupational Title[1]	2004	2014	Total Growth	Percent Change	2006 Annual Wage[2]	Education requirement[3]
Arts, Design, Entertainment, Sports, and Media Occupations	2,070	2,290	230	11	$27,071	Bachelor's degree
Office and Administrative Support Occupations	30,540	30,700	160	1	$24,456	Short-term on-the-job training
Legal Occupations	700	810	110	15	$43,361	First professional degree [4]
Farming, Fishing, and Forestry Occupations	930	1,040	110	12	$26,147	Long-term on-the-job training
Life, Physical, and Social Science Occupations	1,420	1,530	110	8	$43,678	Bachelor's degree
Production Occupations	32,820	32,790	-30	0	$29,698	Moderate-term on-the-job training

1. Self-employed and unpaid family workers excluded.
2. 2006 annual wage is the regional median wage for the occupation from the Occupational Employment Statistics program, conducted by the Indiana Workforce Development Agency for the U.S. Bureau of Labor Statistics.
3. The most prevalent education requirement within each occupational group was assigned to the respective summary group.
4. First professional degree. Completion of the academic program usually requires at least six years of full-time equivalent academic study, including college study prior to entering the professional degree program.

Source: Indiana Department of Workforce Development

Production occupations are expected to have the lowest growth rate in EGR 11, with a projected deficit of 30 jobs.

The Indiana Department of Workforce Development provides job rankings based on projected employment growth, total job openings, and wage factors. Table 38 displays the top 25 jobs for EGR 11.

Table 38: Top 25 Regional Jobs, EGR 11

Rank	Job Title	2004	2014	New Jobs	Growth %	Area Wage
1	Registered Nurses	4,010	5,180	1,170	29	$47,445
2	Postsecondary Teachers	1,430	1,800	370	26	$51,071
3	Truck Drivers, Heavy and Tractor-Trailer	4,000	4,550	550	14	$33,158
4	General and Operations Managers	2,080	2,330	250	12	$80,310
5	Accountants and Auditors	1,280	1,520	240	19	$49,128
6	Computer Software Engineers, Applications	120	170	60	50	$75,724
7	Plumbers, Pipefitters, and Steamfitters	1,230	1,440	210	17	$48,629
8	Team Assemblers	6,390	6,960	570	9	$31,789
9	Dental Hygienists	350	450	100	30	$53,767
10	Customer Service Representatives	2,450	2,820	370	15	$27,464
11	Chief Executives	540	620	90	16	$114,964

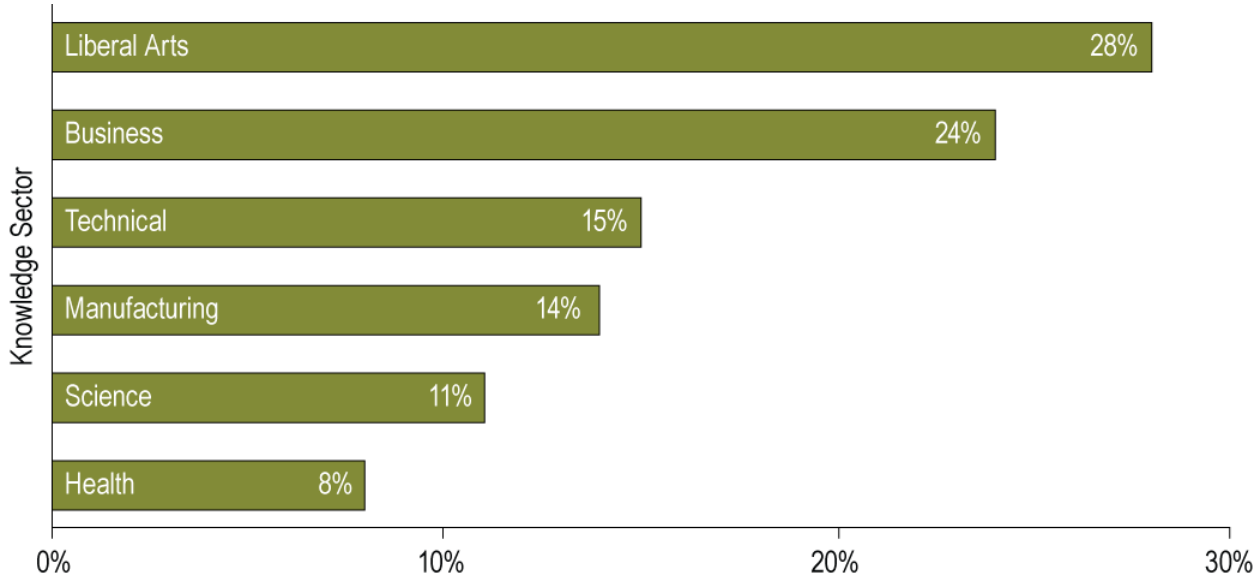
Rank	Job Title	2004	2014	New Jobs	Growth %	Area Wage
12	Carpenters	1,320	1,560	240	19	$29,032
13	Elementary and Kindergarten School Teachers	2,090	2,340	250	12	$48,231
14	Medical and Health Services Managers	500	610	110	21	$63,536
15	Network and Computer Systems Administrators	250	330	80	32	$47,159
16	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	2,330	2,580	250	11	$43,950
17	Physical Therapists	280	360	80	27	$58,855
18	Dental Assistants	320	420	100	30	$31,102
19	Physical Therapist Assistants	230	300	70	33	$42,715
20	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	340	430	90	28	$41,404
21	Computer Systems Analysts	180	230	50	29	$64,355
22	Industrial Engineers	410	490	80	20	$58,535
23	Pharmacists	360	420	60	17	$89,584
24	Network Systems and Data Communications Analysts	80	120	40	49	$56,306
25	Radiologic Technologists and Technicians	380	470	90	24	$39,943

Source: Indiana Department of Workforce Development

Knowledge Sectors and Skills in Demand

Knowledge sector information shows how much regional occupations require different categories of knowledge such as business, technical, manufacturing and other categories of knowledge. The percentage of all knowledge associated with each category is calculated by adding up each competency's required level in each occupation multiplied by the regional employment in that occupation. Knowledge sectors allow for viewing a regional workforce in terms of its competencies, rather than its occupations (see Figure 45).

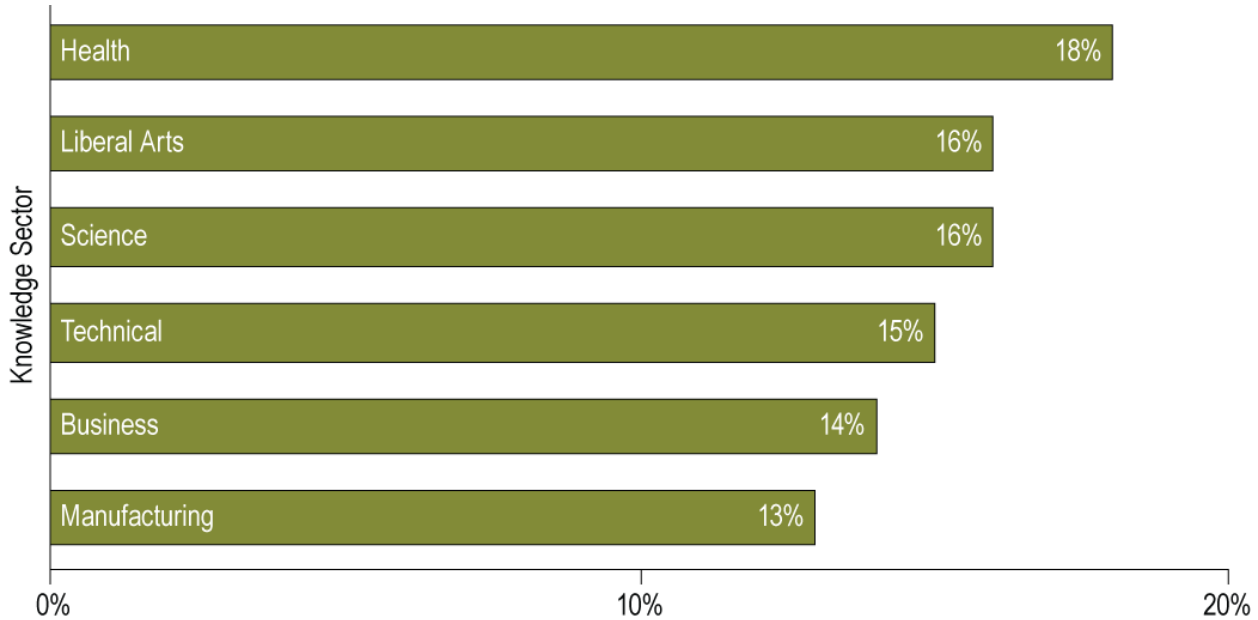
Figure 45: Knowledge Sectors, EGR 11, 2004



Source: EMSI, using the O*NET database and Indiana Department of Workforce Development data

The health knowledge sector is projected to have the most growth, with an 18 percent increase expected from 2004 to 2014. The liberal arts sector and the science sector are expected to grow 16 percent in the same time period (see Figure 46).

Figure 46: Knowledge Sector Growth, EGR 11, 2004-2014



Source: EMSI, using the O*NET database and Indiana Department of Workforce Development data

The Indiana Department of Workforce Development performs matches between job applicants looking for work and employers looking for new employees. Table 39 provides a ranking of the top job skills most often required by employers in EGR 6.

Table 39: Skills in Demand, EGR 11

Rank	Skill
1	Work as a team member
2	Manage time effectively
3	Maintain safe work environment
4	Organize and work with detailed office or warehouse records
5	Meet deadlines
6	Apply good listening skills
7	Adhere to safety procedures
8	Acquire and evaluate information
9	Follow customer instructions
10	Serve customers/clients
11	Perform more than one task at the same time
12	Follow detailed instructions
13	Read and apply information
14	Follow government regulations
15	Use computer
16	Follow emergency procedures
17	Follow and give instructions
18	Keep records and maintain files
19	Use computers to enter, access and retrieve client data
20	Use computer keyboard

Source: Indiana Department of Workforce Development

Profile of West Alabama-East Mississippi WIRED I Region

The West Alabama-East Mississippi (WAEM) region is a first generation WIRED region under the Department of Labor's *Workforce Innovation in Regional Economic Development* grant program. The WAEM region contains 37 counties with a total population of 1,079,869 as of 2007 (see Figure 47). The region is bordered on the west by Jackson, Miss., and on the east by Birmingham, Ala. The largest urban center is Tuscaloosa, Ala., (population: 78,000) where the University of Alabama resides. Meridian, Miss., in Lauderdale County follows with an urban population of almost 40,000.

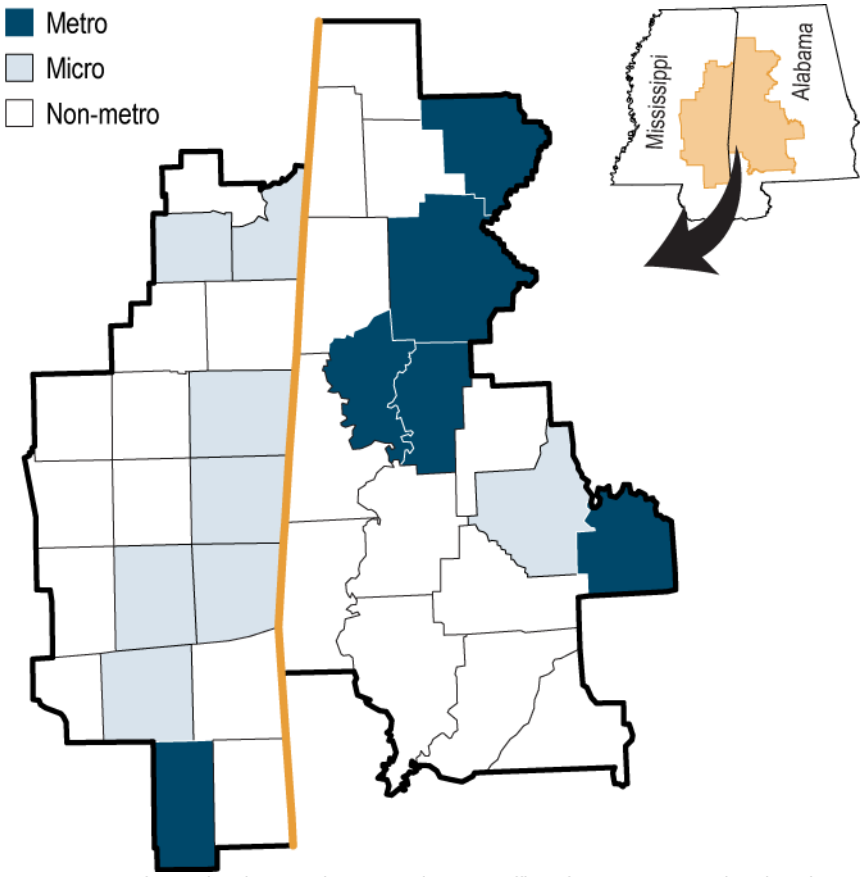
Figure 47: Counties in WAEM Region

Source: Indiana Business Research Center

Urban/Rural Hierarchy

WAEM is a largely rural region bordered by two significant metropolitan statistical areas (MSAs): the Birmingham-Hoover, Ala. MSA and the Jackson, Miss. MSA. The region contains the three-county Tuscaloosa, Ala. MSA. As shown in Figure 48, several counties have achieved micropolitan status according to OMB definitions (roughly stated as non-metro counties with an urban center of 10,000 or more people). Twenty-three of the region's counties are non-metro counties (that is, counties falling below the micropolitan designation).

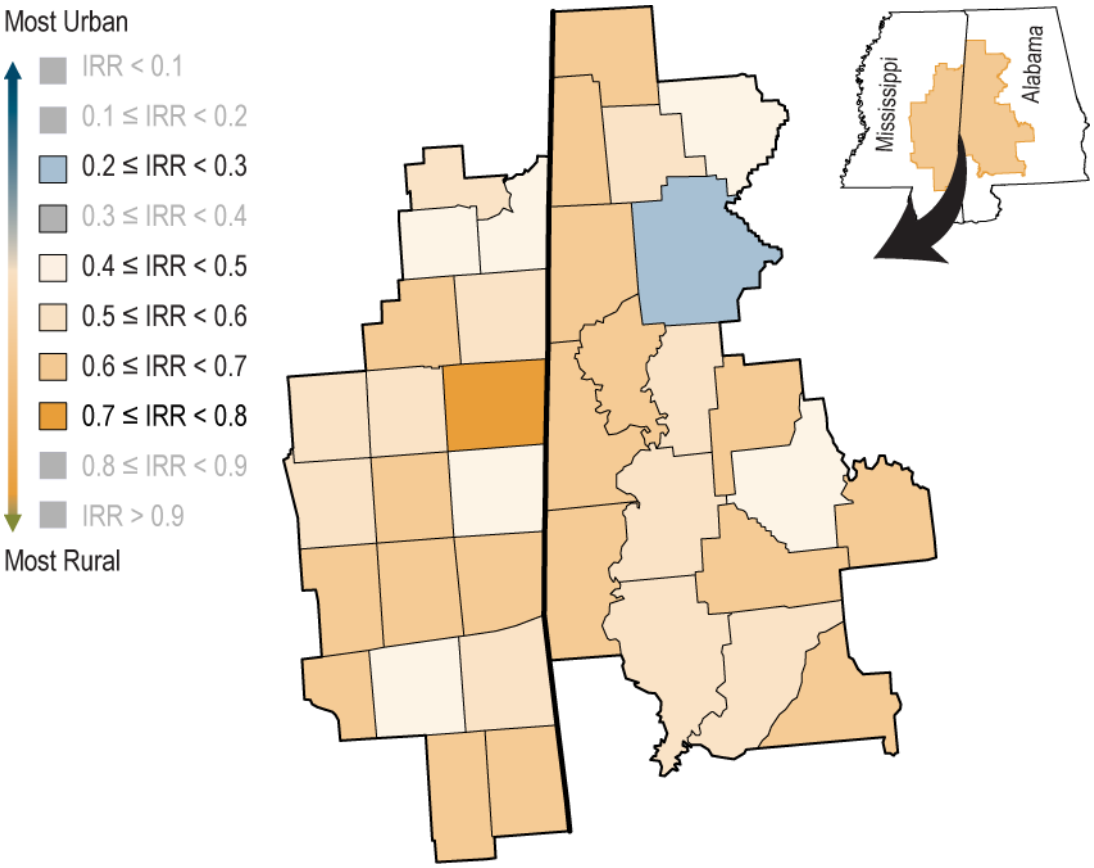
Figure 48: Counties by Type, WAEM



Source: Center for Regional Competiveness, using U.S. Office of Management and Budget data

The Index of Relative Rurality ranks U.S. counties according to four dimensions of rurality: population, density, urbanization and distance to metro areas. Clearly, WAEM is a largely rural region though most counties in the region tend to cluster in the middle of the IRR scale; no county in the region has an IRR above 0.8 (see Figure 49).

Figure 49: Index of Relative Rurality, WAEM, 2000

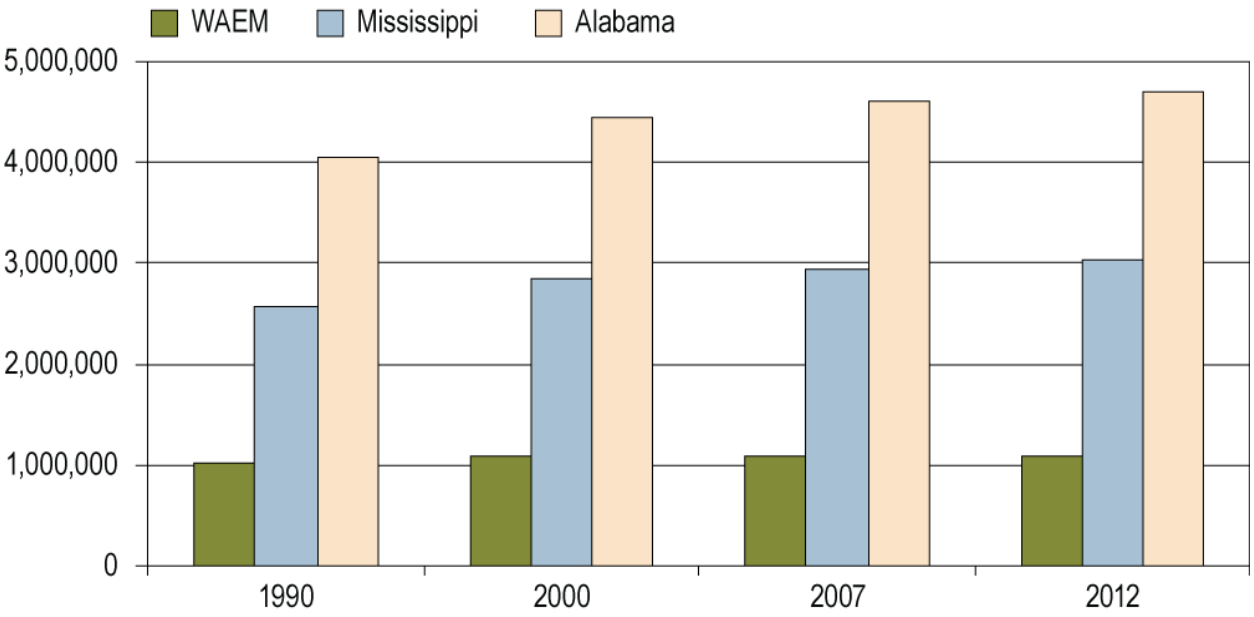


Source: Indiana Business Research Center

Population

WAEM's population of 1,079,869 represents about 14.3 percent of the bi-state region. From 1990 to 2007, the region's population increased by 5 percent while Alabama and Mississippi's increased by 13.8 percent and 14.6 percent, respectively (see Figure 50 and Table 40). By 2012, WAEM's population is expected to increase by less than 1 percent, while Alabama and Mississippi will increase by 2.5 percent and 2.3 percent, respectively. Table 41 shows population estimates by age.

Figure 50: Population, WAEM, 1990-2012



Source: Decision Data Resources

Table 40: County Populations, WAEM, 2007

State	County	2007 Population	Percent of Region	Percent of State
Alabama	Choctaw	14,849	2.72	0.32
	Clarke	27,178	4.97	0.59
	Conecuh	13,161	2.41	0.29
	Dallas	44,114	8.07	0.96
	Fayette	18,066	3.31	0.39
	Greene	9,590	1.76	0.21
	Hale	18,188	3.33	0.40
	Lamar	14,669	2.68	0.32
	Lowndes	13,022	2.38	0.28
	Marion	29,761	5.45	0.65
	Marengo	21,809	3.99	0.47
	Monroe	23,466	4.29	0.51
	Perry	11,404	2.09	0.25
	Pickens	20,114	3.68	0.44
	Sumter	13,815	2.53	0.30
	Tuscaloosa	170,417	31.19	3.70
	Walker	69,869	12.79	1.52
	Wilcox	12,892	2.36	0.28

State	County	2007 Population	Percent of Region	Percent of State
Mississippi	Clarke	17,623	3.30	0.60
	Clay	21,404	4.01	0.73
	Covington	20,578	3.86	0.70
	Greene	13,105	2.46	0.44
	Jasper	18,178	3.41	0.62
	Jones	69,589	13.04	2.36
	Kemper	10,366	1.94	0.35
	Lauderdale	76,976	14.43	2.61
	Leake	23,012	4.31	0.78
	Lowndes	59,896	11.23	2.03
	Neshoba	29,988	5.62	1.02
	Newton	22,289	4.18	0.76
	Noxubee	12,162	2.28	0.41
	Oktibbeha	40,500	7.59	1.37
	Perry	12,272	2.30	0.42
	Scott	28,735	5.39	0.97
	Smith	15,815	2.96	0.54
	Wayne	21,165	3.97	0.72
	Winston	19,832	3.72	0.67

Source: Decision Data Resources

Table 41: Population Estimates by Age, WAEM, 2007

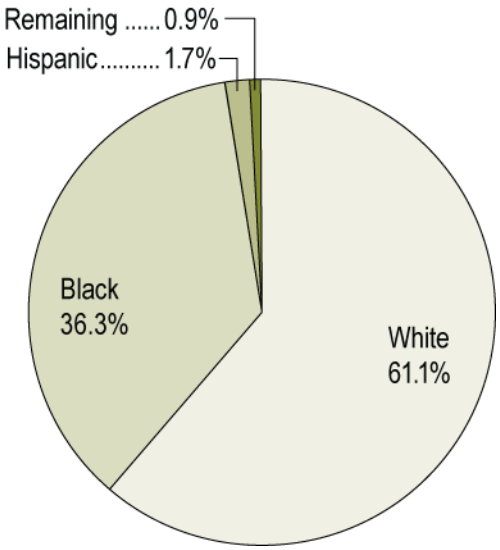
Age Group	Number in WAEM	Percent Distribution		
		WAEM	AL	MS
0 to 4	76,144	7.1	6.5	7.3
5 to 14	144,348	13.4	12.9	13.7
15 to 19	76,961	7.1	6.4	7.2
20 to 24	83,151	7.7	6.7	7.5
25 to 34	148,339	13.7	13.5	13.9
35 to 44	136,107	12.6	12.7	13.2
45 to 54	147,824	13.7	14.0	13.8
55 to 64	118,272	11.0	12.6	10.7
65 to 74	78,779	7.3	8.4	6.9
75+	70,024	6.6	6.7	5.8

Source: Decision Data Resources, using U.S. Census 2000 data

Racial Demographics

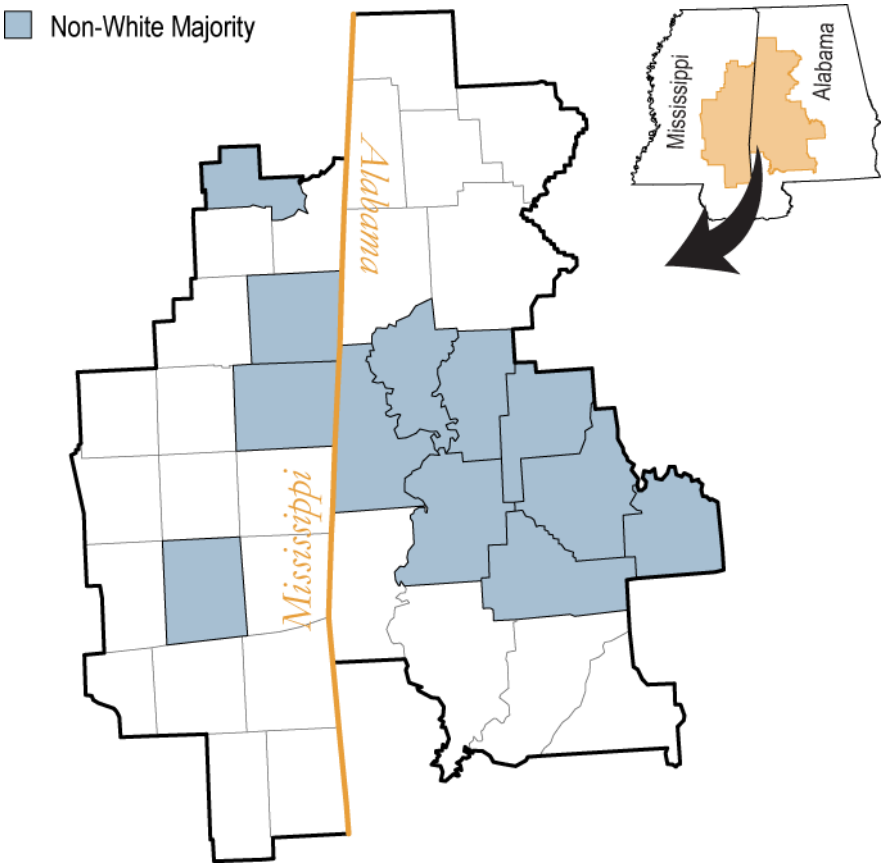
Figure 51 and Figure 52 show the racial composition of the region.

Figure 51: Racial Composition, WAEM, 2007



Source: Decision Data Resources

Figure 52: Non-White Majorities, WAEM

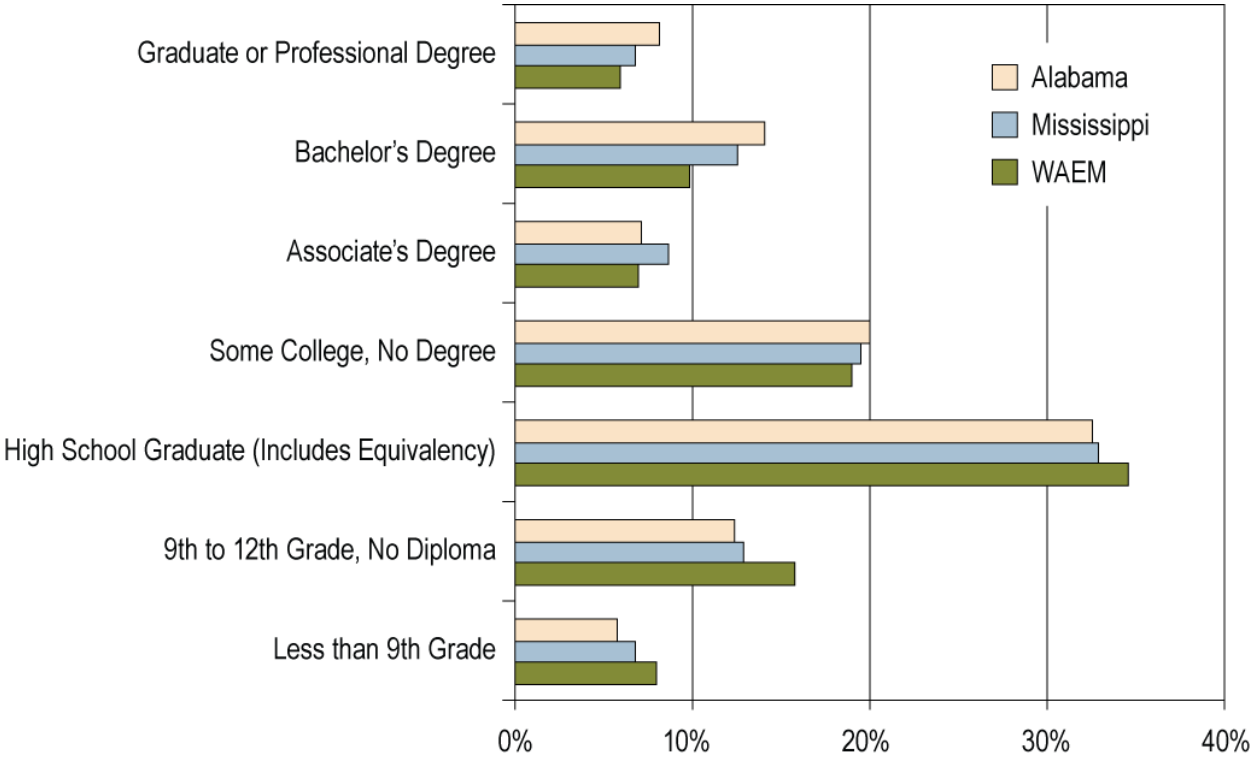


Source: Center for Regional Competiveness, using U.S. Census Bureau data

Educational Attainment

Educational attainment at the higher degree levels in the region lags slightly bi-state completion rates (see Figure 53). The region outperforms in terms of high school graduation rates, but with today's manufacturing jobs requiring greater skills, WAEM will have to move workers up the skills ladder.

Figure 53: Educational Attainment, WAEM, 2000

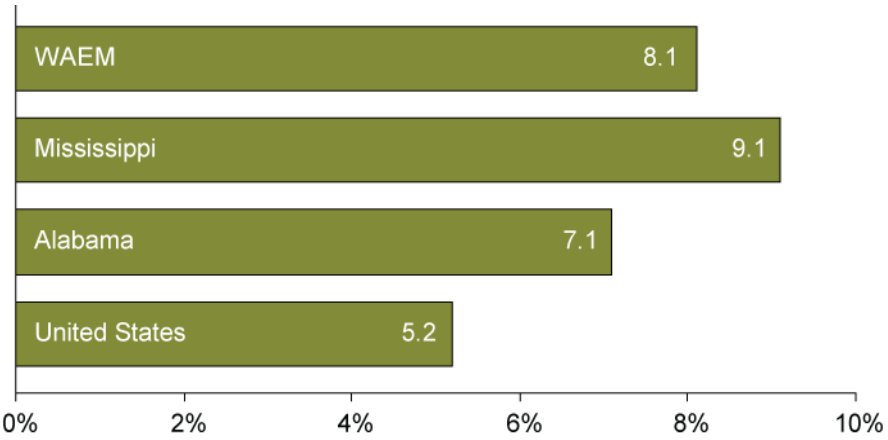


Source: Decision Data Resources, using U.S. Census 2000 data

Unemployment and Labor Force Participation

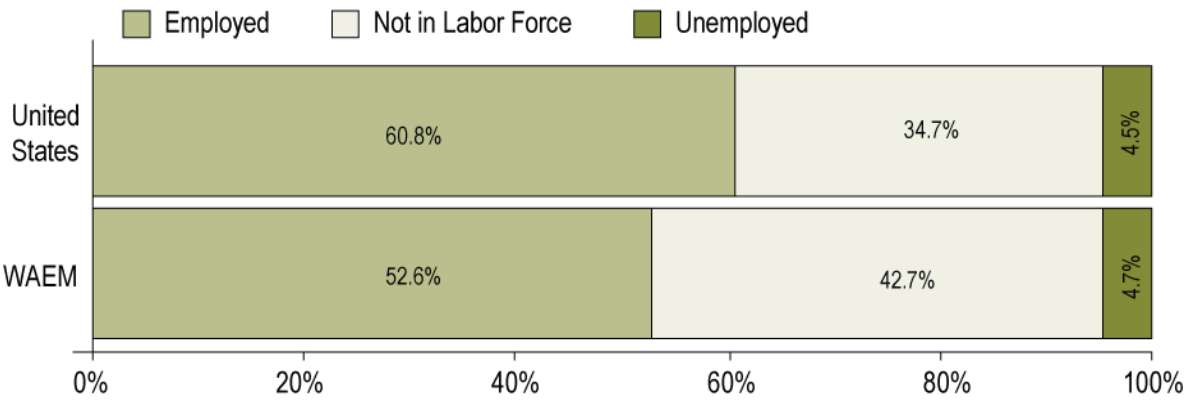
Unemployment in the region is more severe on the Mississippi side verses the Alabama side, though both states and the region have considerably higher unemployment rates than the nation (see Figure 54). Perhaps more significant, a large share of the region's working age population is not actively participating in the labor market as compared to the United States (see Figure 55).

Figure 54: Unemployment Rates, WAEM, 2007



Source: Decision Data Resources, using U.S. Bureau of Labor Statistics, 2007 household survey

Figure 55: Labor Force Participation, WAEM, 2007

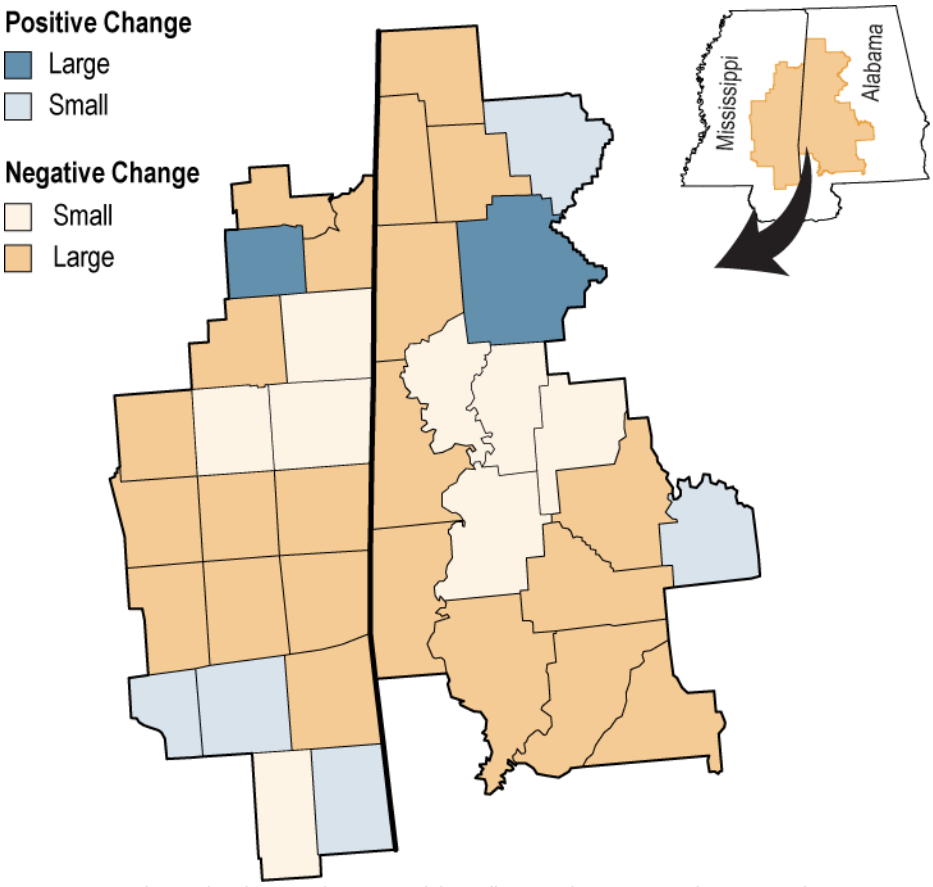


Source: Decision Data Resources, using U.S. Census Bureau, 2007 estimates

Competiveness Standing

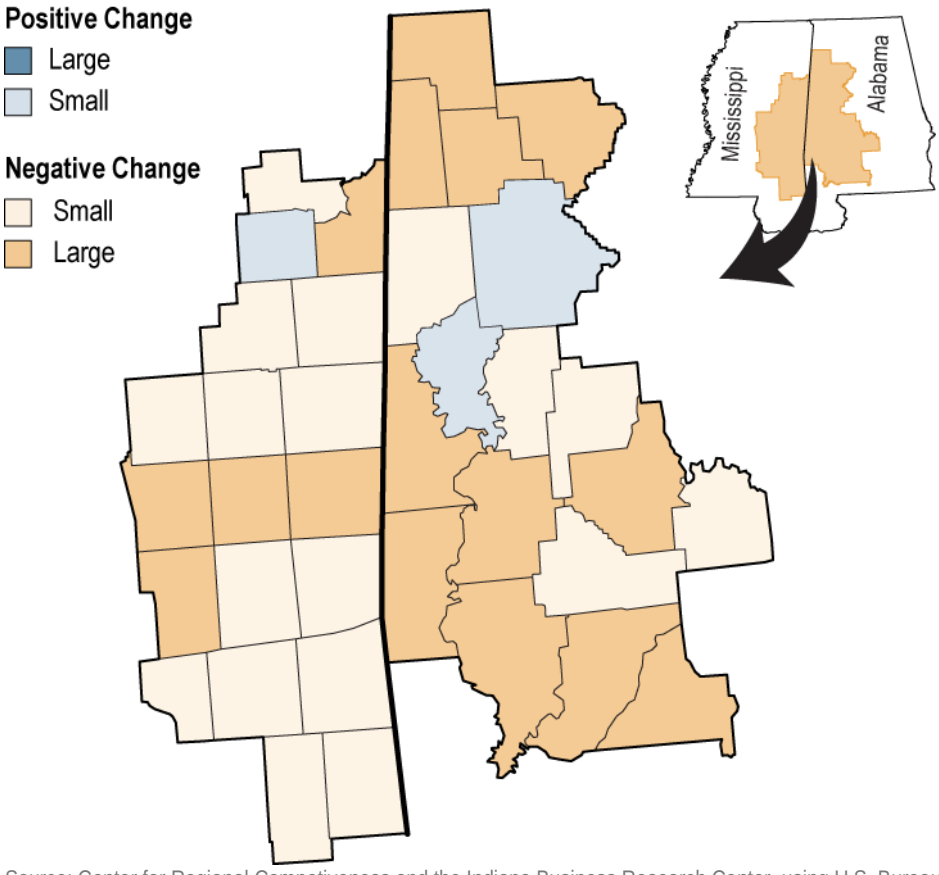
Figure 56 and Figure 57 show the region's competitiveness standing over the last decade as indicated by each county's change in share of U.S. jobs and income. This measure approaches regional competiveness from the perspective that counties that see their "slice" of the U.S. economy grow are more competitive than those with declining shares. By this measure much of the WAEM region has seen its share of the expanding U.S. economy decline on a relative basis for both jobs and income.

Figure 56: Change in Share of U.S. Jobs, WAEM, 1996-2006



Source: Center for Regional Competiveness and the Indiana Business Research Center, using U.S. Bureau of Economic Analysis, REIS data

Figure 57: Change in Share of U.S. Income, WAEM, 1996-2006



Source: Center for Regional Competiveness and the Indiana Business Research Center, using U.S. Bureau of Economic Analysis, REIS data

Industry Cluster and Occupational Profile

The WAEM region's industry clusters shown in Table 42 reveal a strong presence in forest and wood products; transportation and logistics; energy; and sectors related to advanced manufacturing. These data are confirmed by the presence of extensive pine forests in the region, navigable rivers and significant highway infrastructure; prevalent lignite coal deposits; and major auto assembly and steel and fabricated metals industries.

Table 42: Industry Clusters, WAEM, 2007

Cluster Type	Establishments	Employment	Wages
Total All Industries	21,375	362,316	$11,617,549,699
Advanced Materials	255	1,060	$46,473,790
Agribusiness, Food Processing & Technology	358	9,074	$214,262,327
Apparel & Textiles	129	853	$20,191,880
Arts, Entertainment, Recreation & Visitor	487	2,821	$43,219,524
Biomedical/Biotechnical (Life Sciences)	1,090	10,652	$418,995,318
Business & Financial Services	2,324	8,868	$358,350,322

Cluster Type	Establishments	Employment	Wages
Chemicals & Chemical Based Products	208	1,795	$72,182,647
Defense & Security	365	3,029	$124,740,564
Education & Knowledge Creation	630	11,079	$328,335,105
Energy (Fossil & Renewable)	2,103	16,808	$638,318,857
Forest & Wood Products	1,153	18,790	$699,498,303
Glass & Ceramics	64	521	$22,498,856
Information Technology & Telecom	462	3,001	$124,192,112
Transportation & Logistics	927	7,943	$293,585,351
Manufacturing Supercluster	290	13,352	$725,713,872
Primary Metal Mfg	17	955	$73,862,872
Fabricated Metal Product Mfg	157	4,745	$205,397,066
Machinery Mfg	41	534	$18,398,553
Computer & Electronic Product Mfg	16	n/a	n/a
Electrical Equip. Appliance & Component Mfg	12	n/a	n/a
Transportation Equipment Mfg	47	7,118	$428,056,192
Mining	53	119	$4,751,389
Printing & Publishing	264	1,870	$61,008,460

Source: IBRC, using U.S. Bureau of Labor Statistics data. Cluster definitions developed by PCRD.

Table 43 shows the occupational breakdown for the region.

Table 43: Census Occupations, WAEM

Occupation	WAEM (%)	Rank
Aircraft and traffic control occupations	0.1	33
Architects, surveyors, cartographers, and engineers	0.8	24
Arts, design entertainment, sports, and media occupations	1.0	20
Building and grounds cleaning and maintenance occupations	3.5	11
Business operations specialists	1.0	21
Community and social services occupations	1.5	17
Computer and mathematical occupations	0.7	25
Construction trades workers	5.4	6
Drafters, engineering, and mapping technicians	0.6	27
Education, training, and library occupations	6.2	4
Extraction workers	0.4	30
Farmers and farm managers	0.9	23
Farming, fishing, and forestry occupations	1.6	16
Financial specialists	1.3	18
Fire fighting prevention and law enforcement workers	1.1	19

Occupation	WAEM (%)	Rank
Food preparation and serving related occupations	4.0	9
Health diagnosing and treating practitioners and tech	3.1	12
Health technologists and technicians	1.9	15
Health care support occupations	2.2	14
Installation maintenance and repair occupations	5.0	7
Legal occupations	0.5	29
Life, physical, and social science occupations	0.7	26
Management occupations, except farmers and farm management	5.6	5
Material moving workers	3.6	10
Motor vehicle operators	4.3	8
Office and administrative support occupations	13.3	2
Personal care and service occupations	2.5	13
Production	15.1	1
Protective service occupations	0.6	28
Rail, water, and other transportation occupations	0.4	31
Sales and related occupations	10.2	3
Supervisors, construction and extraction workers	1.0	22
Supervisors, transportation and material moving worker	0.2	32
Percent in Blue Collar Occupations	59.9	n/a
Percent in White Collar Occupations	49.1	n/a

Source: Decision Data Resources, using U.S. Census 2000 data

Profile of Riverlands Region

The Riverlands region contains 17 counties with a total population of 598,087 as of 2007 (see Figure 58).[43] The region is bordered on the east by the rural and exurban gateway regions to Chicago, Madison, and Milwaukee. To the west and south, the region is bordered by Cedar Rapids, Iowa City, and Davenport regions. The largest urban center in Riverlands is Dubuque, Iowa (city pop. 57,686, county pop. 92,678). This is followed by Whiteside County, Ill., where most of the county's 60,000 people live in the Sterling-Rock Falls area.

[43] Over the course of this project, three Illinois counties (Lee, Ogle and Whiteside) dropped out of the region, leaving the Riverlands region with 14 counties.

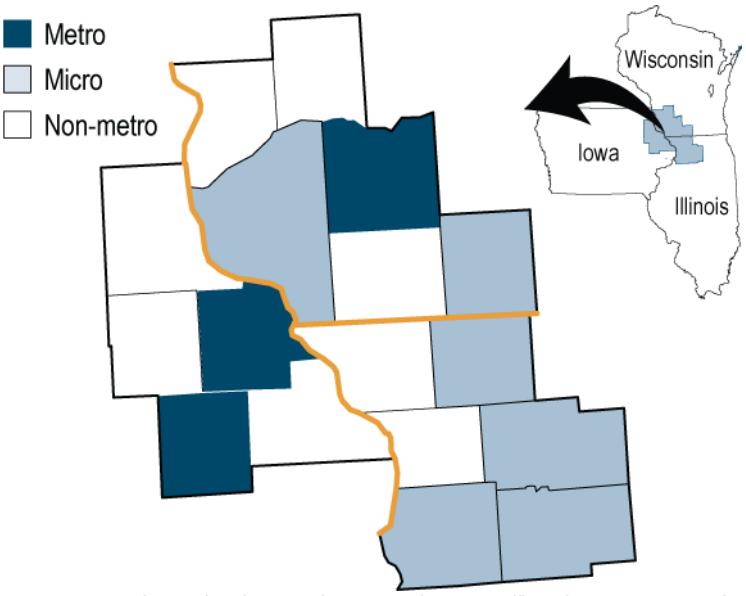
Figure 58: Counties in Riverlands Region

Source: Indiana Business Research Center

Urban/Rural Hierarchy

At its center, the Riverlands region contains a cluster of four non-metro counties ringed to the southeast by five distinct micropolitan counties (roughly stated as non-metro counties with an urban center of 10,000 or more people), as shown in Figure 59. The region contains the single-county Dubuque, Iowa MSA and portions of the Cedar Rapids, Iowa and Madison, Wis. MSAs.

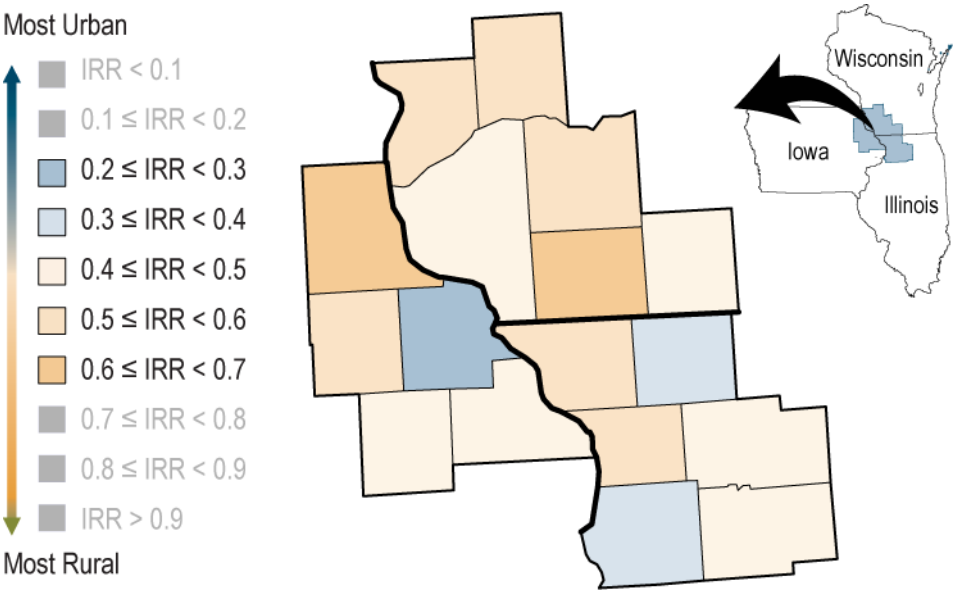
Figure 59: County Type, Riverlands



Source: Center for Regional Competiveness, using U.S. Office of Management and Budget data

The Index of Relative Rurality ranks U.S. counties according to four dimensions of rurality: population, density, urbanization and distance to metro areas. Although in close proximity to dense urban areas, many of the counties in Riverlands are relatively rural (see Figure 60).

Figure 60: Index of Relative Rurality, Riverlands, 2000



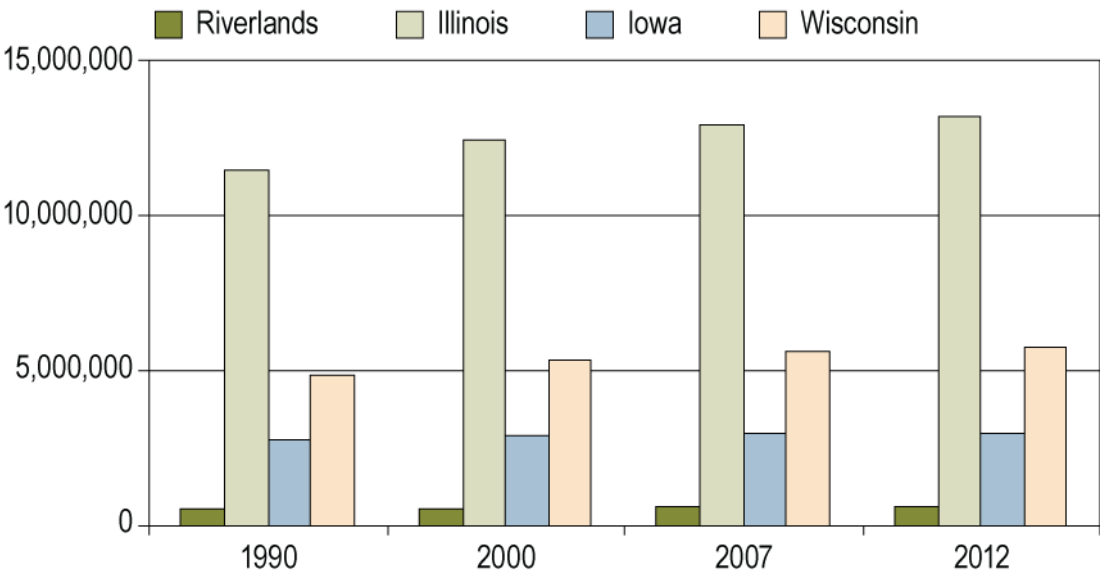
Source: Indiana Business Research Center

Population

Riverlands' population of 598,087 represents only about 3.2 percent of the tri-state region (see Figure 61). From 1990 to 2007, the region's population increased by 7.6 percent. Statewide, Illinois, Iowa, and Wisconsin

increased by 12.8 percent, 7.4 percent, and 14.5 percent, respectively. By 2012, Riverlands' population is expected to increase by 1.6 percent from current levels. Table 44, Table 45, Figure 62 and Figure 63 provide some additional detail.

Figure 61: Census Population, Riverlands, 1990-2012



Source: Decision Data Resources

Table 44: County Populations, Riverlands, 2007

State	County	2007 Population	Percent of Region	Percent of State
Illinois	Carroll	16,057	2.8	0.1
	Jo Daviess	22,630	3.9	0.2
	Lee	35,544	6.1	0.3
	Ogle	54,485	9.4	0.4
	Stephenson	47,832	8.2	0.4
	Whiteside	59,698	10.3	0.5
Iowa	Clayton	18,930	3.3	0.6
	Delaware	17,957	3.1	0.6
	Dubuque	92,672	15.9	3.1
	Jackson	20,255	3.5	0.7
	Jones	20,709	3.6	0.7
Wisconsin	Crawford	16,961	2.9	0.3
	Grant	49,768	8.6	0.9
	Green	35,146	6.0	0.6
	Iowa	23,638	4.1	0.4
	Lafayette	16,393	2.8	0.3

State	County	2007 Population	Percent of Region	Percent of State
	Richland	18,614	3.2	0.3

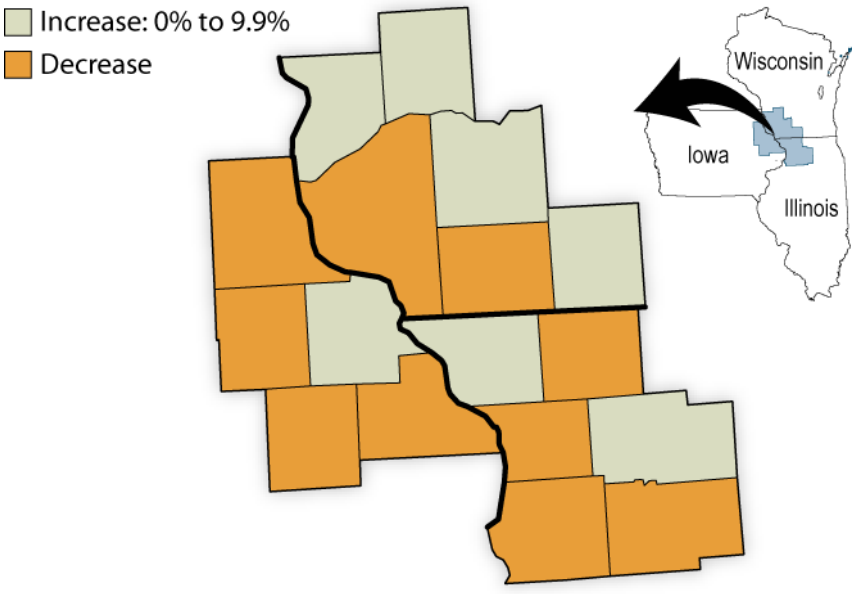
Source: Decision Data Resources

Table 45: Population Estimates by Age, Riverlands, 2007

Age Group	Number in Riverlands	Percent Distribution	
		Riverlands	Tri-state
0 to 4	39,125	5.8	6.7
5 to 14	80,744	11.9	13.3
15 to 19	47,956	7.1	7.0
20 to 24	54,991	8.1	7.1
25 to 34	93,322	13.7	13.6
35 to 44	88,169	13.0	14.1
45 to 54	100,333	14.8	14.7
55 to 64	75,557	11.1	10.8
65 to 74	48,702	7.2	6.5
75+	51,097	7.5	6.4

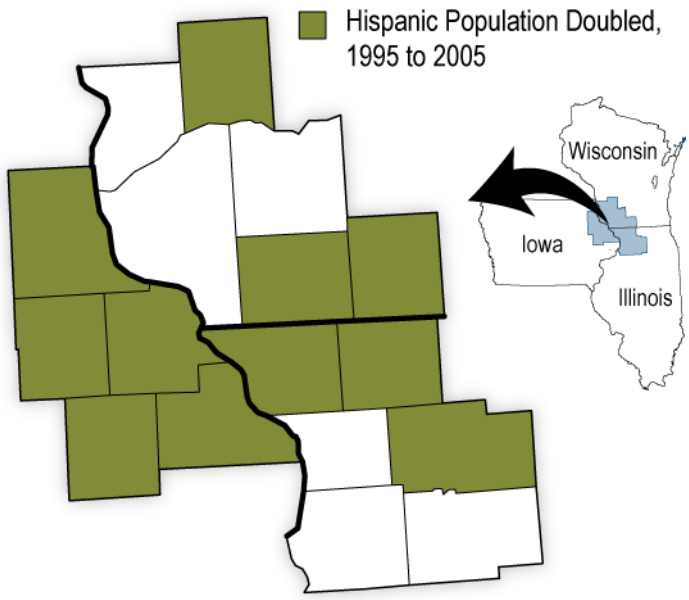
Source: Decision Data Resources, using U.S. Census 2000 data

Figure 62: Population Loss, Riverlands, 1996-2006



Source: Center for Regional Competiveness, using Bureau of Economic Analysis, REIS data

Figure 63: Hispanic Growth Counties, Riverlands, 1995-2005

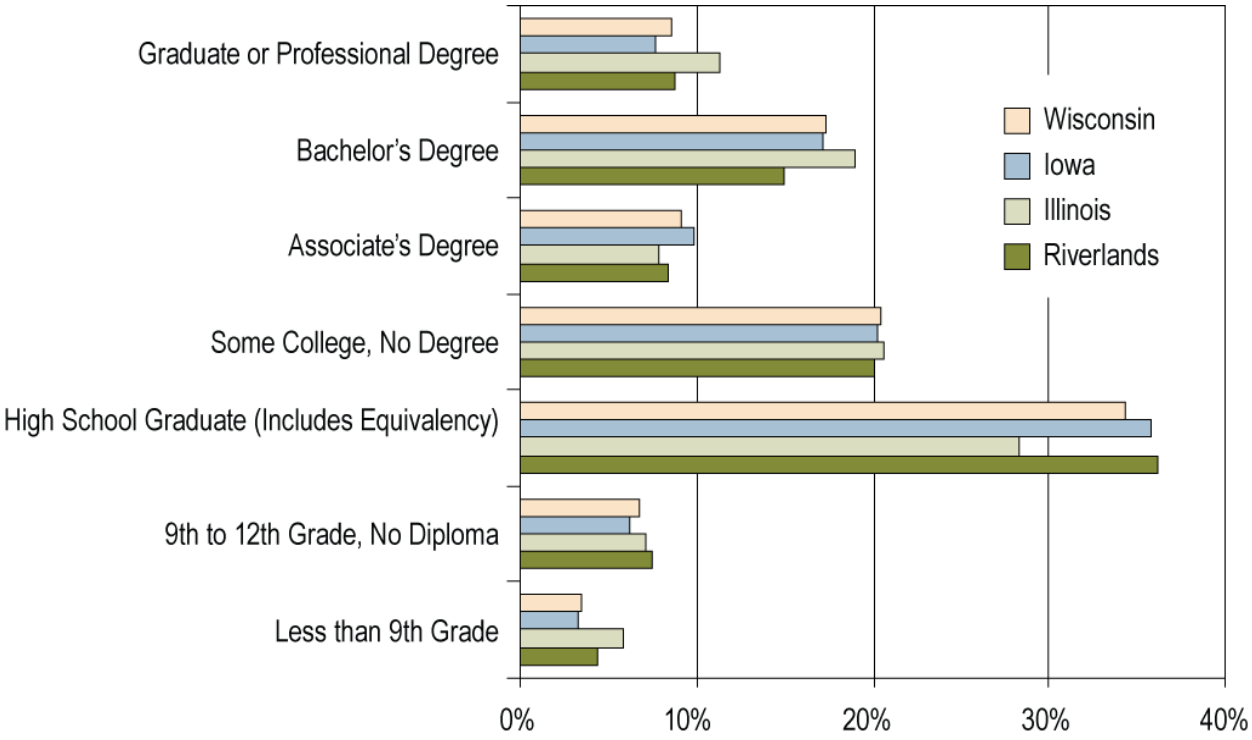


Source: Center for Regional Competiveness, using U.S. Census Bureau data

Educational Attainment

Educational attainment in the region roughly mirrors the tri-state region (see Figure 64). A noticeable difference occurs at the bachelor's degree level: 15 percent in Riverlands versus 17 percent in Iowa and Wisconsin and 19 percent in Illinois).

Figure 64: Educational Attainment, Riverlands, 2000

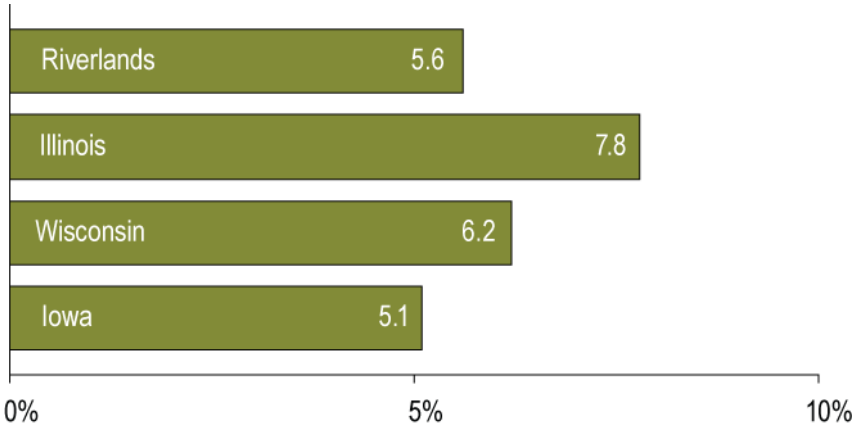


Source: Decision Data Resources, using U.S. Census 2000 data

Unemployment and Labor Force Participation

Unemployment in the region ranks on the low side compared to the states in the tri-state region (see Figure 65). Also encouraging, the region maintains a high a labor market participation rate compared to the nation (see Figure 66).

Figure 65: Unemployment Rates, Riverlands, 2007



Source: Decision Data Resources, using U.S. Bureau of Labor Statistics, 2007 household survey

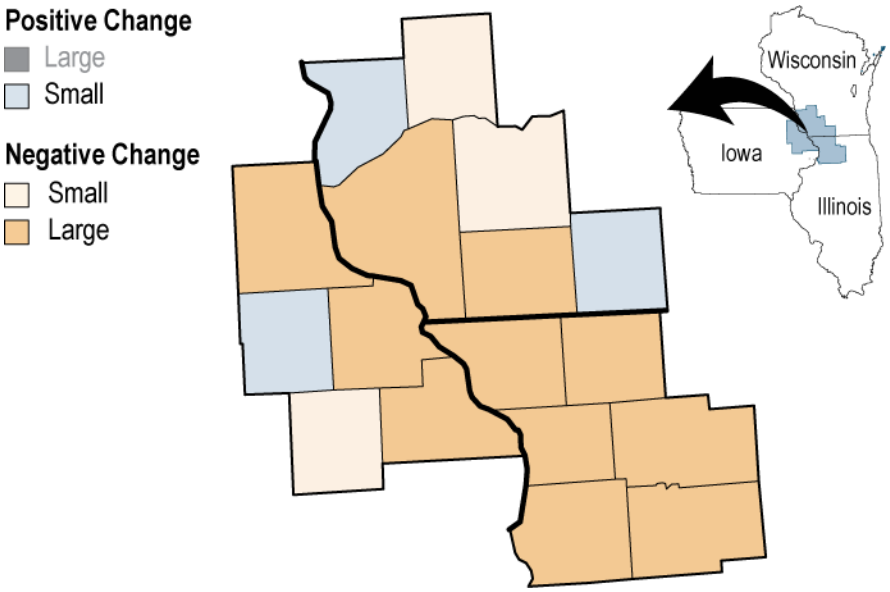
Figure 66: Labor Force Participation, Riverlands, 2007

Source: Decision Data Resources, using U.S. Bureau of Labor Statistics data

Competiveness Standing

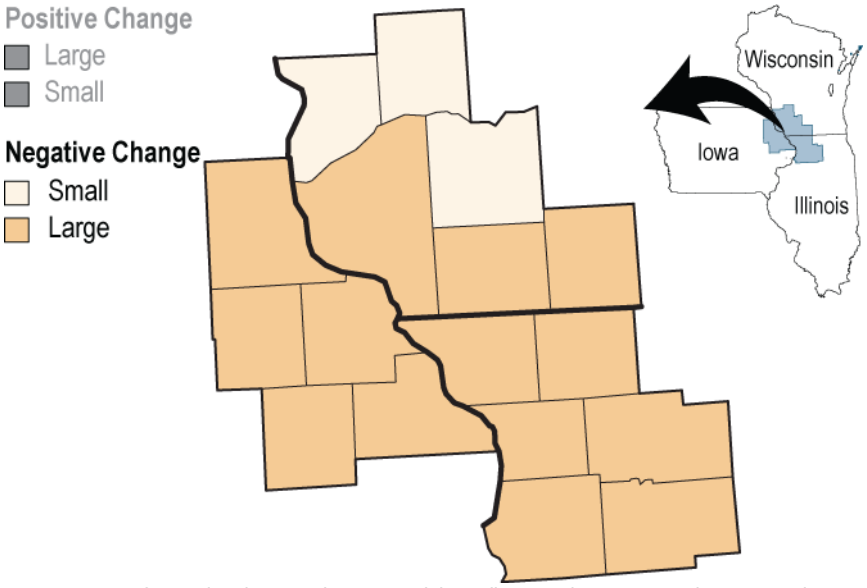
Figure 67 and Figure 68 show the region's competitiveness standing over the last decade as indicated by each county's change in share of U.S. jobs and income. This measure approaches regional competiveness from the perspective that counties that see their "slice" of the U.S. economy grow are more competitive than those with declining shares. By this measure, much of the Riverlands region has seen its share of the expanding U.S. economy decline on a relative basis for both jobs and income.

Figure 67: Change in Share of U.S. Jobs, Riverlands, 1996-2006



Source: Center for Regional Competiveness and the Indiana Business Research Center, using U.S. Bureau of Economic Analysis, REIS data

Figure 68: Change in Share of U.S. Income, Riverlands, 1996-2006



Source: Center for Regional Competiveness and the Indiana Business Research Center, using U.S. Bureau of Economic Analysis, REIS data

Industry Cluster and Occupational Profile

The Riverlands region's industry clusters shown in Table 46 reveal a strong presence in manufacturing; education and knowledge creation; and agribusiness, food processing and technology. Top occupations include office and administrative support, production, and sales and related occupations.

Table 46: Industry Clusters, Riverlands, 2007

Cluster Type	Establishments	Employment	Wages
Total All Industries	15,391	224,666	$7,147,773,162
Advanced Materials	296	1,370	$44,661,001
Agribusiness, Food Processing & Technology	864	9,653	$310,747,678
Apparel & Textiles	76	186	$6,642,783
Arts, Entertainment, Recreation & Visitor	553	4,258	$73,450,725
Biomedical/Biotechnical (Life Sciences)	397	5,956	$279,156,905
Business & Financial Services	1,471	6,168	$299,630,907
Chemicals & Chemical Based Products	188	1,842	$67,120,761
Defense & Security	266	1,283	$50,845,363
Education & Knowledge Creation	466	11,062	$349,324,258
Energy (Fossil & Renewable)	1,087	6,175	$199,470,609
Forest & Wood Products	411	3,636	$129,498,453
Glass & Ceramics	86	340	$13,082,397
Information Technology & Telecom	452	1,683	$85,875,986
Transportation & Logistics	713	4,489	$159,414,474

Cluster Type	Establishments	Employment	Wages
Manufacturing Supercluster	386	17,453	$808,077,558
Primary Metal Mfg	24	821	$29,655,119
Fabricated Metal Product Mfg	161	5,991	$236,310,773
Machinery Mfg	107	7,083	$389,374,812
Computer & Electronic Product Mfg	39	835	$32,337,508
Electrical Equip. Appliance & Component Mfg	22	1,341	$67,337,508
Transportation Equipment Mfg	33	1,382	$52,920,199
Mining	31	105	$4,724,879
Printing & Publishing	272	3,386	$130,274,383

Source: IBRC, using U.S. Bureau of Labor Statistics data. Cluster definitions developed by PCRD.

Table 47 shows the occupational breakdown for the region.

Table 47: Census Occupations, Riverlands

Occupation	Riverlands (%)	Rank
Aircraft and traffic control occupations	0.1	32
Architects, surveyors, cartographers, and engineers	1.0	23
Arts, design, entertainment, sports, and media occupations	1.5	19
Building and grounds cleaning and maintenance occupations	2.9	13
Business operations specialists	1.8	17
Community and social services occupations	1.5	20
Computer and mathematical occupations	1.7	18
Construction trades workers	4.4	7
Drafters, engineering, and mapping technicians	0.5	28
Education, training, and library occupations	5.7	5
Extraction workers	0.0	33
Farmers and farm managers	2.9	14
Farming, fishing, and forestry occupations	1.1	22
Financial specialists	2.0	16
Fire fighting prevention and law enforcement workers	0.8	24
Food preparation and serving related occupations	5.1	6
Health diagnosing and treating practitioners and tech	3.2	11
Health technologists and technicians	1.4	21
Health care support occupations	2.3	15
Installation, maintenance, and repair occupations	3.9	8
Legal occupations	0.6	26
Life, physical, and social science occupations	0.8	25
Management occupations, except farmers and farm management	6.8	4

Occupation	Riverlands (%)	Rank
Material moving workers	3.4	9
Motor vehicle operators	3.3	10
Office and administrative support occupations	15.2	1
Personal care and service occupations	3.2	12
Production	10.8	2
Protective service occupations	0.5	29
Rail, water, and other transportation occupations	0.3	30
Sales and related occupations	10.7	3
Supervisors, construction and extraction workers	0.6	27
Supervisors, transportation and material moving worker	0.2	31
Percent in Blue Collar Occupations	42.8	n/a
Percent in White Collar Occupations	57.2	n/a

Source: Decision Data Resources, using U.S. Census 2000

Appendix C: Innovation Index Definitions, Calculations and Models

Innovation Measures and Variable Definitions

Listed below are the concepts and variables used to construct the Portfolio Innovation Index. At the time of the analysis, 2006 was the latest year available (lya) for most time series. In all cases, researchers used the latest year available for all concepts and data series for this analysis and report. In the future, the innovation website will be updated on a regular basis with the most current data available for each concept or data.

The concepts and variables are grouped by sub-index:

Input: Human Capital (HC) Sub-Index

Annual Average Population Growth Rate for Ages 25-44 – *The rate of growth in county population for the 25-44 age group from 1997 to 2006 for this analysis.* The latest year available—*lya*—for this report was 2006. **Source: Census.**

$$popgroma_i = \frac{\ln(MAPOP_{t=lya}) - \ln(MAPOP_{t=1997})}{lya - 1997}$$

MAPOP = Mid-Aged Population (ages 25-44)

Educational Attainment – Higher educational levels in a population contribute to innovation by providing needed skills and knowledge. Higher educated workers are also more mobile both geographically and occupationally. **Source: Census.**

This indicator is broken into two sub-indicators:

i. ***Some college and associate's degrees*** – Even some college education can contribute to an increased level of skills and knowledge and contribute to a region's capacity to innovate. This measure may be more relevant than the bachelor's degree in more rural areas. This is measured as *percent of the population ages 25 to 64 with some college or an associate's degree.* The 2000 Census is the latest year available for these data.

$$PERASSOC_{i,t=lya} = \frac{ASSOC}{POPlya}$$

ASSOC = Number in Population with Some College or Associate's Degree, ages 25 to 64, lya

POPlya = Population in 2000—the lya for ASSOC–ages 25 to 64

ii. ***Bachelor's degree or higher*** *–Percent of the population ages 25 to 64 with a bachelor's degree or higher.* The 2000 Census is the latest year available for these data.

$$PERBACH_{i,t=lya} = \frac{BACH}{POPlya}$$

BACH = Number in Population with a Bachelor's Degree or Higher, ages 25 to 64, lya

POPlya = Population in 2000—the lya for BACH—ages 25 to 64

Technology-Based Knowledge Occupation Cluster – The technology-based knowledge occupation clusters (KOC) replace the creative class occupational component in earlier version of the innovation index. The KOC includes the following clusters: information technology; engineering; health care and medical science practitioners and scientists; math/stats/accounting; natural science and environmental management; and postsecondary education and knowledge creation. In contrast to the occupations that compose the creative class, the KOC does not include artists, musicians, or designers. The KOC indicator presents a share of technology-based cluster jobs for the year 2007, the latest year available. **Source: EMSI.**

$$KOC_{i,t=lya} = \frac{KOEMPlya}{TOTEMPlya}$$

KOEMPlya = Number of Technology-Based Knowledge Occupation Employment, lya, 2007 in this case*

TOTEMPlya = Total Employment (EMSI Definition), lya, 2007 in this case

* Requires aggregation of the six technology-based knowledge occupation clusters.

High-Tech Employment Share – Firms requiring a highly skilled and specialized workforce contribute to innovation in a county by providing a resource for workers, other firms and other industries. (This metric measures the point-in-time innovative capacity of the region as opposed to the growth of innovative capacity in the productivity and employment index.) High-tech employment, derived from a NAICS-based definition by Moody's, measures an aggregation of employment in key sectors (e.g., telecommunications, Internet providers, scientific laboratories) as the *average high-tech employment share of total employment from 1997 to 2006, the latest year available.* **Source: Moody's.**

$$avghtshare_i = \frac{\sum_{1997}^{lya} HTE_t}{\sum_{1997}^{lya} MdyTotEmp_t}$$

HTE = High Tech Employment in Year t

MdyTotEmp = Moody's Estimated Total Employment in Year t

Input: Economic Dynamics (ED) Sub-Index

The second input index measures *local* resources available to county entrepreneurs and businesses that encourage innovation close to home, or are limiting in the absence of such resources. For instance, direct investment from venture capital firms may provide the infusion of funding to quickly expand an operation. Likewise, Internet availability enables firms and entrepreneurs to learn new techniques based on best practices or communicate more effectively with researchers and innovators located in other geographic regions.

Average Venture Capital – Venture capital provides a source of funds to launch new ideas or expand innovative companies. Because the absolute volume of VC can vary widely, it is adjusted to reflect the relative size of a county's economy. **Sources: Decision Data Resources and Moody's.**

$$avgVCGDP_i = \frac{\sum_{2000}^{lya} VC_t}{\sum_{2000}^{lya} cuGDP_t}$$

VC = Total Venture Capital in Year t

cuGDP = Current-dollar County GDP in Year t

Average Private R&D – Research and development funds provides the resources for companies to launch new ideas or expand innovative companies. Because the absolute volume of R&D can vary widely, it is adjusted to reflect the relative size of a county's labor force. **Sources: Decision Data Resources and BEA.**

$$avgRDpCOMP_i = \frac{\sum_{1998}^{lya} RD_t}{\sum_{1998}^{lya} COMP_t}$$

RD = Total Research & Development Funds in Year t

COMP = Total Worker Compensation in Year t

Broadband Density and Penetration – Innovation and knowledge are linked to widespread Internet usage for individuals and businesses. This indicator measures the relative density of broadband providers available to residents in a given county, which serves as a proxy for broadband penetration that would be better measured by the number of business and residential broadband customers. This indicator is presented as the *population-weighted mean of broadband service providers available per county translated from population-weighted ZIP code data from 2000 to 2007, the latest year available.* Thus, this indicator transforms the FCC ZIP-code level data by weighting the number of broadband providers by population and aggregating it to county-level data. **Sources: IBRC, FCC, and Census.**

(1) $$bb\_lya_i = \frac{WT_{t=lya}}{POPEST_{t=lya}}$$

WT = Broadband Weighting Factor for the lya, in this case, 2007

POPEST = Broadband Population Estimate for the lya, in this case, 2007

(2) $$bbd_i = \frac{\ln\left(\frac{WT_{t=lya}}{POPEST_{t=lya}}\right) - \ln\left(\frac{WT_{t=2000}}{POPEST_{t=2000}}\right)}{lya - 2000}$$

WT = Broadband Weighting Factor for Year t

POPEST = Broadband Population Estimate for Year t

Establishment Churn – Innovative and efficient companies replace outdated firms, or those firms unable to modernize techniques and processes. Average churn measures the creative destruction of a constantly transforming economy by taking *total establishment births and deaths, and expansions and contractions, relative to the total number of firms in a county for all years available.* **Source: Census.**

$$avgchurn_i = \frac{\sum_{1999}^{lya}(Birth + Death + Expansion + Contraction)_t}{\sum_{1999}^{lya}(Death + Expansion + Contraction + Constant)_t}$$

Birth = Establishment Births in Year t

Deaths = Establishment Deaths in Year t

Expansion = Establishment Expansions in Year t

Contraction = Establishment Contractions in Year t

Constant = Establishment Constants in Year t

Establishment Sizes –

1. *Average Small Establishments per 10,000 Workers* from 1997 to 2006, the latest year available. **Sources: Census and BEA.**

$$smestpw_i = \frac{\sum_{1997}^{lya} SMALL_t}{\sum_{1997}^{lya} TOTEMP_t}$$

SMALL = Small Establishments with Less than 20 Employees for Year t from County Business Patterns

TOTEMP = BEA Total Employment in Ten Thousands for Year t

2. *Average Large Establishments per 10,000 Workers* from 1997 to 2006, the latest year available. **Sources: Census and BEA.**

$$lgestpw_i = \frac{\sum_{1997}^{lya} LARGE_t}{\sum_{1997}^{lya} TOTEMP_t}$$

LARGE = Large Establishments with More than 500 Employees for Year t from County Business Patterns

TOTEMP = BEA Total Employment in Ten Thousands for Year t

State Context (SC)

The third index measures state innovation resources available to entrepreneurs and businesses. These resources may not necessarily be used by all businesses, but their proximity and availability provide access to innovation capacity.

S&E Graduates from State Institutions per 1,000 – The number of graduates from science and engineering programs within a given state increases the supply of individuals trained to meet growing demands on the skilled labor force. This measure is the *S&E graduates in the state (or states if a region crosses state boundaries) per 1,000 members of the population.* **Source: Census and National Science Foundation.**

$$SEGRADS_i = \frac{SEGRAD_{lya}}{TOTPOP_{lya}}$$

SEGRAD = Number of Science and Engineering Graduates—Bachelor's and Advanced Degrees—for the latest year available

TOTPOP = Total Population in Thousands for the latest year available

R&D spending per capita – *Total per capita spending by universities and private firms by state (or states if a region crosses state boundaries).* **Source: Census and National Science Foundation**

$$TOTRD_i = \frac{STATERD_{lya}}{TOTPOP_{lya}}$$

STATERD = Research and Development Expenditures by Universities and Private Firms—for the latest year available

TOTPOP = Total Population for the latest year available

Output: Productivity & Employment (PE) Sub-Index

These output indicators measure economic improvement, regional desirability, or are the direct outcomes of innovation. They suggest the extent to which local and regional economies are moving up the value chain, creating an attractive environment for living or are direct consequences of innovation. Innovative economies will attract people seeking particular jobs, exhibit growth in productivity, and contribute new products to the marketplace.

Job Growth – *Change in BEA employment divided by the change in population from 1997 to 2006, the latest year available.* The conditional nature of the equation provides for the fact that a county or region may have growing employment but a declining population, which would be considered a positive outcome. **Sources: BEA and Census.**

$$jobpop_i = \left\{ \begin{array}{c} \text{IF } \left(TOTEMP_{t=lya} - TOTEMP_{t=1997}\right) > (0) \text{ ANDIF} \\ \left(TOTPOP_{t=lya} - TOTPOP_{t=lya}\right) < (0) \\ \text{THEN } \left(\text{ABS } \left(\frac{\left(TOTEMP_{t=lya} - TOTEMP_{t=1997}\right)}{\left(TOTPOP_{t=lya} - TOTPOP_{t=1997}\right)} \right) \right) \\ \text{ELSE } \left(\frac{\left(TOTEMP_{t=lya} - TOTEMP_{t=1997}\right)}{\left(TOTPOP_{t=lya} - TOTPOP_{t=1997}\right)} \right) \end{array} \right\}$$

TOTEMP = BEA Total Employment for Year t

TOTPOP = Population for Year t

Change in Share of High-Tech Employment – Firms requiring a highly skilled and specialized workforce are drawn to innovative areas. Growth in this sector suggests an increasing presence of innovation. High-tech employment, derived from a NAICS-based definition by Moody's, measures an aggregation of employment in key sectors (e.g., telecommunications, internet providers, scientific laboratories). The measure is calculated as *the average annual rate of change in the share of high-tech employment from 1997 to 2006, the latest year available.* **Source: Moody's.**

$$HTESd_i = \frac{\ln\left(\frac{HTE_{t=lya}}{MdyTotEmp_{t=lya}}\right) - \ln\left(\frac{HTE_{t=1997}}{MdyTotEmp_{t=1997}}\right)}{lya - 1997}$$

HTE = Moody's Definition of High-Tech Employment in Year t

MdyTotEmp = Moody's Estimated Total Employment in Year t

Change in Gross Domestic Product per Worker – GDP measures economic output and increases in GDP per worker measures increases in worker productivity. This measure is the *annual rate of change in current-dollar GDP per employee from 1997 to 2006, the latest year available.* **Source: BEA and Moody's.**

$$GDPWcud_i = \frac{\ln\left(\frac{cuGDP_{t=lya}}{TOTEMP_{t=lya}}\right) - \ln\left(\frac{cuGDP_{t=1997}}{TOTEMP_{t=1997}}\right)}{lya - 1997}$$

cuGDP = Current-Dollar County GDP from Moody's for Year t

TOTEMP = BEA Total Employment for Year t

Gross Domestic Product per Worker – GDP measures economic output per worker at a point in time. The measure is *current-dollar GDP per employee in 2006, the latest year available.* **Sources: BEA and Moody's.**

$$cuGDPW_i = \frac{cuGDP_{t=lya}}{TOTEMP_{t=lya}}$$

cuGDP = Current-Dollar County GDP from Moody's for Year t

TOTEMP = BEA Total Employment for Year t

Average Patents per 1,000 Workers – New patented technologies provide an indicator of individuals' and firms' abilities to develop new technologies and remain competitive. The measure is *the number of utility patents issued per 1,000 workers for the entire time period, 1997 to 2006, the latest year available.* **Sources: Decision Data Resources and BEA.**

$$avgPatpw_i = \frac{\sum_{1997}^{lya} Patents_t}{\sum_{1997}^{lya} TOTEMP_t}$$

Patents = Total Patents Issued in Year t

TOTEMP = BEA Total Employment in Thousands for Year t

Output: Economic Well-Being (EWB) Sub-Index

Innovative economies improve the economic well-being of residents because they earn more and enjoy a higher standard of living. This is evident in lower poverty rates, greater job availability, and an economic base that increases the rewards to employees over time.

Average Poverty Rate – Innovative economies have greater employment opportunities with higher compensation, thus lowering rates of poverty. Reduced rates of poverty will tend to lag growth in employment opportunities. As a result, the last three years of the most recent data are used. In addition, a high poverty rate is a negative outcome so this measure is the inverse of the *average poverty rate from 2003 to 2005, the last three years available.* **Source: Census.**

$$avgpovR_i = \frac{\sum_{lya-2}^{lya} POV_t}{\sum_{lya-2}^{lya} POVUNIV_t}$$

POV = Total Impoverished Persons for Year t

POVUNIV = Total Population Estimate (Poverty Universe) for Year t

Average Unemployment Rates – The unemployment rate is the number of persons seeking employment as a percentage of the total labor force. The last three years of the most recent data for this series are used. In addition, a high unemployment rate is a negative outcome. As a result, this measure is the inverse of *average unemployment rate from 2005 to 2007, the last three years available.* **Source: BLS.**

$$avgunempR_i = \frac{\sum_{lya-2}^{lya} UNEMP_t}{\sum_{lya-2}^{lya} LF_t}$$

UNEMP = Number of Unemployed Persons for Year t

LF = Number of Persons in Labor Force for Year t

Average Net Migration – Total migration of all persons into a county or region serves as an indicator of whether an area is attractive to job seekers and families. Net migration is provided as *net-migration rate 2000—the year of the last Census—to 2007, the latest year available.* **Source: Census.**

$$netmigR_i = \frac{\sum_{2000}^{lya} NETMIG_t}{\sum_{2000}^{lya} TOTPOP_t}$$

NETMIG = Total Net Internal Migration for Year t

TOTPOP = Total Population for Year t

Per Capita Personal Income Growth – Personal income is the broadest measure of a person's income because it includes rental income, dividends and interest payments, in addition to salary, wages and benefits. As a result, it is probably the best measure of well-being. On the other hand, the measure is based on the location of residence, not the location of work. Thus, high personal income may or may not reflect the economic returns to innovation. This measure of well-being is the *average annual rate of change in per capita personal income from 1997 to 2006, the latest year available.* **Source: BEA.**

$$PCPId_i = \frac{\ln\left(\frac{INC_{t=lya}}{POP_{t=lya}}\right) - \ln\left(\frac{INC_{t=1997}}{POP_{t=1997}}\right)}{lya - 1997}$$

INC = BEA Personal Income for Year t

POP = BEA Population Estimate for Year t

Compensation – In contrast to personal income as reported by the BEA, compensation is measured based on the place of work. For this reason, there may be a more direct link between the employee returns to innovation and the activity itself. The sources of compensation can be the more traditional source of an employer, as well as "self-compensation" of proprietors. The compensation measures are average rates of change from the base year to the present.

i. ***Annual Wage and Salary Earnings per Worker*** - *Average annual rate of change in wage and salary earnings per worker from 1997 to 2006, the latest year available.* **Source: BEA.**

$$wspWd_i = \frac{\ln\left(\frac{WS_{t=lya}}{WSEMP_{t=lya}}\right) - \ln\left(\frac{WS_{t=1997}}{WSEMP_{t=1997}}\right)}{lya - 1997}$$

WS = BEA Wage & Salary Earnings for Year t

WSEMP = BEA Wage & Salary Employees for Year t

ii. ***Proprietors' Income per Proprietor*** - *Average annual rate of change in proprietors' income per proprietor from 1997 to 2006, the latest year available.* **Source: BEA.**

$$propincd_i = \frac{\ln\left(\frac{PRINC_{t=lya}}{PREMP_{t=lya}}\right) - \ln\left(\frac{PRINC_{t=1997}}{PREMP_{t=1997}}\right)}{lya - 1997}$$

PRINC = BEA Nonfarm Proprietors Income for Year t

PREMP = BEA Nonfarm Proprietors Employment for Year t

Portfolio Innovation Index Calculation

The five dashboard, aggregate indices are weighted as follows to produce the Portfolio Innovation Index:

- 0.3 - Human Capital (HC), an input measure
- 0.3 - Economic Dynamics (ED), an input measure
- 0.3 - Productivity and Employment (PE), an output measure
- 0.1 - Economic Well-Being (EWB), an output measure
- 0.0 - State Context (SC), a statewide measure not included in the PII

The initial calculation ("iteration 0") for county *j* is

$$\mathrm{PII}_{j,0} = 0.3(HC_j) + 0.3(ED_j) + 0.3(PE_j) + 0.1(EWB_j)$$

or alternatively

$$\mathrm{PII}_{j,0} = \sum_{i=1}^{4} \mathrm{A_i X}_{sj}$$

Where each X_{sj} represents a specific sub-index value and A_i represents the weight of the sub-index in the portfolio index.

Sub-indices are generally calculated as

$$\mathrm{X}_{sj} = 100 * \sum_{i=1}^{n} \alpha_i \left(\frac{x_{ij}}{x_{iU}}\right) \ldots \alpha_n \left(\frac{x_{nj}}{x_{nU}}\right)$$

Where x_{ij} is the *i*-th variable (or measure) county j relative to the U.S. average for variable x_i. The ratio is weighted by a specified alpha for the *i*-th variable (given in column four of Table 14).

Several issues arise when attempting to construct PII_j as described above. First, negative values for several measures such as population growth rates or high-tech employment growth rates can dramatically reduce PII_j because their weighted ratios are negative. This can result in a given PII_j to be less than zero. To mitigate this effect, the entire range for a variable (or measure) was shifted upward by the absolute value of the minimum of the range. All data are shifted according to

$$\mathrm{x}_{kj} = \{\min(\mathrm{x}_{ij})\} + \mathrm{x}_{ij} \text{ and } \mathrm{x}_{kU} = \{\min(\mathrm{x}_{ij})\} + \mathrm{x}_{iU}$$

The value of the range-shifted variable is denoted by the subscript *k* for variable *i*. The sum of the range-shifted variables are added to unaltered x_i's for "iteration 1" of the PII for county or region *j*:

$$\mathrm{PII}_{j,1} = 100 * \left[\left(\sum_{k=1}^{n} \alpha_{\mathrm{i}} \left(\frac{\mathrm{x}_{kj}}{\mathrm{x}_{kU}}\right) \ldots \alpha_{\mathrm{n}} \left(\frac{\mathrm{x}_{nj}}{\mathrm{x}_{nU}}\right)\right) + \left(\sum_{\mathrm{i}=1}^{\mathrm{n}} \alpha_{\mathrm{i}} \left(\frac{x_{ij}}{x_{iU}}\right) \ldots \alpha_{\mathrm{n}} \left(\frac{x_{nj}}{x_{nU}}\right)\right)\right]$$

While this procedure eliminates the negative values of the PII, there are extreme values for some variables or measures that can dominate or swamp the index value. The initial calculation can generate results for PII_j an order of magnitude larger than the U.S. average. Such results are usually produced by a single variable with an extreme ratio of x_{ij} to x_{iU}. Such extreme values limit the usefulness of the index. For instance, several counties in California have venture capital investments 18 times the U.S. average. To restrict the results of PII_j and narrow the distribution, limits are applied to each subset of weighted ratios using a conditional statement:

$$\theta_{ij} = \left\{ \begin{array}{c} \text{IF } \left(\frac{x_{ij}}{x_{iU}}\right) > \left(\frac{x_{iU}+2\sigma_{ij}}{x_{iU}}\right) \text{THEN } \alpha_{x_{\mathrm{i}}} \left(\frac{x_{iU}+2\sigma_{ij}}{x_{iU}}\right) \\ \text{ELSE IF } \left(\frac{x_{ij}}{x_{iU}}\right) < \left(\frac{x_{iU}-2\sigma_{ij}}{x_{iU}}\right) \text{THEN } \alpha_{\mathrm{X}_1} \left(\frac{x_{iU}-2\sigma_{ij}}{x_{iU}}\right) \\ \text{ELSE } \alpha_{x_1} \left(\frac{x_{ij}}{x_{iU}}\right) \end{array} \right\} \text{(Equation 5)}$$

where θ_{ij} restricts the value of the index variable x_i to $\pm 2\sigma$ from the U.S. average for variable x_i . In other words, θ_{ij} creates a ceiling for PII_j by capping high ratios for a given variable x_i. The procedure also creates a floor for underperforming counties.

Even by applying limits of θ_{ij}, there are several extreme values of venture capital that generate an extremely large σ_{ij}. To systematically address this issue, values greater than $4\sigma_{ij}$ are omitted from the initial σ_{ij} calculation. This further restriction is only applied to distributions such as venture capital that have a substantial positive skew.

$$\mathrm{PII}_{j,2} = 100 * \left[\left(\sum_{i=1}^{n} \theta_{ij}\right) + \left(\sum_{k=1}^{n} \theta_{kj}\right)\right]$$

Where $\mathrm{PII}_{j,2}$ is the second iteration of the innovation index for county j. The $\mathrm{PII}_{\mathrm{j}}$ in 86 counties were unaltered with the application of this equation. In 2,762 counties, the floor and ceiling thresholds of iteration two had the effect of increasing the county's innovation index (relative to the nation) and decreasing the index in 276 counties (relative to the nation).

Index values discussed and presented in this report are exclusively derived from the equation for $\mathrm{PII}_{\mathrm{j},2}$.

Economic Growth Models for Empirical Index

Data and Variables

The county-level data are derived from numerous sources, including several proprietary sources. The public data sets include the U.S. Census Bureau (Population Estimates, County Business Patterns, TIGER/Line 2007), the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, the Federal Communications Commission, and the U.S Department of Agriculture (Economic Research Service). Proprietary data includes estimates from Moody's economy.com, Innovation Economy 360, and Economic Modeling Specialists, Inc.

Whereas previous studies have focused primarily on states, we examine the innovative variability that occurs at the county level. Of considerable importance is the main dependent variable—GDP per worker. GDP is not estimated by the Bureau of Economic Analysis in geographic units smaller than MSAs, but models from Moody's provide estimates of county-level GDP. Based on these estimates, 97 percent of the counties in the United States experienced positive growth in GDP per worker measured in chained-dollars between 1997 and 2006.

Of the 3,111 counties included in this analysis, 2,924 had some level of utility patenting activity in the past decade. Far fewer counties, 530, benefited from recent venture capital investment and still fewer, 346 counties, received private research and development investments in the past decade. Together these two investment stream reached a combined total of 620 counties.[44] The relative concentration of these latter two investment streams in less than one-fifth of counties begs the question of the extent to which focused investment drives innovation and how much influence they have on growing an economy. If focused investments do drive innovation economies, one would expect to see a positive, statistically significant relationship between this variable and the dependent variable for counties with the presence of these major investments. Similarly, one would expect counties with patenting activity to exhibit stronger growth than others.

In addition to the inputs, we include measures of capacity and dynamics as well as a series of controls.[45] Improvements in economic conditions could be due to any of a number of circumstances and may have little to do with innovation itself. For instance, the presence of extractive industries that collect large rents on natural resources, such as gold mining or oil and gas drilling, could explain substantial growth in GDP but would hardly signify an improvement in innovation (although it may). Conversely, the cessation of significant natural resource extraction operations can adversely affect economic performance (Michaels 2007). Counties with high resource extraction were controlled for by using a modified USDA typology that identified resource-dependent counties as those with 15 percent or more of total compensation involved in resource extractive industries (USDA 2004).[46]

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[44] Ideally, VC related to innovation should focus on seed capital and start-up funds as those are the investments that, while risky, would have the most immediate economic impact with relatively quick changes in productivity and profits. However, since VC is concentrated in relatively few counties, all stages of investment are considered for this analysis.

[45] Variable definitions are available in Table 48.

[46] The typology was modified to remove counties that relied heavily on low-value natural resources in such activities as sand and gravel quarrying.

The location of a county and its proximity to large urban centers is also potentially important. Previous research has identified a substantial difference between urban and rural growth due to knowledge spillovers (Jaffe et al. 1993). To acknowledge urban centers, we control for regions in metropolitan statistical areas as defined by the Office of Management and Budget (OMB) using a dummy variable, coding 1 for counties within MSAs. By definition, an MSA includes counties with substantial in-flows of workers to an urban core. Approximately one-third of U.S. counties are included in MSAs. Three-quarters of these MSA counties received investment flows. Metropolitan counties also show a statistically significant difference from non-metro counties in GDP per worker growth ($p<0.01$).

Economic growth is of primary interest, but current levels of GDP per worker can affect the extent to which growth occurs as neoclassical growth theories have indicated (Rupasingha et al. 2002). Thus, overall economic circumstances, in contrast to regional performance, were controlled for (Bergheim 2008).

Finally, regional considerations may influence growth rates. For example, regionalization effects implicit in random unidentified geographic characteristics such as weather or amenities and economic patterns like cost of living can also affect economic performance. Regionalization was specified using the U.S. Census Bureau's nine geographic divisions: Pacific, Mountain, West North Central, East North Central, West South Central, East South Central, Middle Atlantic, South Atlantic, and New England (Census 2008). Descriptive characteristics for variables included in the model are shown in Table 48 and Table 49.

Regression Results

The research team used the Ordinary Least Squares (OLS) procedure to test a series of competing standardized estimates that test hypotheses on our input variables. First we test the standardized input variables in the full extent as our preferred model, that is, unmodified from their original conception save for normalization. Second, we test the inputs using dummy variables as to determine if their mere presence was enough to influence economic growth. For the first specification standardized estimates are derived for three separate but related dependent variable growth measures from 1997 to 2006: GDP per worker (Model 1), PCPI (Model 3), and compensation per worker (Model 4). The second specification using dummy variables is shown only for GDP per worker (Model 2).

Outliers of the dependent variable ($\pm 2\sigma$) were removed in each specification. This procedure accounted for the removal of 135 extreme growth or loss counties in the GDP per worker specification. Mean GDP per worker growth was only marginally altered, but the procedure did remove all but 14 cases of negative growth (which were dispersed throughout the country). In addition to removing outliers on the dependent variables, exceedingly influential cases on the standardized independent variables were systematically omitted by calculating leverage (h_i).[47] The removal of leverage outliers varied based on dependent variables and model specification.

Summary results are provided in Table 50 and Table 51. The first model with full input values bears an adjusted R-squared of 0.189. Adding regional controls boosts the adjusted R-squared to 0.271 but generates several substantial changes in t-scores. In Model 1A, most of the human capital measures are significant and positive; however, the share of technology-based knowledge occupation workers is significant and negative

[47] The identification of leverage points and removal was based on $h_i > 3(k+1/n)$ where k is the number of variables and n is the number of remaining observations. For discussion of high leverage points, see Belsley et al. 2004; Seaver and Triantis 1995; Martin 1992; Rousseeuw and van Zomeren 1990.

implying that larger shares of knowledge occupations may not always generate increased economic growth, *ceteris paribus*. The economic dynamics measure of establishment churn appears to have a statistically significant negative impact. Further analysis of this measure shows churn to yield a positive relationship in metropolitan counties and a significant negative in non-metro counties. This implies that the notion of churn as an economic driver may be more appropriate for larger economies whereas it is detrimental to smaller, less diverse, or developing economies.

The innovation input measures, while all significant, yield mixed and conflicting results. VC investment is positive with a marginal beta coefficient, whereas patent and R&D investment generated negative relationships.[48] For each, the operationalization may prove limiting to the magnitude and direction of the relationships. There may also be a more systematic problem with the coding of the R&D variable, which relied heavily on the location of a firm's headquarters and not the location of R&D activity. Additionally, annualized estimates with appropriate lags may lead to better results.

In Model 1B, the addition of controls for regionalization suggests that on the whole several regions—East South Central and West South Central—grew substantially more quickly than others relative to the omitted New England region. The two South Central regions are of particular interest given that Hurricane Katrina struck the coastal counties in mid-2005 and may have led to an influx of federal development funds and disaster relief that boosted GDP at the tail end of the measured period (Bergheim 2008). Disaster relief funds are as of yet uncontrolled for.[49] For the other independent variables, the relationships are similar to those from Model 1A; however, bachelor's degrees, patenting activity, and broadband access rates all become insignificant presumably due to regional concentrations of these factors.[50]

The second series of models re-coded the variables for targeted investments (R&D and VC) and patent activity as dummy variables so that any county with the presence of the variable received a one, regardless of the concentration. Both specifications of this model, with and without regional controls, generate results similar to those from Model 1 with one noticeable exception. VC funds appear to be highly sensitive to the binary (or dummy variable) recoding and produce nearly significant negative results, whereas R&D investment is less sensitive to the re-coding. A possible explanation is that VC is only efficacious in larger, more sizeable amounts.

Alternate specifications of the dependent variable using PCPI and wage and salary growth (see Table 51) generate similar results. The obvious differences between the models are that with PCPI, establishment churn becomes positively significant suggesting that higher rates of churn are positive for residence-based income measures. Additionally, technology-based knowledge occupation cluster shares—the human capital measure deemed questionable in the GDP per worker growth model—generate a positive and statistically significant

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[48] The idea that patent activity is negative is counterintuitive but may be consistent with an argument made by Heller and Eisenberg (1998) in the field of biomedical research, namely that increased patent activity in the long-term results in decreased innovation and the underutilization of resources as a result of more stringent intellectual property right enforcement mechanisms (see also Crepon and Duguet 1998). The negative relationship may also be the result of mis-specified patent data. As explained in the text of the main part of the report, patents may or may not be properly assigned to location of the research activity depending upon whether the assignee lives and works in the same county.

[49] We requested county-level data from the Department of Homeland Security's Federal and Emergency Management Agency but were referred to a website providing information at a level of little value in addressing the question at hand.

[50] Future avenues of research include testing for spatial autocorrelation. If spatial dependence is evident in the highly granular county-level data, then future research would employ spatial econometrics to analyze the most important influences of innovation.

coefficient in both alternate specifications. Regardless of the dependent variable, educational attainment, high-tech employment, and venture capital are consistently statistically significant and positive.

Table 48: Summary Statistics for Model Inputs

				All Counties				
Variable	Years	Label	U.S.	Mean	Median	Std	Min	Max
Mid-aged population growth rate, ages 25-44	1997-2006	popgroma	-0.2%	-0.7%	-0.7%	2.1%	-22.2%	9.4%
Percent of population ages 25-64 with some college or an associate's degree	2000	Perassoc	29.5%	29.1%	29.1%	6.2%	11.3%	47.2%
Percent of population ages 25-64 with a bachelor's degree	2000	Perbach	26.5%	18.0%	16.2%	8.2%	4.9%	64.0%
Average high-tech employment share	1997-2006	avghtshare	4.8%	2.9%	2.3%	2.5%	0.1%	51.2%
Average venture capital investment per $10,000 GDP	1997-2006	avgVCGDP	35.2	4.2	0.0	25.2	0.0	648.5
Average private research & development per $1,000 compensation	1997-2006	avgRDpCOMP	2.3	3.0	0.0	28.2	0.0	1081.7
Average patents per 10,000 workers	1997-2006	avgPatpw	18.8	4.0	1.8	7.3	0.0	101.2
Change in broadband density	2000-2007	bbd	16%	21%	21%	6%	0%	88%
Average establishment churn	1999-2004	avgchurn	0.80	0.74	0.74	0.06	0.42	0.96
Average small establishments per 10,000 workers	1997-2004	smestpw	364	412	400	101	36	1,176
Change in high-tech employment share	1997-2006	HTSd	-0.7%	0.0%	-0.2%	4.0%	-21.7%	33.1%
Gross domestic product per worker, current $	2006	cuGDPW	73,989	58,976	57,119	20,831	3,314	622,632
Technology-based knowledge occupations	1997-2007	KOC	1.0	0.6	0.6	0.3	0.1	3.9

Source: IBRC

Table 49: Summary Statistics for Dependent Variables

Variable	Label	U.S.	All Counties Mean	Median	Std	Min	Max
Average annual rate of change in GDP per worker, current $, 1997 to 2006	GDPWcud	3.6%	3.4%	3.4%	1.9%	-25.2%	13.9%
Change in nominal wage and salary compensation per worker, 1997 to 2006	wspWd	3.8%	3.5%	3.5%	0.8%	-4.8%	9.8%
Change in nominal per capita personal income, 1997 to 2006	PCPId	4.1%	3.8%	3.7%	1.1%	-1.7%	15.7%

Source: IBRC

Table 50: Estimation Results for GDP per Worker Growth, 1997-2006

Label	Model 1A Std Beta (t-value)	Sig	Model 1B Stds Beta (t-value)	Sig	Model 2A Std Beta (t-value)	Sig	Model 2B Std Beta (t-value)	Sig
Intercept	0.0508 (12.18)	***	0.0509 (11.45)	***	0.051 (11.63)	***	0.0507 (11.24)	***
Perbach	0.0578 (2.21)	**	0.0357 (1.42)		0.0685 (2.56)	**	0.0375 (1.48)	*
Perassoc	0.0812 (4.19)	***	0.0993 (4.54)	***	0.0774 (4.01)	***	0.1044 (4.85)	***
KOC	-0.1012 (-3.99)	***	-0.0505 (-2.05)	**	-0.0904 (-3.43)	***	-0.043 (-1.7)	*
HTSd	0.1371 (8.02)	***	0.1389 (8.61)	***	0.13 (7.59)	***	0.1371 (8.5)	***
popgroma	0.0478 (2.05)	**	0.055 (2.51)	**	0.0464 (1.97)	**	0.056 (2.56)	**
avgchurn	-0.0917 (-3.87)	***	-0.1114 (-4.64)	***	-0.0781 (-3.27)	***	-0.1044 (-4.31)	***
smestpw	0.1128 (6.06)	***	0.157 (8.64)	***	0.1101 (5.85)	***	0.1507 (8.22)	***
avgPatpw	-0.0515 (-2.44)	**	-0.0182 (-0.89)					
patdumb: Average patents per 10,000 workers dummy					-0.0324 (-1.86)	*	-0.0067 (-0.4)	

Label	Model 1A		Model 1B		Model 2A		Model 2B	
	Std Beta (t-value)	Sig	Stds Beta (t-value)	Sig	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig
avgRDpCOMP	-0.0342 (-1.89)	*	-0.0341 (-1.98)	**				
rddumb: Average private research & development per $1,000 compensation dummy					-0.0478 (-2.22)	**	-0.0172 (-0.84)	
avgVCGDP	0.0355 (1.81)	*	0.0349 (1.88)	*				
vcdumb: Average venture capital investment per $10,000 GDP dummy					-0.0261 (-1.15)		-0.0071 (-0.33)	
bbd	0.0281 (1.6)	*	-0.0109 (-0.63)		0.0285 (1.6)	*	-0.0125 (-0.72)	
oilgas: presence of fossil fuel extraction	0.0586 (3.38)	***	0.0108 (0.65)		0.0651 (3.75)	***	0.0144 (0.86)	
cuGDPW	0.3869 (20.63)	***	0.3632 (19.63)	***	0.3942 (20.63)	***	0.363 (19.4)	***
Metro: metropolitan statistical area county	0.1307 (6.27)	***	0.1345 (6.73)	***	0.1265 (5.99)	***	0.1288 (6.39)	***
ENC: East North Central Census division			0.0267 (0.57)				0.0097 (0.21)	
ESC: East South Central			0.0849 (2.05)	**			0.0741 (1.82)	*
MA: Middle Atlantic			0.011 (0.38)				0.0003 (0.01)	
MT: Mountain			0.0553 (1.54)	*			0.0458 (1.29)	
PAC: Pacific			0.0442 (1.44)	*			0.0347 (1.15)	
SA: South Atlantic			0.0214 (0.45)				0.0097 (0.21)	
WNC: West North Central			0.0764 (1.65)	*			0.0615 (1.35)	
WSC: West South Central			0.3386 (7.7)	***			0.3278 (7.54)	***

Label	Model 1A		Model 1B		Model 2A		Model 2B	
	Std Beta (t-value)	Sig	Stds Beta (t-value)	Sig	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig
N	2,859		2,908		2,868		2,933	
Adj-R^2	0.1893		0.2711		0.1834		0.2661	

*** < .01; ** < .05; * < .15

Note: The variance inflation factor (VIF) is a method to test the severity of multicollinearity. Except for the regional dummy variables, no VIF score exceeded 2.5. Only "Perbach" and "avgchurn" exceeded 2 in model 1B and it should not surprise that the VIF for the regional variables ranged from 3.2 to 8.9. The VIF results for model 2b were similar, with KOC joining Perbach and avgchurn in the range of 2.0 to 2.5.
Source: IBRC

Table 51: Estimation Results for Alternate Dependent Variable Measures

Label	Change in Per Capita Personal Income				Change in Wage and Salary Compensation			
	Model 3A		Model 3B		Model 4A		Model 4B	
	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig
Intercept	0.0094 (3.62)	***	0.0185 (6.64)	***	0.0343 (15.5)	***	0.0427 (17.89)	***
Perbach	0.3164 (10.56)	***	0.286 (9.62)	***	0.1948 (7.39)	***	0.2208 (8.46)	***
Perassoc	-0.0339 (-1.71)	*	0.0561 (2.47)	**	0.0906 (4.57)	***	0.1287 (5.6)	***
KOC	0.0644 (2.55)	**	0.0547 (2.19)	**	0.1109 (4.21)	***	0.1056 (4.04)	***
HTSd	0.0367 (2.14)	**	0.0354 (2.14)	**	0.0789 (4.53)	***	0.0854 (5.05)	***
popgroma	-0.2318 (-9.98)	***	-0.2371 (-10.67)	***	0.1156 (4.8)	***	0.1039 (4.51)	***
avgchurn	0.2527 (10.79)	***	0.2019 (8.4)	***	-0.0012 (-0.05)		-0.0806 (-3.18)	***
smestpw	0.0923 (4.93)	***	0.1002 (5.4)	***	-0.0476 (-2.43)	**	-0.0227 (-1.15)	
avgpatpw	-0.0543 (-2.51)	**	-0.0432 (-2.04)	**	-0.0969 (-4.43)	***	-0.0582 (-2.66)	***
avgRDpCOMP	0.0131 (0.72)		0.0265 (1.5)	*	0.063 (3.4)	***	0.0732 (4.02)	***
avgVCGDP	0.0474 (2.43)	**	0.0386 (2.03)	**	0.1173 (5.82)	***	0.0751 (3.82)	***
bbd	-0.0534 (-3.03)	***	-0.0704 (-4)	***	-0.0454 (-2.54)	**	-0.0591 (-3.3)	***

Label	Change in Per Capita Personal Income				Change in Wage and Salary Compensation			
	Model 3A		Model 3B		Model 4A		Model 4B	
	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig	Std Beta (t-value)	Sig
oilgas: presence of fossil fuel extraction	0.0929 (5.43)	***	0.0766 (4.58)	***	0.137 (7.85)	***	0.1388 (7.99)	***
Pcpi	-0.3651 (-13.86)	***	-0.3093 (-11.7)	***				
Ws					-0.4309 (-17.59)	***	-0.374 (-14.9)	***
Metro: metropolitan statistical area county	0.1069 (4.92)	***	0.0942 (4.48)	***	0.0907 (4.21)	***	0.0758 (3.59)	***
ENC: East North Central Census division			-0.2721 (-5.72)	***			-0.2069 (-4.36)	***
ESC: East South Central			-0.0723 (-1.7)	*			0.0131 (0.31)	
MA: Middle Atlantic			-0.0484 (-1.67)	*			-0.0909 (-3.11)	***
MT: Mountain			-0.0771 (-2.1)	**			-0.0209 (-0.55)	
PAC: Pacific			-0.1367 (-4.46)	***			-0.0068 (-0.22)	
SA: South Atlantic			-0.1398 (-2.91)	***			-0.0144 (-0.3)	
WNC: West North Central			-0.2638 (-5.67)	***			-0.1393 (-2.92)	***
WSC: West South Central			-0.0029 (-0.06)				0.0371 (0.82)	
N	2,856		2,901		2,872		2,930	
Adj-R^2	0.1809		0.2351		0.158		0.1971	

*** < .01; ** < .05; * < .15

Source: IBRC

Table 52: Reweighted Betas from Preferred Empirical Model

Variable	Standardized βx_i's for significant, positive variables	αx_i: Reweighted standardized βx_i's (sum to 1.0)
Perbach: Percent of population, ages 25-64, with bachelor's degrees	0.058	0.12
Perassoc: Percent of population, ages 25-64, with some college or an associate's degree	0.081	0.16
popgroma: Population growth rate for ages 25-44	0.048	0.10
HTSd: Change in high-tech employment share	0.137	0.27
smestpw: Average small establishments per 10,000 workers	0.113	0.23
avgVCGDP: Average venture capital investment per $10,000 GDP	0.036	0.07
bbd: Change in broadband density	0.028	0.06

Note: Negative values (in red) in Table 50 were not included in the empirical index.
Source: IBRC

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Appendix D: National Occupation Cluster Technical Report

Tech Clusters in U.S. Regions

Technology-Based Knowledge Occupation Clusters

While the regional analyses of occupation clusters in Economic Growth Regions 6 and 11 in Indiana (see Section 3.5 of the main report) describe the most significant aspects of all 15 clusters for each region, this special analysis focuses on six clusters that were judged to be the most significant indicators for the production of innovation in the economy. The selection of these clusters was based upon previous studies that attempted to identify factors most likely to produce innovations. The six selected clusters (technology-based knowledge occupation clusters, henceforward "tech clusters") include the following:

- Information Technology (IT)
- Engineering (ENG)
- Health Care and Medical Science (Medical Practitioners and Scientists) (MED)
- Mathematics, Statistics, Data and Accounting (MATH)
- Natural Sciences and Environmental Management (SCI)
- Postsecondary Education and Knowledge Creation (ED)

Together, these six clusters account for slightly more than 8 percent of total national employment. With the exception of the engineering occupations, which encompass a wide range of types of engineers and other scientists,[51] all tech clusters grew in absolute numbers between 2001 and 2007 (see Table 53).

Table 53: Tech Clusters in the United States, 2001-2007

	IT	ENG	MED	MATH	SCI	ED
Jobs 2001	3,387,709	1,829,729	1,937,418	4,017,474	727,122	1,900,595
Percent of Total	2.1	1.1	1.2	2.4	0.4	1.2
Jobs 2007	3,462,215	1,814,229	2,146,086	4,176,567	791,011	2,198,071
Percent of Total	2.0	1.0	1.2	2.4	0.5	1.2
Percent Change 2001-2007	2.2	-0.9	10.8	4.0	8.8	15.7

Source: EMSI Complete Employment 2008 Spring Release v. 2

However, most states deviate from the national averages. For example, the share of the tech clusters (as a percent of total jobs) is substantially smaller in Indiana than in the nation. Job growth in Indiana exceeds the nation in IT and Indiana lost jobs at a slightly slower rate than the United States for engineering occupations. However, Indiana lags behind the nation in the remaining four tech clusters (see Table 53 and Table 54).

[51] A list of occupations that are included in each cluster is provided in Appendix H.

Table 54: Tech Clusters in Indiana, 2001-2007

	IT	ENG	MED	MATH	SCI	ED
Jobs 2001	46,188	33,146	36,916	63,415	11,753	39,670
Percent of Total	1.3	0.9	1.0	1.8	0.3	1.1
Jobs 2007	48,784	32,880	39,981	64,734	12,429	45,032
Percent of Total	1.4	0.9	1.1	1.7	0.3	1.2
Percent Change 2001-2007	5.6	-0.8	8.3	2.1	5.8	13.5

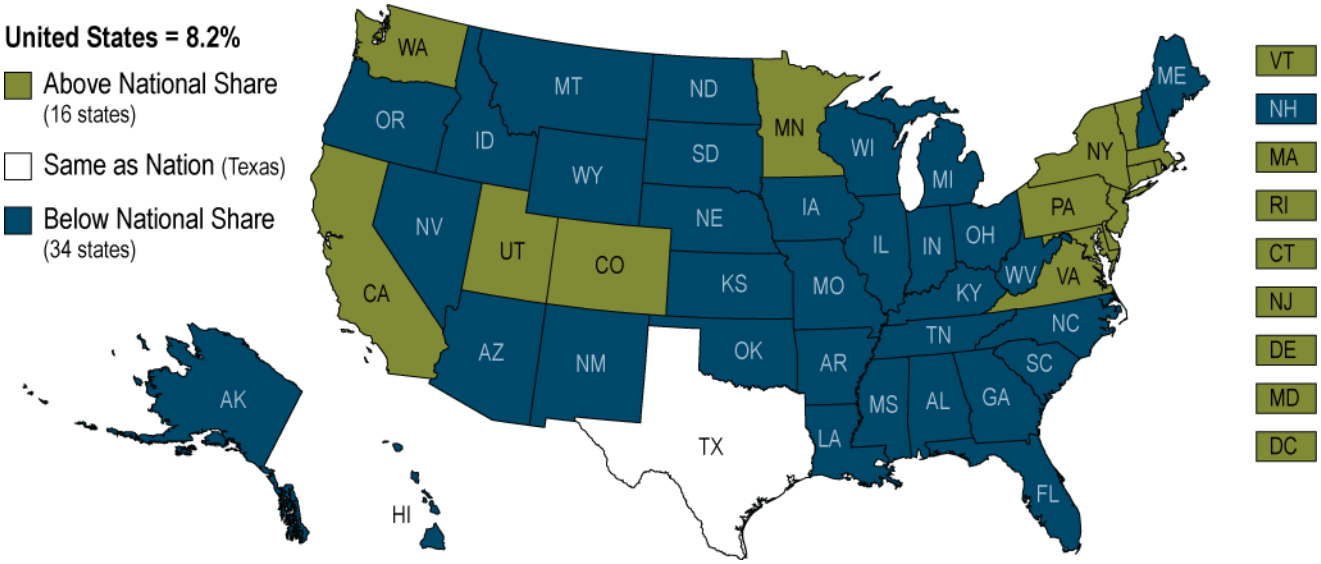
Source: EMSI Complete Employment 2008 Spring Release v. 2

Regional Variations in Tech Clusters among the States

Regional Variations in the Share of Tech Clusters

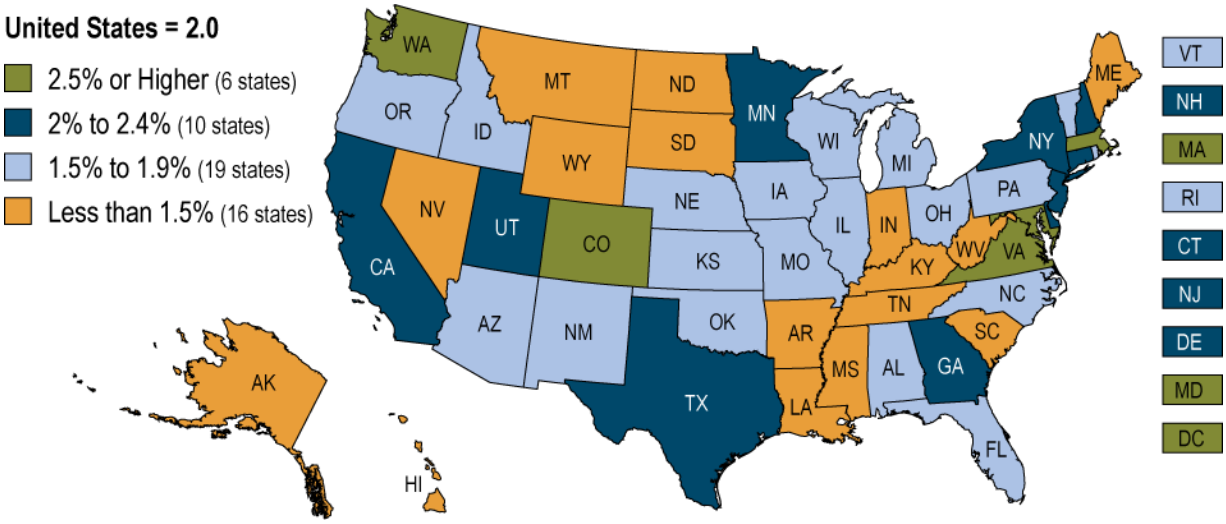
In 2007, the six tech clusters made up 8.2 percent of U.S. total jobs. The share of jobs in the tech clusters exceeds the national share in 16 states, 11 of those are located along the East Coast and two are on the West Coast (see Figure 69). Combined, these 16 states account for almost half (47.7 percent) of all U.S. jobs in the tech clusters. Figure 70 though Figure 75 show the job shares of the individual tech clusters by state across the United States.

Figure 69: Percent of Jobs in Tech Clusters Combined



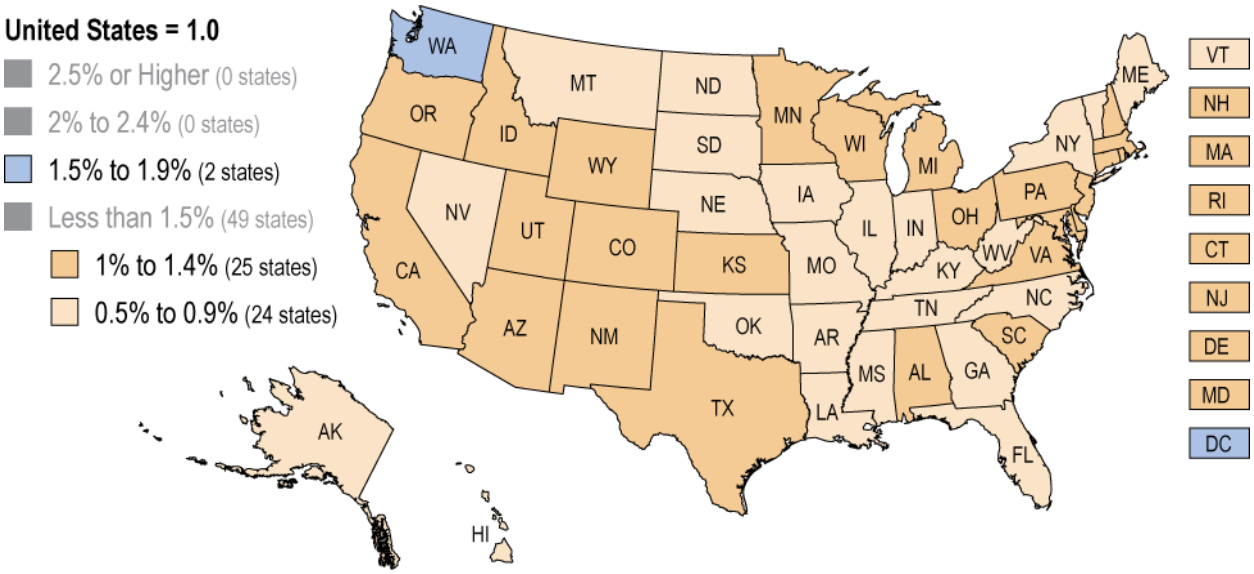
Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Figure 70: Jobs in the Information Technology Cluster as a Percent of Total Jobs, 2007



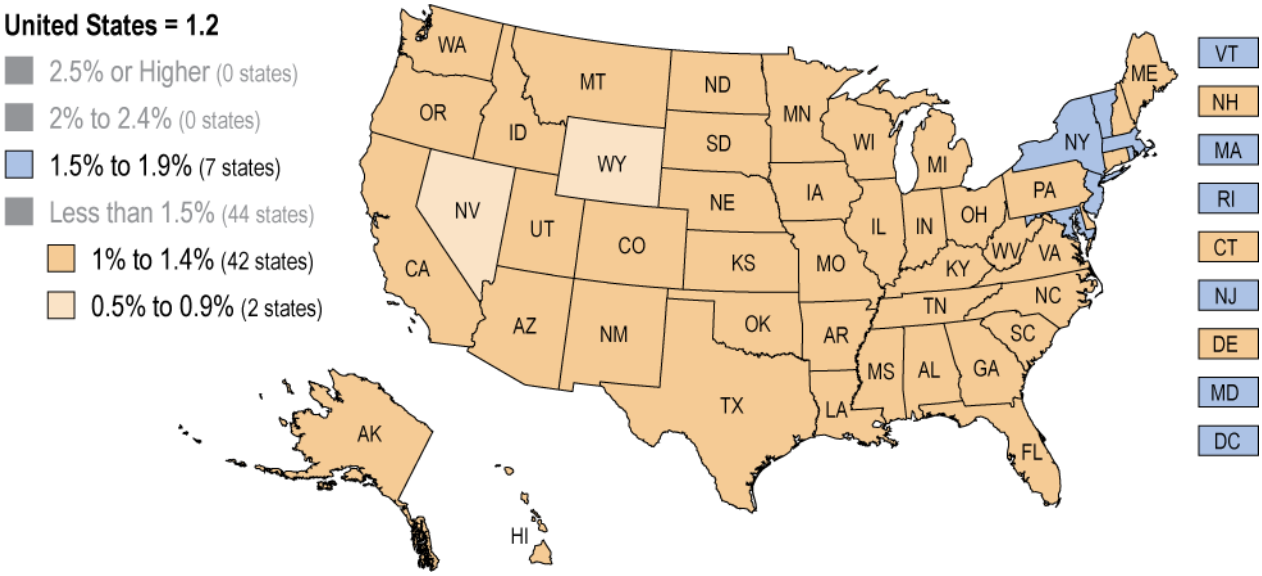
Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Figure 71: Jobs in the Engineering Cluster as a Percent of Total Jobs, 2007



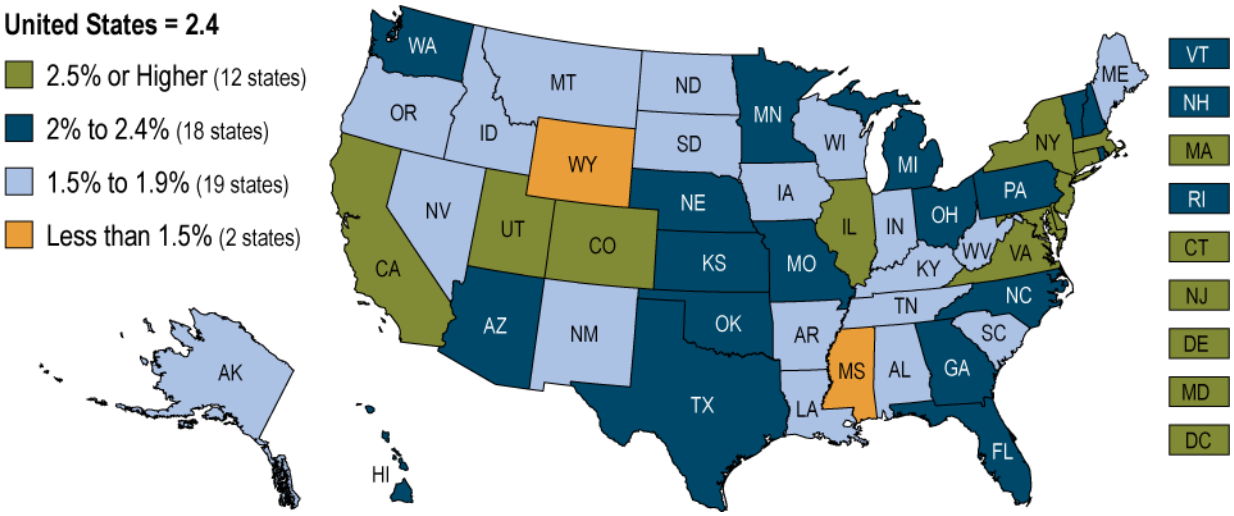
Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Figure 72: Jobs in the Medical Practitioners and Scientists Cluster as a Percent of Total Jobs, 2007



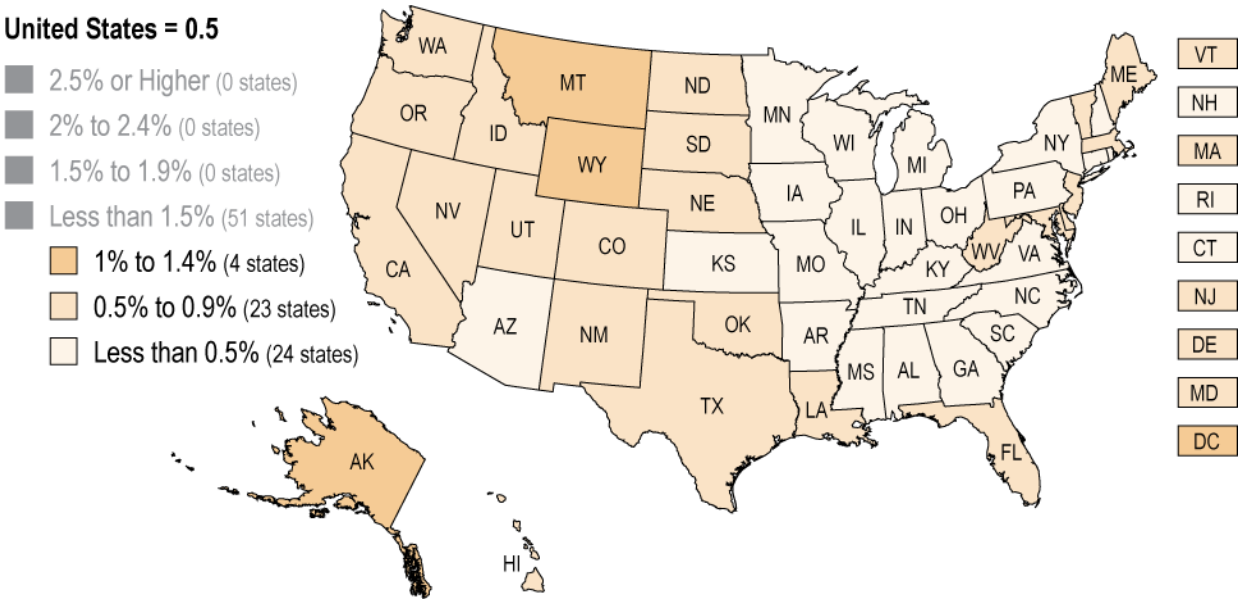
Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Figure 73: Jobs in the Mathematics, Statistics, Data and Accounting Cluster as a Percent of Total Jobs, 2007



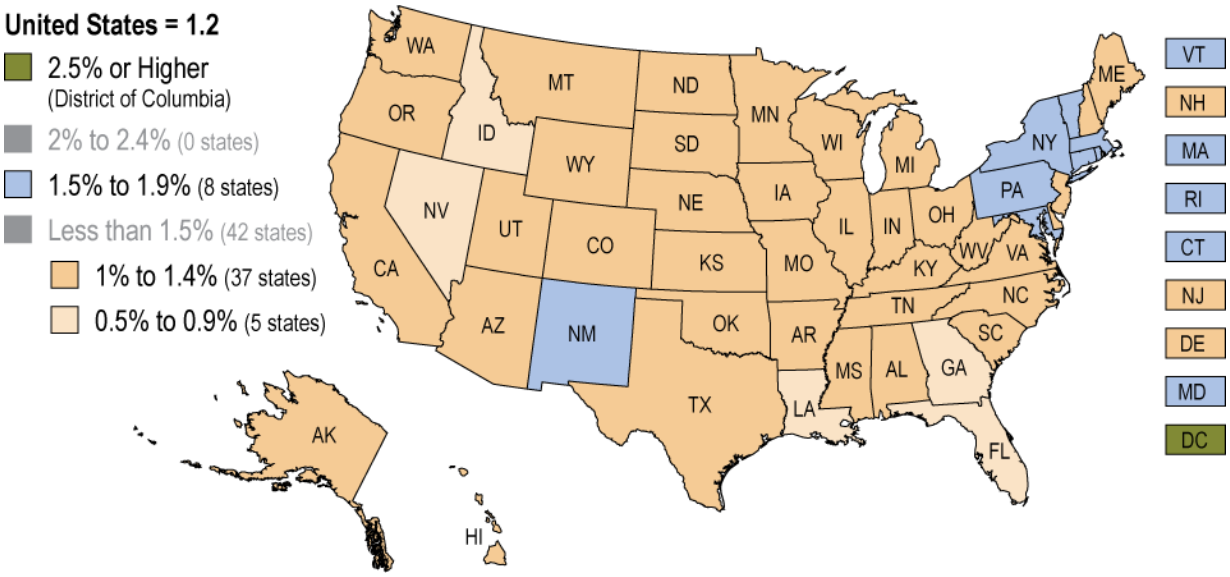
Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Figure 74: Jobs in the Natural Sciences and Environmental Management Cluster as a Percent of Total Jobs, 2007



Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Figure 75: Jobs in the Postsecondary Education and Knowledge Creation Cluster as a Percent of Total Jobs, 2007



Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Regional Variations in the Growth of Tech Clusters, 2001 to 2007

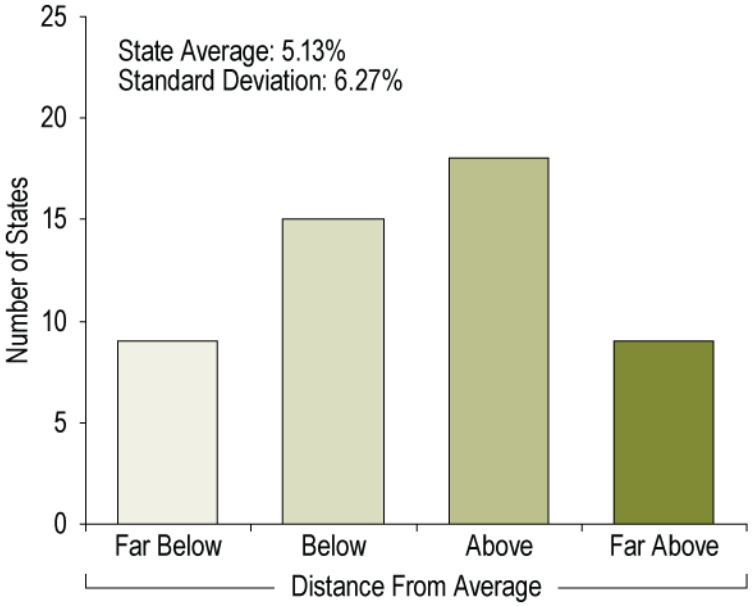
In Figure 76 through Figure 81, state job growth for each tech cluster is broken into four categories:

- *Far below average:* less than state average minus standard deviation
- *Below average:* between state average minus standard deviation and state average

- *Above average:* between state average and state average plus standard deviation
- *Far above average:* greater than state average plus standard deviation

Note that the state average and standard deviation differ across tech clusters. Note also that the state average does not necessarily equal the national average discussed earlier in this chapter.

Figure 76: Information Technology Cluster Job Growth, 2001-2007



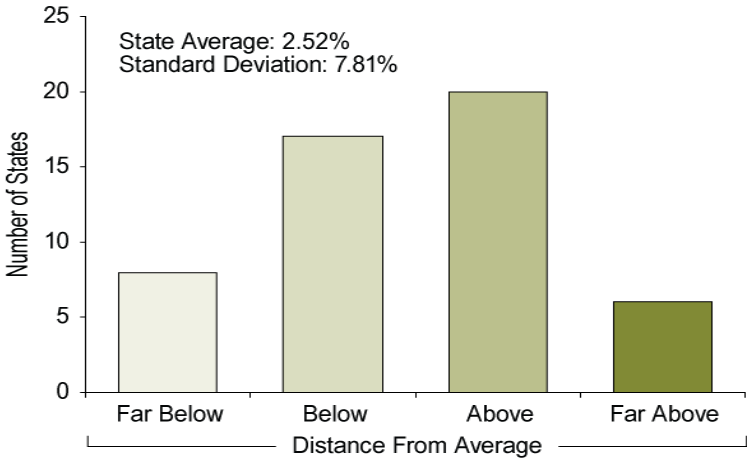
Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 55: Top and Bottom 10 States in Information Technology Cluster Job Growth, 2001-2007

Top 10		Bottom 10	
District of Columbia	18.3	Kansas	-0. 7
Nevada	17.3	Oklahoma	-1.4
North Dakota	14.6	New York	-1.5
Wyoming	12.8	New Hampshire	-1.9
South Carolina	12.6	Delaware	-2.1
Hawaii	12.3	Georgia	-2.3
Montana	11.9	Michigan	-3.0
Arkansas	11.7	California	-3.6
Rhode Island	11.6	Massachusetts	-8.2
Florida	11.3	Colorado	-9.8

Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 77: Engineering Cluster Job Growth, 2001-2007



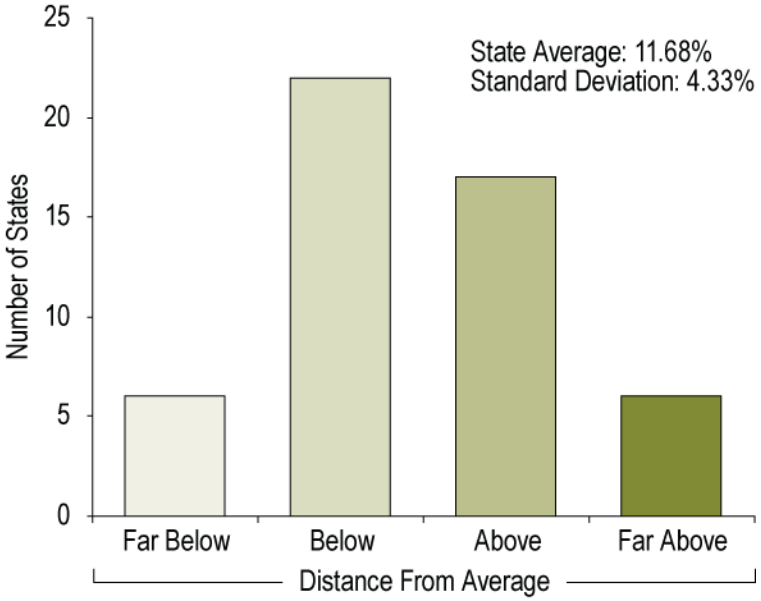
Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 56: Top and Bottom 10 States in Engineering Cluster Job Growth, 2001-2007

Top 10		Bottom 10	
Nevada	25.7	Connecticut	-4.7
Wyoming	20.3	Ohio	-4.8
North Dakota	19.6	Pennsylvania	-5.4
Hawaii	17.1	California	-6.1
Montana	14.3	Vermont	-7.1
Utah	12.9	Illinois	-8.1
Alaska	10.0	Massachusetts	-8.1
Virginia	8.2	New Hampshire	-9.5
Florida	7.9	Delaware	-10.1
Alabama	7.8	Michigan	-12.5

Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 78: Medical Practitioners and Scientists Cluster Job Growth, 2001-2007



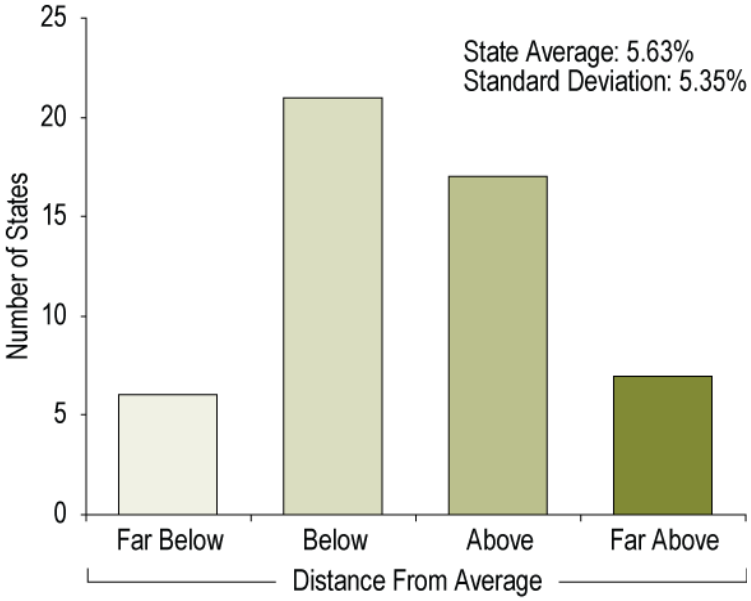
Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 57: Top and Bottom 10 States in Medical Practitioners and Scientists Cluster Job Growth, 2001-2007

Top 10		Bottom 10	
Nevada	24.5	Wisconsin	9.0
Arizona	23.8	Illinois	8.8
Idaho	20.1	Indiana	8.3
New Mexico	18.0	New York	8.1
North Carolina	17.6	Ohio	7.0
Georgia	17.2	West Virginia	6.3
Utah	15.8	Iowa	5.1
Virginia	15.7	California	4.9
Texas	15.3	District of Columbia	4.5
Tennessee	15.1	Louisiana	4.0

Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 79: Mathematics, Statistics, Data and Accounting Cluster Job Growth, 2001-2007



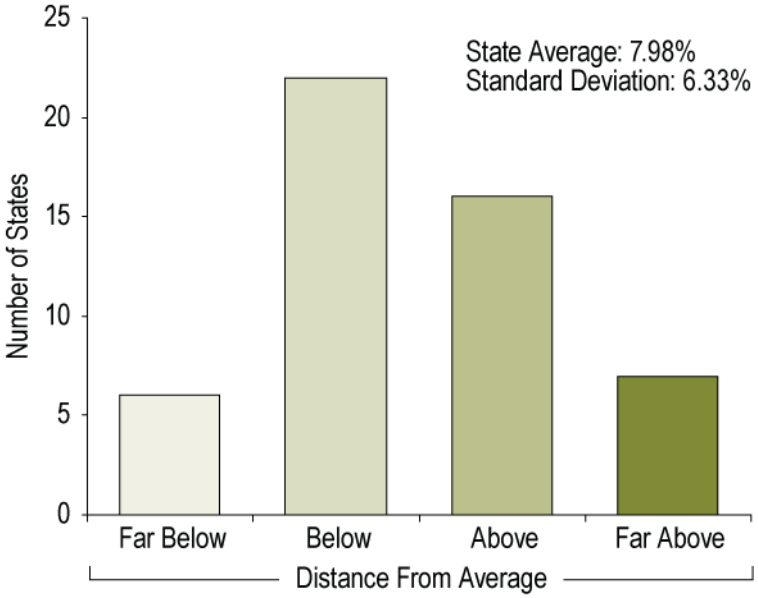
Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 58: Top and Bottom 10 States in Mathematics, Statistics, Data and Accounting Cluster Job Growth, 2001-2007

Top 10		Bottom 10	
Nevada	26.3	Vermont	1.4
Arizona	14.5	Ohio	0.8
Wyoming	14.3	New Jersey	0.7
Florida	13.2	Kansas	0.5
Utah	12.5	Louisiana	0.1
Hawaii	11.8	Illinois	0.1
South Carolina	11.2	California	-1.0
Montana	10.1	Delaware	-2.1
North Dakota	9.9	Massachusetts	-3.7
North Carolina	9.8	Michigan	-4.4

Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 80: Natural Sciences and Environmental Management Cluster Job Growth, 2001-2007



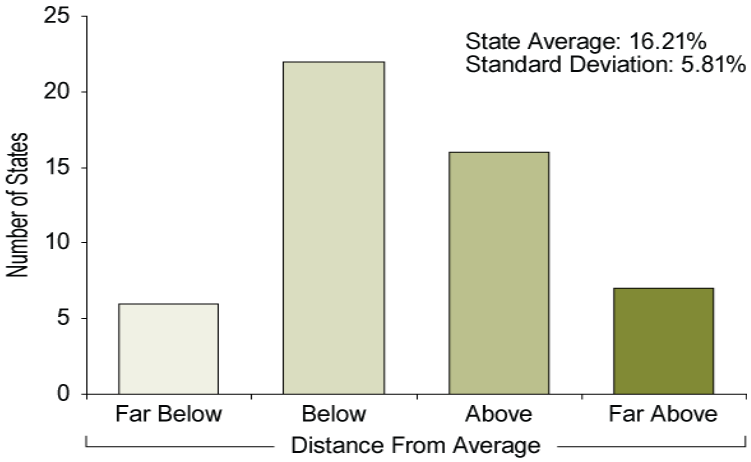
Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 59: Top and Bottom 10 States in Natural Sciences and Environmental Management Cluster Job Growth, 2001-2007

Top 10		Bottom 10	
Nevada	27.4	Ohio	3.9
Florida	18.2	Kansas	3.7
Virginia	17.2	New York	3.4
Arizona	17.0	Connecticut	2.5
North Carolina	15.7	Mississippi	1.5
North Dakota	15.6	Illinois	1.0
Texas	14.4	Idaho	0.7
Arkansas	13.2	Louisiana	-1.1
Colorado	12.9	Michigan	-2.5
Oklahoma	12.3	Delaware	-17.2

Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 81: Postsecondary Education and Knowledge Creation Cluster Job Growth, 2001-2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 60: Top and Bottom 10 States in Postsecondary Education and Knowledge Creation Cluster Job Growth, 2001-2007

Top 10		Bottom 10	
Nevada	40.7	Maine	12.9
Arizona	27.3	New Mexico	12.3
Oregon	25.8	Ohio	12.2
Arkansas	23.4	Mississippi	11.2
Colorado	21.7	Illinois	9.8
Virginia	21.7	West Virginia	7.6
Alabama	21.1	Michigan	7.6
District of Columbia	21.1	Delaware	6.5
North Carolina	20.8	New Hampshire	6.4
North Dakota	20.2	Louisiana	5.3

Source: EMSI Complete Employment 2008 Spring Release v. 2

Co-location of Tech Clusters

High positive correlation coefficients between the state percentages of jobs in the various tech clusters indicate their tendencies to be strongly represented in the same states (see Table 61 and Table 62).

Table 61: Correlation Coefficients between State Percentages of Tech Clusters, 2001

	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.703	1.000				
MED	0.384	0.268	1.000			
MATH	0.860	0.613	0.599	1.000		

SCI	0.051	0.140	0.197	0.098	1.000	
ED	0.511	0.389	0.687	0.682	0.338	1.000

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 62: Correlation Coefficients between State Percentages of Tech Clusters, 2007

	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.705	1.000				
MED	0.401	0.274	1.000			
MATH	0.882	0.609	0.575	1.000		
SCI	0.100	0.177	0.090	0.075	1.000	
ED	0.618	0.422	0.637	0.715	0.316	1.000

Source: EMSI Complete Employment 2008 Spring Release v. 2

Surprisingly, the natural science and environmental management cluster does not co-locate with any other tech cluster (all correlation coefficients are smaller than 0.2).

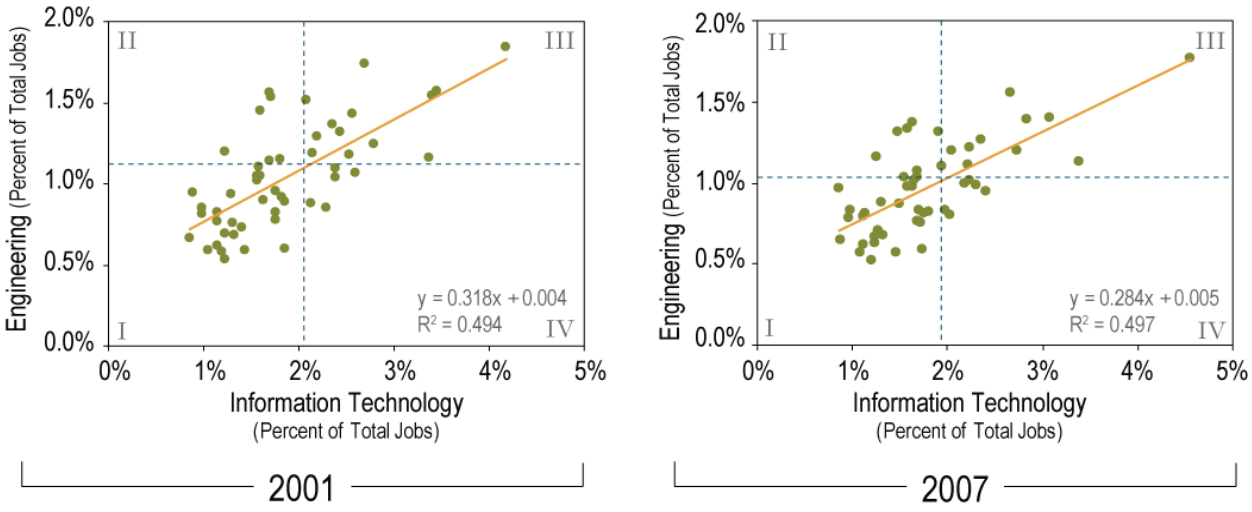
The postsecondary education and knowledge creation cluster co-locates most strongly with the mathematics, statistics, data and accounting cluster but also with the medical practitioners and scientists cluster and the IT cluster

The strongest co-location exists among information technology, engineering, and the mathematics, statistics, data and accounting cluster.

Co-location of Information Technology and Engineering

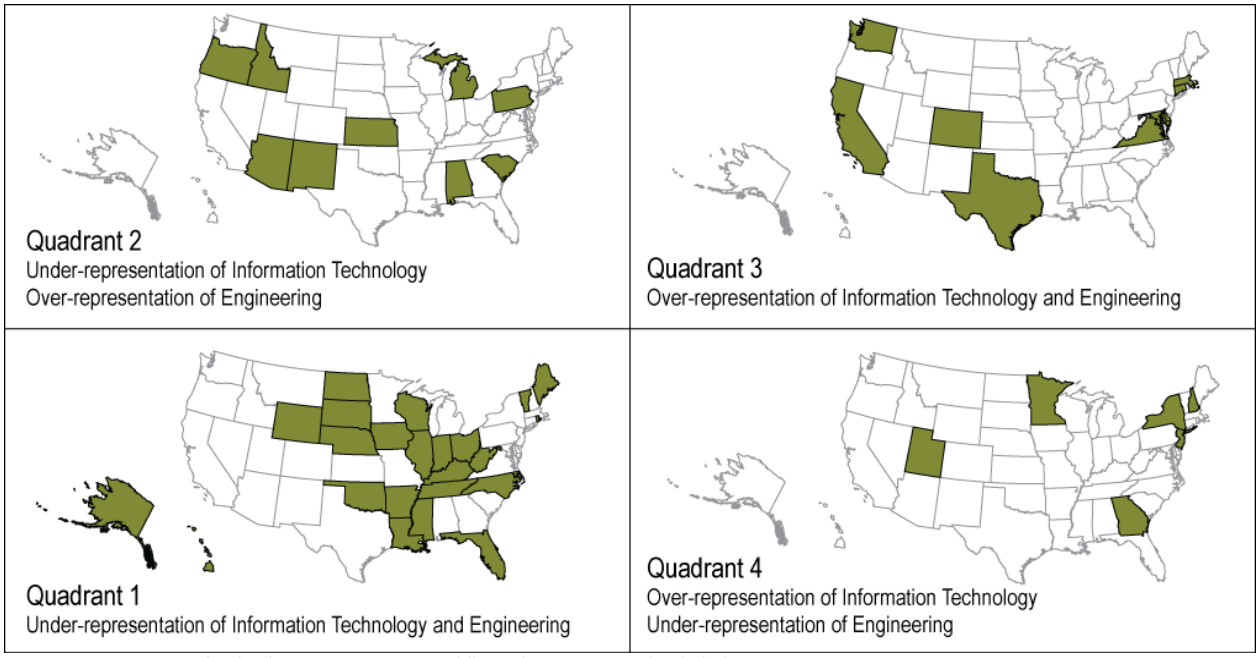
States with a high percentage of IT jobs also have a high percentage of jobs in the engineering cluster (see Figure 82 and Figure 83). The strong co-location is persistent over time (correlation coefficient $r = 0.7$ in both years).

Figure 82: Co-location of Engineering Cluster Jobs and Information Technology Cluster Jobs, 2001 and 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 83: Distribution of States across Quadrants, 2007



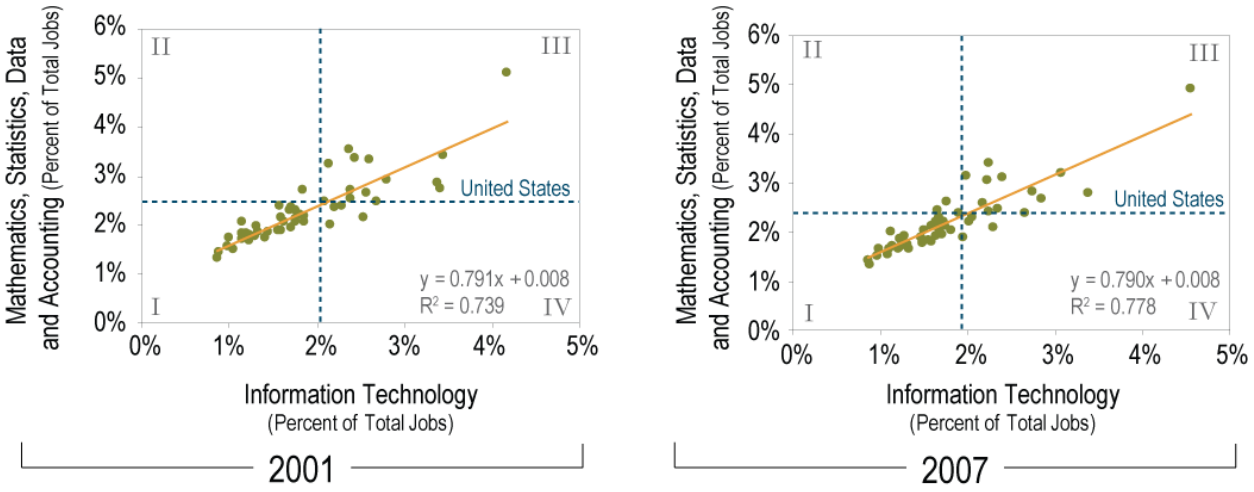
Note: Over-representation is above U.S. average, while under-representation is below U.S. average.

Source: IBRC, using EMSI Complete Employment 2008 Spring Release v. 2

Co-location of IT and MATH

States with a high percentage of IT jobs also have a high percentage of jobs in the mathematics, statistics, data and accounting cluster (see Figure 84). The correlation coefficient was $r = 0.86$ in 2001 and slightly increased to $r = 0.88$ in 2007.

Figure 84: Co-location of Mathematics, Statistics, Data and Accounting Cluster Jobs and Information Technology Cluster Jobs, 2001 and 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Regional Specialization

Tech cluster jobs are unevenly distributed across U.S. states, with the District of Columbia having the highest percentage (17.3 percent) and Mississippi having the lowest percentage (5.4 percent) of its jobs in the tech clusters.

The dissimilarity index indicates the percentage of tech cluster jobs that would need to be relocated to other states to achieve an even distribution. An even distribution is achieved when each state has its "fair share" of jobs in the tech clusters. For example, if a state has 2 percent of total U.S. jobs, an even distribution implies that the state should also have 2 percent of all tech cluster jobs. In other words, an even distribution implies that there is *no specialization*.

The dissimilarity index ranges from 0 percent (all states have their fair share of jobs in the knowledge economy) to 100 percent (all tech cluster jobs are located in one state only). Therefore, an increasing dissimilarity index also suggests an increasing degree of specialization throughout the spatial system.

As shown in Table 63, the dissimilarity in the distribution of tech cluster jobs across states basically remained the same during the study period (6.2 percent in 2001 versus 6.3 percent in 2007). Interestingly, the medical occupation cluster and the postsecondary education cluster have the lowest dissimilarity indices in both years. This suggests that medical services and education are ubiquitous services that every state provides for its residents.

Information technology, however, is much more spatially concentrated. More than 10 percent of all information technology would need relocation to achieve an equal distribution of these jobs across states. It is also noteworthy that the dissimilarity of the information technology and engineering occupation clusters decreased slightly between 2001 and 2007, whereas the distribution of the medical and education cluster occupations became more dissimilar across states.

Table 63: Dissimilarity in the Regional Distribution of Tech Cluster Jobs, 2001 and 2007

Cluster	2001	2007
Tech Clusters Combined	6.2	6.3
Information Technology	12.0	10.7
Engineering	11.1	10.3
Medical Practitioners and Scientists	6.1	6.2
Mathematics, Statistics, Data and Accounting	8.2	7.6
Natural Sciences and Environmental Management	11.4	11.3
Postsecondary Education and Knowledge Creation	7.6	7.8

Source: EMSI Complete Employment 2008 Spring Release v. 2

Uneven Growth

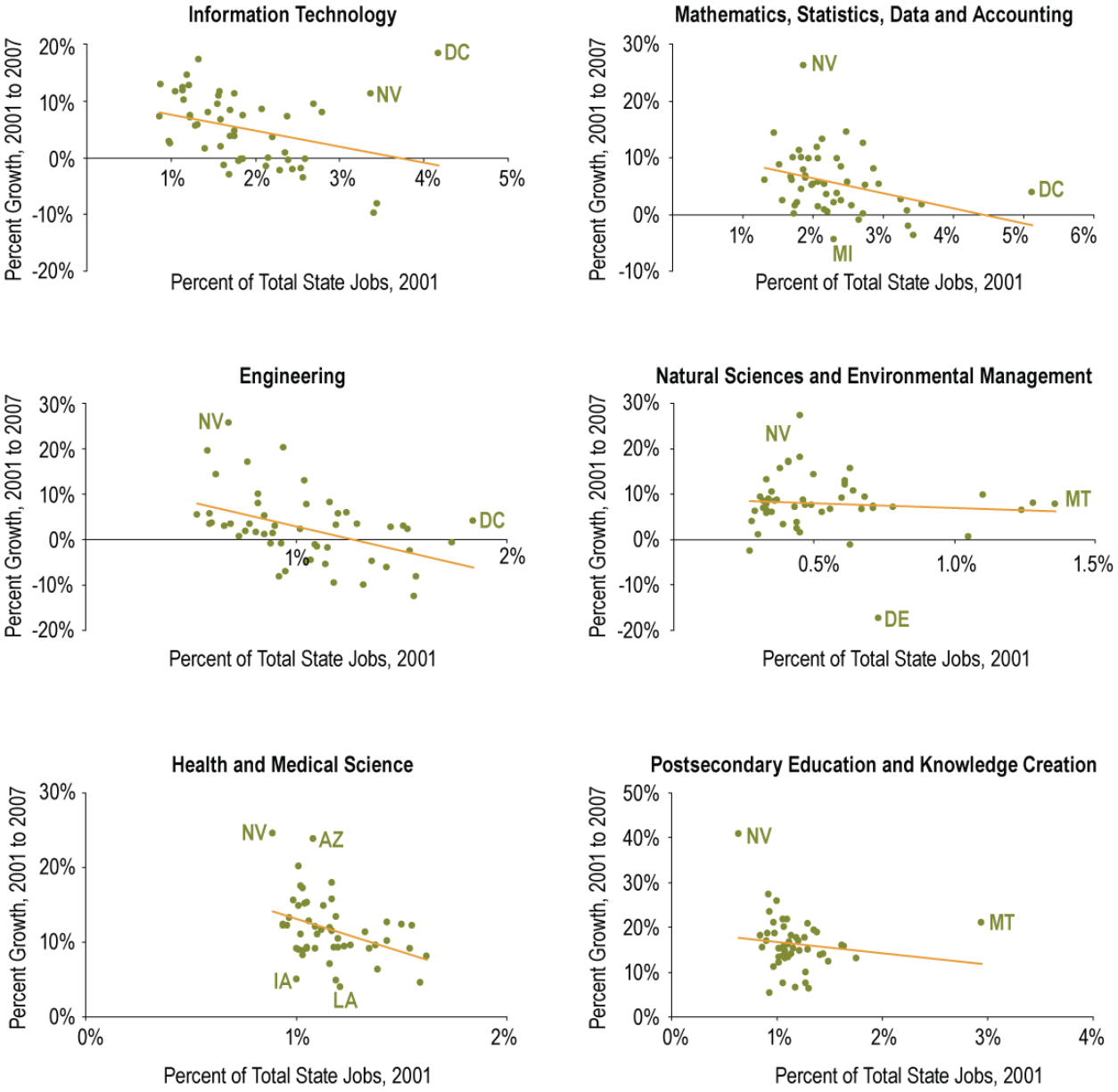
States with a low share of tech cluster jobs tend to have a slightly higher growth rate of tech cluster jobs. This results in a negative slope of the associated trend lines (see Table 64 and Figure 85).

Table 64: Estimated Slope of Trend Lines

Cluster	b	R^2
IT	-2.79	0.105
ENG	-10.714	0.203
MED	-8.912	0.145
MATH	-2.626	0.108
SCI	-2.112	0.008
ED	-2.467	0.020

Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 85: Relationship between Relative Size of Cluster and Cluster Growth, 2001-2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

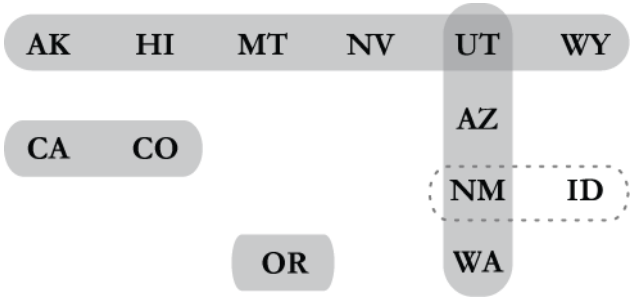
Similarities in the Structure of the Knowledge Economy

In the analysis below, states are compared with respect to:

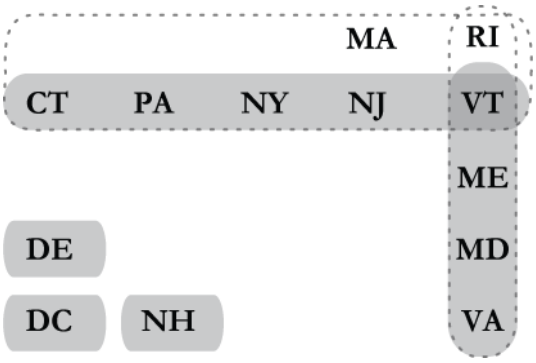
- The percent share in the six tech clusters in 2001
- The percent growth of the six tech cluster jobs between 2001 and 2007

States with a correlation coefficient of 0.9 or higher are considered similar. In the western United States, four groups of similar states can be identified. The first group is comprised of Alaska, Hawaii, Montana, Nevada, Wyoming, and Utah. The second group includes Utah, New Mexico, Arizona, and Washington as a core with

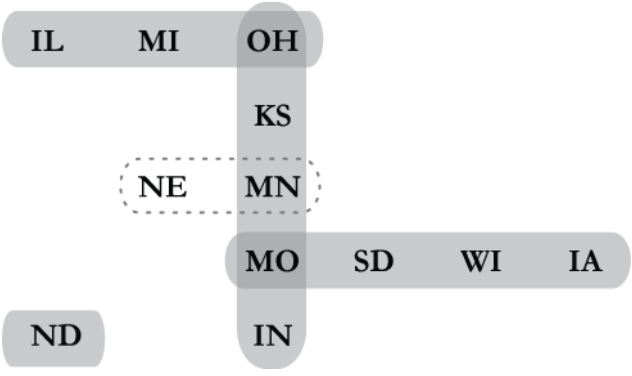
mutually strong similarities. Idaho is linked to this group as it has a strong similarity with New Mexico, but not with the other states in the group. Note that Utah is in both groups. The third group consists of California and Colorado. Finally, Oregon is a group by itself that does not have strong similarities with any of the other states in the West.



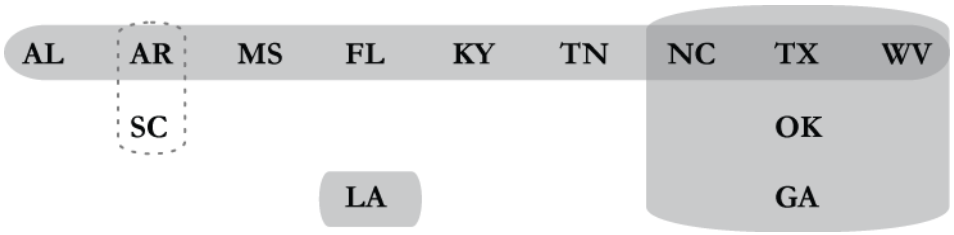
The East Coast consists of five groups. The first is made up of New Jersey, New York, Pennsylvania, Connecticut, and Vermont, with some links to Massachusetts and Rhode Island. The second group includes Maine, Maryland, Virginia and Vermont and also has a weak link to Rhode Island. Vermont is a member of both groups. Finally, Delaware, the District of Columbia and New Hampshire are so dissimilar from any other state on the East Coast that each one is assigned to a separate group.



In the interior, four groups can be distinguished, with North Dakota being the most dissimilar from the other states and forming a group by itself.



Finally, the southern states form three groups with Louisiana being the most dissimilar from all other southern states. It can be speculated that the after-effects of Hurricane Katrina may have some bearing on Louisiana's degree of similarity from the other southern states.



County-Based Tech Cluster Specialization across Broad U.S. Regions

Specialization in Technology-Based Knowledge Occupations

The six tech clusters account for slightly more than 8 percent of all jobs in the United States. The vast majority of U.S. counties have a lower percentage of jobs in the six tech clusters than the national averages. In some counties, however, the percentage of jobs in one or more tech cluster exceeds the national percentage substantially. In this study, we consider an area as specializing in a tech cluster if the percentage of jobs in the cluster is at least 1.2 times as high as the respective percentage in the nation as a whole, that is, if the location quotient is greater than 1.2. Forty-three percent of all U.S. counties are specialized in at least one tech cluster. County specialization levels for every U.S. county can be seen on the project website by viewing Map Series C (Occupation Cluster LQ) at www.statsamerica.org/innovation/maps_next_regional_frontier_2009.aspx.

The following graphs show the percentage of counties specializing in the various tech clusters, separately for each broad region of the United States (as defined in Table 65). These data are then summarized at the end of the section in Table 66.

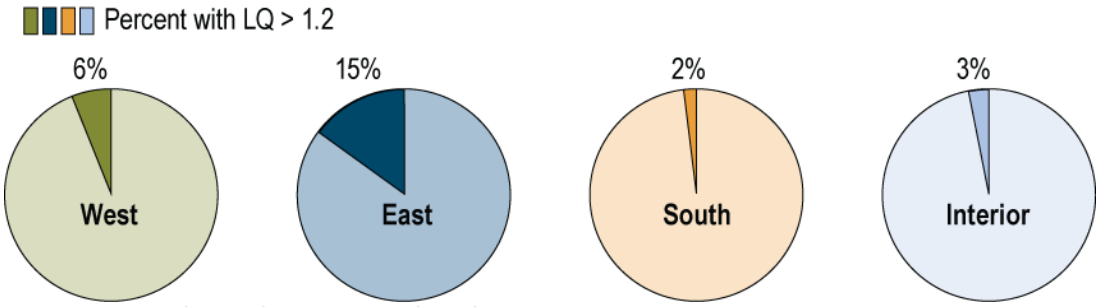
Table 65: Region Definitions

West (445 counties)	Interior (1,055 counties)	South (1,261 counties)	East (379 counties)
Alaska	Illinois	Alabama	Connecticut
Arizona	Indiana	Arkansas	Delaware
California	Iowa	Florida	District of Columbia
Colorado	Kansas	Georgia	Maine
Hawaii	Michigan	Kentucky	Maryland
Idaho	Minnesota	Louisiana	Massachusetts
Montana	Missouri	Mississippi	New Hampshire
Nevada	Nebraska	North Carolina	New Jersey
New Mexico	North Dakota	Oklahoma	New York
Oregon	Ohio	South Carolina	Pennsylvania
Utah	South Dakota	Tennessee	Rhode Island
Washington	Wisconsin	Texas	Vermont
Wyoming		West Virginia	Virginia

Source: Brigitte Waldorf, Dept. of Agricultural Economics, College of Agriculture, Purdue University

Information Technology: In the East, the proportion of counties specializing in information technology is much larger (almost 15 percent) than in any of the other regions (see Figure 86). In fact, specialization in information technology is almost non-existent in the South and the Interior. The West takes on a middle position with 6 percent of the counties specializing in information technology.

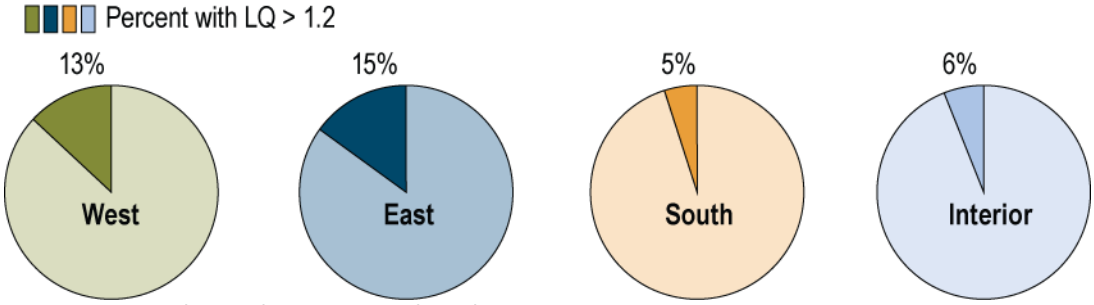
Figure 86: Percentage of Counties Specializing in Information Technology, 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Engineering: Specialization in engineering is most common in the East and the West (see Figure 87). Interestingly, engineering specialization in the South and the Interior is still quite rare, but not as uncommon as specialization in information technology.

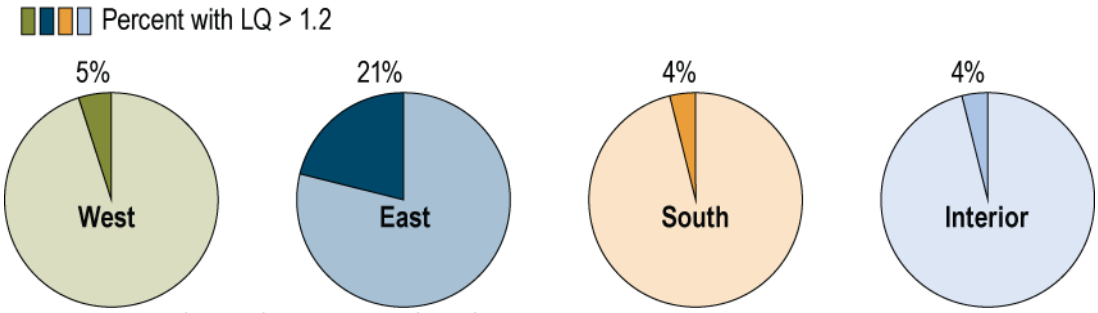
Figure 87: Percentage of Counties Specializing in Engineering, 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Medical Practitioners and Scientists: Specialization in this cluster is quite common in the East where more than one fifth of all counties exceed the specialization threshold (LQ of 1.2). In all other regions, it is quite rare (see Figure 88).

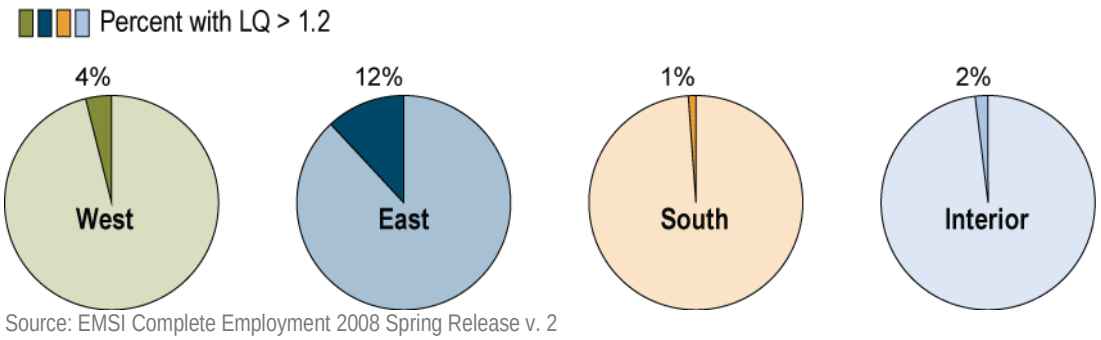
Figure 88: Percentage of Counties Specializing in Medical Practitioners and Scientists, 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Mathematics, Statistics, Data and Accounting: Nationwide, only 104 counties have a specialization in this tech cluster and half of those are located in the East. In the Interior and South, only a handful of counties specialize in the mathematics, statistics, data and accounting cluster (see Figure 89). In the South, four each are located in Texas and in North Carolina, and three each in Florida and Georgia. Alabama, Oklahoma, South Carolina and Tennessee have one county each. In the Interior, Illinois and Missouri have four counties specializing in the mathematics, statistics, data and accounting occupation cluster, Ohio has three, Indiana, Iowa, Kansas and Minnesota have two, Michigan and Nebraska have one, and the Dakotas and Wisconsin have none.

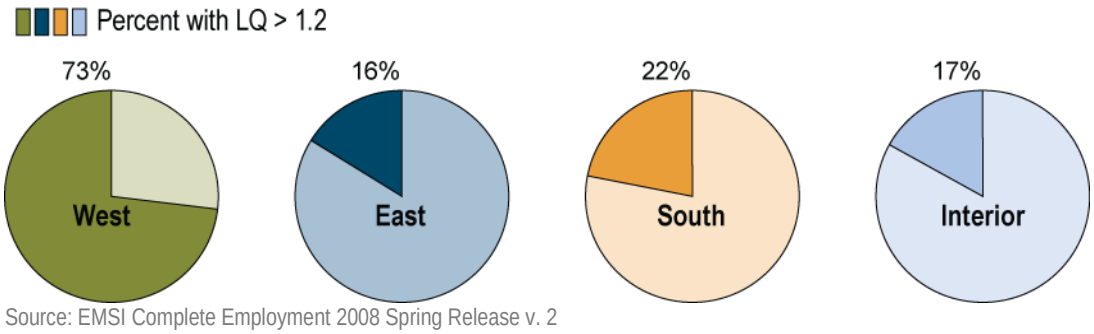
Figure 89: Percentage of Counties Specializing in Mathematics, Statistics, Data and Accounting, 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Natural Sciences and Environmental Management: The spatial distribution of counties specializing in the natural sciences and environmental management occupation cluster is quite different than for the other tech clusters. In the West, almost three-quarters (73.5 percent) of the counties specialize in natural sciences and environmental management; meanwhile, the percentage of specialized counties in the three other regions hovers around 15 percent (see Figure 90). In Wyoming, all counties are specialized in natural sciences and environmental management, followed by Montana (93 percent), Alaska (89 percent), Idaho (84 percent), and Oregon and Washington (80 percent each). California and Colorado are at the bottom of the ranking with 55 percent and 53 percent, respectively. Two plausible explanations for this occurrence is are: 1) the size and number of state and federally owned national parks and forests, reserves and wildlife habitats in the West; and 2) the proportionally higher number of endangered and threatened species in the West compared to the remainder of the United States.

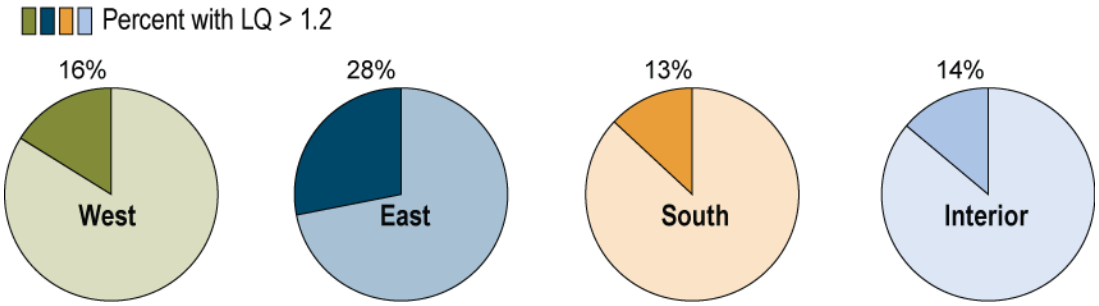
Figure 90: Percentage of Counties Specializing in Natural Sciences and Environmental Management, 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Postsecondary Education and Knowledge Creation: Specialization in postsecondary education and knowledge creation is most frequent in the East, where more than a quarter of all counties have an LQ that exceeds 1.2 (see Figure 91). For the three other regions, the percentage of counties specializing in the cluster hovers around 15 percent.

Figure 91: Percentage of Counties Specializing in Postsecondary Education and Knowledge Creation, 2007



Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 66: Summary of County-Level Specialization across Broad U.S. Regions, 2007

Tech Cluster	Percent of All U.S. Jobs	Specialization Threshold	Number of Counties Specialized in Tech Cluster (% of counties)			
			West	Interior	South	East
Information Technology	2.06%	2.47%	27 (6.1%)	27 (2.6%)	24 (1.9%)	56 (14.8%)
Engineering	1.11%	1.33%	57 (12.8%)	60 (5.7%)	62 (4.9%)	58 (15.3%)
Medical Practitioners and Scientists	1.18%	1.42%	22 (4.9%)	41 (3.9%)	52 (4.1%)	80 (21.1%)
Mathematics, Statistics, Data and Accounting	2.44%	2.93%	18 (4.0%)	21 (2.0%)	18 (1.4%)	47 (12.4%)
Natural Sciences &Environmental Management	0.44%	0.53%	327 (73.5%)	177 (16.8%)	273 (21.6%)	60 (15.8%)
Postsecondary Education & Knowledge Creation	1.15%	1.38%	71 (16.0%)	150 (14.2%)	165 (13.1%)	105 (27.7%)

Note: The specialization threshold corresponds to a location quotient of 1.2 and indicates the percentage of tech cluster jobs required to be categorized as being specialized in the cluster.

Source: EMSI Complete Employment 2008 Spring Release v. 2

Co-location of Tech Clusters

High positive correlation coefficients between the county percentages of jobs in the various tech clusters indicate their tendencies to be strongly represented in the same states. The county-level results are, by and large, consistent with the state-level results. In particular, the strong co-location among information technology; engineering; and mathematics, statistics, data and accounting is confirmed, for all U.S. counties as well as when zooming out to the four broad regions (see Table 67).

Table 67: Correlation Coefficients between County Percentages of Knowledge Occupation Clusters in United States and Broad Regions, 2007

United States	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.605	1.000				
MED	0.359	0.179	1.000			
MATH	0.844	0.516	0.443	1.000		
SCI	0.077	0.187	0.146	0.058	1.000	
ED	0.277	0.126	0.345	0.279	0.159	1.000

West	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.618	1.000				
MED	0.301	0.081	1.000			
MATH	0.822	0.518	0.358	1.000		
SCI	-0.062	0.195	0.044	-0.105	1.000	
ED	0.216	0.129	0.397	0.195	0.177	1.000

Interior	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.565	1.000				
MED	0.420	0.264	1.000			
MATH	0.844	0.528	0.439	1.000		
SCI	0.054	0.029	0.244	0.019	1.000	
ED	0.288	0.085	0.289	0.241	0.160	1.000

South	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.572	1.000				
MED	0.274	0.124	1.000			

South	IT	ENG	MED	MATH	SCI	ED
MATH	0.817	0.495	0.351	1.000		
SCI	0.094	0.231	0.211	0.177	1.000	
ED	0.263	0.083	0.336	0.271	0.230	1.000

East	IT	ENG	MED	MATH	SCI	ED
IT	1.000					
ENG	0.621	1.000				
MED	0.281	0.110	1.000			
MATH	0.842	0.487	0.460	1.000		
SCI	0.476	0.389	0.324	0.473	1.000	
ED	0.213	0.140	0.296	0.243	0.351	1.000

Source: EMSI Complete Employment 2008 Spring Release v. 2

The regional variation in the co-location patterns of the natural science and environmental management cluster is noteworthy. In the West, Interior and the South, the cluster does not co-locate with any of the other tech clusters. In the West, the correlation coefficient between the job share of the natural science and environmental management and the job shares of information technology and math/stats is actually negative. In contrast, in the East, the correlation coefficient is positive. The team speculated that the kind of natural science and environmental management jobs in the Northeast are fundamentally different from those in the West. Closer investigation into the structure and composition of this cluster by geographic location revealed some interesting results likely to be related to the degree of urbanization in the Northeast and to physical and biologic features (terrain, vegetation and wildlife) in the West. That is, in the Northeast, these jobs are more likely to occur in the area of regulation and prevention, while in the West they are more likely to occur in the area of conservation and preservation. Table 68 highlights the major differences between the two regions.

Table 68: East-West Differences in Occupation Concentrations in the Natural Science and Environmental Management Occupation Cluster, 2007

SOC Code	Natural Science and Environmental Management Selected Cluster Occupations	Western States % Share	Western States LQ	NE States % Share	NE States LQ
13-1041	Compliance officers, except agriculture, construction, health & safety, & transportation	25.2%	1.06	34.9%	1.21
19-2041	Environmental scientists and specialists, including health	12.0%	1.25	11.5%	1.01
19-4093	Forest and conservation technicians	8.0%	2.75	1.1%	0.33
17-3031	Surveying and mapping technicians	8.0%	0.92	7.3%	0.70

11-9121	Natural sciences managers	6.2%	1.46	6.9%	1.37
19-2042	Geoscientists, except hydrologists and geographers	5.6%	1.16	3.4%	0.60
19-1023	Zoologists and wildlife biologists	3.9%	1.93	1.5%	0.64
19-1029	Biological scientists, all other	3.9%	1.33	3.6%	1.04
19-4091	Environmental science and protection technicians, including health	3.8%	1.04	4.2%	0.99
19-1031	Conservation scientists	3.1%	1.27	2.3%	0.79
19-2043	Hydrologists	2.9%	1.22	2.0%	0.73
19-1021	Biochemists and biophysicists	2.6%	1.20	4.9%	1.91
17-1021	Cartographers and photogrammetrists	2.6%	1.44	2.0%	0.94
45-4011	Forest and conservation workers	2.3%	1.54	1.4%	0.78
19-1032	Foresters	2.3%	1.30	1.4%	0.68
19-4041	Geological and petroleum technicians	2.0%	1.36	0.7%	0.41
19-1013	Soil and plant Scientists	1.9%	1.34	1.2%	0.72
19-1022	Microbiologists	1.7%	1.01	3.0%	1.55
19-2021	Atmospheric and space scientists	1.5%	1.40	1.2%	0.98
19-1011	Animal scientists	0.5%	0.74	0.8%	0.91
33-2022	Forest fire inspectors and prevention specialists	0.2%	0.16	4.6%	3.20

Note: Numbers highlighted in red indicate areas of the greatest difference between the two regions. Western states include California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming and Arizona. Northeastern states include Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia and Connecticut.

Source: EMSI Complete Employment, v.2 2008

Regional Specialization

The tech cluster jobs are not evenly distributed across U.S. counties and regions. In other words, not every county or regional economy has the same percentage of jobs in IT, engineering, postsecondary education, etc. In fact there is quite a range of difference with Butte, Idaho, having the highest percentage of all tech cluster jobs combined (37.1 percent) and Chattahoochee, Ga., having the lowest percentage (1.3 percent).[52] An index of dissimilarity is used in this analysis to indicate the degree to which the geographic distribution of tech clusters vary from the norm (U.S. average percent of tech cluster jobs).

[52] In some counties and places, data for certain high-tech industries and government installations are suppressed. For example, Los Alamos, N.M., does not show up in the data, so that the county seems to have the lowest percentage of tech cluster jobs in the nation (less than 1 percent of its jobs in the tech cluster). Of course, this is not really the case, and the individual analyst must make adjustments where necessary to cover such discrepancies.

The dissimilarity in the distribution of tech cluster jobs across U.S. counties basically remained the same over the last seven years, with the dissimilarity index amounting to 14.6 percent in 2001 and 14.2 percent in 2007 (see Table 69). The dissimilarity across counties is most pronounced for information technology, engineering, and the natural sciences. It is least pronounced for medical practitioners and scientists. Interestingly, however, unlike at the state level, the postsecondary education cluster does not have a low dissimilarity index in either year. In each state, postsecondary education jobs are concentrated within a few counties (presumably the college towns/counties).

Table 69: Dissimilarity in the Distribution of Tech Cluster Jobs across Counties, 2001 and 2007

Cluster	2001	2007
Tech Clusters Combined	14.6	14.2
Information Technology	23.7	22.7
Engineering	20.6	19.9
Medical Practitioners and Scientists	10.6	10.6
Mathematics, Statistics, Data and Accounting	16.2	15.6
Natural Sciences and Environmental Management	20.5	20.3
Postsecondary Education and Knowledge Creation	19.3	19.6

Source: EMSI Complete Employment 2008 Spring Release v. 2

Within the four regions, the dissimilarity across counties tends to be highest in the Interior and in the South, followed by the East (see Table 70). In the West, counties are not as dissimilar from each other with respect to their shares of tech cluster jobs as in the rest of the nation, possibly because counties in the western United States tend to be bigger and more heterogeneous.

Table 70: Dissimilarity in the Distribution of Tech Cluster Jobs across Counties by Region, 2001 and 2007

Cluster	Year	West	Interior	South	East
Tech Clusters Combined	2001	12.7	14.2	14.8	12.8
	2007	12.3	14.0	14.0	13.0
Information Technology	2001	22.8	23.4	26.0	21.1
	2007	21.4	22.9	24.3	21.1
Engineering	2001	21.1	17.8	21.8	17.7
	2007	19.0	17.8	21.5	17.2
Medical Practitioners and Scientists	2001	6.4	10.3	11.0	9.9
	2007	6.7	10.6	10.6	9.9
Mathematics, Statistics, Data and Accounting	2001	13.2	16.5	16.4	15.8
	2007	12.7	15.9	15.8	15.5
Natural Sciences & Env. Mgmt	2001	21.1	19.1	18.9	18.0
	2007	20.7	19.4	18.9	17.9

Postsecondary Education and Knowledge Creation	2001	15.4	19.0	19.5	19.0
	2007	15.5	19.5	19.2	19.8

Source: EMSI Complete Employment 2008 Spring Release v. 2

Uneven Growth

At the state level, states with a small share of tech cluster jobs tend to have a slightly higher growth rate of tech cluster jobs than states with a large share. This yields a negative slope of the associated trend line. When zooming in to the smaller spatial scale of counties, the result is confirmed: the smaller the initial share, the higher the growth. However, as shown in the regression results (see Table 71) and the following graphs, some variation occurs across both tech clusters and regions.

Table 71: Regression Results—Dependent Variable: Percent Job Growth, 2001-2007

	IT		ENG		MED		MATH		SCI		ED	
	b	*t*	*b*	*t*	*b*	*t*	*b*	*t*	*b*	*t*	*b*	*t*
Intercept	13.579	9.998	15.130	10.990	19.443	9.774	8.807	5.891	8.538	9.284	15.811	13.016
West	6.348	2.925	0.944	0.448	5.074	1.268	6.816	2.813	6.241	3.448	6.457	2.633
South	5.291	2.990	-1.358	-0.716	9.175	3.355	2.683	1.357	8.357	6.006	3.550	2.144
East	-1.169	-0.464	-7.434	-2.744	-0.535	-0.133	0.888	0.350	5.208	2.137	5.821	2.389
2001 Share (%)	-5.447	-3.717	-15.895	-8.367	-12.926	-5.748	-2.687	-2.578	-6.177	-3.605	-4.270	-4.054
West*%	-0.662	-0.357	12.650	5.458	0.595	0.142	-0.188	-0.120	-0.409	-0.202	-2.244	-1.097
South*%	-1.049	-0.558	8.764	3.349	-3.771	-1.220	1.077	0.769	-7.630	-2.798	-0.876	-0.601
East*%	3.590	1.919	11.798	4.164	6.591	1.784	1.294	0.910	-7.826	-1.395	1.309	0.741
R Square	0.031		0.042		0.045		0.026		0.042		0.026	

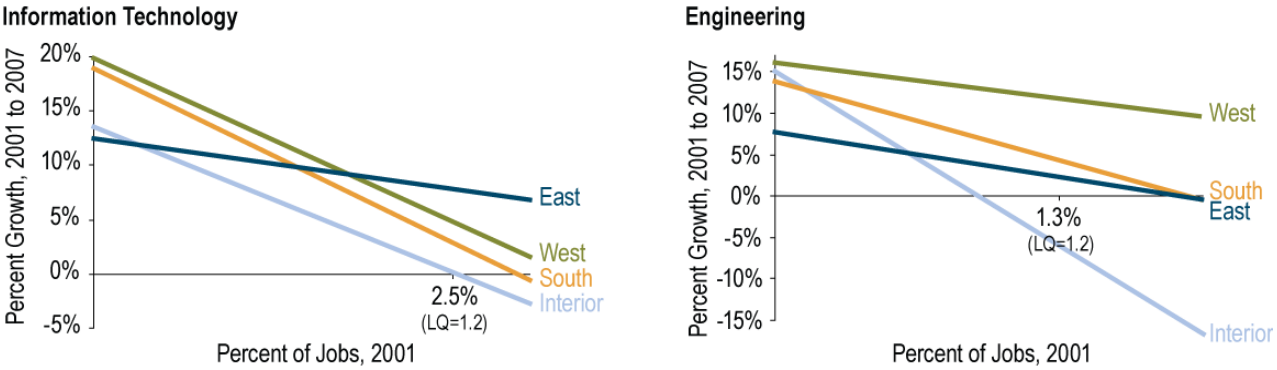
Note: The notation West*% is the name for the interaction formed by multiplying the variable "West" and the variable "2001 % Share."
Source: EMSI Complete Employment 2008 Spring Release v. 2

In Figure 92 though Figure 94, the horizontal axis shows the percentage of jobs in a tech cluster in the year 2001. It has a marker for the specialization threshold, i.e., the share of jobs at which the location quotient exceeds 1.2. The vertical axis shows the percentage growth of a tech cluster between 2001 and 2007. Each of the four lines represents the estimated relationships between the 2001 job share and the 2001-2007 job growth for the counties in one of the four regions.

For information technology jobs, the inverse relationship between initial job share and percentage job growth is most unfavorable in the interior counties (see Figure 92). In the Interior, counties not specializing in IT (percent jobs less than 2.47 percent) had some growth in the IT sector between 2001 and 2007 but the job growth is smaller than in comparable counties in the other regions. Moreover, counties in the interior that do specialize in IT experienced a decline in IT jobs. In counties in the Eastern region, IT job growth is estimated to be less affected by the initial share than in the other regions.

For engineering jobs, growth in the interior counties is estimated to be negative even below the specialization threshold of 1.3 percent. In contrast, the Western counties have the most favorable growth rates for engineering jobs.

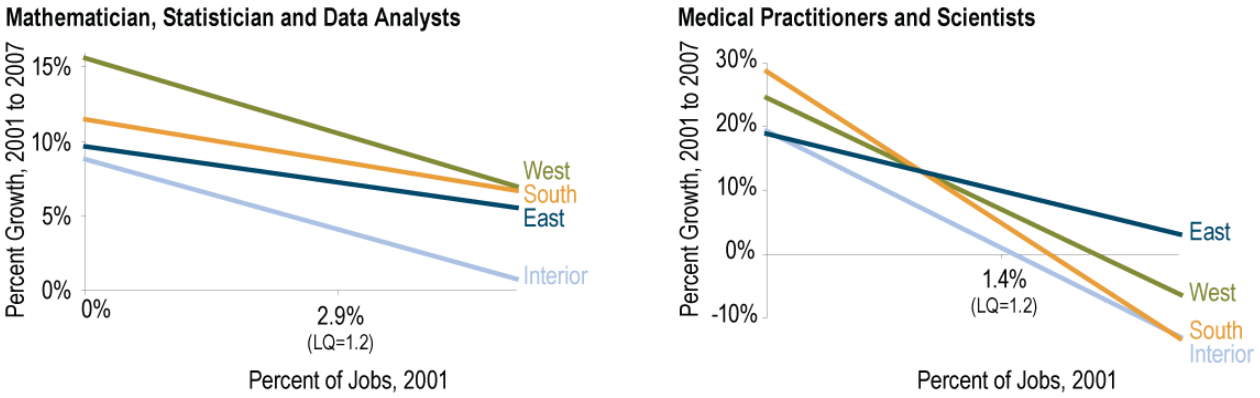
Figure 92: Job Share and Cluster Growth, IT and Engineering



Source: EMSI Complete Employment 2008 Spring Release v. 2

For both tech clusters shown in Figure 93, the interior counties have the most unfavorable job growth.

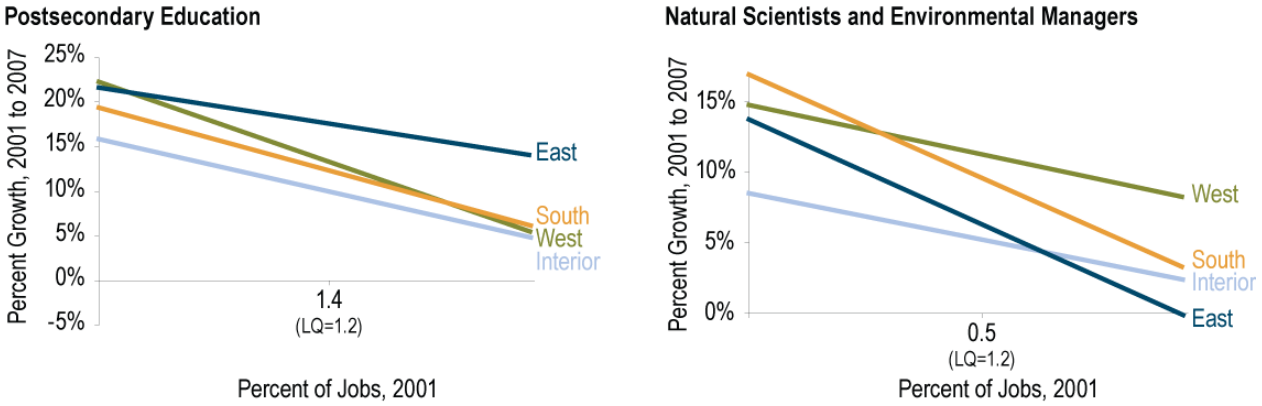
Figure 93: Job Share and Cluster Growth, Math/Stats and Medical Practitioners and Scientists



Source: EMSI Complete Employment 2008 Spring Release v. 2

Job growth in natural sciences and environmental management is weakest in the eastern and interior counties (see Figure 94). It is particularly noteworthy that counties specializing in natural sciences and environmental manager jobs (greater than 0.53 percent) have the highest growth rates in the West—the region where most counties already have a very strong representation in that tech cluster. Similarly, job growth in the postsecondary education cluster is strongest in the East—the region where postsecondary education is most strongly represented. *Both results suggest that current job growth patterns may exaggerate the existing regional disparities across the United States—an important finding.*

Figure 94: Job Share and Cluster Growth, Postsecondary Education and Natural Science and Environmental Management



Source: EMSI Complete Employment 2008 Spring Release v. 2

Technology Occupation Clusters in Indiana

Tech Clusters in Indiana

Indiana is not specialized in any of the tech occupation clusters (using a specialization threshold of LQ = 1.2). Table 72 shows that the highest location quotient is in postsecondary education and knowledge creation, but even that remains slightly smaller than 1 (although it has increased slightly between 2001 and 2007). Information technology is the most under-represented occupation cluster in Indiana.

Table 72: Location Quotients of Tech Clusters in Indiana, 2001 and 2007

Tech Cluster	2001	2007
Information Technology	0.63	0.67
Engineering	0.84	0.87
Medical Practitioners and Scientists	0.88	0.89
Mathematics, Statistics, Data and Accounting	0.73	0.74
Natural Sciences and Environmental Management	0.75	0.75
Postsecondary Education and Knowledge Creation	0.96	0.98

Source: EMSI Complete Employment 2008 Spring Release v. 2

Tech Cluster Specialization across Indiana Counties

Although the Indiana economy as a whole is not specialized in any of the tech clusters, Indiana's landscape of tech cluster knowledge occupations is not uniformly flat but has some distinct geographic peaks of tech cluster specialization. First, the most specialized counties are identified, followed by an exploration of the relationship between rurality and tech cluster specialization.

Tech Cluster Specialized Counties

Martin, Monroe, and Tippecanoe counties are specialized in tech cluster occupations (see Table 73). When using the location quotient of the combined six tech clusters, three counties meet the specialization threshold of LQ ≥ 1.2 both in 2001 and 2007. Moreover, for all three counties the LQ increased between 2001 and 2007. Table 74 through Table 79 show the top LQs for the individual tech clusters.

Table 73: Top 10 Location Quotients for Tech Clusters Combined by Indiana County, 2001 and 2007

Rank	County	2001	2007
1	Martin	1.77	2.16
2	Monroe	1.39	1.48
3	Tippecanoe	1.20	1.24
4	Marion	1.08	1.11
5	Hamilton	1.04	1.02
6	Putnam	1.00	0.92
7	Grant	0.96	0.90
8	St. Joseph	0.94	1.00
9	Allen	0.91	0.90
10	Jefferson	0.90	0.84

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 74: Top 10 Location Quotients for Information Technology by Indiana County, 2001 and 2007

Rank	County	2001	2007
1	Martin	1.26	2.17
2	Hamilton	1.22	1.29
3	Marion	1.06	1.13
4	Allen	0.93	0.98
5	St. Joseph	0.80	0.86
6	Monroe	0.73	0.74
7	Tippecanoe	0.70	0.79
8	Pike	0.67	0.69
9	Bartholomew	0.66	0.74
10	Johnson	0.66	0.71

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 75: Top 10 Location Quotients for Engineering by Indiana County, 2001 and 2007

Rank	County	2001	2007
1	Martin	5.26	6.33
2	Pike	2.02	2.16
3	Dubois	1.61	1.31

4	Posey	1.58	1.74
5	Ripley	1.51	1.46
6	Bartholomew	1.50	1.58
7	Wabash	1.50	1.18
8	Jefferson	1.40	1.36
9	Huntington	1.35	1.49
10	Spencer	1.16	1.13

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 76: Top 10 Location Quotients for Medical Practitioners and Scientists by Indiana County, 2001 and 2007

Rank	County	2001	2007
1	Martin	1.53	1.52
2	Boone	1.25	1.05
3	Delaware	1.24	1.29
4	Hamilton	1.20	1.14
5	Warrick	1.16	1.24
6	Jefferson	1.12	1.05
7	Marion	1.08	1.08
8	Floyd	1.03	0.87
9	Vanderburgh	1.03	1.07
10	Vigo	1.02	1.11

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 77: Top 10 Location Quotients for Mathematics, Statistics, Data and Accounting by Indiana County, 2001 and 2007

Rank	County	2001	2007
1	Hamilton	1.36	1.28
2	Martin	1.16	1.58
3	Marion	1.03	1.05
4	Ripley	0.94	0.80
5	Jasper	0.90	1.14
6	Allen	0.85	0.83
7	St. Joseph	0.83	0.84
8	Floyd	0.80	0.80
9	Hancock	0.79	0.84
10	Boone	0.77	0.78

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 78: Top 10 Location Quotients for Natural Science and Environmental Management by Indiana County, 2001 and 2007

Rank	County	2001	2007
1	Martin	2.27	2.30
2	Marion	1.55	1.60
3	Posey	1.55	1.63
4	Hancock	1.18	1.12
5	Tippecanoe	1.03	1.00
6	Monroe	1.02	1.16
7	Vermillion	1.01	1.00
8	Vanderburgh	0.90	0.94
9	Sullivan	0.89	0.83
10	Putnam	0.83	0.80

Source: EMSI Complete Employment 2008 Spring Release v. 2

Table 79: Top 10 Location Quotients for Postsecondary Education and Knowledge Creation by Indiana County, 2001 and 2007

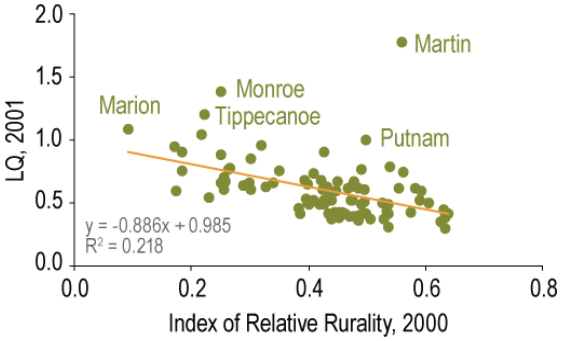
Rank	County	2001	2007
1	Monroe	4.83	5.16
2	Tippecanoe	3.52	3.50
3	Putnam	3.07	2.56
4	Grant	2.63	2.52
5	Delaware	2.05	1.97
6	Sullivan	1.98	1.87
7	St. Joseph	1.72	2.04
8	Vigo	1.70	1.70
9	Parke	1.65	1.66
10	Jefferson	1.61	1.47

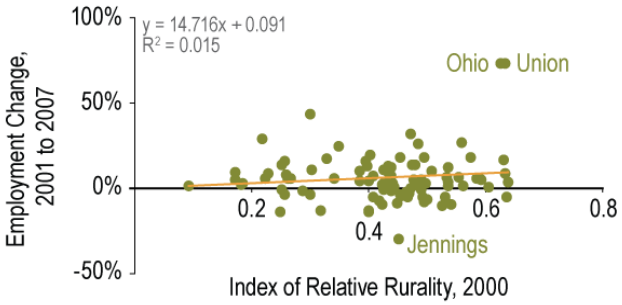
Source: EMSI Complete Employment 2008 Spring Release v. 2

Tech Cluster Specialization and Rurality

In general, the location quotients of tech clusters decline with increasing rurality in Indiana. As shown in Figure 95 through Figure 101, this relationship holds true for all six tech clusters combined, as well as for individual tech clusters (with the exception of engineering). The inverse relationship between tech cluster specialization and rurality is strongest for postsecondary education, medical practitioners/scientists, and information technology. Martin County is a clear outlier. It is a rather rural county but is heavily specialized in tech cluster occupations due to the presence of a military base (Naval Surface Warfare Center–Crane).

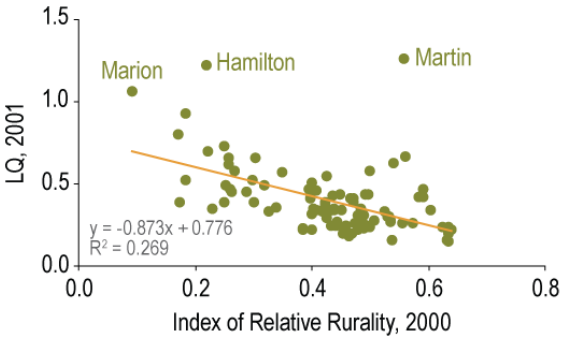
Figure 95: All Tech Clusters Combined, Indiana

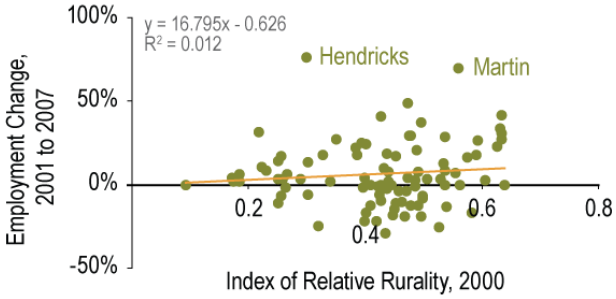




Source: EMSI Complete Employment 2008 Spring Release v. 2

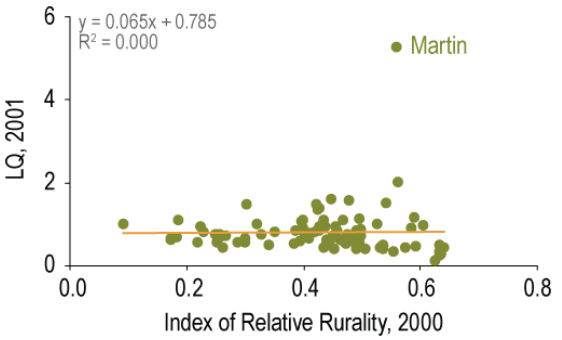
Figure 96: Information Technology, Indiana

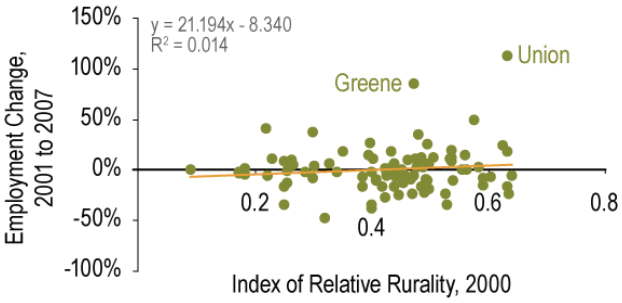




Source: EMSI Complete Employment 2008 Spring Release v. 2

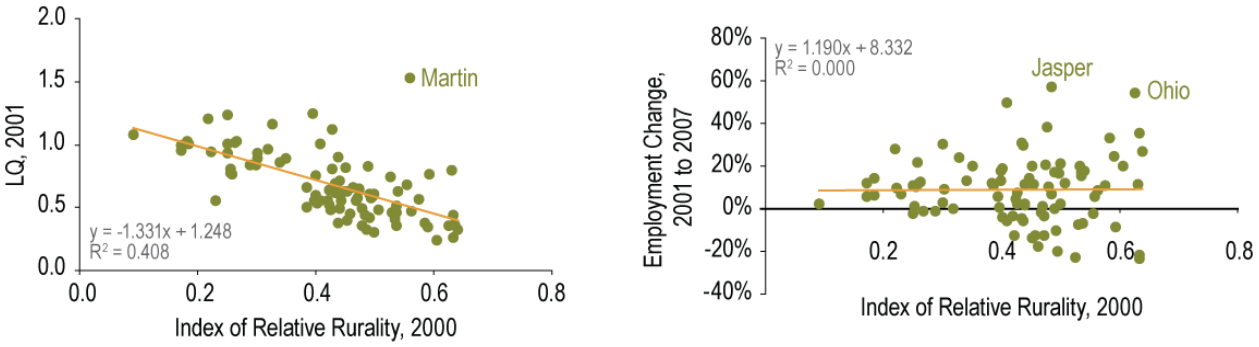
Figure 97: Engineering, Indiana





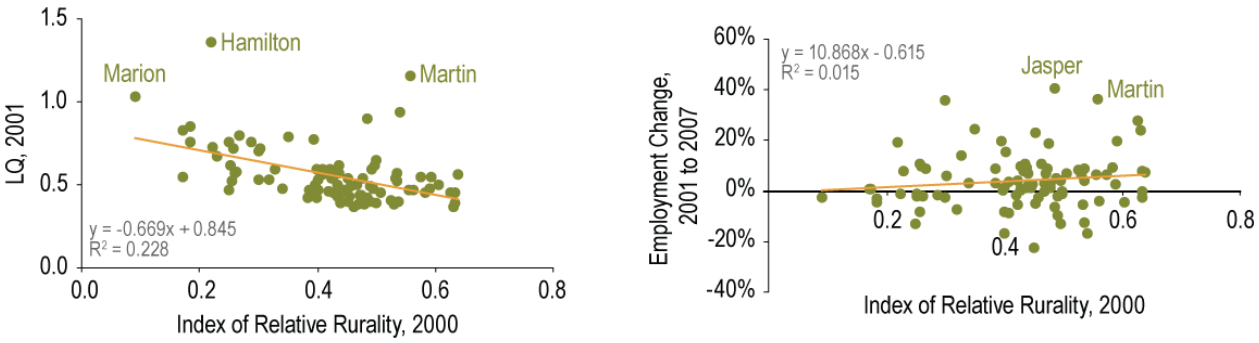
Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 98: Medical Practitioners and Scientists, Indiana



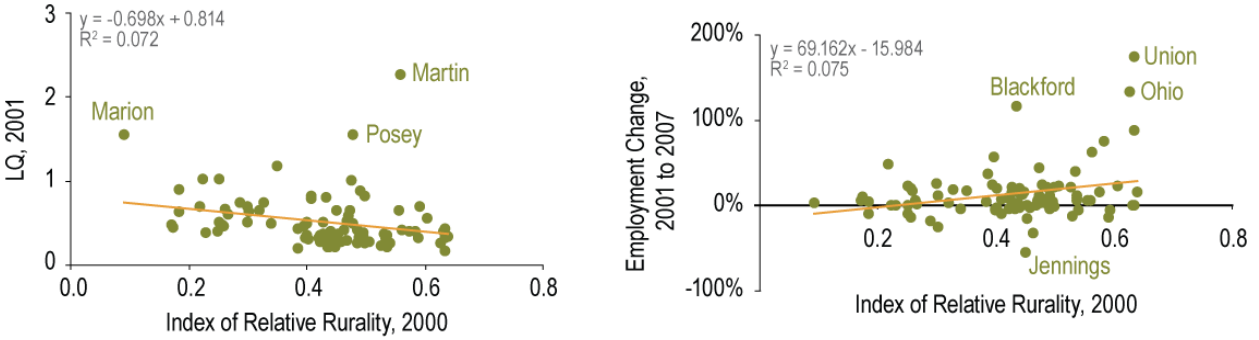
Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 99: Mathematics, Statistics, Data and Accounting, Indiana



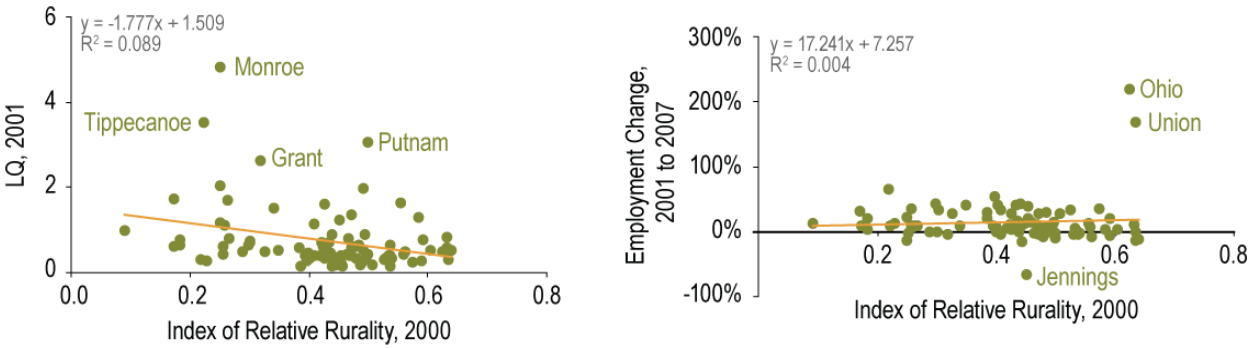
Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 100: Natural Sciences and Environmental Management, Indiana



Source: EMSI Complete Employment 2008 Spring Release v. 2

Figure 101: Postsecondary Education and Knowledge Creation, Indiana



Source: EMSI Complete Employment 2008 Spring Release v. 2

There is no statistical relationship between rurality and employment growth in the tech clusters in Indiana (see Table 80). Ohio and Union counties are worth noting because they belong to the group of most rural counties in Indiana and have seen exceptional growth in tech cluster jobs in recent years.

Table 80: The Effect of Rurality on LQs and Employment, Indiana

	LQ in 2001 [1]		Employment Change [2]	
Tech Cluster	b	R^2	b	R^2
All Tech Clusters Combined	–0.866	0.218	14.716	0.015
Information Technology	–0.873	0.269	16.795	0.012
Engineering	0.065	0.000	21.194	0.014
Medical Practitioners and Scientists	–1.331	0.408	1.190	0.000
Mathematics, Statistics, Data and Accounting	–0.669	0.228	10.868	0.015
Natural Sciences and Environmental Management	–0.698	0.072	69.162	0.075
Postsecondary Education and Knowledge Creation	–1.777	0.089	17.241	0.004

[1] Slope (b) and R^2 of the bivariate regression $LQ_{2001} = a + b\ IRR_{2000} + e$, estimated separately for each tech cluster where *IRR* is the index of relative rurality and *LQ* is the location quotient.

[2] Slope (b) and R^2 of the bivariate regression $\Delta E_{01\text{-}07} = a + b\ IRR_{2000} + e$, estimated separately for each tech cluster where *IRR* is the index of relative rurality and $\Delta E_{01\text{-}07}$ is the change in jobs between 2001 and 2007.

Source: EMSI Complete Employment 2008 Spring Release v. 2

Occupation-Industry Linkages in Indiana: Tech Cluster Specialization by Industry Cluster

Indiana specializes in five major industry clusters, and five of the six sub-clusters of the manufacturing supercluster, using a specialization threshold of LQ = 1.2 (see Table 81).

Table 81: Indiana's Industry Clusters

Industry Cluster	LQ 2001	LQ 2007	Percent Change
Industry Cluster with LQ ≥1.2			
Primary Metal Manufacturing Sub-Cluster	4.79	4.67	-2.4
Transportation Equipment Manufacturing Sub-Cluster	3.20	3.50	9.1
Biomedical/Biotechnical (Life Sciences)	3.24	3.16	-2.6
Manufacturing Supercluster	2.06	2.18	5.7
Advanced Materials	1.92	1.91	-0.4
Chemicals & Chemical Based Products	1.73	1.82	5.1
Fabricated Metal Product Manufacturing Sub-Cluster	1.73	1.75	1.1
Machinery Manufacturing Sub-Cluster	1.67	1.75	4.6
Transportation & Logistics	1.25	1.30	4.2
Electrical Equipment, Appliance & Component Manufacturing Sub-Cluster	1.55	1.20	-22.6
Industry Cluster with LQ <1.2			
Forest & Wood Products	1.15	1.11	-3.4
Glass & Ceramics	1.09	1.07	-2.4
Mining	0.98	0.93	-4.4
Agribusiness, Food Processing & Technology	0.85	0.92	7.7
Printing & Publishing	0.77	0.82	6.2
Computer & Electronic Product Manufacturing Sub-Cluster	0.69	0.75	8.9
Arts, Entertainment, Recreation & Visitor Industries	0.73	0.69	-4.4
Defense & Security	0.63	0.68	7.4
Apparel & Textiles	0.45	0.66	47.3
Business & Financial Services	0.64	0.64	0.6
Energy (Fossil & Renewable)	0.61	0.56	-9.4
Information Technology & Telecommunications	0.51	0.46	-8.7
Education & Knowledge Creation	0.36	0.38	4.5

Note: Italics indicate sub-clusters of the manufacturing supercluster
Source: PCRD, using QCEW data supplied by the IBRC

Although the Indiana economy as a whole is not specialized in any of the tech clusters, a few vitally important industry clusters show a strong specialization in some of the tech clusters (see Table 82). Most importantly, the primary metal industry cluster specializes intensely in all six tech groups as does the chemicals and chemical-based products industry cluster. The fabricated metal products industry cluster specializes in all but the medical occupations cluster, while the machinery manufacturing industry cluster specializes in all but the medical and natural science occupation clusters. The transportation equipment manufacturing industry cluster specializes in the engineering; mathematics, statistics and accounting; and the postsecondary education and knowledge creation occupation clusters. The electrical equipment manufacturing industry cluster is weakly

specialized in engineering occupations while the transportation and logistics industry cluster, does not specialize in any of the knowledge-based tech occupation clusters. Both the biomedical and the advanced materials clusters specialize in the natural sciences and environmental management occupation cluster.

Additionally, several of the industry clusters that have an LQ less than 1.2 in the Indiana economy have a specialization in tech occupation clusters including: IT, engineering, mathematics, and postsecondary education and knowledge creation in the glass and ceramics industry cluster; engineering and postsecondary education in the agribusiness and food processing industry cluster; IT, engineering, and mathematics in the forest and wood products industry cluster; along with natural science and environmental management specialization in the arts, entertainment, recreation and visitor industries cluster and mathematics, statistics, data and accounting occupations in the apparel and textile industry cluster.

Table 82: Indiana's Tech Occupation Cluster OCIC Location Quotients, 2007

Industry Cluster	IT	ENG	MED	MATH	SCI	ED
Industry Cluster with LQ ≥1.2						
Primary Metal Manufacturing Sub-Cluster	**4.82**	**4.68**	**2.27**	**3.58**	**2.27**	**5.33**
Transportation Equipment Manufacturing Sub-Cluster	0.87	**1.33**	0.60	**1.88**	0.67	**2.11**
Chemicals & Chemical Based Products	**1.93**	**1.80**	**1.30**	**1.70**	**4.10**	**1.98**
Fabricated Metal Product Manufacturing Sub-Cluster	**1.37**	**1.46**	0.91	**1.42**	**1.53**	**1.62**
Machinery Manufacturing Sub-Cluster	**1.45**	**1.70**	0.73	**1.46**	0.85	**1.39**
Manufacturing Supercluster	0.63	**1.13**	0.73	**1.24**	0.85	**1.29**
Biomedical/Biotechnical (Life Sciences)	0.78	1.00	1.05	0.98	**1.57**	1.13
Advanced Materials	0.68	1.08	0.57	1.13	**1.57**	1.11
Electrical Equipment, Appliance & Components Sub-Cluster	1.12	1.19	0.00	0.97	0.00	0.76
Transportation & Logistics	0.86	0.63	0.51	1.01	0.59	0.71
Industry Cluster with LQ <1.2						
Glass & Ceramics	**1.53**	**1.61**	0.00	**1.41**	0.00	**2.04**
Agribusiness, Food Processing & Technology	0.93	**1.40**	0.42	0.95	0.52	**1.52**
Forest & Wood Products	**1.29**	**1.53**	0.09	**1.33**	0.39	1.08
Education & Knowledge Creation	0.80	0.99	0.87	0.87	1.05	0.90
Business & Financial Services	0.53	0.59	0.51	0.63	0.78	0.70
Arts, Entertainment, Recreation & Visitor Industries	0.63	0.75	0.86	0.60	**1.39**	0.65
Computer & Electronic Product Manufacturing Sub-Cluster	0.46	0.67	0.75	0.59	0.75	0.65
Printing & Publishing	0.62	0.71	0.55	0.70	0.64	0.65
Energy (Fossil & Renewable)	0.62	0.56	0.22	0.48	0.68	0.60
Defense & Security	0.51	0.46	0.22	0.59	0.56	0.58
Information Technology & Telecommunications	0.54	0.60	0.23	0.53	0.51	0.49
Apparel & Textiles	0.68	0.62	0.17	0.67	**1.33**	0.40
Mining	1.00	0.69	0.85	1.06	0.36	0.00

Note: Bold numbers indicate an LQ greater than or equal to 1.2
Source: EMSI Complete Employment 2008 Spring Release v. 2

Appendix E: Knowledge Variables and Descriptions

Administration and Management—Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.

Biology—Knowledge of plant and animal organisms, their tissues, cells, functions, interdependencies, and interactions with each other and the environment.

Building and Construction—Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.

Chemistry—Knowledge of the chemical composition, structure, and properties of substances and of the chemical processes and transformations that they undergo. This includes uses of chemicals and their interactions, danger signs, production techniques, and disposal methods.

Clerical—Knowledge of administrative and clerical procedures and systems such as word processing, managing files and records, stenography and transcription, designing forms, and other office procedures and terminology.

Communications and Media—Knowledge of media production, communication, and dissemination techniques and methods. This includes alternative ways to inform and entertain via written, oral, and visual media.

Computers and Electronics—Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

Customer and Personal Service—Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

Design—Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.

Economics and Accounting—Knowledge of economic and accounting principles and practices, the financial markets, banking and the analysis and reporting of financial data.

Education and Training—Knowledge of principles and methods for curriculum and training design, teaching and instruction for individuals and groups, and the measurement of training effects.

Engineering and Technology—Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

English Language—Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.

Fine Arts—Knowledge of the theory and techniques required to compose, produce, and perform works of music, dance, visual arts, drama, and sculpture.

Food Production—Knowledge of techniques and equipment for planting, growing, and harvesting food products (both plant and animal) for consumption, including storage/handling techniques.

Foreign Language—Knowledge of the structure and content of a foreign (non-English) language including the meaning and spelling of words, rules of composition and grammar, and pronunciation.

Geography—Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.

History and Archeology—Knowledge of historical events and their causes, indicators, and effects on civilizations and cultures.

Law and Government—Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.

Mathematics—Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.

Mechanical—Knowledge of machines and tools, including their designs, uses, repair, and maintenance.

Medicine and Dentistry—Knowledge of the information and techniques needed to diagnose and treat human injuries, diseases, and deformities. This includes symptoms, treatment alternatives, drug properties and interactions, and preventive health-care measures.

Personnel and Human Resources—Knowledge of principles and procedures for personnel recruitment, selection, training, compensation and benefits, labor relations and negotiation, and personnel information systems.

Philosophy and Theology—Knowledge of different philosophical systems and religions. This includes their basic principles, values, ethics, ways of thinking, customs, practices, and their impact on human culture.

Physics—Knowledge and prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub-atomic structures and processes.

Production and Processing—Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

Psychology—Knowledge of human behavior and performance; individual differences in ability, personality, and interests; learning and motivation; psychological research methods; and the assessment and treatment of behavioral and affective disorders.

Public Safety and Security—Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.

Sales and Marketing—Knowledge of principles and methods for showing, promoting, and selling products or services. This includes marketing strategy and tactics, product demonstration, sales techniques, and sales control systems.

Sociology and Anthropology—Knowledge of group behavior and dynamics, societal trends and influences, human migrations, ethnicity, cultures and their history and origins.

Telecommunications—Knowledge of transmission, broadcasting, switching, control, and operation of telecommunications systems.

Appendix F: The EMSI "Complete Employment" Data Set

Introduction and Rationale

QCEW-derived data are a widely used resource in regional/local economic and labor market research. However, they exclude some payroll jobs and all non-payroll jobs such as proprietors and partners. Particularly in some sectors, such as agriculture, construction, professional/technical services, or real estate, non-payroll workers may have a very significant presence.

EMSI seeks to overcome this limitation of QCEW with its Complete Employment dataset. This data set attempts to record nearly every job in every sector at the local level.

Data Sources Used for EMSI Complete Employment

- EMSI Covered Employment
- Nonemployer Statistics (NES), Census Bureau
- Regional Economic Accounts and State/Local Personal Income reports, Bureau of Economic Analysis
- Current Employment Statistics, Bureau of Economic Analysis
- County Business Patterns (CBP), Census Bureau
- Ten-Year Industry Projections (BLS; various state agencies)

Employment Coverage of EMSI Complete Employment

EMSI's Complete Employment dataset has a significantly expanded definition of "jobs" compared to EMSI Covered Employment. As a result, job numbers in most areas are significantly higher. Since many non-covered jobs are part-time, and a person can hold more than one job, this is to be expected.

Whereas EMSI *Covered* Employment matches the coverage of the Bureau of Labor Statistics' Quarterly Census of Employment and Wages, EMSI *Complete* Employment uses Bureau of Economic Analysis data (www.bea.gov/bea/regional/) as its top-level benchmark, with a few adjustments. In addition to covered jobs taken care of by QCEW, BEA data attempt to count all types of paid employment.

Apart from farm employment, perhaps the most important class of workers excluded from QCEW but included in BEA data is the self-employed, which includes sole proprietorships and partnerships. Like covered jobs, self-employed jobs include both full- and part-time positions (e.g., one worker with a covered wage/salary job and self-employment on the side would be counted as two jobs). Unlike covered jobs, self-employed jobs from BEA data (1) may be reported geographically by place of residence *or* place of work (since they are based on the self-employed workers' tax returns which may show a business or home address); and (2) represent the sum of all self-employed jobs existing at any time during the year, instead of an annual average. For these reasons, EMSI Complete Employment job figures may appear inflated to some researchers, especially those who are used to looking at covered employment only.

Industry Earnings in EMSI Complete Employment

In EMSI Complete, industry earnings are the total of three components:

- **Wages and salaries**
- **Supplements to wages and salaries:** Includes employer contributions to employee pension and insurance funds (private and/or government) as well as employer contributions to government social insurance.
- **Proprietors' earnings:** For nonfarm proprietors, this is generally what is reported as "net-profit-less-loss" to the IRS on forms 1040 and 1065); however, see the "Smoothing the BEA's Proprietor Earnings" section for important adjustments that EMSI makes to proprietors' earnings.

Note that the "supplements to wages and salaries" component is defined very differently from the one used by the EMSI Covered Employment dataset, even though both are called "supplements." For more information, see the Bureau of Economic Analysis's glossary definition of "Earnings by Place of Work" (www.bea.gov/regional/definitions/).

Methodology for Creating EMSI Complete Employment

In order to capture its complete picture of historical industry employment and earnings, EMSI basically combines covered employment data from Quarterly Census of Employment and Wages (QCEW) produced by the Department of Labor with total employment data published by the Bureau of Economic Analysis (BEA), augmented with County Business Patterns (CBP) and Nonemployer Statistics (NES) published by the U.S. Census Bureau.

The process is not nearly as simple as this description makes it appear; there are literally hundreds of details that must be worked out in order for this process to yield valid data, and millions of data points must be processed. EMSI has spent thousands of staff hours gaining a complete understanding of the data sources involved, and even with several powerful computers, the process takes many hours to complete.

The primary steps in the process are as follows:

1. Perform the EMSI *Covered* Employment process (see above)
2. Create a dataset of "non-covered" jobs
    a. Unsuppress and extend Nonemployer Statistics (NES) to six-digit 2002 NAICS.
    b. Combine this modified NES with BEA State/Local Income Reports to produce farm and non-farm proprietor-by-industry estimates at the county level. For the most recent years, BEA/NES data may not be available, so EMSI uses projections to move the datasets forward. During this process we also "smooth" BEA proprietor earnings (see below).
    c. Estimate non-covered wage and salary (non-proprietor) employment by county using County Business Patterns.
3. Now the three basic data sets we need are built: (1) covered jobs, (2) non-covered proprietors, and (3) non-covered wage and salary jobs. Next EMSI combines the three to arrive at complete employment estimates by county. Again, there are hundreds of details to be worked out in the process, but they are proprietary to EMSI and beyond the scope of this document.

4. Geography adjustment: at this point, there may be aggregation error due to slightly different estimates at the county, state, and national levels. So EMSI performs a national adjustment to ensure that employment figures aggregate correctly for various geographies.
5. For the current and up to two most recent years, BEA data is projected from published data (which generally is one to two years old) using QCEW, which are updated more frequently.
6. After historical data are finalized, EMSI creates 10-year projections using 15-year past trends and projections produced by state/federal agencies. This process is beyond the scope of this document.
7. Finally, EMSI uses ZIP Code Business Patterns and USPS delivery statistics to create ZIP code industry employment estimates and projections. This process is beyond the scope of this document.

Smoothing the BEA's Proprietor Earnings

There is one issue in BEA proprietors' income that EMSI seeks to correct, and which can cause significant differences between earnings in BEA data and earnings in EMSI Complete Employment. In reporting proprietors' income, the BEA has blurred the line between labor and capital (or "property") income, while its primary intent is to report only labor income. To understand the problem further, let's get some background first. While a salaried employee's income is usually 100 percent labor income, proprietors are different because they are self-employed and may own capital or property used in their business. To take a simple example, a proprietor who owns a trucking business and owns the eighteen-wheeler he drives is receiving income from both his labor and his capital.

Proprietor income reported by the BEA is calculated from income tax forms and basically represents "net profit less loss." Because of this, it can vary wildly from year to year for a given industry and county as proprietors experience boom and bust cycles or simply take a loss on capital investments. The industry total for a county can even be negative.

This poses two problems for EMSI's data process:

- EMSI's input/output model depends on data for a single "base year" to calculate impact scenarios. If data for that base year is atypical or varies greatly from year to year, model results will be unreliable. The model needs an "average" base year of data.
- Labor market researchers need to know if a given industry for proprietors is generally profitable and pays well. This can be obscured in year-to-year swings.

Admittedly, it is sometimes impossible to separate the two types of earnings for proprietors, but EMSI believes that the raw numbers reported by the BEA require some interpretation in order to be usable by input-output models and labor market researchers, especially when they exhibit significant year-to-year variations in the same county and industry. Accordingly, EMSI *smoothes* proprietor earnings using Nonemployer Statistics (NES, another source for proprietor income) by analyzing the variation between NES and the BEA in industry-specific earnings across all states. In effect, EMSI gravitates toward the NES figure when this variation is high.

Appendix G: Technical Description of the Clustering Process

Ward's clustering procedure belongs to the family of hierarchical clustering. The clustering method seeks to minimize within cluster variation based on the differences in measurements for the 33 knowledge variables for each occupation. The differences in this context are measured in terms of Euclidean distance. The within cluster variation is considered minimized when the sum of squared deviations from the measured knowledge variables (i.e., points) to centroids cannot be reduced any further. The algorithm is given a subjective restriction in the number of clusters formulated.[53] In other words, if the user desires 40 clusters, then the algorithm will optimize within cluster variation for 40 clusters.

Ward's clustering process is good for determining cluster patterns in a large multivariate set of data. One shortcoming, however, is the clustering process is sensitive to outlier observations. The outliers "pull" the centroids away from occupation observations that may have otherwise further minimized within cluster variance. In order to circumvent this shortcoming, outlier occupations were identified and removed from the clustering process.

Data Standardization and Augmentation

Measuring the knowledge variable characterization based on the current scales (0 to 5 for knowledge importance and 1 to 7 for knowledge level) posed a challenge when using Ward's clustering method. The degree of difference between the measurements can become skewed when using a clustering method that is based on Euclidean distance between variables. To bypass this issue, both measurements were standardized on a scale from 0 to 10. Additionally, as per the goal of the knowledge occupation cluster development, larger weight was given to knowledge level. The reasoning for this augmentation was to highlight and separate knowledge depth/specialization from knowledge breadth. To this end, knowledge level was squared. This allows a non-linear component of knowledge level identification and measurement to emphasize occupation specialization. Furthermore, knowledge importance was maintained within the clustering process in order to maintain occupational shape. Occupational shape in this sense is the multivariate description of the knowledge importance components of a given occupation. In other words, job shape describes the key aspects of knowledge necessary to perform a given occupation.

Results

Once outliers are removed (e.g., by removing Job Zone 1 and Job Zone 2 codes), Ward's clustering algorithm was utilized to develop knowledge occupation clusters. The goal of the clustering algorithm is to provide an objective, statistically driven process to identify clusters of occupations that share similar constructs of knowledge. However, subjectivity and evaluation remains a component in the entire clustering process in order to create occupation clusters that can be used by regional practitioners.

[53] In this case, centroids are a vector of variable means for the cluster observations that serve as a cluster midpoint.

Appendix H: Occupation Cluster Definitions

The following tables provide the standard occupational classification (SOC) codes and names for the 15 knowledge-based occupation clusters, as well as Job Zones 1 and 2.

Managerial, Sales, Marketing and HR

SOC	SOC Name
11-1011	Chief executives
11-1021	General and operations managers
11-2011	Advertising and promotions managers
11-2021	Marketing managers
11-2022	Sales managers
11-2031	Public relations managers
11-3011	Administrative services managers
11-3031	Financial managers
11-3041	Compensation and benefits managers
11-3042	Training and development managers
11-3049	Human resources managers, all other
11-3061	Purchasing managers
11-3071	Transportation, storage, and distribution managers
11-9051	Food service managers
11-9071	Gaming managers
11-9081	Lodging managers
11-9131	Postmasters and mail superintendents
11-9141	Property, real estate, and community association managers
13-1022	Wholesale and retail buyers, except farm products
13-1071	Employment, recruitment, and placement specialists
13-1072	Compensation, benefits, and job analysis specialists
13-1081	Logisticians
13-1111	Management analysts
13-1121	Meeting and convention planners
19-3021	Market research analysts
19-3022	Survey researchers
27-3031	Public relations specialists
35-1011	Chefs and head cooks
41-1012	First-line supervisors/managers of non-retail sales workers
41-3011	Advertising sales agents

SOC	SOC Name
41-3031	Securities, commodities, and financial services sales agents
41-4011	Sales representatives, wholesale and manufacturing, technical and scientific products
41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products
41-9031	Sales engineers
43-1011	First-line supervisors/managers of office and administrative support workers
43-4161	Human resources assistants, except payroll and timekeeping

Skilled Production Workers: Technicians, Operators, Trades, Installers & Repairers

SOC	SOC Name
11-3051	Industrial production managers
11-9021	Construction managers
17-2141	Mechanical engineers
17-3012	Electrical and electronics drafters
17-3027	Mechanical engineering technicians
37-1011	First-line supervisors/managers of housekeeping and janitorial workers
47-1011	First-line supervisors/managers of construction trades and extraction workers
47-2022	Stonemasons
47-2031	Carpenters
47-2051	Cement masons and concrete finishers
47-2073	Operating engineers and other construction equipment operators
47-2111	Electricians
47-2152	Plumbers, pipefitters, and steamfitters
47-4021	Elevator installers and repairers
49-1011	First-line supervisors/managers of mechanics, installers, and repairers
49-2092	Electric motor, power tool, and related repairers
49-2093	Electrical and electronics installers and repairers, transportation equipment
49-2094	Electrical and electronics repairers, commercial and industrial equipment
49-2095	Electrical and electronics repairers, powerhouse, substation, and relay
49-2096	Electronic equipment installers and repairers, motor vehicles
49-2098	Security and fire alarm systems installers
49-3011	Aircraft mechanics and service technicians
49-3023	Automotive service technicians and mechanics
49-3031	Bus and truck mechanics and diesel engine specialists
49-3041	Farm equipment mechanics
49-3042	Mobile heavy equipment mechanics, except engines

SOC	SOC Name
49-3051	Motorboat mechanics
49-3052	Motorcycle mechanics
49-9012	Control and valve installers and repairers, except mechanical door
49-9021	Heating, air conditioning, and refrigeration mechanics and installers
49-9031	Home appliance repairers
49-9041	Industrial machinery mechanics
49-9042	Maintenance and repair workers, general
49-9044	Millwrights
49-9051	Electrical power-line installers and repairers
49-9092	Commercial divers
49-9097	Signal and track switch repairers
51-1011	First-line supervisors/managers of production and operating workers
51-2041	Structural metal fabricators and fitters
51-4012	Numerical tool and process control programmers
51-4032	Drilling and boring machine tool setters, operators, and tenders, metal and plastic
51-4035	Milling and planing machine setters, operators, and tenders, metal and plastic
51-4041	Machinists
51-4061	Model makers, metal and plastic
51-4062	Patternmakers, metal and plastic
51-4111	Tool and die makers
51-7011	Cabinetmakers and bench carpenters
51-7032	Patternmakers, wood
51-8012	Power distributors and dispatchers
51-8013	Power plant operators
51-8021	Stationary engineers and boiler operators
51-8092	Gas plant operators
51-9195	Molders, shapers, and casters, except metal and plastic
53-1021	First-line supervisors/managers of helpers, laborers, and material movers, hand
53-1031	First-line supervisors/managers of transportation and material-moving machine and vehicle operators
53-5031	Ship engineers
53-6051	Transportation inspectors
53-7021	Crane and tower operators

Health Care and Medical Science (Aggregate)

SOC	SOC Name
11-9061	Funeral directors
11-9111	Medical and health services managers
13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation
19-1041	Epidemiologists
19-1042	Medical scientists, except epidemiologists
19-3031	Clinical, counseling, and school psychologists
21-1011	Substance abuse and behavioral disorder counselors
21-1012	Educational, vocational, and school counselors
21-1013	Marriage and family therapists
21-1014	Mental health counselors
21-1015	Rehabilitation counselors
21-1021	Child, family, and school social workers
21-1022	Medical and public health social workers
21-1023	Mental health and substance abuse social workers
21-1092	Probation officers and correctional treatment specialists
29-1011	Chiropractors
29-1021	Dentists, general
29-1022	Oral and maxillofacial surgeons
29-1023	Orthodontists
29-1024	Prosthodontists
29-1031	Dietitians and nutritionists
29-1041	Optometrists
29-1051	Pharmacists
29-1069	Physicians and surgeons
29-1071	Physician assistants
29-1081	Podiatrists
29-1111	Registered nurses
29-1121	Audiologists
29-1122	Occupational therapists
29-1123	Physical therapists
29-1124	Radiation therapists
29-1125	Recreational therapists
29-1126	Respiratory therapists
29-1127	Speech-language pathologists
29-2011	Medical and clinical laboratory technologists
29-2021	Dental hygienists

SOC	SOC Name
29-2031	Cardiovascular technologists and technicians
29-2032	Diagnostic medical sonographers
29-2033	Nuclear medicine technologists
29-2034	Radiologic technologists and technicians
29-2051	Dietetic technicians
29-2053	Psychiatric technicians
29-2054	Respiratory therapy technicians
29-2055	Surgical technologists
29-2056	Veterinary technologists and technicians
29-2061	Licensed practical and licensed vocational nurses
29-2071	Medical records and health information technicians
29-2081	Opticians, dispensing
29-2091	Orthotists and prosthetists
31-2011	Occupational therapist assistants
31-2021	Physical therapist assistants
31-9092	Medical assistants
31-9094	Medical transcriptionists
39-4011	Embalmers
49-9062	Medical equipment repairers
51-9082	Medical appliance technicians

Health Care and Medical Science (Medical Practitioners and Scientists)

SOC	SOC Name
11-9061	Funeral directors
11-9111	Medical and health services managers
13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation
19-1041	Epidemiologists
19-1042	Medical scientists, except epidemiologists
29-1011	Chiropractors
29-1021	Dentists, general
29-1022	Oral and maxillofacial surgeons
29-1023	Orthodontists
29-1024	Prosthodontists
29-1031	Dietitians and nutritionists
29-1041	Optometrists
29-1069	Physicians and surgeons
29-1071	Physician assistants

SOC	SOC Name
29-1081	Podiatrists
29-1121	Audiologists
29-1126	Respiratory therapists
29-2081	Opticians, dispensing
29-2091	Orthotists and prosthetists
39-4011	Embalmers

Health Care and Medical Science (Medical Technicians)

SOC	SOC Name
29-1051	Pharmacists
29-1124	Radiation therapists
29-2011	Medical and clinical laboratory technologists
29-2021	Dental hygienists
29-2031	Cardiovascular technologists and technicians
29-2032	Diagnostic medical sonographers
29-2033	Nuclear medicine technologists
29-2034	Radiologic technologists and technicians
29-2051	Dietetic technicians
29-2054	Respiratory therapy technicians
29-2055	Surgical technologists
29-2056	Veterinary technologists and technicians
29-2071	Medical records and health information technicians
31-9092	Medical assistants
31-9094	Medical transcriptionists
49-9062	Medical equipment repairers
51-9082	Medical appliance technicians

Health Care and Medical Science (Therapy, Counseling, Nursing and Rehabilitation)

SOC	SOC Name
19-3031	Clinical, counseling, and school psychologists
21-1011	Substance abuse and behavioral disorder counselors
21-1012	Educational, vocational, and school counselors
21-1013	Marriage and family therapists
21-1014	Mental health counselors
21-1015	Rehabilitation counselors
21-1021	Child, family, and school social workers

SOC	SOC Name
21-1022	Medical and public health social workers
21-1023	Mental health and substance abuse social workers
21-1092	Probation officers and correctional treatment specialists
29-1111	Registered nurses
29-1122	Occupational therapists
29-1123	Physical therapists
29-1125	Recreational therapists
29-1127	Speech-language pathologists
29-2053	Psychiatric technicians
29-2061	Licensed practical and licensed vocational nurses
31-2011	Occupational therapist assistants
31-2021	Physical therapist assistants

Mathematics, Statistics, Data and Accounting

SOC	SOC Name
11-3021	Computer and information systems managers
11-3031	Financial managers
13-1023	Purchasing agents, except wholesale, retail, and farm products
13-2011	Accountants and auditors
13-2031	Budget analysts
13-2051	Financial analysts
13-2061	Financial examiners
15-1021	Computer programmers
15-1061	Database administrators
15-2011	Actuaries
15-2021	Mathematicians
15-2031	Operations research analysts
15-2041	Statisticians
15-2091	Mathematical technicians
19-3011	Economists
43-9011	Computer operators
43-9111	Statistical assistants

Legal and Financial Services and Real Estate

SOC	SOC Name
13-1031	Claims adjusters, examiners, and investigators
13-1032	Insurance appraisers, auto damage
13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation
13-1051	Cost estimators
13-1071	Employment, recruitment, and placement specialists
13-2021	Appraisers and assessors of real estate
13-2041	Credit analysts
13-2052	Personal financial advisors
13-2053	Insurance underwriters
13-2071	Loan counselors
13-2072	Loan officers
13-2081	Tax examiners, collectors, and revenue agents
13-2082	Tax preparers
23-1011	Lawyers
23-1021	Administrative law judges, adjudicators, and hearing officers
23-1023	Judges, magistrate judges, and magistrates
23-2011	Paralegals and legal assistants
23-2091	Court reporters
23-2092	Law clerks
23-2093	Title examiners, abstractors, and searchers
25-4011	Archivists
25-4031	Library technicians
33-9021	Private detectives and investigators
41-3021	Insurance sales agents
41-3031	Securities, commodities, and financial services sales agents
41-9021	Real estate brokers
43-3011	Bill and account collectors
43-3021	Billing and posting clerks and machine operators
43-3031	Bookkeeping, accounting, and auditing clerks
43-3051	Payroll and timekeeping clerks
43-3061	Procurement clerks
43-4011	Brokerage clerks
43-4031	Court, municipal, and license clerks
43-4041	Credit authorizers, checkers, and clerks
43-4061	Eligibility interviewers, government programs
43-4071	File clerks

SOC	SOC Name
43-4121	Library assistants, clerical
43-4131	Loan interviewers and clerks
43-6011	Executive secretaries and administrative assistants
43-6012	Legal secretaries

Information Technology

SOC	SOC Name
15-1031	Computer software engineers, applications
15-1032	Computer software engineers, systems software
15-1041	Computer support specialists
15-1051	Computer systems analysts
15-1071	Network and computer systems administrators
15-1081	Network systems and data communications analysts
17-2061	Computer hardware engineers
17-3023	Electrical and electronic engineering technicians
17-3024	Electro-mechanical technicians
25-9011	Audio-visual collections specialists
27-4011	Audio and video equipment technicians
27-4012	Broadcast technicians
49-2011	Computer, automated teller, and office machine repairers
49-2021	Radio mechanics
49-2022	Telecommunications equipment installers and repairers, except line installers
49-2091	Avionics technicians

Natural Sciences and Environmental Management

SOC	SOC Name
11-9121	Natural sciences managers
13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation
17-1021	Cartographers and photogrammetrists
17-3031	Surveying and mapping technicians
19-1011	Animal scientists
19-1013	Soil and plant Scientists
19-1021	Biochemists and biophysicists
19-1022	Microbiologists
19-1023	Zoologists and wildlife biologists

SOC	SOC Name
19-1029	Biological scientists, all other
19-1031	Conservation scientists
19-1032	Foresters
19-2021	Atmospheric and space scientists
19-2041	Environmental scientists and specialists, including health
19-2042	Geoscientists, except hydrologists and geographers
19-2043	Hydrologists
19-4041	Geological and petroleum technicians
19-4091	Environmental science and protection technicians, including health
19-4093	Forest and conservation technicians
33-2022	Forest fire inspectors and prevention specialists
45-4011	Forest and conservation workers

Agribusiness and Food Technology

SOC	SOC Name
11-9011	Farm, ranch, and other agricultural managers
11-9012	Farmers and ranchers
13-1021	Purchasing agents and buyers, farm products
19-1012	Food scientists and technologists
19-4011	Agricultural and food science technicians
19-4021	Biological technicians
19-4031	Chemical technicians
25-9021	Farm and home management advisors
29-1131	Veterinarians
37-3012	Pesticide handlers, sprayers, and applicators, vegetation
45-1099	Supervisors, farming, fishing, and forestry workers
45-2011	Agricultural inspectors
45-2021	Animal breeders
45-4023	Log graders and scalers
51-8031	Water and liquid waste treatment plant and system operators

Primary/Secondary and Vocational Education, Remediation and Social Services

SOC	SOC Name
11-9031	Education administrators, preschool and child care center/program

SOC	SOC Name
11-9032	Education administrators, elementary and secondary school
11-9151	Social and community service managers
13-1073	Training and development specialists
19-4061	Social science research assistants
21-1091	Health educators
21-1093	Social and human service assistants
21-2011	Clergy
21-2021	Directors, religious activities and education
23-1022	Arbitrators, mediators, and conciliators
25-2011	Preschool teachers, except special education
25-2012	Kindergarten teachers, except special education
25-2021	Elementary school teachers, except special education
25-2022	Middle school teachers, except special and vocational education
25-2023	Vocational education teachers, middle school
25-2031	Secondary school teachers, except special and vocational education
25-2032	Vocational education teachers, secondary school
25-2041	Special education teachers, preschool, kindergarten, and elementary school
25-2042	Special education teachers, middle school
25-2043	Special education teachers, secondary school
25-3011	Adult literacy, remedial education, and GED teachers and instructors
25-9031	Instructional coordinators
25-9041	Teacher assistants
27-2022	Coaches and scouts
27-2023	Umpires, referees, and other sports officials
29-9091	Athletic trainers
39-9032	Recreation workers
39-9041	Residential advisors
43-4111	Interviewers, except eligibility and loan

Building, Landscape and Construction Design

SOC	SOC Name
17-1011	Architects, except landscape and naval
17-1012	Landscape architects
17-1022	Surveyors
17-3011	Architectural and civil drafters
17-3012	Electrical and electronics drafters

SOC	SOC Name
17-3013	Mechanical drafters
17-3022	Civil engineering technicians
17-3031	Surveying and mapping technicians
19-3051	Urban and regional planners
19-4061	Social science research assistants
47-4011	Construction and building inspectors
51-7031	Model makers, wood

Engineering and Related Sciences

SOC	SOC Name
11-9041	Engineering managers
17-2011	Aerospace engineers
17-2021	Agricultural engineers
17-2031	Biomedical engineers
17-2041	Chemical engineers
17-2051	Civil engineers
17-2071	Electrical engineers
17-2072	Electronics engineers, except computer
17-2081	Environmental engineers
17-2111	Health and safety engineers, except mining safety engineers and inspectors
17-2112	Industrial engineers
17-2121	Marine engineers and naval architects
17-2131	Materials engineers
17-2151	Mining and geological engineers, including mining safety engineers
17-2161	Nuclear engineers
17-2171	Petroleum engineers
17-3021	Aerospace engineering and operations technicians
17-3023	Electrical and electronic engineering technicians
17-3025	Environmental engineering technicians
17-3026	Industrial engineering technicians
19-2011	Astronomers
19-2012	Physicists
19-2031	Chemists
19-2032	Materials scientists
19-4041	Geological and petroleum technicians
19-4051	Nuclear technicians

SOC	SOC Name
27-1021	Commercial and industrial designers
51-8011	Nuclear power reactor operators

Personal Services Occupations

SOC	SOC Name
25-3021	Self-enrichment education teachers
31-9011	Massage therapists
35-2013	Cooks, private household
39-1021	First-line supervisors/managers of personal service workers
39-5011	Barbers
39-5012	Hairdressers, hairstylists, and cosmetologists
39-5092	Manicurists and pedicurists
39-5094	Skin care specialists
39-6021	Tour guides and escorts
39-6022	Travel guides
39-9011	Child care workers
39-9031	Fitness trainers and aerobics instructors
41-3041	Travel agents
49-9064	Watch repairers

Arts, Entertainment, Publishing and Broadcasting

SOC	SOC Name
13-1011	Agents and business managers of artists, performers, and athletes
27-1011	Art directors
27-1013	Fine artists, including painters, sculptors, and illustrators
27-1014	Multi-media artists and animators
27-1022	Fashion designers
27-1024	Graphic designers
27-1025	Interior designers
27-1027	Set and exhibit designers
27-2012	Producers and directors
27-2031	Dancers
27-2032	Choreographers
27-2041	Music directors and composers
27-2042	Musicians and singers

SOC	SOC Name
27-3011	Radio and television announcers
27-3021	Broadcast news analysts
27-3022	Reporters and correspondents
27-3041	Editors
27-3042	Technical writers
27-3043	Writers and authors
27-3091	Interpreters and translators
27-4013	Radio operators
27-4014	Sound engineering technicians
27-4021	Photographers
27-4031	Camera operators, television, video, and motion picture
27-4032	Film and video editors
43-9031	Desktop publishers
43-9081	Proofreaders and copy markers
49-2097	Electronic home entertainment equipment installers and repairers
49-9061	Camera and photographic equipment repairers
49-9063	Musical instrument repairers and tuners
51-5021	Job printers
51-5022	Prepress technicians and workers
51-6092	Fabric and apparel patternmakers
51-9071	Jewelers and precious stone and metal workers
51-9195	Molders, shapers, and casters, except metal and plastic

Public Safety and Domestic Security

SOC	SOC Name
13-1061	Emergency management specialists
17-2111	Health and safety engineers, except mining safety engineers and inspectors
19-4092	Forensic science technicians
29-9011	Occupational health and safety specialists
29-9012	Occupational health and safety technicians
33-1011	First-line supervisors/managers of correctional officers
33-1012	First-line supervisors/managers of police and detectives
33-1021	First-line supervisors/managers of fire fighting and prevention workers
33-2011	Fire fighters
33-2021	Fire inspectors and investigators
33-3012	Correctional officers and jailers

SOC	SOC Name
33-3021	Detectives and criminal investigators
33-3031	Fish and game wardens
33-3051	Police and sheriff's patrol officers
33-3052	Transit and railroad police
53-2011	Airline pilots, copilots, and flight engineers
53-2012	Commercial pilots
53-2021	Air traffic controllers
53-2022	Airfield operations specialists
53-5021	Captains, mates, and pilots of water vessels
53-6041	Traffic technicians
53-6051	Transportation inspectors

Postsecondary Education and Knowledge Creation

SOC	SOC Name
11-9033	Education administrators, postsecondary
15-2021	Mathematicians
15-2041	Statisticians
19-2011	Astronomers
19-2012	Physicists
19-2031	Chemists
19-3011	Economists
19-3032	Industrial-organizational psychologists
19-3041	Sociologists
19-3091	Anthropologists and archeologists
19-3092	Geographers
19-3093	Historians
19-3094	Political scientists
25-1099	Postsecondary teachers
25-4012	Curators
25-4013	Museum Technicians and Conservators
25-4021	Librarians

Job Zone 2

SOC	SOC Name
13-1041	Compliance officers, except agriculture, construction, health and safety, and transportation
27-1012	Craft artists
27-1023	Floral designers
27-1026	Merchandise displayers and window trimmers
27-2011	Actors
27-2021	Athletes and sports competitors
27-2042	Musicians and singers
27-3012	Public address system and other announcers
29-2012	Medical and clinical laboratory technicians
29-2041	Emergency medical technicians and paramedics
29-2052	Pharmacy technicians
31-1011	Home health aides
31-1012	Nursing aides, orderlies, and attendants
31-1013	Psychiatric aides
31-2012	Occupational therapist aides
31-2022	Physical therapist aides
31-9091	Dental assistants
31-9093	Medical equipment preparers
31-9095	Pharmacy aides
31-9096	Veterinary assistants and laboratory animal caretakers
33-2011	Fire fighters
33-3011	Bailiffs
33-3041	Parking enforcement workers
33-9011	Animal control workers
33-9031	Gaming surveillance officers and gaming investigators
33-9032	Security guards
35-1012	First-line supervisors/managers of food preparation and serving workers
35-2012	Cooks, institution and cafeteria
35-2014	Cooks, restaurant
35-3011	Bartenders
37-1012	First-line supervisors/managers of landscaping, lawn service, and groundskeeping workers
37-2021	Pest control workers
37-3013	Tree trimmers and pruners
39-1011	Gaming supervisors
39-1012	Slot key persons
39-2011	Animal trainers

SOC	SOC Name
39-2021	Nonfarm animal caretakers
39-3011	Gaming dealers
39-3012	Gaming and sports book writers and runners
39-3021	Motion picture projectionists
39-3092	Costume attendants
39-4021	Funeral attendants
39-5091	Makeup artists, theatrical and performance
39-6012	Concierges
39-6031	Flight attendants
39-6032	Transportation attendants, except flight attendants and baggage porters
39-9011	Child care workers
39-9021	Personal and home care aides
41-1011	First-line supervisors/managers of retail sales workers
41-2012	Gaming change persons and booth cashiers
41-2022	Parts salespersons
41-2031	Retail salespersons
41-9011	Demonstrators and product promoters
41-9022	Real estate sales agents
41-9041	Telemarketers
41-9091	Door-to-door sales workers, news and street vendors, and related workers
43-2011	Switchboard operators, including answering service
43-2021	Telephone operators
43-3021	Billing and posting clerks and machine operators
43-3041	Gaming cage workers
43-3071	Tellers
43-4021	Correspondence clerks
43-4031	Court, municipal, and license clerks
43-4041	Credit authorizers, checkers, and clerks
43-4051	Customer service representatives
43-4081	Hotel, motel, and resort desk clerks
43-4141	New accounts clerks
43-4151	Order clerks
43-4171	Receptionists and information clerks
43-4181	Reservation and transportation ticket agents and travel clerks
43-5011	Cargo and freight agents
43-5021	Couriers and messengers
43-5031	Police, fire, and ambulance dispatchers

SOC	SOC Name
43-5032	Dispatchers, except police, fire, and ambulance
43-5041	Meter readers, utilities
43-5051	Postal service clerks
43-5052	Postal service mail carriers
43-5053	Postal service mail sorters, processors, and processing machine operators
43-5061	Production, planning, and expediting clerks
43-5071	Shipping, receiving, and traffic clerks
43-5081	Stock clerks and order fillers
43-5111	Weighers, measurers, checkers, and samplers, recordkeeping
43-6013	Medical secretaries
43-6014	Secretaries, except legal, medical, and executive
43-9021	Data entry keyers
43-9022	Word processors and typists
43-9041	Insurance claims and policy processing clerks
43-9051	Mail clerks and mail machine operators, except postal service
43-9061	Office clerks, general
43-9071	Office machine operators, except computer
45-1099	Supervisors, farming, fishing, and forestry workers
45-2091	Agricultural equipment operators
47-2011	Boilermakers
47-2021	Brickmasons and blockmasons
47-2031	Carpenters
47-2042	Floor layers, except carpet, wood, and hard tiles
47-2043	Floor sanders and finishers
47-2044	Tile and marble setters
47-2053	Terrazzo workers and finishers
47-2071	Paving, surfacing, and tamping equipment operators
47-2072	Pile-driver operators
47-2081	Drywall and ceiling tile installers
47-2082	Tapers
47-2121	Glaziers
47-2131	Insulation workers, floor, ceiling, and wall
47-2132	Insulation workers, mechanical
47-2141	Painters, construction and maintenance
47-2142	Paperhangers
47-2151	Pipelayers
47-2161	Plasterers and stucco masons

SOC	SOC Name
47-2171	Reinforcing iron and rebar workers
47-2181	Roofers
47-2211	Sheet metal workers
47-2221	Structural iron and steel workers
47-3012	Helpers, carpenters
47-3013	Helpers, electricians
47-3015	Helpers, pipelayers, plumbers, pipefitters, and steamfitters
47-4031	Fence erectors
47-4041	Hazardous materials removal workers
47-4051	Highway maintenance workers
47-4061	Rail-track laying and maintenance equipment operators
47-4091	Segmental pavers
47-5012	Rotary drill operators, oil and gas
47-5013	Service unit operators, oil, gas, and mining
47-5021	Earth drillers, except oil and gas
47-5031	Explosives workers, ordnance handling experts, and blasters
47-5041	Continuous mining machine operators
47-5042	Mine cutting and channeling machine operators
47-5051	Rock splitters, quarry
47-5061	Roof bolters, mining
47-5071	Roustabouts, oil and gas
47-5081	Helpers, extraction workers
49-3021	Automotive body and related repairers
49-3022	Automotive glass installers and repairers
49-3043	Rail car repairers
49-3053	Outdoor power equipment and other small engine mechanics
49-3091	Bicycle repairers
49-3092	Recreational vehicle service technicians
49-9011	Mechanical door repairers
49-9043	Maintenance workers, machinery
49-9045	Refractory materials repairers, except brickmasons
49-9052	Telecommunications line installers and repairers
49-9091	Coin, vending, and amusement machine servicers and repairers
49-9094	Locksmiths and safe repairers
49-9095	Manufactured building and mobile home installers
49-9096	Riggers
49-9098	Helpers—Installation, maintenance, and repair workers

SOC	SOC Name
51-2011	Aircraft structure, surfaces, rigging, and systems assemblers
51-2021	Coil winders, tapers, and finishers
51-2022	Electrical and electronic equipment assemblers
51-2023	Electromechanical equipment assemblers
51-2031	Engine and other machine assemblers
51-2091	Fiberglass laminators and fabricators
51-2092	Team assemblers
51-2093	Timing device assemblers, adjusters, and calibrators
51-3011	Bakers
51-3021	Butchers and meat cutters
51-3091	Food and tobacco roasting, baking, and drying machine operators and tenders
51-3092	Food batchmakers
51-3093	Food cooking machine operators and tenders
51-4011	Computer-controlled machine tool operators, metal and plastic
51-4021	Extruding and drawing machine setters, operators, and tenders, metal and plastic
51-4022	Forging machine setters, operators, and tenders, metal and plastic
51-4023	Rolling machine setters, operators, and tenders, metal and plastic
51-4031	Cutting, punching, and press machine setters, operators, and tenders, metal and plastic
51-4033	Grinding, lapping, polishing, and buffing machine tool setters, operators, and tenders, metal and plastic
51-4034	Lathe and turning machine tool setters, operators, and tenders, metal and plastic
51-4051	Metal-refining furnace operators and tenders
51-4052	Pourers and casters, metal
51-4071	Foundry mold and coremakers
51-4072	Molding, coremaking, and casting machine setters, operators, and tenders, metal and plastic
51-4081	Multiple machine tool setters, operators, and tenders, metal and plastic
51-4121	Welders, cutters, solderers, and brazers
51-4122	Welding, soldering, and brazing machine setters, operators, and tenders
51-4191	Heat treating equipment setters, operators, and tenders, metal and plastic
51-4192	Lay-out workers, metal and plastic
51-4193	Plating and coating machine setters, operators, and tenders, metal and plastic
51-4194	Tool grinders, filers, and sharpeners
51-5011	Bindery workers
51-5012	Bookbinders
51-5023	Printing machine operators
51-6011	Laundry and dry-cleaning workers
51-6041	Shoe and leather workers and repairers
51-6042	Shoe machine operators and tenders

SOC	SOC Name
51-6051	Sewers, hand
51-6052	Tailors, dressmakers, and custom sewers
51-6061	Textile bleaching and dyeing machine operators and tenders
51-6062	Textile cutting machine setters, operators, and tenders
51-6063	Textile knitting and weaving machine setters, operators, and tenders
51-6064	Textile winding, twisting, and drawing out machine setters, operators, and tenders
51-6091	Extruding and forming machine setters, operators, and tenders, synthetic and glass fibers
51-6093	Upholsterers
51-7041	Sawing machine setters, operators, and tenders, wood
51-7042	Woodworking machine setters, operators, and tenders, except sawing
51-8091	Chemical plant and system operators
51-8093	Petroleum pump system operators, refinery operators, and gaugers
51-9011	Chemical equipment operators and tenders
51-9012	Separating, filtering, clarifying, precipitating, and still machine setters, operators, and tenders
51-9021	Crushing, grinding, and polishing machine setters, operators, and tenders
51-9023	Mixing and blending machine setters, operators, and tenders
51-9031	Cutters and trimmers, hand
51-9032	Cutting and slicing machine setters, operators, and tenders
51-9041	Extruding, forming, pressing, and compacting machine setters, operators, and tenders
51-9051	Furnace, kiln, oven, drier, and kettle operators and tenders
51-9061	Inspectors, testers, sorters, samplers, and weighers
51-9071	Jewelers and precious stone and metal workers
51-9081	Dental laboratory technicians
51-9083	Ophthalmic laboratory technicians
51-9111	Packaging and filling machine operators and tenders
51-9121	Coating, painting, and spraying machine setters, operators, and tenders
51-9122	Painters, transportation equipment
51-9123	Painting, coating, and decorating workers
51-9131	Photographic process workers
51-9132	Photographic processing machine operators
51-9141	Semiconductor processors
51-9191	Cementing and gluing machine operators and tenders
51-9192	Cleaning, washing, and metal pickling equipment operators and tenders
51-9193	Cooling and freezing equipment operators and tenders
51-9194	Etchers and engravers
51-9195	Molders, shapers, and casters, except metal and plastic
51-9196	Paper goods machine setters, operators, and tenders

SOC	SOC Name
51-9197	Tire builders
53-1011	Aircraft cargo handling supervisors
53-3011	Ambulance drivers and attendants, except emergency medical technicians
53-3021	Bus drivers, transit and intercity
53-3022	Bus drivers, school
53-3032	Truck drivers, heavy and tractor-trailer
53-3033	Truck drivers, light or delivery services
53-4021	Railroad brake, signal, and switch operators
53-4031	Railroad conductors and yardmasters
53-4041	Subway and streetcar operators
53-5011	Sailors and marine oilers
53-5022	Motorboat operators
53-7011	Conveyor operators and tenders
53-7031	Dredge operators
53-7032	Excavating and loading machine and dragline operators
53-7033	Loading machine operators, underground mining
53-7041	Hoist and winch operators
53-7051	Industrial truck and tractor operators
53-7062	Laborers and freight, stock, and material movers, hand
53-7063	Machine feeders and offbearers
53-7071	Gas compressor and gas pumping station operators
53-7072	Pump operators, except wellhead pumpers
53-7073	Wellhead pumpers
53-7081	Refuse and recyclable material collectors
53-7111	Shuttle car operators
53-7121	Tank car, truck, and ship loaders

Job Zone 1

SOC	SOC Name
33-9091	Crossing guards
33-9092	Lifeguards, ski patrol, and other recreational protective service workers
35-2011	Cooks, fast food
35-2015	Cooks, short order
35-2021	Food preparation workers
35-3021	Combined food preparation and serving workers, including fast food
35-3022	Counter attendants, cafeteria, food concession, and coffee shop

SOC	SOC Name
35-3031	Waiters and waitresses
35-3041	Food servers, nonrestaurant
35-9011	Dining room and cafeteria attendants and bartender helpers
35-9021	Dishwashers
35-9031	Hosts and hostesses, restaurant, lounge, and coffee shop
37-2011	Janitors and cleaners, except maids and housekeeping cleaners
37-2012	Maids and housekeeping cleaners
37-3011	Landscaping and groundskeeping workers
39-3031	Ushers, lobby attendants, and ticket takers
39-3091	Amusement and recreation attendants
39-3093	Locker room, coatroom, and dressing room attendants
39-6011	Baggage porters and bellhops
41-2011	Cashiers, except gaming
41-2021	Counter and rental clerks
41-9012	Models
43-5081	Stock clerks and order fillers
45-2041	Graders and sorters, agricultural products
45-2092	Farmworkers and laborers, crop, nursery, and greenhouse
45-2093	Farmworkers, farm and ranch animals
45-3011	Fishers and related fishing workers
45-4021	Fallers
45-4022	Logging equipment operators
47-2041	Carpet installers
47-2061	Construction laborers
47-3011	Helpers, brickmasons, blockmasons, stonemasons, and tile and marble setters
47-3014	Helpers, painters, paperhangers, plasterers, and stucco masons
47-4071	Septic tank servicers and sewer pipe cleaners
47-5011	Derrick operators, oil and gas
49-3093	Tire repairers and changers
49-9093	Fabric menders, except garment
51-3022	Meat, poultry, and fish cutters and trimmers
51-3023	Slaughterers and meat packers
51-6021	Pressers, textile, garment, and related materials
51-6031	Sewing machine operators
51-7021	Furniture finishers
51-9022	Grinding and polishing workers, hand
51-9198	Helpers—Production workers

SOC	SOC Name
53-3031	Driver/sales workers
53-3041	Taxi drivers and chauffeurs
53-6011	Bridge and lock tenders
53-6021	Parking lot attendants
53-6031	Service station attendants
53-7061	Cleaners of vehicles and equipment
53-7064	Packers and packagers, hand