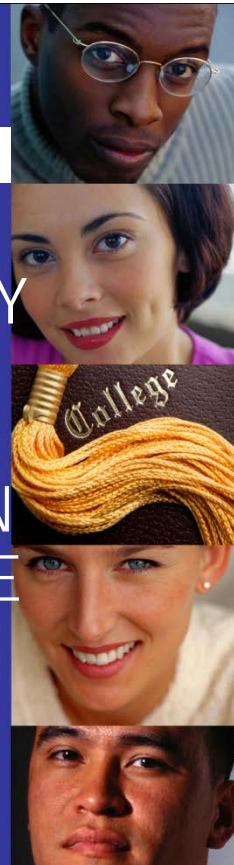


INDIANA'S COMPETITIVE ECONOMIC ADVANTAGE:

THE
OPPORTUNITY
TO WIN THE
GLOBAL
COMPETITION
FOR COLLEGE
EDUCATED
TALENT



Prepared for: Central Indiana Corporate Partnership

Prepared By: Battelle Technology Partnership Practice

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The Technology Partnership Practice (TPP) is the economic development consulting arm of Battelle, the world's largest independent non-profit research and development organization with over \$6 billion in annual revenues. Battelle TPP has an established track record in developing and advising many of the most successful modern development programs in the U.S. and is a leader in advancing workforce development strategies across the U.S. Battelle TPP also has worked extensively in Indiana in assessing industry cluster developments and advising in targeted sector development strategies.

Complementing the economic analysis and policy expertise of Battelle TPP on this project is Walker Information, a leading survey research firm based in Indiana. While widely known as a customer strategy consultant for industry, Walker also has applied its expertise in survey research to informing policy development on economic development and higher education questions over the years, including collaborating with Inside Indiana Business with an online panel of 4,000 Indiana business professionals who are surveyed on a periodic basis on business and economic issues.

The approach taken by the Battelle-Walker project team was to do a comprehensive assessment guided by an Advisory Committee organized by CICP. The key steps involved in the comprehensive assessment included:

- Review of past studies in Indiana and nationally on issues related to the alignment of supply and demand for college educated workforce. A full listing of the studies analyzed is provided in Appendix A.
- Quantitative analysis of available secondary data sources on occupational employment, bachelor and graduate degree awards, and population migration patterns. Battelle supplemented the occupational employment data by examining job vacancies posted by Indiana companies on their websites and public access job boards during the Fall of 2011 to gain more insights on the types of jobs, degrees and skills being sought by industry for college graduates. Indiana also has established a unique Indiana Workforce Intelligence System (IWIS) that links together disparate data sets from within the Department of Workforce Development to enable the tracking of college graduates into the workforce in Indiana across public universities in the state. This unique IWIS dataset allows for the analysis of retention of college graduates as they enter the workforce.
- Survey research analysis by Walker Information of recent college graduates from Indiana public and private universities and of Indiana employers. This survey research was conducted through the use of an on-line survey tool with 1,934 college graduates from 2008 to 2011 completing the college graduate survey and 889 companies completing the employer survey.
- Interviews and focus group discussions with career development staff at public and private universities in Indiana and industry groups associated with CICP to provide information on their experiences in placing and hiring college graduates in employment within Indiana and to help in interpreting the results of the analyses undertaken.

Executive Summary

Call to Action for Indiana: Aligning Human Capital and Economic Growth

While Indiana has done much in recent years to bolster job creation and raise the state's economic output, a more fundamental challenge confronting Indiana's economy has largely resisted the best efforts of state policymakers. **Indiana is falling short in generating rising state per capita income—a measure of the standard of living found in the state.** Indiana has lagged behind the national average in per capita income for the last half-century and has steadily declined relative to the nation over the last decade-and-a-half. Today the average Hoosier earns 85 cents for every dollar earned by the typical American (and a significant gap remains even when adjusting for the state's low cost of living).

Why is this happening? The most straightforward and fundamental explanation involves Indiana not keeping pace with the evolution to a knowledge-based economy where the quality of jobs and income levels are based on the skills and education level of the workforce.

This finding seems out of sync with the fact that Indiana places in the upper half of states in both college entry and completion, and confers bachelor's degrees at a rate higher than the national average. But the retention of these graduates becomes a key issue when examining Indiana's economic plight.

Simply put, a lack of job opportunities for these graduates—due to the state's low concentration of knowledge-intensive occupations—leads to their migration, and ultimately to the state's low adult educational attainment ranking relative to the nation, despite a strong higher education pipeline.

If Indiana is to achieve rising per capita incomes that close the gap with the U.S. average, it must accelerate the creation of high-skill jobs. In short, the state must develop a knowledge-intensive economy that employs a greater share of college graduates. With this comes retention of collegians, who by commanding higher wages raise the state's collective income.

This ambitious aim relies on alignment between Indiana's demand for college-educated talent and the supply of graduates emerging from its colleges and universities: The state must pursue simultaneous economic development and human capital plans, 'upskilling' its economy to require more high-skill workers (see 'Notes,' vi) while constantly reorienting its human capital through education and workforce development strategies to meet the specific needs of employers.

This study is focused on realizing Indiana's potential advantages in college educated talent, by assessing the alignment between recent college graduates and high-quality career opportunities in the state. Ultimately, it will call attention to a number of strategies designed to break the vicious cycle that sees Indiana's slow evolution to a knowledge and innovation-based economy drive away its most precious resource—its young college graduates—depressing per capita income and leading its employers to struggle further in recruiting more experienced high skill workers.

This White Paper assesses the ‘supply and demand’ employment concerns of both college graduates and employers, with an in-depth focus on those science, engineering, technology and business occupations critical to the traded sector industries that tend to drive economic development in the state (see ‘Notes,’ vi). It focuses on examining three primary questions:

- Does Indiana industry generate sufficient job opportunities for college educated workers with at least a bachelor’s degree?
- Is Indiana generating sufficient supply of college graduates, and are they adequately prepared for the jobs available?
- Is Indiana able to retain and attract college educated workers by better connecting them to jobs and increasing the supply and quality of career opportunities?

CICP commissioned the Battelle Technology Partnership Practice, with support from Walker Information, to undertake the research and analysis to answer these questions. This study focuses on and only references supply and demand for bachelor level and above college graduates, focusing primarily on those seeking high skilled occupations in management, business and financial operations, computer related, engineering, scientists and selected high skilled technicians, deployed by the state’s major industry clusters. (This report also assesses the supply and demand dynamics for other occupational groups at a broader level – see page 23.)

The key conclusions of this report are summarized as follows:

Does Indiana industry generate sufficient job opportunities (in science, engineering, technology and business occupations) for college educated workers with at least a bachelor’s degree?

Answer: “NO”

- Indiana lags behind the nation in the share and growth of industry demand for workers across occupations requiring at least a bachelor’s degree. This lower demand is found consistently across industries driving the economic growth of Indiana.
- Nearly all economic growth-generating industries in Indiana are increasing their share of employment of high skilled workers in occupations requiring at least a bachelor’s degree. However, the growth is typically at a slower pace than the nation, working against Indiana ‘catching up’ with the U.S. in relative high-skill employment. (There are a few exceptions, including information technology and the energy industry, where Indiana is growing new jobs for college educated workers at a pace faster than the nation – though starting from a lower baseline.)
- Though the state falls behind the U.S. in utilization of college educated talent, Indiana faces a significant demand for more experienced workers in “high skilled” occupations once replacements for those retiring and changing occupations are considered—estimated to be 113,000 jobs in a ten year period. (For other locally-oriented high skilled jobs, such as physicians, nurses and teachers, this cumulative demand reaches an additional 82,000 jobs in a decade.) Indiana’s demand for replacement workers in high

skilled occupations is on par with the nation, though higher for a number of specific high skilled positions, including life scientists, physical scientists and physical scientist technicians. ***However, many of these jobs are not available to recent college graduates based on the experience level required by employers.***

Is Indiana generating sufficient supply of college educated workers in science, engineering, technology and business occupations?

Answer: A qualified “YES”

- Indiana public and private universities are already generating a high number of college graduates and have been increasing the number of new college graduates in highly sought after science, technology, engineering and math degrees as well as business degrees.
- The lower level of industry demand and strong performance in generating college graduates results in more annual college graduates than job openings available, even when only considering Indiana in-state graduates as well as adjusting for employer interest in hiring entry level workers. There is also a significant surplus of graduates in fields associated with locally-based industries.
- This points towards a potential comparative advantage for Indiana: Indiana has a significant opportunity to grow, attract and retain industries desiring knowledge workers in competition with other parts of the U.S. as well as globally.

Is Indiana able to retain and attract college educated workers?

Answer: “MIXED”

- The level of recent college graduates from Indiana universities and colleges working in Indiana declines over time consistently across the period of 2000 to 2009, whether the college graduates were originally in-state residents or from out-of-state.
- Recent college graduates view the quality of jobs in Indiana as lower than those found outside of Indiana, which makes it harder for Indiana employers to retain and attract them. Annual wages for high skilled occupations generally are significantly lower in Indiana, even after adjusting for lower cost of living in the state; survey results further show that recent graduates regard Indiana positions as offering less opportunity for advancement on average.
- Still, slightly more older and experienced college educated workers ages 25 to 54 are moving to Indiana than moving out over the period 2004 to 2010, suggesting that Indiana employers are actively recruiting more experienced college educated workers from out of state.

Bringing together the data-driven analysis along with the in-depth survey research of employers and recent college graduates suggests that Indiana must address a harmful dynamic: Employers are not generating sufficient numbers of bachelor’s-appropriate jobs compared to their national counterparts, while at the same time concerns about the quality of jobs in Indiana spurs migration

of recent graduates. This creates challenges for employers to find qualified workers in Indiana, especially as they seek experienced workers in these high skilled occupations.

It should be added that the current ‘surplus’ of college graduates relative to appropriate job opportunities doesn’t suggest that Indiana should curtail its efforts to educate its citizens—the **problem isn’t too many graduates, it’s too few jobs. The state’s solid higher education pipeline is an asset to be strengthened and exploited.**

Indeed, the silver lining from the analysis of the demand and supply of college educated workers in Indiana is the significant opportunity Indiana has to win in the competition for talent. Unlike other regions that must be concerned about attracting college graduates from outside their state, Indiana has a substantial base of college graduates being generated by in-state universities and colleges that can meet a growing demand for job openings in occupations requiring college degrees.

The state’s challenges are to: 1) implement programs and policies to generate greater employment demand for these workers; 2) pursue a full-fledged talent development strategy to ensure these graduates are prepared for existing and emerging opportunities; and 3) ensure alignment among industry, academia and the graduates themselves to effectively connect workers to jobs.

To address these goals, four strategic priorities are identified:

- **Creating demand for talent** – encouraging the creation of high skilled jobs in Indiana
- **Preparing talent for work** – making job readiness a top priority in Indiana’s higher education system
- **Connecting talent to jobs** – enhancing career services to match college graduates with industry opportunities
- **Retaining talent** – creating tangible pathways to meaningful careers

The summary table below lays out actions for these key strategic interventions.

Strategic Intervention	Strategic Actions
<i>Creating Demand for Talent</i> by encouraging the creation of high skilled jobs in Indiana	<ul style="list-style-type: none"> • Advance technology deployment and development through industry cluster initiatives. Indiana should advance competitive grants to spur collaborative projects that advance technology deployment and development for targeted industry clusters in Indiana. • Encourage closer collaboration between economic development agencies and economic cluster initiatives. • Market Indiana’s human capital ‘surplus’ in key fields as a business attraction advantage to lure growing companies that employ large concentrations of college educated, high skilled workers. • Promote industry-university collaborations to leverage Indiana’s university research base for advancing applied R&D and technology commercialization. State support is needed across the continuum of industry-university engagement activities including: <ul style="list-style-type: none"> • Relationship building through visiting scientist programs and incentives for pro-active university policies to support and encourage collaborations with industry; • Proof-of-concept and technology commercialization funding;

	<ul style="list-style-type: none"> • Matching grants for industry-university applied R&D projects; • Multi-institutional, multi-disciplinary initiatives where Indiana can be positioned as a global leader in a specific technology niche with significant market potential; • Targeting economic development activities in geographic ‘innovation zones’ around research universities. <ul style="list-style-type: none"> • Develop a business climate that encourages entrepreneurial activity and business start-ups. <ul style="list-style-type: none"> • Create an entrepreneurial center of excellence to provide start-up services, competitive business plan vetting and incubation infrastructure for fledgling ventures; • Identify supply chain gaps and opportunities in key industry clusters and incentivize entrepreneurs to pursue appropriate enterprises; • Target business financing/tax incentives to high-potential start-up firms. • Incentivize high skilled hiring through tax incentives targeted to college graduate employment (akin to existing Edge credits) and exploring public subsidies for graduate fellowship programs in key career fields.
<p><i>Preparing Talent for Work</i> by making job readiness a top priority in Indiana’s higher education system.</p>	<ul style="list-style-type: none"> ▪ Create a career orientation component to freshman curriculum across higher education in Indiana. ▪ Forge an industry-higher education career development partnership in Indiana. Create a faculty professional development program for workplace connections and encourage faculty externships with industry. ▪ Advance Professors of Practice across disciplines in colleges and universities. ▪ Establish an Indiana Academic Futures Initiative to advance new academic degree programs in emerging and multi-disciplinary fields that respond to long term industry skill needs such as cloud computing, bio-informatics, supply chain management, web design and product development engineering. ▪ Develop a ‘Bridges to Employment’ post-baccalaureate certificate program that helps college graduates further refine their skills to compete for existing/emerging high skill career opportunities or transition to new opportunities early in their professional lives.
<p><i>Connecting Talent</i> by enhancing career services to match college graduates with industry opportunities.</p>	<ul style="list-style-type: none"> • Scale up internships in Indiana. An effective means to scale up internships is to offer incentives and to better target in highly sought fields and occupational shortage areas. • Advance a statewide approach to career services. There is no magic bullet, but a variety of services should be considered, including: <ul style="list-style-type: none"> ▪ Provide funding for dedicated career recruitment services for employers who commit to hiring Indiana graduates; ▪ Target career services and internship stipends to high performing Indiana college students in science, engineering, computer sciences and business fields; ▪ Advance alumni career services through a statewide consortium effort that creates a talent bank of alumni for Indiana employers and hosts young professional networking events in Indiana and key metropolitan areas outside of Indiana; ▪ Leverage the presence of industry cluster organizations found in Indiana to develop mentors, job shadowing, internships, job postings for alumni, etc.
<p><i>Retaining Talent</i> by creating tangible pathways for college graduates to meaningful careers.</p>	<ul style="list-style-type: none"> • Set career pathway standards of excellence and recognize employers who excel in offering career pathways for high skilled positions requiring college education. • Provide tax credits for employers who establish and hire college graduates in certified career pathway positions.

Notes on the Study's Focus and Terminology:

Bachelor's Degree/High Skilled Jobs:

As referenced above, this study is focused on the pipeline of bachelor's degree (and higher) college graduates and employment opportunities that typically require at least a bachelor's degree and yield high-paying, high skilled jobs. While outside of the scope of this work, the importance of 'middle skill' jobs (those requiring more than a high school diploma but less than a four-year degree) as a large and growing segment of Indiana employment, and the accompanying need for applicants with appropriate associate's degrees and industry-valued certificates must be acknowledged.

In the course of this study, the term 'college' may be used to refer to bachelor's degree programs, and 'high skill job/employment' may refer to positions demanding such a degree. This does not imply that associate's and certificate-holders are not a valuable part of Indiana's educated workforce or that many jobs requiring such credentials do not often demand advanced skills and command wages significantly higher than the national per capita income.

"Traded Sector" Industries:

To further refine the study's scope, this White Paper will focus primarily on those high skilled occupations requiring a bachelor's degree or more that primarily fall within the 'traded sector' industries of Indiana's economy. Traded sector industries address needs beyond local residents and businesses. They are either involved in exports or the generation of goods/services that serve a market beyond the local community, and have the greatest sustainable potential for investment and job creation. This report may also refer to these sectors as "wealth creating" or as the primary drivers of economic growth—they are of critical importance because they bring 'new money' into the region of origin that in turn supports locally-focused industries (i.e. retail, construction, healthcare, education). Indiana's major traded sector industries include manufacturing, distribution logistics, the life sciences, technology, corporate headquarters and finance, and engineering technical services. The occupational analysis therefore focuses on science, engineering, computer-related and business fields.

Demand for College Educated Talent – Economic Development Strategies:

A major finding of this study centers on Indiana's relative lack of demand by employers for recent college graduates—symptomatic of the state's broader lag in high skill employment. Accordingly, this paper advances a number of recommendations to spur high skill job creation and advance Indiana's knowledge-based economy. These should, however, be regarded more as a menu of options rather than a comprehensive economic strategy for the state. This study does not propose such a plan, but rather distills the challenges facing Hoosiers in this area, provides potential approaches, and calls on public and private stakeholders to come together and develop a realistic, Indiana-centric blueprint for action.

Call to Action for Indiana in the Competition for College Educated Talent

In the wake of the recession, the focus of Indiana's policymakers has been appropriately focused on retaining and attracting jobs and investment, stabilizing the state's economy amid the turmoil in global markets.

These economic development efforts have succeeded on many fronts—bringing down the state's unemployment rate, attracting historic levels of foreign investment (primarily in the manufacturing sector) and increasing exports and Gross State Product at a rate faster than the nation.

However, these short-term indicators of progress ignore more fundamental challenges confronting Indiana's economy.

These challenges are best embodied in the state's **per capita income**, which has lagged behind the national average for the last half-century and has steadily declined relative to the nation over the last decade-and-a-half. Today the average Hoosier earns 85 cents for every dollar earned by the typical American (and a significant gap remains even when adjusting for the state's low cost of living).

Per capita income reflects the value commanded in the marketplace by the collective efforts of Hoosiers, as well as the standard of living of individual workers. Its decline therefore indicates a real decline in Indiana's economic competitiveness and the well-being of its citizens.

Why is this happening?

Rise of the Knowledge Economy: The Connection Between Education & Income

The most straightforward and fundamental explanation involves the evolution to a knowledge-based global economy where the quality of jobs and income levels are based on the skills and education level of the workforce. As the Organization for Economic Co-Operation and Development explains: "Employment in the knowledge-based economy is characterized by increasing demand for more high skilled workers ... Changes in technology, and particularly the advent of information technologies, are making educated and skilled labor more valuable, and unskilled labor less so."¹

The movement towards a knowledge-based economy has been widely noted since the 1970s. Stanford economic sociologists, Woody Powell and Kaisa Snellman explain, "The key components of a knowledge economy include a greater reliance on intellectual capabilities than on physical inputs or natural resources..."

In the 1990s and the 21st century, these trends came to fruition in the global economy as well.

¹ OECD, "The Knowledge-Based Economy," Paris, 1996, page 7.

As Bruce Mehlman, Assistant Secretary of Commerce in the George W. Bush Administration explains, “There are many highly talented researchers and technical workers among the more than six billion people on the planet who are not United States citizens, and some foreign nations such as China are now graduating more physical science and engineering students than the U.S. every year.”²

To illustrate the point, the number of science and engineering degrees granted in Asia now far outnumbers those conferred in the U.S. annually. (And it should not surprise that a recent *Wall Street Journal* analysis estimates that 85 percent of R&D job creation by U.S. multi-national companies is occurring overseas—primarily in Asia.)

Study after study demonstrates that communities that have enjoyed significantly higher gains in per capita income and other economic measures have higher levels of college educated workers at a bachelor’s level and above. A comprehensive study by the Federal Reserve Bank of Cleveland found that for the period 1939 to 2004 the proportion of a state’s population with at least a bachelor’s degree, along with the state’s generation of patents (which further reflect the presence of a highly educated workforce), are the most influential factors explaining a state’s relative per capita personal income.³

These trends don’t simply coincide with the rise of technology-based industries such as life sciences or information technology or renewable energy. Roughly six of every 10 information technology workers are employed outside of computer and telecommunications industries, with high concentrations found in finance, insurance, logistics, and manufacturing. Established products such as automobiles, industrial machinery, plastics, and measuring and control devices have growing high-technology content embedded in them and their production processes, leading to many mature, production-focused industries being defined by the U.S. Bureau of Labor Statistics as “high technology” because they have twice the number of workers in scientific, engineering, and computing occupations than all industries nationally. [This explains why this study primarily examines high-skill occupations – jobs typically requiring a bachelor’s degree or above – rather than looking at industry clusters, which after all employ workers at all skill levels.]

Not surprisingly, the ability of communities to generate, attract and retain college educated talent is becoming an increasingly critical factor to promoting a positive business climate. As the National Governors’ Association points out in their series on State Leadership in the Global Economy: “CEOs report that the availability of technically trained talent is their top priority—one that often determines where they locate high-value investments.”⁴

² Remarks by Bruce P. Mehlman, Assistant Secretary for Technology Policy, U.S. Department of Commerce, “21st Century Policy Challenges for American Innovation Leadership,” Fall 2003.

³ See Paul Bauer et al, “State Growth Empirics: The Long Run Determinants of State Income Growth,” Federal Reserve Bank of Cleveland, 2006, Working Paper #6.

⁴ National Governors’ Association, State Leadership in the Global Economy, 2002.

Where does Indiana Stand?

Indiana lags the nation in the educational attainment of its workforce – a fact that is inextricably connected to its declining position in per capita income. In 1990, 15.6 percent of Indiana's population aged 25 years and older held at least a bachelor's degree compared to 20.3 percent nationally. By 2009, 22.5 percent of the state's population aged 25 years or older had earned at least a bachelor's degree, but the national mark had grown to 27.9 percent. So the gap in college educated workforce for Indiana compared to the nation actually widened, from 4.7 percentage points to 5.4 percentage points. The most recent available data ranks the state 44th among states in college educated adults (as a percentage of the population).

This finding seems out of sync with the fact that Indiana places in the upper half of states in both college entry and completion, and confers bachelor's degrees at a rate higher than the national average. But the retention of these graduates becomes a key issue when examining Indiana's economic plight.

Simply put, a lack of job opportunities for these graduates—due to the state's low concentration of knowledge-intensive occupations—leads to their migration, and ultimately low adult attainment despite a strong higher education pipeline.

The popular notion is that young recent graduates seek out “hip and cool” places. Indeed, a strong sense of ‘place’ is important and should be incorporated into Indiana's overall strategy for attracting and retaining human capital.

But study after study shows that the presence of high quality jobs is the critical factor: As Robert Weissbourd, who consults with The Brookings Institution in its Metropolitan Business Planning Initiative, notes in a detailed review of past studies: “While amenities do contribute to the location decisions of high skilled workers, the magnitude of the impact is significantly smaller than the impact of the availability of high skilled jobs.”⁵

Echoing these findings, an extensive survey of recent college graduates from Indiana universities and colleges conducted for this effort found that the leading factors for where graduates choose to live are work related—salary and benefits as well as job roles and responsibilities being the two leading factors.

Economic data confirms that the state's economy—in key wealth-creating industries and overall—has lower proportions of high skill employment requiring college degrees than the nation.

If Indiana is to achieve rising per capita incomes that close the gap with the U.S. average, the state must develop a knowledge-intensive economy that employs a greater share of college graduates. With this comes retention of collegians, who in turn command higher wages and raise the state's collective income. This demands a simultaneous economic development and human capital strategy that generates greater industry demand for talent while refining the supply of graduates to meet the specific needs of employers.

⁵ Weissbourd et al, Developing and Deploying Human Capital, unpublished paper for The Brookings Institution Metropolitan Business Plan Initiative, 2011.

This study is focused on realizing Indiana’s potential advantages in college educated talent, by assessing the alignment between recent college graduates and high-quality career opportunities in the state. Ultimately, it will call attention to a number of strategies designed to break the vicious cycle that sees Indiana’s slow evolution to a knowledge and innovation-based economy drive away its most precious resource—its young college graduates—depressing per capita income and leading its employers to struggle further in recruiting more experienced high skill workers.

In the sections that follow, this White Paper provides a detailed data-driven analysis of the central questions related to the marketplace of college educated talent in Indiana:

- Does Indiana industry generate sufficient job opportunities for college educated workers with at least a bachelor’s degree?
- Is Indiana generating sufficient supply of college graduates, and are they adequately prepared for the jobs available?
- Is Indiana able to retain and attract college educated workers by better connecting them to jobs and increasing the supply and quality of career opportunities?

The answers to these central questions set out the challenges and opportunities for Indiana. To more fully understand the specifics and subtleties of the Indiana situation, this White Paper offers insights from in-depth survey research of recent college graduates and employers, along with field interviews and focus group discussions with university career development officials, employers and students. Through this more qualitative assessment the White Paper is able to consider the dynamics taking place in Indiana in the interplay of supply and demand for college educated workers based on insights from the actual participants as well as through a statistical analysis.

Does Indiana industry generate sufficient demand for college educated workers with at least a bachelor's degree?

The question of industry demand for college educated workers goes to the heart of how competitive Indiana stands. As the blue-ribbon panel of industry and university leaders brought together by the National Academies explains: "...the fundamental measure of competitiveness is quality jobs. It is jobs that to a considerable degree define the quality of life of a nation's individual citizens."⁶ Higher demand for college educated workers reflects the level of value-added of goods and services produced in a state as well as a state's capacity to advance innovation in new products and processes.

In order to measure demand by industry for college educated workers we need to identify which occupations require at least a bachelor's degree. Occupations are an essential lens for examining job responsibilities and similarity in skill sets across all industries. Through data gathering efforts by the U.S. Department of Labor and the Indiana Department of Workforce Development, employment by occupations are compiled based on detailed surveys of employers and standardized projection techniques. This allows for the measurement of current demand for occupations, recent trends in occupational changes, and projected job openings to provide a sound understanding of the demand for specific skills and broader skill levels across industry. Refining the analysis to college educated talent in Indiana requires a focus on "high skilled" occupations.

Mapping College Degrees to High Skilled Occupations that Drive Economic Development

Battelle identified 19 occupational groups that predominantly require a bachelor's degree or higher. This mapping of college degrees and skill requirements to occupations was developed by analyzing information from the U.S. Bureau of Labor Statistics Employment Projections Program. The projections program tracks the specific education levels and other requirements for hundreds of occupations using a variety of sources from the Department of Labor's Occupational Information Network, or O*NET, to the Census Bureau's American Community Survey.⁷

Altogether these 19 high skilled occupational groups map to approximately 45,000 bachelor's and higher degrees out of a total of nearly 57,000 awarded by Indiana colleges and universities in 2010. The relatively few degrees that do not map to these occupational groups fall into two categories—one is occupations like criminal justice and sports and fitness where the degree is closely tied to an occupation that has a broad mix of educational levels required and the other is where the degree is so general in nature that it does not directly map to any occupation including degrees such as liberal arts, general studies, philosophy and interdisciplinary studies.

This White Paper will provide a broad view of 'supply and demand' dynamics across these occupational groups to the extent possible. A closer examination of these 19 high skilled

⁶ Rising Above the Gathering Storm, Revisited, page 17–18

⁷ For a complete listing of detailed occupations included within these groups see Appendix B.

occupational groups, however, finds that not all are closely aligned with industries that drive economic development in Indiana.

The objective of this White Paper is to assess the supply and demand dynamics for recent college graduates in Indiana, and suggest ways to advance economic prosperity by increasing demand for this talent. It is therefore particularly important to focus on those industries that address the “economic base” or “traded sectors” of the state’s economy. (These traded sector industries address needs beyond local residents, producing goods and services that are consumed primarily outside their region of origin and therefore generate new wealth and have the greatest growth potential for investment and job creation.)

By examining the high skilled occupational groups concentrated in traded sector industries, it is possible to take a more refined look at the current and future talent supply and demand in Indiana for high skilled occupations from an economic development perspective.

The most effective way to assess traded sector industry drivers is to focus on broad industry clusters or sectors. Clusters consist of groups of firms and related institutions within the same economic sector or complementary supply chain in geographic proximity, drawing comparative advantage from their location, shared workforce and other and connections with one another. Industry clusters have become a mainstay of regional economic analysis because of the recognition that individual industries do not stand alone within local economies, but are better understood as being part of a broader complex of industries that are interrelated.

Based on efforts by CICP⁸ the traded sector industries in Indiana fall into eight statewide industry clusters:

- Advanced Manufacturing (includes major subsectors such as aerospace; metals; auto manufacturing; food products & processing; plastics; electronics; and more)
- Life Sciences
- Corporate Headquarters & Business Services
- Energy
- Finance & Insurance
- Freight Transportation, Distribution, & Logistics
- Information Technology
- Engineering, Management, and Technical Consulting Services

Among the high skilled occupational groupings that are most typically employed by traded sector industries are the following ten:

- Management
- Business & Financial Operations

⁸ See *Nurturing Central Indiana’s Pillar Industries for 21st Century Midwestern Pre-Eminence*, Battelle Technology Partnership Practice, December 2000.

- Computer-related
- Engineers
- Engineering Technicians⁹
- Life Scientists
- Life Science Technicians
- Physical Scientists
- Physical Science Technicians
- Medical & Clinical Lab Technicians (work primarily in diagnostic laboratories)

These ten high skilled occupational groups critical to Indiana's traded sector industries represent nearly 26,000 unique bachelor's and higher degrees out of the 56,949 awarded in 2010 by Indiana colleges and universities, or about 45 percent of all degrees.¹⁰

Non-traded sector industries, often referred to as local or sheltered economic activity, do not generate new economic wealth for the state. However, they are important because they address local needs and ensure a high quality of life for residents. Typically, these non-traded sector industries include most retail services, physician offices, state and local government, and other firms that provide services to local residents.

It is important to note that many of these high skilled occupations important to traded sector industries are also utilized by non-traded sector industries. So all industries in Indiana employ workers in business and financial operations, management and computer related occupations.

There are, however, nine high skilled occupational groups that are predominantly utilized in non-traded industries, including:

- Allied Health & Therapists
- Counseling & Social Service
- Designers & Artists
- K-12 Educators & Librarians
- Legal
- Media & Communications
- Pharmacists
- Physicians & Dentists
- Social Science, Urban Planning and Architects

⁹ Educational requirements for Engineering Technicians are primarily seen as Associate's level although in its work around the country, Battelle has seen an increasing shift in requirements for this key advanced manufacturing skill set toward 4-year Bachelor's degrees.

¹⁰ Management degrees draw from a wide variety of college degrees depending upon the expertise required or the nature of the industry or position (e.g., engineering managers will most often have a Bachelor's or higher degree in an engineering field). Therefore when management is considered there is a high degree of double-counting across degree fields and the supply scope widens considerably with degrees counted in both their subject-specific fields but also separately within the talent pipeline for management.

Altogether these occupational groups that are primarily employed by non-traded sector industries represent more than 19,000 individual bachelor's and higher degrees awarded in 2010 by Indiana colleges and universities (about 34 percent of all degrees).

Going forward in this analysis, the primary focus is on the high skilled occupations that are critical to advancing traded sector industry clusters in Indiana, recognizing that many working in these occupations are also employed in non-traded sector industries.

For those high skilled occupations that are predominantly employed only in non-traded sector industries, this report does provide insights into the levels of new graduates compared to expected job openings, but the labor market dynamics surrounding these high skilled occupational groups are not explored in detail.

MAJOR FINDING: Occupational Trends Show Indiana's Economy Falls Short in Its Use of High Skilled Workers

Indiana is not highly concentrated in its employment of high skilled, college educated workers critical to traded sector industries. One way to measure the degree of job concentration within Indiana as compared to the nation is through the use of Location Quotients (LQs). A statewide LQ greater than 1.0 is said to have a greater concentration than the national average. When the LQ is significantly above average, 1.2 or greater, the state is said to have a "*specialization*" in the occupation. Among the key high skilled occupational groups, none in Indiana met or exceeded this specialized threshold in 2010. Just one group, life science technicians, exceeded 1.0 with a 1.13 LQ or 13 percent greater concentration in Indiana relative to its private sector.

Indiana's largest high skilled occupational groups critical to traded sector industries are in decline, outside of computer-related occupations, while more niche high skilled occupations in physical and life sciences are on the rise. Over the 2004 to 2010 period—a period of time that encompasses strong economic growth, a severe recession and a slow paced economic recovery—there were five growing high skilled occupations and five declining high skilled occupations in Indiana.

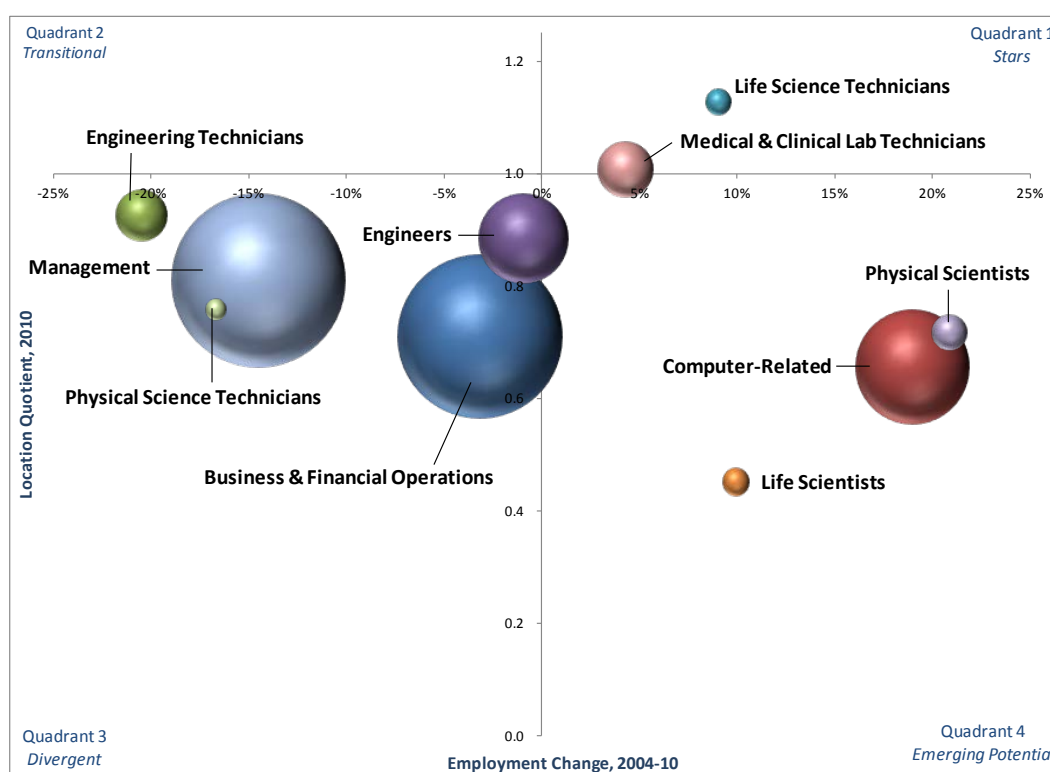
The growing high skilled occupations in Indiana were led by physical scientists at 21 percent growth, followed closely by computer-related occupations with 19 percent growth. A number of life sciences occupations also rose during this 2004 to 2010 period, including life scientists (10 percent growth), life science technicians (9 percent growth) and medical/lab technicians (4.3 percent growth).

At the same time, Indiana suffered significant declines in a number of large high skilled occupations, primarily associated with advanced manufacturing. From 2004 to 2010, management occupations, the largest high skilled occupational grouping in Indiana, fell by 14.5 percent. Business and financial operations occupations, another large occupational group in Indiana, also fell by 3.1 percent, while engineers slipped slightly by 0.9 percent. The most severe

decline in high skilled occupations were for engineering technicians, at 20.5 percent from 2004 to 2010, while physical science technicians fell by 16.7 percent.

The bubble chart below graphically depicts the current position and recent trends of each high skilled occupational group in Indiana relative to the others. Occupations are mapped in the chart across three key variables—current employment size (size of bubble), relative employment concentration (location quotients, or LQ) compared to the nation, and recent employment change. This clearly shows that the largest occupational groups are in decline, outside of computer-related occupations, while more niche high skilled occupations in physical and life sciences are on the rise.

Figure 1. Key High Skilled Occupations in Indiana—Degree of Specialization, Job Growth, and Size, 2010



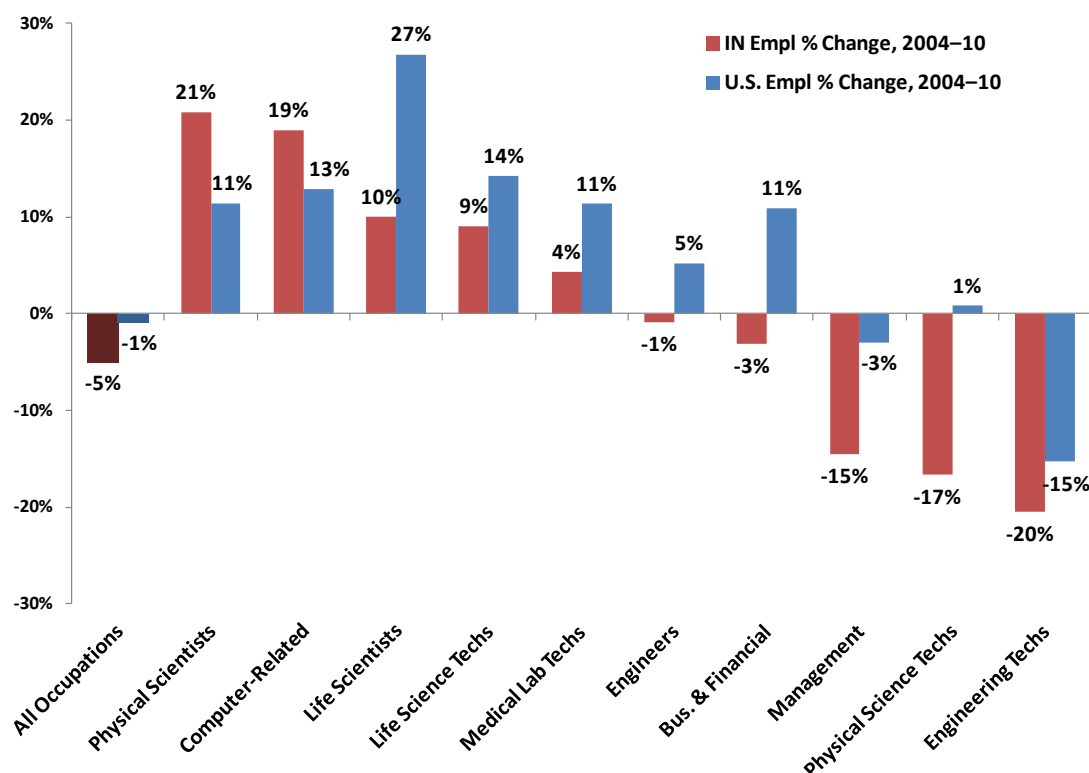
Across nearly all high skilled occupations critical to traded sector industries, Indiana is either growing slower or declining faster than the U.S. average. This is a clear indication of the weakness in demand for high skilled occupations appropriate for bachelor's and above college graduates found in Indiana. Only in the growth in physical scientists and computer-related occupations did Indiana outpace the nation. Among the other growing high skilled occupations in Indiana found in the life sciences, Indiana is not keeping pace with overall U.S. growth, including medical/clinical laboratory technicians, life scientists and life science technicians (See Figure 2).

What is particularly concerning is that there are several growing high skilled occupations in the U.S. that are declining in Indiana. This includes business and financial operation occupations, which fell in Indiana by 3.1 percent from 2004 to 2010, but grew nationally by 10.9 percent. Similarly, engineering occupations fell slightly by 0.9 percent in Indiana, but grew by 5.2 percent

nationally. And in physical science technicians, Indiana fell a substantial 16.7 percent, while recording a minimal growth of 0.8 percent nationally.

This poor standing of Indiana's growth in high skilled occupations over the 2004 to 2010 period compared to the national average is depicted in Figure 2 below.

Figure 2. In Most Key High Skilled Occupations, Indiana Lags the Nation in Employment Growth (2004–10)



In summary, recent evidence suggests Indiana lags the nation in both relative concentration and growth in the high-skill occupations most critical to the state's traded sector industries. Table 1 provides a summary of the key data on Indiana's current employment levels in high skilled occupations, the degree of concentration of employment in high skilled occupations relative to the national average, and growth rates for high skilled occupations from 2004 to 2010 across all industries.

Table 1. Indiana is less concentrated, slower growing in key occupations than the U.S (2004–10)

High Skilled Occupational Group	Current Employment & Trends			
	Indiana Empl. 2010	Indiana Location Quotient, 2010	Indiana Empl. % Change, 2004–10	U.S. Empl. % Change, 2004–10
All Occupations	2,724,850	1.00	-4.9%	-0.8%
Management	104,600	0.81	-14.5%	-3.0%
Business & Financial Operations	92,730	0.71	-3.1%	10.9%
Computer-Related	44,660	0.66	19.0%	12.8%
Engineers	27,590	0.88	-0.9%	5.2%
Medical & Clinical Lab Technicians	10,370	1.01	4.3%	11.4%
Engineering Technicians	8,730	0.93	-20.5%	-15.3%
Physical Scientists	4,000	0.72	20.8%	11.4%
<i>Life Scientists</i>	<i>2,430</i>	<i>0.45</i>	<i>10.0%</i>	<i>26.8%</i>
Life Science Technicians	2,170	1.13	9.0%	14.2%
Physical Science Technicians	1,300	0.76	-16.7%	0.8%

Source: Battelle analysis of BLS, Occupational Employment Statistics data.

MAJOR FINDING: Indiana's Major Traded Sector Industry Clusters Lag in Employment of Highly Skilled Workers

Examining more closely the specific trends associated with high skilled occupations on an industry cluster by cluster basis reveals some important findings.

Even on an industry-by-industry basis, the concentration of high skilled occupations is generally lower in Indiana than the national average. Industry staffing patterns data, available nationally from BLS and at the state level through the Indiana Department of Workforce Development (DWD), allow us to compare relative deployment of high skilled workers across key industry clusters. Indiana's lower shares of workers in high skilled occupations signal a relatively lower value added set of activities in the state's industry clusters compared with the nation.

One industry that is expected to have a higher level of high skilled workers than found across the nation is in life sciences – however, the italicized data in Table 1 suggests a lower Location Quotient for Life Scientists in Indiana. This counters the fact that average wages in the life sciences industry in Indiana are slightly higher than the nation; combined with broader employment data this suggests a greater concentration of high skilled workers. One key sector of the state's life sciences industry is its significant pharmaceutical sector, which provides 18,000 jobs (or approximately 35 percent of total industry employment).

Unfortunately, occupational data for pharmaceutical-related employment is suppressed for confidentiality reasons due to the high share of employment found in one firm, Eli Lilly & Company. (Overall industry employment data are available from a different source than the staffing pattern information used for this occupational analysis of clusters.) However, the higher-than-average wages for the pharmaceutical industry and the life sciences sector as a whole

strongly suggests that high skilled occupations exist in greater concentration in Indiana for this cluster.

Table 2. Share of Industry Cluster Employment in High Skilled Occupations, Indiana vs. U.S., 2010

Major Indiana Industry Clusters	Indiana Employment, 2010		Share in High-Skilled Occupations, 2010	
	All Jobs	High-Skilled Jobs	Indiana	U.S.
Total, All Industries	2,724,850	298,580	11%	14%
Subtotal, All Major Industry Clusters*	866,950	140,580	16%	26%
Advanced Manufacturing	376,960	36,620	10%	16%
Life Sciences	50,002	↑	↑	51%
Corporate Headquarters & Business Services	85,110	23,220	27%	31%
Energy	19,930	3,470	17%	18%
Finance & Insurance	93,480	27,560	29%	36%
Freight Transportation, Distribution, & Logistics	217,830	14,490	7%	11%
Information Technology	43,010	21,410	50%	56%
Engineering, Mgmt & Technical Consulting Services	30,630	13,810	45%	54%
Subtotal, All Other Industries (outside of clusters)**	1,857,900	158,000	9%	9%

Source: Battelle analysis of occupation-industry matrix data provided by the IN Dept. of Workforce Development and BLS (national).

Note: Data for Indiana affected by suppression of estimates due to limited sample sizes and confidentiality requirements.

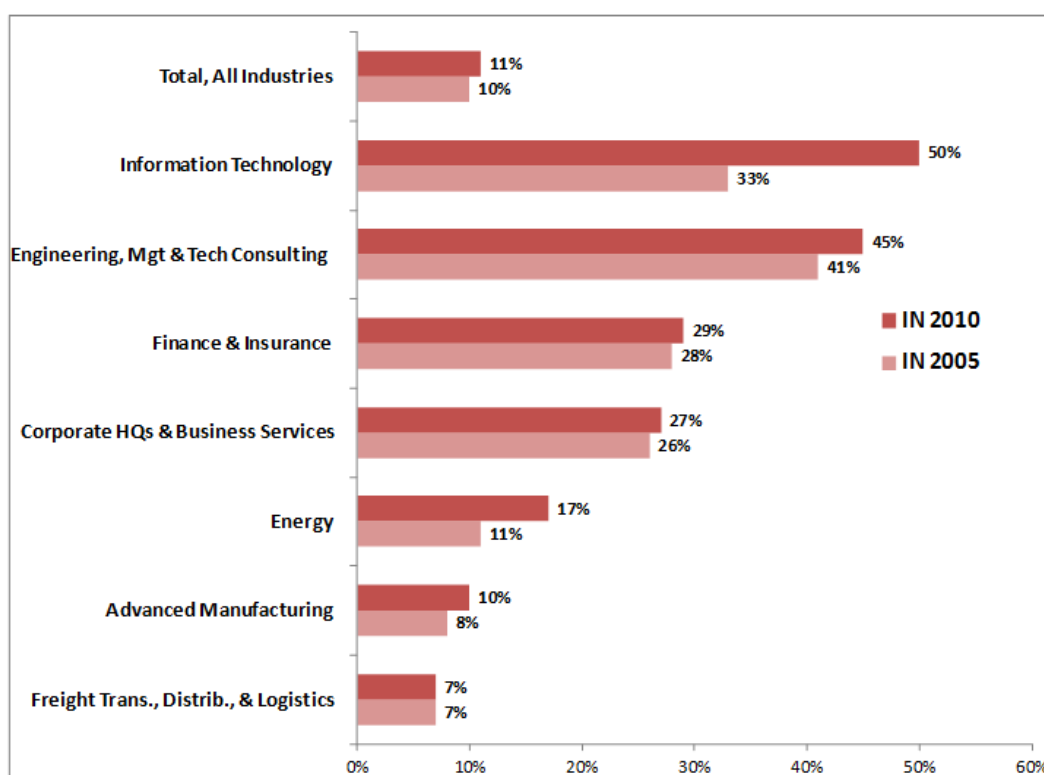
*Total industry cluster data do not include life sciences due to significant suppression of staffing patterns data particularly within drugs and pharmaceuticals manufacturing. Note that upward arrow (↑) for life sciences indicates a likely greater share of high skilled jobs within the cluster compared with the national cluster at large—available wage data and industry mix for Indiana’s life sciences cluster point to likely greater concentration of high skilled workers.

Data for Subtotals will not sum to Totals due to suppression of estimates for some industries in the Industry Staffing Patterns matrix.

**All other industries include sheltered state sectors such as construction, retail, restaurants, public admin., mining and others.

On a positive note, nearly all primary industries in Indiana serving as economic growth generators are increasing their share of employment of high skilled workers across occupations requiring at least a bachelor’s degree. Of particular note are the sharp gains in the share of high skilled workers in the information technology (up 17 percentage points) and energy (up 6 percentage points) industry clusters. The only industry cluster not to increase its share of employment in high skilled occupations in Indiana was freight transportation, distribution and logistics. However, it’s again important to note that these improvements (with the exceptions of IT and energy) still fall behind the national growth curve – even as Indiana makes some progress, it’s likely to continue falling further behind the U.S. if these trends hold.

Figure 3. Indiana is growing high-skill employment in its key cluster industries (but growth generally lags the nation), 2005 and 2010

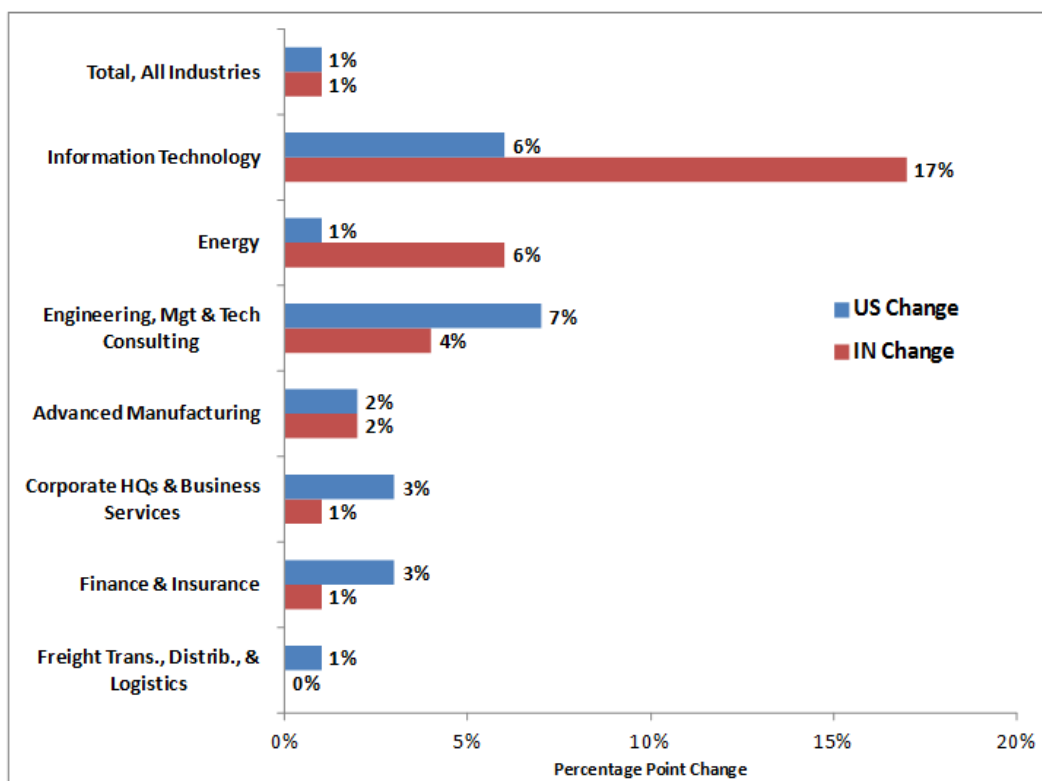


Note: Historical data on industry-occupational composition only available back to 2005 from the Indiana Dept. of Workforce Development and therefore differs with the time period for other occupational assessments which are comparable back to 2004.

Outside of the information technology and energy industry clusters, Indiana is still losing ground to other states. Unfortunately, while science, engineering, technology and business occupations requiring primarily bachelor's and above-level talent are generally growing, Indiana is not keeping pace with the nation as a whole. It is important to realize that these same primary industries across the nation are not standing still; they are also growing in their deployment of high skilled workers.

It is noteworthy that in the information technology and energy industry clusters, Indiana is growing new jobs for bachelor's and above college educated workers at a pace faster than the nation, even though still lagging the nation in the share of high skilled workers employed. Sadly, in all other primary industry clusters for Indiana's economy, the state is not keeping pace with national growth and so only slipping further in the deployment of high skilled workers with the possible exception of the life sciences industry (which appears to be competitive with national trends but cannot be fully quantified due to the suppression of certain workforce data, as noted previously).

Figure 4. Change in the Share of Cluster Employment in High Skilled Occupations, 2005–2010



MAJOR FINDING: Job Growth Alone Does Not Drive Demand for

High Skilled Occupations Critical to Traded Sector Industries – The Need for Replacement Workers in Indiana is Significant and Outpaces the Nation.

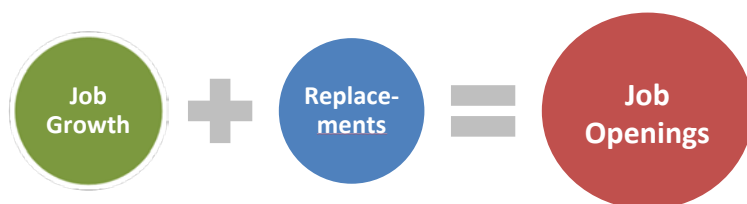
Net job growth or loss can be deceiving with respect to assessing overall demand for college educated or other workers. The demand for high skilled occupations requiring a college educated workforce is much stronger in Indiana than the net change might imply largely due to replacement needs amidst an aging workforce.

Labor demand includes not only the growth of new jobs as an economy or individual sector expands, but also job openings due to replacements. Many workers leave their jobs because of retirement or a change in occupation; consequently, employers have a need for replacement workers in addition to any new jobs that are created. In many cases, the demand for workers due to the need for job replacements within an occupation well outpace the change in total number of workers due purely to growth.

So, the full measure of labor demand is best calculated by adding together both the job growth in total employment in the occupations along with the need for replacement workers—which is

commonly referred to as job openings. Figure 5 presents a simple graphic explaining how to calculate job openings.

Figure 5: Depiction of How Job Growth and Job Replacements Relate to Job Openings



Indiana faces a significant demand for high skilled occupations critical to traded sector industries once replacements for those retiring or changing occupations are considered—estimated to be 113,000 jobs in a ten year period. Together job growth and job replacements across high skilled occupations requiring a bachelor’s degree or higher is estimated to have an annual demand of more than 11,000 each year. Over a ten-year period, this amounts to 113,000 job openings in Indiana for high skill occupations. (Indiana’s age distribution is generally consistent with the nation, so these workforce trends should not significantly diverge from the U.S.)

The need for replacement workers in high skilled occupations critical to traded sector industries in Indiana well outpaces expected growth in these high skilled occupations. The average annual expected demand from 2008 to 2018 for replacement workers in Indiana far outstrips new jobs. Across all high skilled occupations, the Indiana Department of Workforce Development estimates that each year the number of replacement workers required will stand at 7,376 compared to new jobs from growth of 3,966, so just over 1.5 replacement jobs for every 1 new job due to growth. These estimates for replacement workers by the Department of Workforce Development take into account the demographic composition of Indiana’s workforce across occupations as well as other factors shaping staffing patterns. (See Table 3, next page).

The high skilled occupational grouping with the largest expected demand for replacement workers is management, which is not surprising given that it is the largest high skilled occupational area in Indiana. But what is striking is that for every new job generated in management, there is a need for more than 3 replacement jobs. Engineering and engineering technicians are other high skilled occupations of considerable size where replacements significantly outpace new job growth. In the much smaller physical scientist technician occupational group, there is hardly any growth expected, so its small level of replacements are well in excess of new job growth.

A number of occupations are much closer in the size of job openings from growth and replacement. In particular, business and financial operations, computer-related occupations and life scientists are particularly aligned.

Table 3. Indiana High Skilled Occupations—Current Size and 10-year Projections, 2008–18

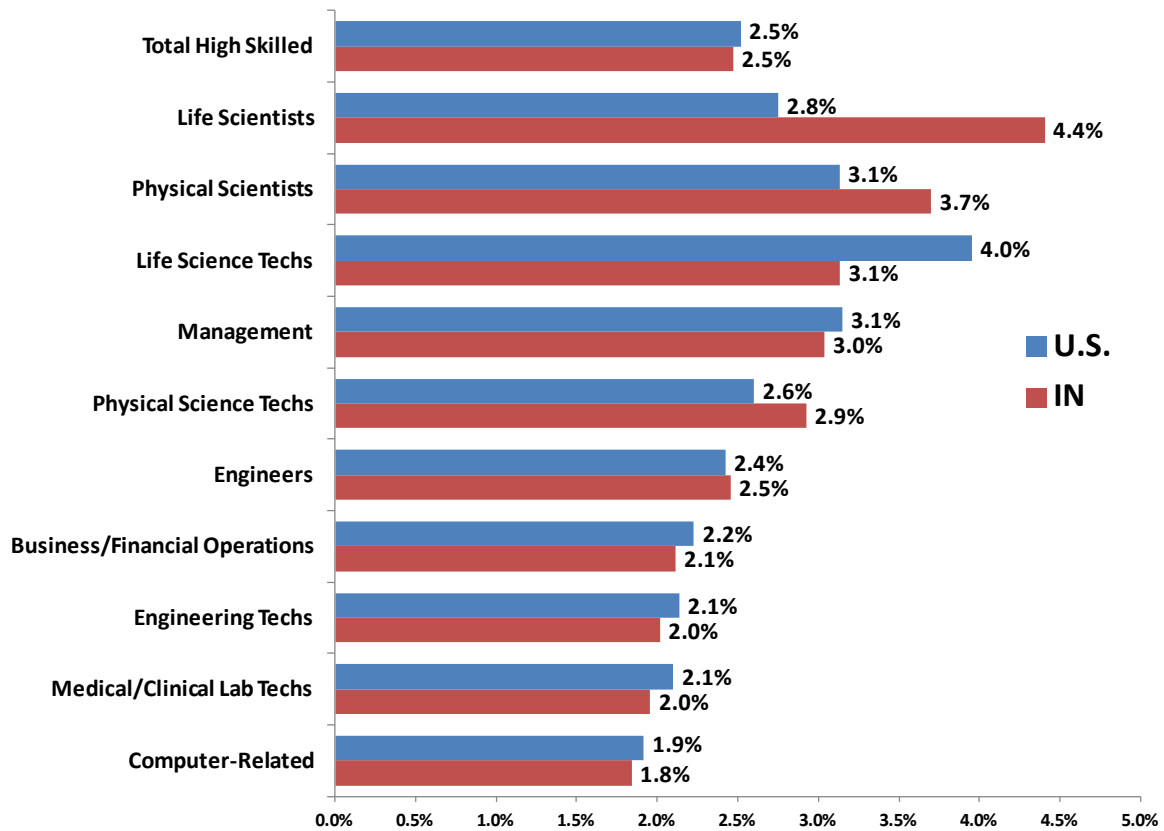
High Skilled Occupational Group	Indiana Employment, 2010	IN Occupational Projections, 2008–18			IN Avg. Annual Replacements (% Projected Total Openings)
		Avg. Annual Openings, Growth	Avg. Annual Openings, Replacements	Avg. Annual Openings, Total	
Total High Skilled Occupations	298,580	3,966	7,376	11,342	65%
Business & Financial Operations	92,730	1,571	1,960	3,531	56%
Computer-Related	44,660	798	822	1,620	51%
Engineering Technicians	8,730	62	176	238	74%
Engineers	27,590	258	677	935	72%
Life Science Technicians	2,170	25	68	93	73%
Life Scientists	2,430	101	107	208	51%
Management	104,600	908	3,177	4,085	78%
Medical & Clinical Lab Technicians	10,370	171	203	374	54%
Physical Science Technicians	1,300	1	38	39	97%
Physical Scientists	4,000	71	148	219	68%

Source: Battelle analysis of BLS, Occupational Employment Statistics (OES) and Occupational Projections data from IN Dept. of Workforce Development.

While Indiana is expected to see the same replacement rate as the nation in high skilled jobs overall, it does vary considerably on an occupation by occupation basis. Several high skilled occupations in Indiana stand out as needing a greater percentage of replacement workers than the nation – including life scientists, physical scientists and physical scientist technicians. Only life science technicians in Indiana have a substantially lower level of replacement worker need than the nation relative to current employment. Otherwise, the differences are only 0.1 percent for most high skilled occupations, including management, engineering, engineering technicians, computer related occupations, business and financial services, and medical and clinical lab technicians.

In short, like the U.S. as a whole, Indiana faces an oncoming workforce churn as the Baby Boomer generation approaches retirement. This will yield a large number of replacement openings in high skilled occupations – unfortunately, many of these positions will not be suitable for relatively inexperienced recent college graduates, and further, the trend of new job creation appears relatively anemic in comparison.

Figure 6. Indiana High Skilled Occupations—Projected Annual Replacements as a Share of Current Employment, 2008–18



Source: Battelle analysis of BLS, Occupational Employment Statistics (OES) and Occupational Projections data from IN Dept. of Workforce Development.

Is Indiana generating sufficient supply of college educated workers?

Indiana is home to world class public and private universities and is a national leader in the generation of college and university graduates. Indiana institutions confer more than 50,000 degrees each year at the bachelor's level and above. Indiana's role in the national higher education system is clearly significant as an educator not only for Hoosiers but also for thousands of students from other states and nations each year.

(It should also be noted that Indiana has an excellent community college system conferring associate's degrees and certificates to meet the state's middle-skill employment demands. While these graduates are outside the scope of this study, the community colleges also provide approximately 12,000 students annually who complete associate's-level programs and transfer to complete a four-year degree—contributing further to the state's strong baccalaureate pipeline.)

But how does the state fare in supplying a college educated talent base for its own economy? The varied dynamics around this key question are explored here as we examine the supply of graduates, their alignment with demand in high skilled occupations, their likeliness to remain in the state following graduation, and the factors that drive this decision.

MAJOR FINDING: Indiana Stands Out as a Leading Generator of Bachelor Level and Higher College Degrees.

Indiana stands out in its production of bachelor level degrees. Indiana's outstanding colleges and universities attract students from all around the country, and the globe. Ball State found Indiana ranked second in 2008 among all states in net migration of college students into the state to attend college (second only to Pennsylvania).¹¹ The difference in number of students coming into Indiana to attend college versus leaving Indiana to attend college totaled nearly 8,400.

This is a compliment to the state's higher education institutions and represents an opportunity for Indiana and its industries to tap a high number of college students from both in-state and out-of-state attending college in Indiana. As a destination state for college, Indiana is reaping tremendous economic benefits in the form of tuition, housing, and other expenditures of students and their families and the indirect economic impacts to the education "supply chain" throughout the state.

The strength of Indiana's universities and colleges in generating bachelor level degree graduates is demonstrated by Indiana having a substantially higher level of bachelor degrees awarded given its population of 18 to 24 year olds than compared to national levels. For the nation, there were 52.7 bachelor level degrees conferred per 100,000 population of 18 to 24 year olds in 2009, while in Indiana there were 61.5 percent.¹²

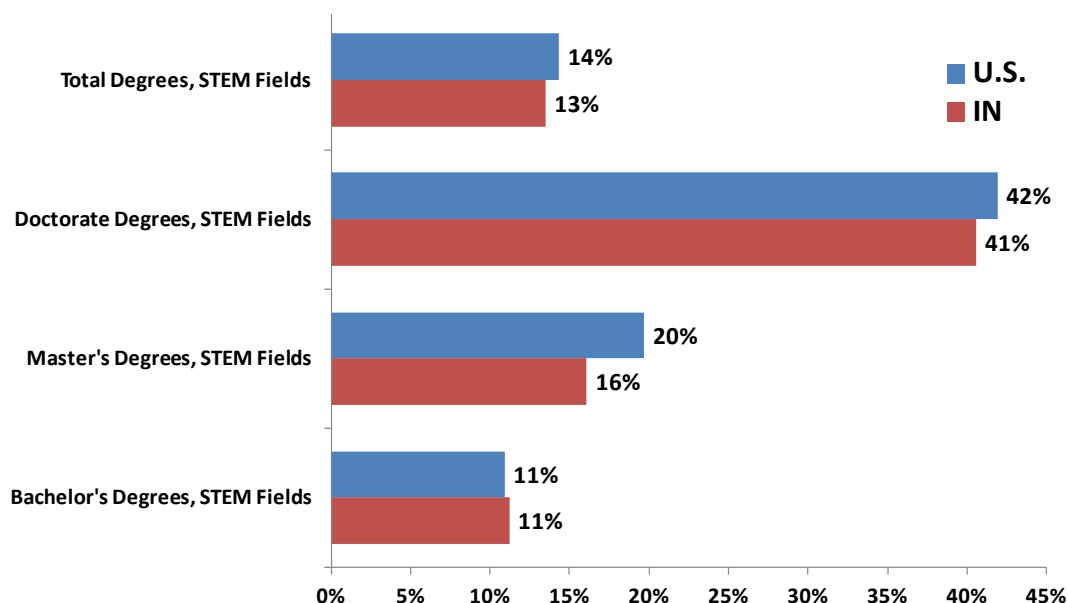
¹¹ Policy Brief: *Educational Attainment in Indiana, An Exploratory Analysis*, Ball State University Center for Business and Economic Research, July 2011.

¹² National Science Foundation, 2012 Science & Engineering Indicators, Table 8–16.

College degrees related to high skilled occupations critical to traded sector industries are growing in Indiana—at a pace similar to the nation. To frame the supply and demand context, relevant degree fields can be cross walked to key high skill occupations. The breadth of skills and college majors that span these high skilled occupations are primarily within the “STEM” fields of science, technology, engineering, and math along with business-related degrees.

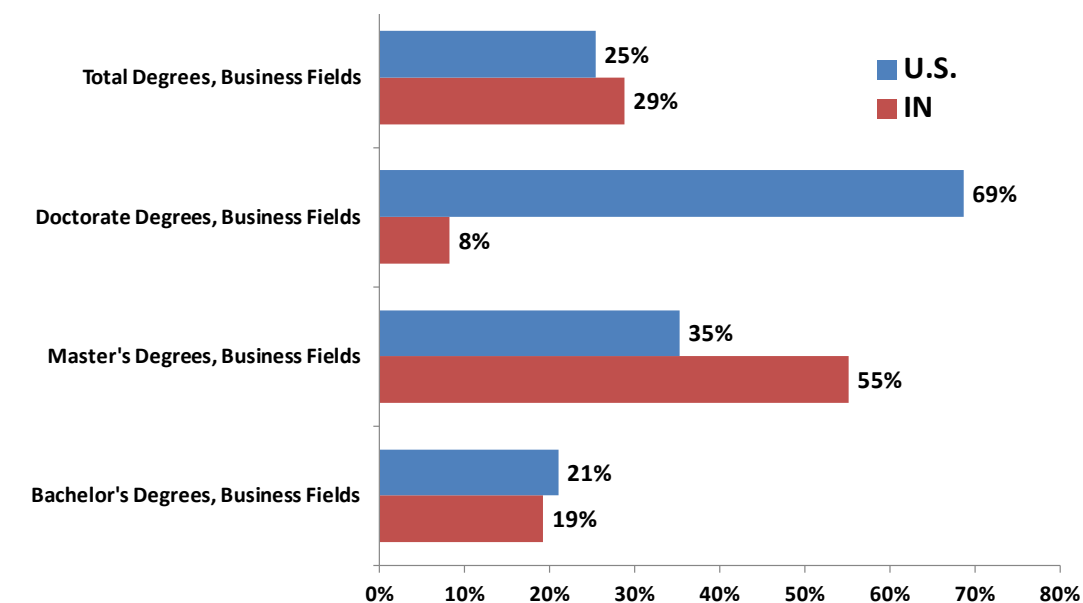
Indiana colleges and universities have generally been keeping pace with the nation in the growth of STEM college degrees overall since 2003. In business-related degrees, the state is just outpacing the national trend, conferring 29 percent more business degrees in 2010 than in 2003. Indiana has slightly lagged national growth in business-related bachelor’s degrees though still grew this group of graduates by 19 percent over the 7-year period. At the master’s level, Indiana has strongly outpaced national degree growth, up more than 50 percent, with an increased emphasis on MBA programs (See Figures 7 and 8).

Figure 7. Recent Trends in STEM Degrees, Bachelor’s Level and Above, 2003–2010



Source: Battelle analysis of National Center for Education Statistics (NCES) degree data from the IPEDS database.

Figure 8. Recent Trends in Business-related Degrees, Bachelor's Level and Above, 2003–2010



Source: Battelle analysis of National Center for Education Statistics (NCES) degree data from the IPEDS database.

MAJOR FINDING: Aligning Annual Level of College Graduates
by Key Degree Field to Annual Job Openings by Occupations Points
to a Surplus of College Graduates Each Year.

Aligning a dynamic workforce with industry demand is an inexact and constantly-shifting goal. There are inherent challenges in reconciling current data sources regarding supply with the real-time business calculations and macro-economic conditions affecting employers, as well as recognizing that firms cannot always hire recent graduates for available job openings because some positions require experience.

Sheer numbers of recent graduates do not provide the realistic supply side story, particularly in a state such as Indiana which imports a large volume of non-resident college students, not all of whom would be expected to remain in the state following graduation. To assess supply, adjustments can be made to account for realistic expectations for retention of out of state and foreign students.

Focus groups held with Indiana companies and industry organizations indicated hiring foreign students is difficult given many or most are looking to leave the state or the country and certain key Indiana industries such as aerospace are unable to hire or contract with foreign nationals. These graduates have been removed from the supply side of the analysis in Table 4. Further, a second downward adjustment is made to remove graduates from out-of-state, as tracking data and survey information indicate a large majority leave the state following graduation.

On the demand side, recent graduates (generally with little to no professional work experience) cannot qualify for all job openings. High skilled jobs in particular often require work experience or

technical on-the-job training beyond the entry level. With that said, there are many job openings for which employers consider or seek out entry level talent through recent graduates and those with some work experience.

Indiana employers surveyed in the Battelle-Walker company survey were asked about annual hiring both overall and of recent college graduates. Results indicate about half of all annual hires were recent college graduates with at least some work experience through summer jobs, internships, etc. These shares were used specific to each occupational group and applied to the job openings data for a reasonable assessment of entry level demand in Table 4.

A clear pattern is established showing that the supply of new graduates in degrees related to high skilled occupations critical to traded sector industries is exceeding projected annual job openings for which employers are likely to hire new graduates. In Table 4, we compare total annual projected job openings as well as openings adjusted for those likely to consider hiring new graduates against the number of annual graduates for both all U.S. student graduates of Indiana schools and also for just all in-state residents who graduate. The differences in supply and demand are very substantial not only for all U.S. graduates of Indiana schools but even for native Hoosiers. The figures in Table 4 show a surplus of graduates across projected job opportunities in nearly all high skilled occupations (the one exception is for medical and clinical lab technicians which shows a modest shortage of students).

Table 4. Indiana High Skilled Occupations: Projected Job Openings versus Supply of New Graduates, Bachelor's Level and Above

Occupational Group	IN Total Avg. Annual Openings (Projected 2008–18)	Annual Openings Adjusted for Employer Willingness to Hire New Graduates	Surplus/Shortage of U.S. Students Graduating in Indiana (Job Openings minus U.S. Student Degrees)	Surplus/Shortage of In-State Residents Graduating in Indiana (Job Openings minus In-State Resident Degrees)
Business & Financial Operations	3,531	2,228	10,427	6,279
Computer Related	1,620	839	487	170
Engineers	935	490	1,916	530
Life Science Technicians	93	55	120	94
Life Scientists**	208	88	270	239
Medical & Clinical Lab Techs	374	197	138	143
Physical Scientists**	219	197	102	64

Note: Postsecondary degrees include Bachelor's, Master's, and Doctorates; do not include Professional degrees (MD and JD degrees).

**Degree data for Scientist occupations limited to Master's and Doctorate's only as it is very rare for those with a Bachelor's only to work as Scientists.

Source: Battelle analysis of Occupational Employment Statistics (OES) and Occupational Projections data from IN Dept. of Workforce Development; Postsecondary Degree data from National Center for Education Statistics, IPEDS database; Occupation to Degrees crosswalk developed by the National Crosswalk Service Center, Iowa.

On a cumulative basis these annual talent surpluses in high skilled occupations critical to traded sector industries really add up. While annual demand projections for any individual occupation or group of occupations may seem relatively small, it is the cumulative impacts of persistent talent surpluses that ultimately have a significant effect. Perennial talent surpluses—over time—lend credence to a perception among college students and talented young professionals that Indiana is not a viable place to begin and advance a career. Even among those that find work, if they perceive their career options and opportunities are limited beyond their current company or role they may choose to live elsewhere in order to maintain broader career choices.

The annual supply surpluses for new graduate hiring shown in Table 5 accumulate quickly. Though one can easily extrapolate beyond one year, the table below highlights the cumulative impacts of chronic talent surpluses for a 5-year and 10-year span. Across the high skilled occupations, surpluses after five years exceed 36,000 total in-state graduates. After 10 years these same surpluses reach more than 70,000 for in-state graduates. Annual surpluses as a share of annual in-state graduates are currently sizable for several of the key high skilled groups—business and finance (74 percent of graduates); life scientists (73 percent); life science technicians (63 percent); and engineers (52 percent).

Table 5. Indiana High Skilled Occupations: 5- and 10-year Projected Job Openings versus Supply of New Graduates, Bachelor's Level and Above

Occupational Group	5-Year Cumulative Surplus/ Shortage of In-State Residents Graduating in Indiana	10-Year Cumulative Surplus/ Shortage of In-State Residents Graduating in Indiana	Annual Surplus/ Shortage as a Share of Annual In-State Graduates
Business & Financial Operations	31,397	62,795	74%
Computer Related	850	1,701	17%
Engineers	2,651	5,302	52%
Life Science Technicians	471	943	63%
Life Scientists**	1,195	2,390	73%
Medical & Clinical Lab Techs	-717	-1,434	-268%
Physical Scientists**	319	638	36%

Note: Postsecondary degrees include Bachelor's, Master's, and Doctorates; do not include Professional degrees.

**Degree data for Scientist occupations limited to Master's and Doctorate's only as it is very rare for those with a Bachelor's only to work as Scientists.

Source: Battelle analysis of Occupational Employment Statistics (OES) and Occupational Projections data from IN Dept. of Workforce Development; Postsecondary Degree data from National Center for Education Statistics, IPEDS database; Occupation to Degrees crosswalk developed by the National Crosswalk Service Center, Iowa.

A Look at High Skilled Occupations Employed Primarily in Locally Based Industries Finds Similar Surplus of College Graduates Compared to Expected Job Openings

The concern about the generation of high skilled occupations touches even those high skilled occupations employed primarily among locally based industries. For the more than 8,200 annual job openings in high skilled occupations found primarily in locally-based industries —some of which must also be filled by those with more experience than recent college graduates—there are more than 19,000 projected degree graduates.

The table below presents total job openings expected on an annual basis, not adjusted by employer preferences for experienced workers and total graduates in 2010 in related degree fields, and not adjusted by removing out of state students. Making the assumption that these factors generally offset one another, persistent surpluses of four-year graduates are still seen across these broad occupational groupings.

Indiana Additional Skilled Occupations: Projected Job Openings versus Supply of New Graduates, Bachelor's Level and Above

Occupational Group	IN Total Avg. Annual Openings (Projected 2008-18)	IN Degrees in Occupationally Relevant Fields, 2010	Surplus/Shortage of Graduates (Job Openings minus Degrees)
Additional Skilled Occupations	8,232	19,254	11,022
Allied Health & Therapists	795	1,323	528
Counseling & Social Service	1,231	3,727	2,496
Designers & Artists	381	1,351	970
K-12 Educators & Librarians*	3,600	5,271	1,671
Legal	507	1,024	517
Media & Communications	415	2,301	1,886
Pharmacists	248	329	81
Physicians & Dentists	878	601	-277
Social Science, Urban Planning, & Architects	177	3,327	3,150

Note: Postsecondary degrees include Bachelor's, Master's, and Doctorates; include Professional degrees (MD and JD degrees) where applicable.

*Degree data for K-12 Educators include Postbaccalaureate and Postmaster's Certificates in Education. One of the largest Bachelor's degree areas was dropped from the Education supply analysis as there were just over 1,000 degrees in Physical Education and Coaching with likely relatively few directly related job openings.

Source: Battelle analysis of Occupational Employment Statistics (OES) and Occupational Projections data from IN Dept. of Workforce Development; Postsecondary Degree data from National Center for Education Statistics, IPEDS database; Occupation to Degrees crosswalk developed by the National Crosswalk Service Center, Iowa.

Is Indiana able to retain and attract college educated workers?

It is clear that many bachelor and higher degree graduates, even those in-state residents, need to leave the state upon graduation in order to find work given weak levels of demand for high skilled workers, even for replacements for those retiring or changing occupations. What about those bachelors level and above college graduates who do stay to work in Indiana? Do they stay or do they also leave over time?

MAJOR FINDING: Each Year Following Graduation Fewer
and Fewer Native Hoosiers Graduating from Indiana Universities
and Colleges are Employed in Indiana.

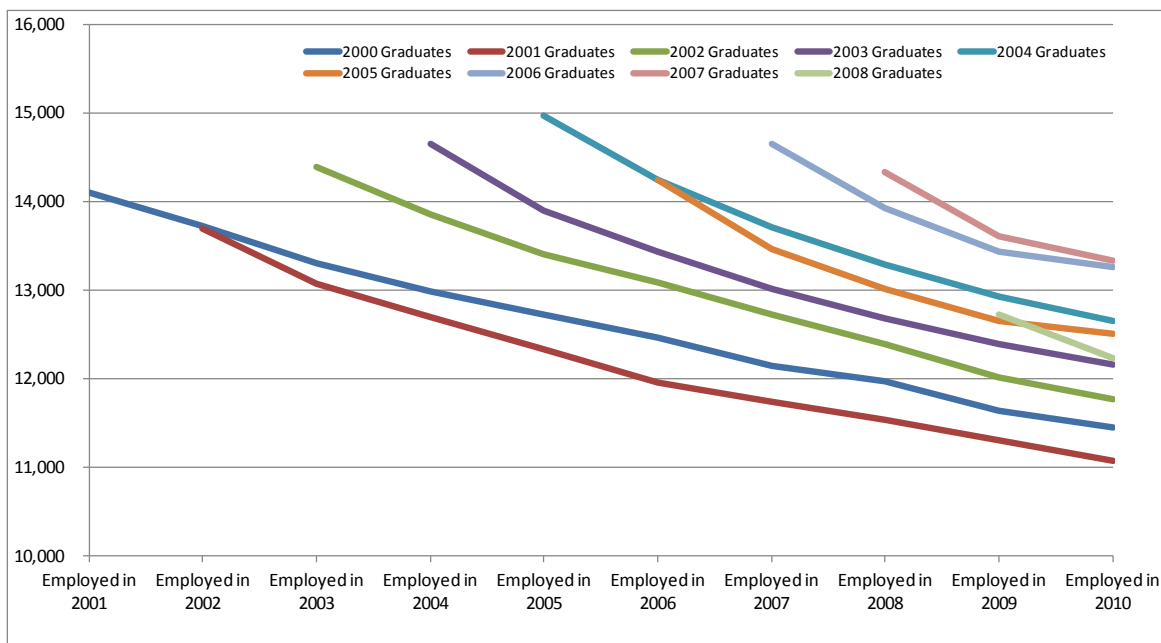
Based on a unique database developed in Indiana, known as the Indiana Workforce Intelligence System (IWIS), which links together disparate data sets from within the Department of Workforce Development to enable the tracking of college graduates into the workforce in Indiana across public universities in the state, it is possible to consider the flows in and out of college. This unique IWIS dataset allows for the analysis of retention of college graduates as they enter the workforce.

Looking at recent college graduates since 2000, the trend is a steady decline over time (see Figure 9). This pattern is also similar for college graduates from out-of-state. The trends are consistent year-by-year with attrition occurring immediately with an average of 70 percent of native Hoosiers remaining and employed in Indiana one year following graduation and just 15 percent of those originally from outside of Indiana employed in the state one year later. For each graduating class, year by year, there is a fall off in recent college graduates and by ten years out another 15 percent to 20 percent of in-state college graduates leaving the state.

To illustrate this attrition among graduates, just over 28,000 students at Indiana's public institutions graduated in 2000 with a bachelor's degree or higher. Among these were 20,000 students from Indiana and 8,000 from other states.

- For the 20,000 native Hoosiers, in 2001 the number working in Indiana had dropped to 14,000 (70 percent of the original group) but by 2010 this number had declined to 11,400 or about 57 percent of the original in-state class still working in Indiana.
- For the 8,000 out-of-state students (not shown in Figure 9), in 2001 the number working in Indiana had dropped to less than 1,500 (18 percent of the original group) and by 2010 this number had declined to less than 900 or about 11 percent of the original out-of-state class still working in Indiana.

Figure 9. Employment of Native Indiana Graduates of Public Colleges and Universities in Indiana Following Graduation, Bachelor's Level and Above, Class of 2000–2008



Source: Battelle analysis of Indiana Workforce Intelligence System (IWIS) provided by IBRC at Indiana University; data are for public postsecondary institutions.

It should be acknowledged that the IWIS system is not a perfect gauge for measuring the ongoing attrition of four-year college graduates. IWIS is only for public schools—however, the experience among private schools is likely even greater attrition and out-migration of students given they attract a greater share of non-native Hoosiers. More importantly, IWIS does not differentiate between graduates who leave the state to pursue employment and those who voluntarily leave the workforce (to start a family, for example) or pursue graduate studies outside the state. However, even with these caveats, it is clear that there is a persistent trend of graduates migrating from the state—reinforced by the responses of these graduates themselves to questions about the quality of employment in Indiana versus elsewhere.

So what's driving out-migration of recent college graduates? The answer is straightforward—quality jobs. Based on the survey of nearly 2,000 recent college graduates conducted by Walker Information for this study, it is clear that the leading factors driving where recent college graduates live is the quality of jobs. “Quality” here refers not only to pay and compensation but also job roles and responsibilities and whether the job is seen as a step toward advancing a career path. In making decisions on where to live and work, recent graduates put these job and career characteristics ahead of other more personal or preferential characteristics such as family ties to the region or the lifestyle associated with a location. Jobs in Indiana are viewed by these recent college graduates as not offering as high a level of job quality as jobs outside of Indiana (see next section reporting survey results for more details).

A validation of lower quality of jobs in Indiana is reflected in average wages for high skilled jobs that generally fall well below the national averages. Earnings reflect the skill sets of workers and the activities on the job with those that earn premiums involved in greater value adding activities. Wages for Indiana life science occupations, for example, essentially meet the national averages and reflect the competitive nature of the life sciences industry cluster in Indiana involved in a range of higher value adding sectors including drugs and pharmaceuticals and medical device manufacturing. Likewise, the industry is competing for top tier talent among life scientists and must pay competitive wages. Generally, though, high skilled workers in Indiana are earning significantly less than their counterparts nationally.

A lower cost of living can explain a portion of lower average wages but much of the difference can be attributed to the nature of work conducted by these workers in Indiana and the competitiveness of their respective industries. The Census Bureau's Cost of Living Index indicates Indiana's cost of living is 92 percent of the national average. As shown in the table, a majority of major high skilled groups earn less than this share of the national average—included in this group are the four largest groups of high skilled workers: managers, business professionals, computer-related, and engineers. Each of these is paying average wages not only well below the national average but also lower wages considering cost of living.

Table 6. Average Annual Wages for High Skilled Occupational Groups, 2010

Occupational Group	Avg. Annual Wages, 2010		
	Indiana	U.S.	Indiana as a Share of U.S.
All Occupations	\$ 39,020	\$ 44,410	88%
Business & Financial Operations	\$ 60,070	\$ 67,690	89%
Computer-Related	\$ 63,616	\$ 77,117	82%
Engineering Technicians	\$ 53,141	\$ 53,578	99%
Engineers	\$ 73,074	\$ 87,453	84%
Life Science Technicians	\$ 39,629	\$ 40,499	98%
Life Scientists	\$ 77,867	\$ 75,747	103%
Management	\$ 90,890	\$ 105,440	86%
Medical & Clinical Lab Technicians	\$ 39,657	\$ 42,891	92%
Physical Science Technicians	\$ 43,700	\$ 48,962	89%
Physical Scientists	\$ 64,071	\$ 79,792	80%

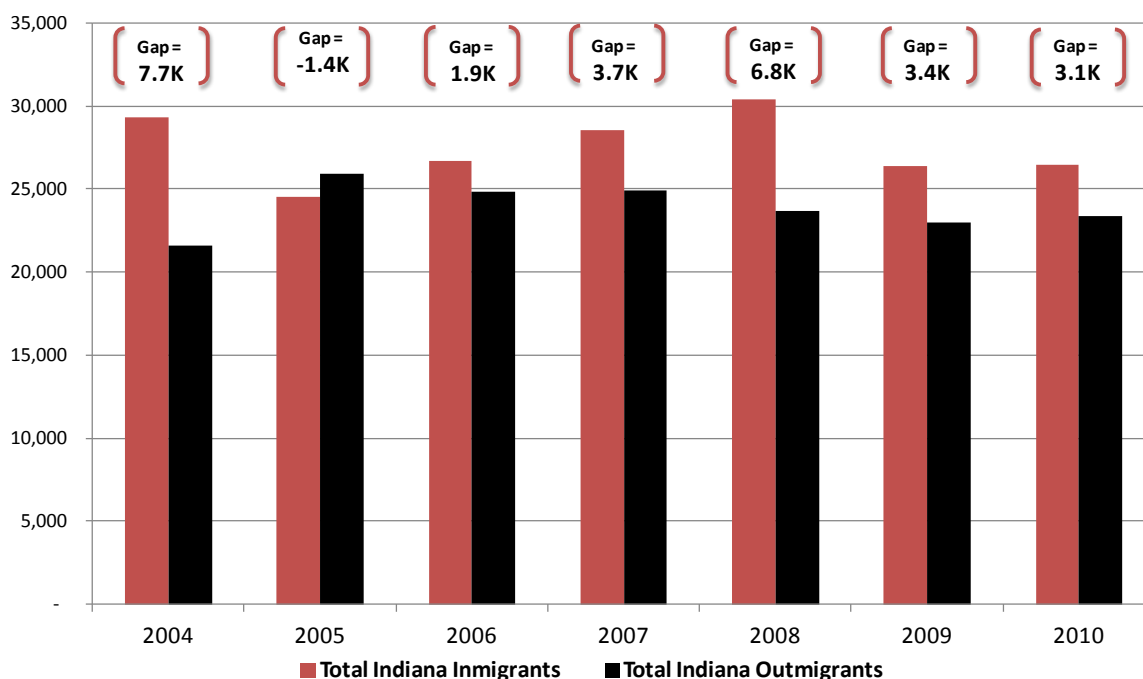
Source: Battelle analysis of BLS, Occupational Employment Statistics (OES) data.

MAJOR FINDING: Among the broader base of older college graduates in the workforce, Indiana is attracting workers.

The significance of talent retention of high skilled workers does not diminish as college educated Hoosiers age and gain more experience. Also, since many of the high skill job openings by employers require college educated workers with experience, it is important to examine what happens among older, experienced college educated workers. The annual U.S. Census Bureau's American Community Survey (ACS) makes it possible to examine the flows in and out of Indiana across a broader age group of college educated workers.

From 2004 through 2010 Indiana experienced a net in-migration of these workers in the prime working age group (ages 25 to 54) in six of seven years, averaging 3,600 per year. This is a positive finding in terms of talent inflow, though the overall levels by which those moving in exceed those moving out are relatively small in light of the total levels of in and out migration of 25 to 54 year old college educated workers, as seen below.

Figure 10. Migration of Individuals Ages 25–54 with a Bachelor's Degree & Higher In and Out of Indiana, 2004–2010



Source: Battelle analysis of Census Bureau American Community Survey Public Use Microdata System provided by IBRC at Indiana University.

What are the implications for this small, but steady in-migration of experienced college educated talent in recent years to Indiana? On the face of it, attracting 25 to 54 college educated workers to Indiana is a positive sign that Indiana is attractive to high skilled workers, and Indiana employers are able to address their needs for experienced workers. Still, in a state with relatively weak industry demand for high skilled workers, however, this may lead to heated competition for quality jobs and a crowding out of a segment of the college educated workforce. This, in turn, could lead to “underemployment” of the college educated where lack of demand for their skill set

leads to work that does not fully utilize their skills (e.g., trained accountants working in retail). It is also further confirmation of the harmful dynamic that sees newly-minted graduates leave the state in search of better opportunities—these graduates do not remain in Indiana to hone their skills, leading to the need for employers to look outside state borders to recruit more experienced workers.

Summing Up the Detailed Data-Driven Analysis on the Demand and Supply of College Educated Talent in Indiana

The results of the assessment of the supply and demand for the college educated workforce in Indiana reveals specific answers to the key questions posed:

Does Indiana industry generate sufficient job opportunities for college educated workers with at least a bachelor's degree?

Answer: “NO”

- Indiana lags behind the nation in the share and growth of industry demand for high skilled workers across occupations requiring at least a bachelor's degree. This lower demand is found consistently across industries driving the economic growth of Indiana.
- While nearly all economic growth-generating industries in Indiana are increasing their share of high skilled employment, they are generally doing so at a slower pace than the nation with just two notable exceptions. (Those industries in Indiana that are growing new jobs for college educated workers at a pace faster than the nation, even though still lagging the nation in the level of high skilled workers, include the information technology and energy industries.)
- Indiana faces a significant demand for high skilled occupations once replacements for those retiring and changing occupations are considered—estimated to be 113,000 jobs in a ten year period. Indiana's demand for replacement workers in high skilled occupations is on par with the nation, though higher for a number of specific high skilled positions, including life scientists, physical scientists and physical scientist technicians. However, many of these jobs are not available to recent college graduates based on the experience level required by employers.

Is Indiana generating sufficient supply of college educated workers?

Answer: A qualified “YES”

- Indiana public and private universities are already generating a high number of college graduates and have been increasing the number of new college graduates in highly sought after science, technology, engineering and math degrees as well as business degrees.
- The lower level of industry demand and strong performance in generating college graduates results in more annual college graduates than job openings available, even

when only considering Indiana in-state graduates as well as adjusting for employer interest in hiring not only entry level but also more experienced workers.

- This points towards a potential comparative advantage for Indiana: Indiana has a significant opportunity to grow, attract and retain industries desiring knowledge workers in competition with other parts of the U.S. as well as globally.
- To utilize this advantage, however, Indiana must maintain a strong higher education pipeline while implementing strategies to increase high skill employment opportunities (particularly for younger workers) – the challenge for the state is to simultaneously continue to aggressively improve its human capital standing while adopting a knowledge-based economic development approach.

Is Indiana able to retain and attract college educated workers?

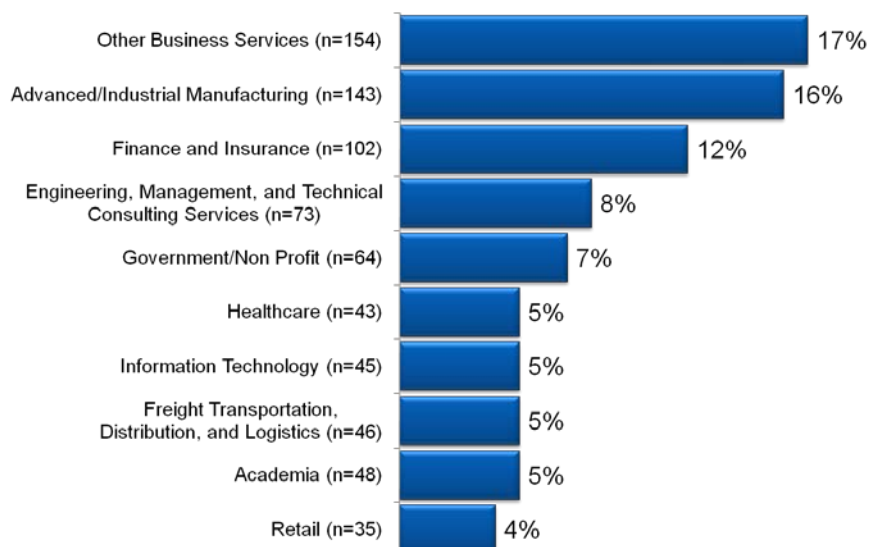
Answer: “MIXED”

- The level of recent college graduates from Indiana universities and colleges working in Indiana declines over time consistently across the period of 2000 to 2009, whether the college graduates were originally in-state residents or from out-of-state. (This trend is due to a persistent lack of career and advancement opportunities for recent graduates, leading to ongoing migration.)
- Recent college graduates view the quality of jobs in Indiana as lower than that found outside of Indiana, which makes it harder for Indiana employers to retain and attract them. Annual wages for high skilled occupations generally are significantly lower in Indiana, even after adjusting for lower cost of living in the state; survey results further shows that recent graduates regard Indiana positions as offering less opportunity for advancement on average
- Still, slightly more older and experienced college educated workers ages 25 to 54 are moving to Indiana than moving out over the period 2004 to 2010, suggesting that Indiana employers are actively recruiting more experienced college educated workers from out of state (having already lost the opportunity to hire and develop Indiana’s ample supply of new four-year graduates).

The Indiana Talent Situation: Insights from the Key Participants – Employers and Recent College Graduates

To more fully understand the specifics and subtleties of the Indiana situation, it is important to consider the insights from the key participants in Indiana's demand and supply of college educated workers...the employers and recent college graduates. An in-depth survey of recent college graduates and employers was conducted by Walker Information that provides important insights into dynamics of the interplay of demand and supply for college educated workforce in Indiana.

More Details on Survey Responses from Indiana Employers and Recent College Graduates



- 889 companies completed the survey, representing a broad mix of Indiana's economy
- 1,934 college graduates* over past 3 years (4 grad classes) completed survey with overwhelming majority in the workforce
 - Overwhelming majority are in the workforce with 1,396 working full-time and another 276 part-time
 - 864 work in Indiana today and 802 work outside of Indiana
 - 1,165 were in-state residents and 725 were out-of-state residents when they attended college
 - 75 percent of in-state graduates are working in Indiana, while only 20 percent of out-of-state graduates working in Indiana
 - Total respondents by class: 2008–404; 2009–450; 2010–558; 2011–522

Note: Battelle investigating the company industry responses in Biomedical Mfg as responses were relatively low though specific responses regarding positions in the life sciences were somewhat higher.

*Graduates with a 4-year degree. Respondent subtotals will not necessarily sum to total as not all survey questions were addressed in each response.

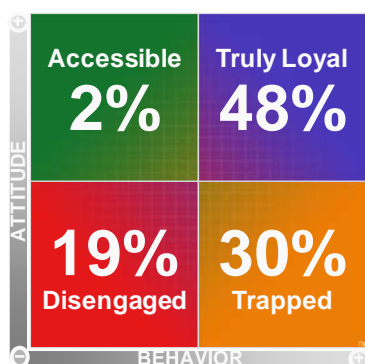
From the employer perspective, what emerges is that Indiana college graduates matter to industry's competitiveness, but the importance of work experience stands out most:

- **Employers in Indiana have a strong loyalty to hiring Indiana college graduates, as reflected in both their attitude and behavior towards hiring Indiana college graduates.**

Nearly 50 percent of Indiana employers responding to the survey indicated that they have a high commitment to hiring college graduates from Indiana, and are actively seeking job candidates from Indiana colleges. What stands out is that a small but significant minority of Indiana employers would be considered to be disengaged from hiring Indiana college graduates in neither having a commitment nor actively seeking to hire Indiana college graduates.

Loyalty by Indiana employers in hiring recent college graduates from Indiana is strong.

Figure 9. Loyalty to Hiring Indiana College Graduates by Employers



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Figures represents responses to the following:

Employers were asked "level of commitment to hiring college graduates from Indiana" and "how likely to be continuing to seek candidates from Indiana colleges."

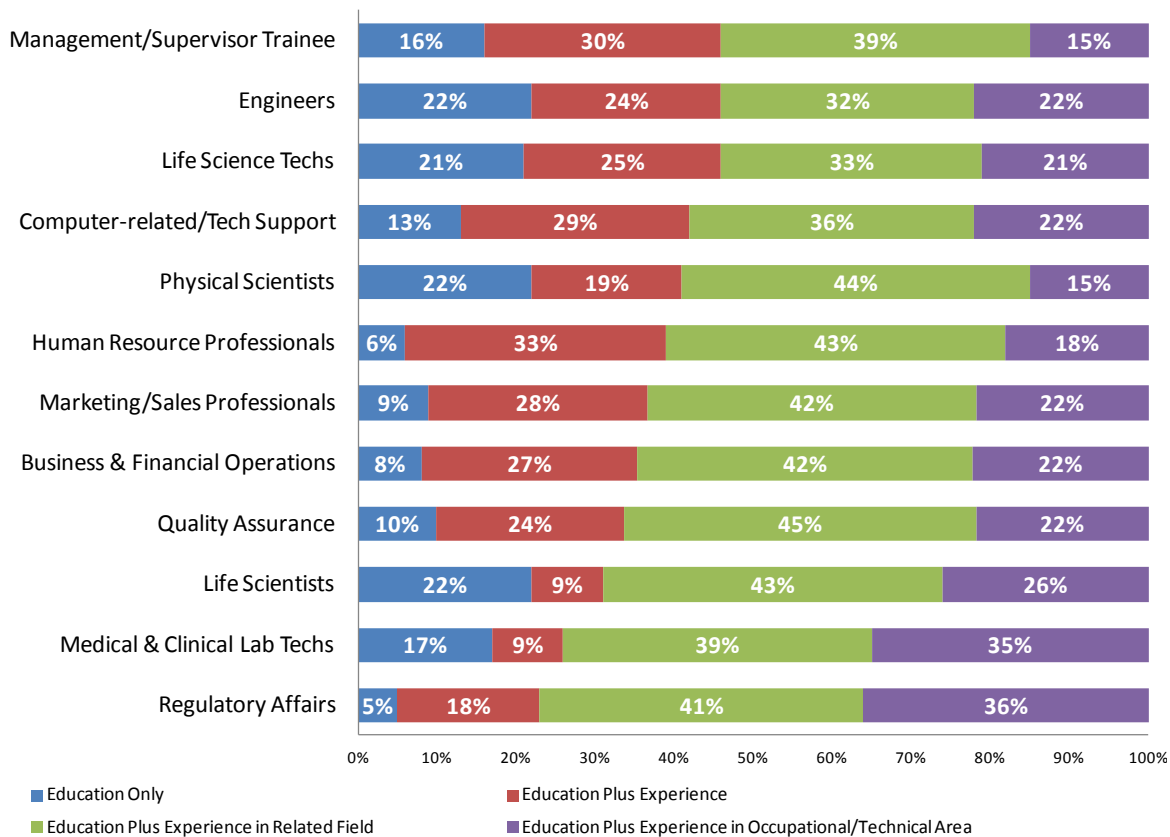
Categories imply the following – 'Accessible' employers express a commitment to Indiana, but find themselves compelled to recruit out-of-state to occasionally fill challenging positions; 'Truly Loyal' employers are committed to recruiting primarily from Indiana colleges and universities, now and in the future; 'Disengaged' employers express no significant commitment to Indiana and often recruit out-of-state; 'Trapped' employers don't express a significant commitment to the state, but lack the resources or critical need to recruit elsewhere at present.

At the same time, college education alone is not sufficient to meet the needs of Indiana employers—experience does matter. The nearly 900 Indiana companies participating in the survey were asked for each occupational group they employ what level of work experience is usually required. What comes across from the employer responses on minimum experience is that firms are truly seeking a mix of workers across experience levels.

No one level of experience dominates across Indiana employers interests in hiring, though the most prevalent is having education plus experience in a related field. But at the extremes very experienced workers and education only/some experience are typically in equal demand across Indiana employers for high skilled occupations.

Generally among more "universal" positions employed by most all companies (such as management, sales, HR, etc.), a large majority of employers require at least some experience while for more industry-specific jobs (such as scientists, engineers, and lab technicians), there is a more mixed range of experience requirements.

Figure 10. Work Experience Usually Required for Bachelor Degreed Positions



The category requiring “Education plus some experience” was generally interpreted by employers to include work experience programs undertaken during school or summer breaks including internships, work study, and/or co-ops. This indicates a “leg up” in the talent search for those graduates that have participated in one or more industry work experience opportunities. Employers provided considerable commentary on the importance of internships and real world learning experiences to create a better work-ready college graduate.

- In their recruiting efforts at Indiana colleges, employers place a great emphasis on getting to know college graduates seeking jobs and finding the right fit. In other words, for employers it is not a numbers game of sorting through resumes, but a focus on quality referrals and contacts with job candidates. Among

Provide more internship/co-op experiences

“Actual internships/work experience would help prepare the college grad. Even more than just the degree.”

“One or two semesters specific job related intern program.”

“Having internships for all the above (positions) that are robust.”

“Co-op and internships would be helpful to fully prepare students prior to graduation. Less classroom and more real world experience.”

“We’d like, and I think the students would like, more internship experiences. It orients them to work environment (such as) how departments interact, and can provide some specific experience.”

optional ways to recruit at colleges and universities, employers find the extremely or very effective methods to be on-campus interviews (57 percent) or counselor matching students to job requirements (49 percent) which gets beyond simply resumes and less intensive contact. Less valuable to employers in their campus recruiting are responses to online job postings or job fairs. Similarly for employers

Build real-world skills/work experience into coursework

"Inserting real-life work into the college curriculums, whether through labs, homework, etc."

"Real world applications including problem solving, team building, and self management. These skill sets would help all positions and all employers to consider a candidate right out of school. My biggest concern is how long will it take for a potential candidate to become a productive member of the team."

"Colleges need to teach students to think, reason and solve problems; not just recite (answers) to same questions asked for years."

"Greater involvement in real world business activities...too many students imagine themselves solving some complex problem their first year on the job. We simply want employees (able to) do the day to day jobs..."

in their independent recruiting efforts for college graduate workers they report that the use of headhunters and recruiting agencies is the most effective approach (48 percent find it extremely or very effective) followed by the use of social networking sites (41 percent).

The recent college graduate perspectives, however, suggest a more complex interplay of demand and supply in which Indiana must earn the allegiance of recent college graduates, even among those who now work in Indiana.

- Unlike employers, recent college graduates now located in Indiana **do not** have a strong loyalty to working in Indiana. Only 22 percent of Indiana resident graduates have a strong loyalty to working in Indiana, as reflected by their attitude towards working in Indiana rather than other states and in the likelihood of their continuing to work in Indiana. **Over 40 percent of Indiana recent resident college graduates are disengaged and so are neither committed nor seeking to continue their careers in Indiana.**

Loyalty to Indiana by recent college graduates is not strong.

Figure 11. Loyalty to Indiana by Recent College Graduates

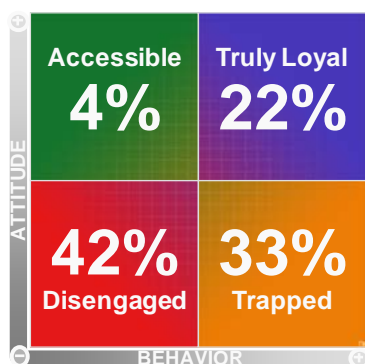


Figure represents responses to the following:

Recent Indiana Graduates who were currently living in the state were asked "would they rather work in Indiana than other state" and "likelihood to continue to live in Indiana 3 years from now."

Categories imply the following – 'Accessible' grads express a preference for Indiana and see initial opportunities, but don't see themselves living there in three years; 'Truly Loyal' grads prefer Indiana and see themselves in the state in three years; 'Disengaged' grads express no significant commitment to Indiana and will likely leave within three years; 'Trapped' grads don't express a particular preference for the state, but still see themselves living there in three years.

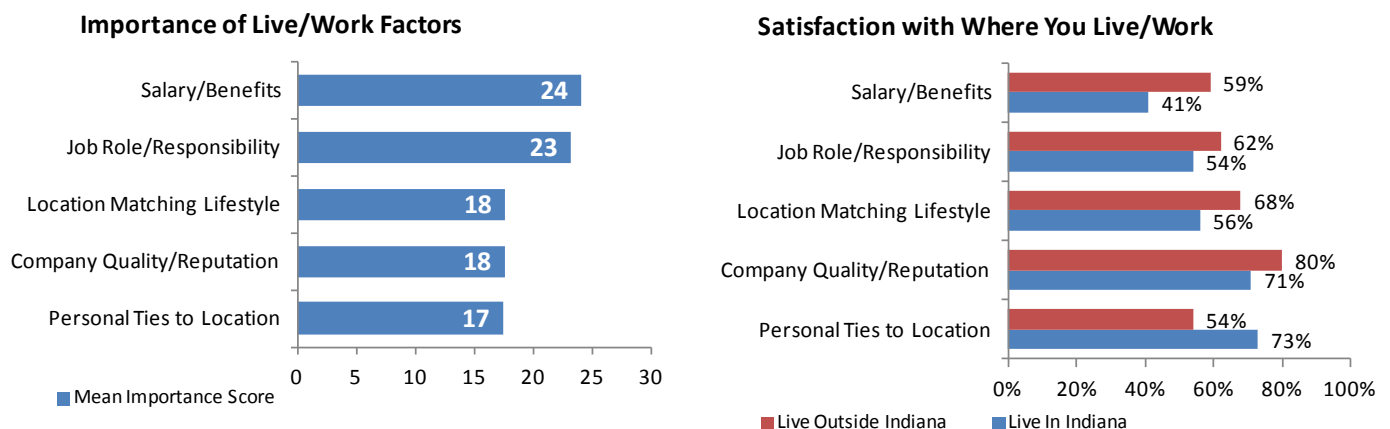
- The quality of jobs matters most as to where recent college graduates from Indiana live and work after graduation and Indiana does not fare well. Work related factors of salary, benefits, job role and responsibility matter most too recent college graduates in their likelihood to stay in Indiana. Of less importance are non-work related factors, such as location matching lifestyle and personal ties to the location.

For those recent college graduates working in Indiana, their job satisfaction in work-related key factors was lower than those recent college graduates working outside of Indiana. In salary and benefits, 59 percent working outside of Indiana are satisfied compared to 41 percent working in Indiana—a substantial 18 percentage point gap. On job role and responsibility, 62 percent of those recent college graduates working outside of Indiana are satisfied compared to 54 percent for those working in Indiana.

Having fewer quality jobs also shapes whether recent college graduates who do work in Indiana want to stay in Indiana over time. Recent college graduates report that their likelihood of living in Indiana in three years declines sharply based on whether or not they believe their current position is likely to help their career path. Just 43 percent of Hoosiers are likely to stay in Indiana when they do not view their current job as helping their career path, compared with 66 percent likely to stay when they have jobs in Indiana today that are helping their career path.

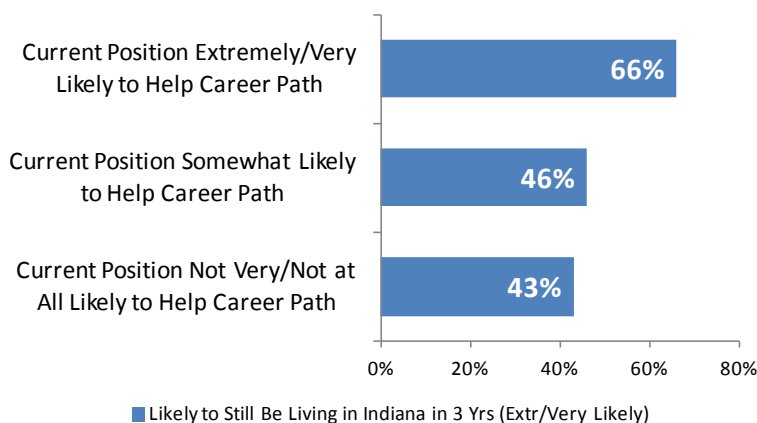
With Quality of jobs leading the factors in where recent college graduates choose to live and work—Indiana not stacking up well in satisfaction

Figure 12. Factors in the Live/Work Location Decision



Having a job that will help advance one's career path/goals significantly increases the likelihood they will still be living in Indiana three years from now.

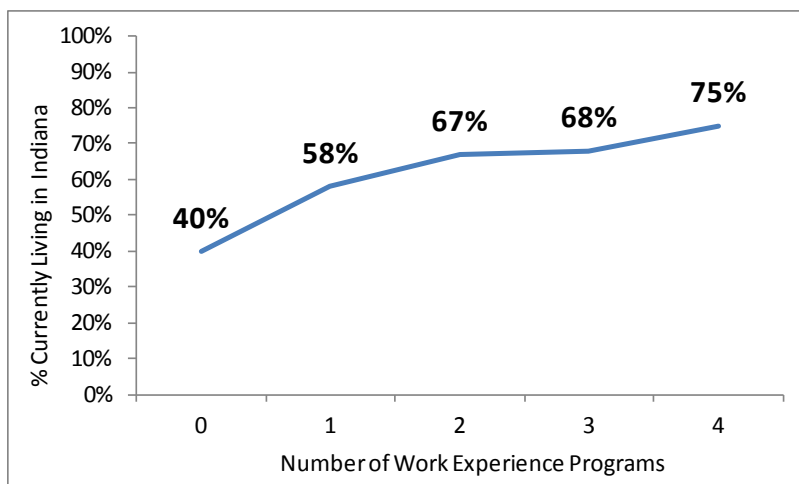
Figure 13. Career Advancement and the Likelihood of Still Living in Indiana in 3 Years



- Recent college graduates from Indiana universities and colleges also seem to make their minds up as to whether to stay or leave Indiana in how they go about their job search. For those currently working in Indiana, 69 percent of their job search activities, including where they sent their resumes and where they interviewed for jobs, were in Indiana. In contrast, for those recent college graduates from Indiana universities and colleges not working in the Indiana, 79 percent of their job search activities were conducted outside of Indiana.
- Students also differ from employers in what they find effective in their job searching, with online job postings standing out in both their independent and campus related job searching activities. In their independent search activities, over 50 percent of the student rate online job posting sites as either extremely or very helpful, followed by 41 percent finding company-specific job boards effective. Other methods such as social networking, job fairs and headhunters all were rated by less than 30 percent as effective. For campus-related job search activities, while on campus interviews are among the highest rated approaches by students, so are online tools providing job postings and networking with alumni.
- What students share with employers is the importance of being engaged in experiential learning programs, such as internships, work study, capstone projects with industry, industry mentoring and job shadowing, among others, while undergraduates in Indiana. From the survey results, it was calibrated that the likelihood of recent college graduates from Indiana universities and colleges to be living in Indiana rises substantially when they participate in work experience activities. Even one work experience activity raises the likelihood of an Indiana college graduate to live in the state beyond graduation, rising from 40 percent to 58 percent. There is also another substantial leap if the recent college graduate engages in at least two work experience activities while a college student.

Student engagement in up to two Indiana work experience programs keeps a significant share in Indiana beyond graduation.

Figure 14. Participation in Student Work Experience Programs and Likelihood of Living in Indiana Beyond Graduation



These employer and recent college graduate survey results suggest some key implications for Indiana going forward:

- Indiana employers recognize that their ability to compete on talent is closely tied to the graduates of Indiana universities and colleges, but they reported in the employer surveys a desire for an enhanced talent product from a university that is oriented to the world of work.
- Indiana college students are more footloose and concerned about where they can find their best career opportunities. Indiana employers need to measure up to a higher standard to attract and retain college graduates and not assume, as they may have in the past, that physical proximity gives them a built-in advantage in recruiting high skilled graduates.

Simply going to college in Indiana is not sufficient to create a connection to living and working in Indiana upon graduation. Engaging with students earlier to create connections to Indiana firms and careers is critical. Waiting until undergraduate students are ready to initiate their job search is too late. Experiential learning stands out as critical to create connections to Indiana for work after graduation as well as for providing students with the needed work experience to be qualified candidates for jobs.

Strategic Interventions to Repair the Talent Dynamic and Build on Indiana's Comparative Advantages

The findings of this White Paper can be easily summarized: Indiana has not yet exploited a substantial competitive advantage in the knowledge-based economy—a robust pipeline of four-year college graduates. Employer demand for college educated talent lags the nation, and students do not perceive lucrative and rewarding career pathways in Indiana to the degree they find these opportunities elsewhere.

While Indiana's institutions of higher education are productive in conferring degrees (including in high-demand science, technology, engineering, mathematics and business fields), a significant number of graduates leave the state in search of promising career opportunities. Such migration is not inherently troubling—knowledge-based economies thrive on a constant churn of people and ideas.

But in Indiana's case, the migration is driven by a lack of high skill employment opportunities, symptomatic of the state's lack of economic competitiveness. Indiana's issue is not the overproduction of college graduates, it is the underperformance of its economy. This leads to a bottom-tier ranking in adult educational attainment and a widening gap in per capita income.

Indiana must address this harmful dynamic: Its employers overall do not generate sufficient numbers of high skilled jobs compared to their national counterparts; this lack of opportunity, combined with concerns about the quality of existing jobs, spurs migration of recent graduates. This ultimately creates challenges for employers seeking more experienced workers in these high skilled occupations, as such talent has not been adequately developed in the state.

The silver lining from this analysis of the demand and supply of college educated workers is Indiana's ample supply of graduates. Hoosiers have a great opportunity to win the human capital competition by simply retaining a greater share of its graduates and better aligning them with the needs of the state's employers. The challenge is implementing a simultaneous economic development and talent preparation strategy that accelerates the state's progress towards a knowledge-based economy and capitalizes on its college educated workers to meet the resulting needs of industry.

Indiana must: 1) implement programs and policies to generate greater employment demand for these workers; 2) pursue a full-fledged talent development strategy to ensure these graduates are prepared for existing and emerging opportunities; and 3) ensure alignment among industry, academia and the graduates themselves to effectively connect workers to jobs.

To address these goals, four strategic priorities are identified:

- **Creating demand for talent** – *encouraging the creation of high skilled jobs in Indiana*

- **Preparing talent for work** – *making job readiness a top priority in Indiana’s higher education system*
- **Connecting talent to jobs** – *enhancing career services to match college graduates with industry opportunities*
- **Retaining talent** – *creating tangible pathways to meaningful careers*

These strategies by themselves do not comprise a comprehensive talent development strategy for Indiana since they do not address needs at the K-12 and community college levels (with the latter especially important given the rise in ‘middle skill’ job opportunities). But high skill employment must be addressed as a priority; Indiana’s ‘knowledge base’ supports the economy as a whole, and its high skilled positions hold the greatest potential for raising the state’s per capita income.

While this study focuses on growing high skilled, high wage jobs in Indiana, it also does not purport to offer a comprehensive economic development strategy for the state. It is a significant challenge for Indiana’s policymakers, business community, education leaders and economic development officials to build consensus and work collaboratively towards a strategy (with a strong focus on innovation, entrepreneurship and the deployment of human capital) to create more high skill jobs.

What this study *does* offer are recommendations that touch on higher education, workforce and economic development, enhancing the connectivity among them to lay the foundation for a more comprehensive effort to grow Indiana’s economy and raise its per capita income by improving both the supply of and demand for Hoosier homegrown talent.

As the Business-Higher Education Forum, an alliance of the American Council on Education and the National Business Alliance, notes: “Many distinguished commissions and task forces have examined the connection between school and work; however, virtually all confine their interest to the skills and competencies of high school graduates. Very few have examined the implications of changes in the global economic environment and the modern workplace for the preparation of American undergraduate, graduate and professional students.”¹³

For each strategic intervention, a brief action plan is laid out that recounts the strategic need for Indiana, the objectives to be pursued and details on the recommendations.

Creating Demand for Talent by encouraging the creation of high skilled jobs in Indiana

Strategic Need for Indiana

Indiana lags behind the nation in the share and growth of industry demand for high skilled workers across occupations requiring at least a bachelor’s degree. At the same time, this study shows that Indiana’s public and private universities are already generating a high number of

¹³ Business-Higher Education Forum, Spanning the Chasm: Academic & Corporate Collaboration – Key to Preparing Tomorrow’s High-Performance Workforce,” page 4.

college graduates (conferring comparatively more degrees per capita than the nation as a whole), and have been increasing the number of new graduates in highly sought-after science, technology, engineering and math fields as well as business degrees.

The imbalance between the productivity of the state's higher education system and the relative low-skill employment base found across many of its leading traded sector industries creates cumulative surpluses of college graduates (even when refining the supply of graduates to only native-born Hoosiers)—new degree-holders entering the workforce that find it difficult or impossible to find appropriate employment in their chosen fields.

As stated in this White Paper's Executive Summary, characterizing the state's output of college graduates as a "surplus" does not mean to imply an *overproduction* of college graduates. Just the opposite. Indiana's supply of college graduates can be a competitive advantage for growing and attracting industries that demand a plentiful base of knowledge workers. *Again, the current problem isn't too many college graduates—it's too few high skill jobs.*

Objectives to be Pursued

- Align state economic development policies with key industry clusters to support the expansion of homegrown knowledge and innovation-based businesses and the attraction of high skilled industry activities to Indiana, while marketing the state's human capital 'surplus' as a competitive advantage.
- Tap into the economic potential of research universities by promoting industry-university collaborations for advancing applied R&D and technology commercialization and targeting economic development around Indiana's research universities.
- Build regional entrepreneurial capacity by advancing best-in-class entrepreneurial support services, uncovering supply chain opportunities for Indiana entrepreneurs and targeting growth acceleration assistance for emerging companies.
- Create incentives for hiring of high skilled workers by established and emerging high-growth oriented companies.

Proposed Actions

Aligning state economic development policies with the state's knowledge-based clusters: Best practice in economic development recognizes that each state and its regions have a set of target industry sectors or "industry clusters" in which it can differentiate itself and build specialized areas of expertise where it can be a world leader.

Indiana has a strong set of industry cluster initiatives focused on the life sciences, advanced manufacturing and logistics, information technology, and energy/clean technologies, primarily developed through the Central Indiana Corporate Partnership (based on an initial blueprint provided by the Battelle Memorial Institute in 2000). However, these efforts continue to be

largely driven by the private sector in close collaboration with the state's higher education institutions. There is a substantial role that the state's economic development efforts can play to support and advance furthering the state's industry clusters.

Action 1: Advance technology deployment and development through industry cluster

initiatives. The ability of a region to lead in technology innovation and deployment in particular areas of industry is a defining driver of economic competitiveness—and a critical source of high skill employment growth. Indiana should advance competitive grants to spur collaborative projects advancing technology deployment and development for targeted industry clusters. These grants would aim towards supporting shared services and infrastructure that address key industry needs and challenges. Key selection criteria should include the breadth of industry engagement, potential impact on high-quality job creating and growing sales, and the commercialization of new product and processes.

Recent efforts in Maine and Oregon provide examples for how to advance such initiatives. In Maine, seven targeted sectors were identified and competitive grants have included efforts to commercialize biopolymers from potatoes and forest biomass, advance a shared online ordering system for selling farm produced foods and shared equipment in a manufacturing applications center focused on use of precision manufacturing for new products.

In Oregon, a statewide Innovation Council has targeted six industry clusters and focuses on providing project support for efforts of industry clusters. One example is support for the Oregon Nanoscience and Microtechnologies Institute (ONAMI), a public-private partnership that provides matching funding for collaborative research projects, industry access to university-based shared user facilities, and commercialization funding.

Action 2: Establish closer collaboration between economic development agencies and cluster organizations to attract high value industry activities to Indiana. It is critical that Indiana's efforts to advance higher value industry activities that call for high skilled workers also guide the business attraction efforts of the Indiana Economic Development Corporation (IEDC). A proactive, outreach marketing program to attract high value industry activities, such as R&D, engineering and testing services and complex component manufacturing, would be an important complement to IEDC's outstanding record in attracting more assembly line and basic manufacturing to the state.

Indiana's industry clusters can be an important resource in advancing business attraction for high value industry activities. These industry clusters can identify opportunities for growth and expansion of their supply chains, and particularly to help in targeting missing capabilities in the supply chain that would help making existing firms more competitive. Many times these supply chain needs would be for cutting edge, high growth potential developments within the industry cluster, such as electrification for the auto industry or tissue engineering for the medical device industry. In addition, the firms comprising the industry cluster offer a natural business attraction target for raising the level of high value industry activities in Indiana whether the firm is already headquartered in Indiana or operates a branch manufacturing plant in the state.

By working at the level of an industry cluster, IEDC can develop sophisticated and tailored approaches that would entice existing companies in Indiana within specific industry clusters to bring additional high value industry activities to the state. The IEDC has worked with the BioCrossroads organization since its inception in 2002 to bolster its bioscience attraction activities, and more recently has collaborated (and helped finance) efforts with the Conexus Indiana (manufacturing and logistics) initiative to assess industry needs in the aerospace/defense and automotive sectors, as well as a promotional campaign for the state's new media/digital marketing cluster with the TechPoint initiative. There are ample opportunities to expand and formalize such partnerships to yield strategies for attraction and growing knowledge-based firms in key economic sectors.

Action 3: Market Indiana's human capital "surplus." In advancing business attraction, Indiana also needs to develop specific strategies that leverage the strong pipeline of college graduates in business, science, engineering and technology. One approach might be to identify the leading firms recruiting Indiana graduates and target them for business recruitment focusing on leveraging strong in-state incentives.

Another approach might be to identify as prospects out-of-state companies with sponsored research and development at universities—here the benefit is that the relationship is to specific faculty and so there can be a more relationship-based outreach along with tying to key students of the faculty member. Again, private sector cluster organizations can be valuable partners in developing these campaigns and identifying targets.

There are successful examples of this strategy, as when the state aggressively pursued and landed a major mail-order prescription distribution hub (Medco, now ExpressScripts) by promoting the region's robust pipeline of pharmacy graduates and existing logistics workforce, but such efforts need to be ongoing and systematic rather than ad hoc and episodic.

The objective of tapping the economic potential of Indiana's research universities offers another proven approach to advancing the demand for high skilled talent. According to a study prepared for the U.S. Small Business Administration, "research universities and investment in research universities are major factors contributing to economic growth in the labor market areas in which universities are situated."¹⁴ The Milken Institute noted that research centers and institutes are "indisputably the most important factors in incubating high-tech industries" in a widely cited study, which found that 65 percent of the difference in economic success for regions from 1975 to 1998 is accounted for by the presence and growth of high-technology industries.¹⁵

Indiana today has a substantial university research base, standing at over \$1 billion in 2009 and substantially outpacing the nation in growth from 2005 to 2009 (32 percent growth for universities in Indiana compared to 20 percent growth nationally), and so has the ability to generate substantial economic growth in concert with its university research base.

¹⁴ Bruce Kirchhoff, "The Influence of R&D Expenditures on New Firm Formation and Economic Growth," BJK Associates, 2002.

¹⁵ Milken Institute, *America's High-Tech Economy*, 1999.

Increasingly, states are recognizing that the stature of their universities should be measured not only by the “size” of their research and talent generation activities, but the “translation” of that research base into fostering industry clusters, advancing new product development, and generating new company formation. Indeed, industry-university collaborations are a hallmark of achieving this translation. With the shift towards networked innovation, where companies are moving away from a reliance on internal R&D labs and instead focusing on diversifying the sources of innovation from which they draw, there is a rising need for strategic alliances across universities and industry to fill the demand for innovation. GE’s 2012 Global Innovation Barometer surveying senior business executives reported that partnerships were most likely to drive innovation through the next decade and that working with universities and research labs was among the top five drivers for successful innovation.¹⁶

Action 4: Promote industry-university collaborations to leverage Indiana’s university research base for advancing applied R&D and technology commercialization. Recent efforts by BioCrossroads have identified the need for Indiana state government to take a leadership role in supporting the advancement of sustained, systematic linkages across Indiana’s industry and academic institutions.

This effort needs to consider the continuum of industry-university engagement activities focused on the intersections between the state’s core research/business competencies and emerging/high-growth market opportunities. These efforts should address the spectrum of engagement from awareness and relationship building to technology problem solving and new technology development to strategic partnering to address a broad transformative initiative. Only through a comprehensive approach, such as taken by Ohio Third Frontier or the Kansas Bioscience Authority, can Indiana expect to realize the full economic benefits in technology development leading to higher demand for college educated workforce from its universities. State support should include:

- Relationship building through visiting scientist programs and incentives for pro-active university policies to support and encourage collaborations with industry;
- Proof-of-concept and technology commercialization funding;
- Matching grants for industry-university applied R&D projects;
- Multi-institutional, multi-disciplinary initiatives where Indiana can be positioned as a global leader in a specific technology niche with significant market potential.

With regard to commercialization funding and encouraging industry-academic collaboration, Indiana’s 21st Century Fund was launched as a vehicle for building a more pro-active state government effort in technology and innovation advancement. With its shift in structure as of April of 2011 into the privately managed Elevate Ventures, its focus is now on later-stage capital formation issues for launching high-growth potential ventures or “gazelles.”

¹⁶ GE Global Innovation Barometer, Prepared by StrategyOne, January 2012.

Thus, a successor initiative should be launched to address the need to finance early-stage technology development on campus and advance research partnerships between industry and universities with clear commercialization goals. State government in Indiana needs to step to the plate substantially more and make investments in universities and industry-university technology collaborations.

Multi-institutional initiatives have also been driven primarily by the private sector—i.e. the recently-announced Battery Innovation Center, which involves the University of Notre Dame, Purdue University, and Indiana University-Purdue University Indianapolis. There is a productive role for state government in further encouraging and incentivizing such partnerships.

Action 5: Targeting economic development around Indiana’s research universities. Universities are increasingly viewed as vital resources to be tapped for technology development and economic growth. University research provides a pool of knowledge that can be translated into advanced technologies and products. Moreover, universities house a wealth of research talent that can be harnessed for novel ideas and insight into technology development. In the more knowledge-based global economy, where other countries are investing heavily in their own research and technology development, the nation must maximize the value of its research universities to remain competitive.

Another broad approach for Indiana to capitalize on its talent generation in high skilled occupations is to target economic development around its research universities. This effort would complement the Indiana certified technology parks efforts already underway, with locations associated with Indiana University, Indiana University-Purdue University, Notre Dame, Purdue University, Ball State University and Rose Hulman.

One way to expand this is to stimulate community development, university technology commercialization and business development within a broad geographic area surrounding research universities through preferred access to state infrastructure investments, special pools of technology development grants and targeted business incentives for companies partnering with universities on talent and technology development. This type of program was put in place in Pennsylvania with its Keystone Opportunity Zones that began in 1999, and now has added zones in 2001, 2003, 2004 and 2009.

Building regional entrepreneurial capacity is a critical objective, recognizing that attraction and retention strategies alone will not enhance Indiana’s concentration of knowledge-based enterprises sufficiently to raise the state’s high skill employment to match or exceed the nation. States and regions with strong innovation sectors similarly boast a strong entrepreneurial culture and a broad base of homegrown high-tech companies. And with two-thirds of all new job creation coming from small start-up firms in today’s economy, ramping up the creation and growth of new knowledge-based companies in Indiana can yield handsome dividends in high skill employment opportunities for young college graduates.

Unfortunately, Indiana faces significant challenges in building a truly vibrant and productive entrepreneurial environment. Despite recent progress—particularly in information technology and the life sciences—the state has relatively low measures of venture capital investment and business starts and survival. The dominant business culture is also generally conservative and risk-averse, in contrast to areas where entrepreneurship is valued as a pioneering course.

Action 6: Advance best-in-class entrepreneurial acceleration services across the regions of Indiana. To overcome this risk-averse business culture, there is a need for a convener to manage entrepreneurial initiatives and accelerate business creation efforts, focused first on the Central Indiana region as the most promising center of technology commercialization.

A regional Entrepreneurial Center of Excellence should be established by a non-profit lead partner, to serve as this organizational nexus for a variety of efforts designed to strengthen and improve connectivity within Central Indiana’s entrepreneurial sector. Among other categories of activity, the Center would provide:

- Mentoring by veteran entrepreneurs and business professionals with needed expertise for new entrepreneurs;
- Competitive market assessments and business planning—leading to funding and more intensive mentoring/technical assistance for exceptional submissions;
- Access to a professional services ecosystem geared towards the needs of start-up firms—legal, accounting, marketing, etc. (develop a network of service providers with experience supporting these ventures, providing some level of pro-bono service as well);
- A role in developing/supporting physical facilities for start-up companies to locate and grow (i.e. business incubator infrastructure) as well as shared space for collaboration (i.e. the Speakeasy model);
- Ongoing networking/presentation opportunities designed to bring related industry players together, connect the business and research communities, and generally build a more cohesive community to yield greater collaboration/partnership opportunities.

Action 7: Link supply chain opportunities to new business start-up activities. Established companies often identify needs that aren’t being met by existing suppliers or internal departments—for example, healthcare firms may need specialized software application, a large manufacturer could value a specialized type of RFID technology, or the regional biotech industry may share a common need for a certain type of testing/validation service. Similarly, firms may have existing engagements that aren’t fully meeting their needs, or desire a supply chain partner in closer proximity to their Indiana operations.

Earlier, these gaps within existing industry supply chains were discussed as a way to target business attraction efforts; similarly, they can provide opportunities for Hoosier entrepreneurs. The region’s cluster organizations, economic development agencies and other relevant non-

profits, with direction from veteran entrepreneurs and industry leaders, should create a systematic way to identify and take action on these opportunities, based on:

- Regular surveys of business leaders and the formation of business advisory councils to provide ongoing market intelligence;
- Input from existing cluster organizations;
- Input from university industry engagement/technical assistance programs.

One concrete opportunity to support the integration of fledgling start-ups into industry supply chains would be scaling up the existing Supplier INsight initiative administered by Conexus Indiana—this interactive database allows the posting of procurement opportunities from Indiana companies as well as the capabilities of potential in-state suppliers, facilitating connections among them. Its scope could be broadened by more aggressive promotion from other cluster initiatives, universities and state agencies.

Action 8: Target business finance and tax incentives to emerging high growth potential companies. A recent report by the Indiana Business Research Center (“Where the jobs are” – Slaper/Krause) observes that in the five years prior to the last recession (2003–2008) most mid-sized and large Indiana employers shed workers; the state’s economic development efforts attracted sufficient outside investment to compensate for these losses. The source of positive job growth for the state’s economy was high-growth homegrown companies (start-ups that also tend to employ a larger percentage of scientists, engineers and technologists than the typical business establishment). While the efficacy of tax incentives is often questioned, a focused initiative to target tax and financing incentives for these firms (which operate with much smaller operating margins) could be an impactful strategy, while also serving as a ‘tiebreaker’ in attracting knowledge-based business to the state.

A number of such targeted business finance and tax incentives include:

- Explore funding options to expand the direct investment and SBIR/STTR matching grants available through Elevate Ventures (the public-private partnership successor to the 21st Century Research and Technology Fund) and provide more incentives for match-matching to connect innovative small business technology companies in Indiana with large OEM companies seeking new technology solutions, small and mid-sized manufacturers who can partner with them and research faculty who can provide technology insights, testing and other research services.
- Offer a new product development refundable tax credit based on the level of new state revenue generated by this new economic activity for up to three years for emerging companies. Utah has successfully used such an incentive targeted to medical device and semiconductor industries that offers a refundable tax credit based on a portion of corporate or partnership income tax generated, wage tax withholdings and sales tax generated from a new product or project undertaken.

- Assess the competitiveness of state tax incentives supporting innovation-driven entrepreneurial firms—i.e., angel investments, venture capital and R&D tax credits, income tax exemption for patent income, tax advantages for location within a certified technology park;
- Consider networking and programmatic efforts to help smaller innovation-driven firms more easily explore global markets, given the advantageous environment for growing U.S. exports.

Creating Incentives for Hiring High Skilled Workers:

Action 9: Create direct job tax credits to employers adding more high skilled workers to their payroll and to new graduates who take jobs in high skilled occupations in Indiana. In the case of hiring high skilled workers, the Indiana EDGE tax credit is often used for large scale development projects; the credit adjusts based on the average wage of the job commitments.

To further incent the creation of high skill positions, the EDGE credit could be doubled for positions above the median wage paid to college educated workers—creating a more dramatic benefit for attracting knowledge-intensive work to Indiana.

Indiana also offers a Headquarters Relocation Tax Credit that offsets a company's state tax liability by up to 50 percent for a relocation of its principal offices. This credit could be expanded, or a similar incentive created, covering the relocation of business units that employ a high percentage of college educated workers, i.e., R&D and engineering centers, certain technical support operations.

In addition, other incentives can be targeted to the recent graduates themselves for taking jobs in high skilled occupations in Indiana, including some level of loan forgiveness or a personal income tax credit for down payments for homes.

Action 10: Create incentives to allow high skilled talent attending universities in Indiana to work with emerging, high growth potential companies to help in generating a job for them in the future. This can include efforts such as advancing a Talent Fellowship initiative for recent Ph.D.s to work with emerging, high growth potential companies on a two year postdoctoral fellowship, or having graduating seniors and Masters students have a co-op or internship opportunity to work at emerging high-growth potential companies.

Such an effort can be seen in the technology-focused Orr Fellows program, which places promising Hoosier graduates with high-tech entrepreneurial firms. While successful, this program typically impacts 20–25 graduates and 10–15 firms annually; these initiatives should be broadened and encompass other key clusters, perhaps strengthened through grants subsidizing salary stipends for the fellows and off-setting costs for the participating firms.

Another way to deploy high skilled talent in Indiana is to seek to equip and incentivize graduate level students in science and engineering fields to start their own businesses. In conjunction with universities focusing entrepreneurial training and business plan competitions for graduate level

students in the sciences and engineering fields, Indiana can provide incentives to investors to offer seed investments to endow these business plan competitions.

Preparing Talent for Work by making job readiness a top priority in Indiana's higher education system

Strategic Need for Indiana

Indiana employers have made it clear that a college degree alone does not provide the sufficient skills needed to hire college graduates. Some experience and understanding of the world of work is necessary to help college graduates translate their education into practical workplace skills. This demand for college graduates with workplace skills and experience represents a shift in the demands of the external world demonstrating the pressures a global knowledge-based economy places on talent to be relevant to work.

This emphasis on advancing job ready skills can raise concerns within higher education about narrowing the breadth of education and de-emphasizing many core academic subjects such as the humanities, art, music and history. But the reality is that today's workplace demands workers who can solve problems, work in less well-defined circumstances and take initiative and responsibility, all skills that a liberal education can foster. Moreover, cognitive research on learning suggests that putting education in an industry context can give a coherence to academic studies that is difficult to create when subjects are taught in the abstract.¹⁷

Objectives to be Pursued

- Ensure that curriculum and degree programs offer college students a strong orientation towards career opportunities and practical applications of their skills to the world of work. This includes integrating work experience into the curriculum and exposing students to basic work skills in the knowledge based economy involving working in teams, problem solving and self management.

Proposed Actions

Action 11: Create a career orientation component to freshman curriculum across higher education in Indiana. Each of the universities and colleges in Indiana should be encouraged to develop a career orientation course that can expose students to career opportunities across different fields of study. These efforts can build on the standard tools of career development, such as self-assessments, as well as offer seminars and forums with alumni from various fields.

Action 12: Forge an industry-higher education career development partnership in Indiana. As states have learned with school-to-work initiatives, the hardest part of career development is gaining the participation of employers. Indiana needs a coordinated outreach effort and consistent platform across higher education institutions to stimulate and implement employer

¹⁷ Thomas R. Bailey, Integrating Academic and Industry Skill Standards, Institute on Education and the Economy Brief #18, January 1998, pages 1–2.

involvement with internship programs, job shadowing and other work experience activities for students. Public policies to encourage and provide incentives for business participation should be pursued. One major issue, particularly for smaller businesses, is the concern about the bureaucracy involved in supporting interns. It is proposed that the industry-higher education career development partnership, in coordination with the career development staff at higher education institutions, serve as a facilitator in working with consortium of employers to develop internship projects.

Action 13: Create a faculty professional development program for workplace connections and encourage faculty externships with industry. Curriculum development and modification are largely the prerogative of the faculty. Yet, there is little investment in professional development for faculty to learn about the changing demands of the workplace and to be involved in externships around specific industry functions relating to their fields. It is proposed that faculty be able to apply for professional development sabbaticals and summer externships in which they can develop case studies, course materials and student career development programs in concert with industry in Indiana.

Action 14: Advance Professors of Practice across disciplines in colleges and universities. The key to the success of universities and colleges to engage in improved curriculum and development of meaningful work experiences as part of the curriculum lies predominantly with the orientation, abilities and experience of the faculty. New approaches are called for to strategically use the best and brightest in industry to complement tenured faculty as Professors of Practice. Simply filling the ranks of universities and colleges with adjuncts offers a second-best solution and misses the point of how to effectively complement tenured faculty with the hands-on experience of industry professionals. Professors of Practice should be viewed as extensions of higher education into the workplace and be used to help design in collaboration with tenured faculty new programs and curriculum.

Action 15: Establish an Indiana Academic Futures Initiative to advance new academic degree programs in emerging and multi-disciplinary fields that respond to long term industry skill needs such as bio-informatics, supply chain management, and product development engineering. Today new program development for higher education must compete with the pressure of maintaining existing programs, and so frequently does not get the priority it deserves. Yet, it is critical that new programs be created that take into consideration market needs and have been updated to meet market demands.

Currently there is no dedicated source of funding in Indiana to undertake the costly process of designing, developing and delivering new programs in emerging and multi-disciplinary fields. It is proposed that such a fund be created by setting aside a small percentage of each year's allocation of higher education spending to support new program development. Higher education institutions would need to compete for the funding, with requirements that new programs involve a consortium of employers working together with the higher education institution. Availability of industry matching funding, commitments to pay tuition of students or to hire students as interns and full-time workers upon graduation should be among the key criteria.

Other key industry needs (i.e., specialized cloud computing or web design skills) might be better met through certificate programs—see Action 16.

It should be noted that many of the activities described in Actions 12, 13 and 15 are being undertaken by Conexus Indiana at the K-12 and community college levels to better prepare high school and associate's/certificate-level students for careers in manufacturing and logistics, by strengthening ties between industry and educators at those levels. A promising industry-academic collaboration is also underway under the auspices of the Orthoworx initiative with Trine University and Grace College to better prepare students for careers in the medical device industry. No systematic efforts exist to develop new programs and ensure that four-year college curricula remain aligned with the evolving demands of Indiana's key economic clusters, however.

Action 16: Create “Bridges to Employment” occupational certificate program.

Many students graduate from college to find that their vocational interests have shifted from the major they chose 2–3 years earlier, or that their degree does not specifically match job openings in the marketplace. To help these individuals further their skills or make an early career ‘leap’ to more fruitful opportunities, create ‘Bridges to Employment:’

“Bridges to Employment” would utilize the state’s higher education institutions and other partners as appropriate (i.e., Employ Indy) to administer an evolving catalogue of one-year, post-baccalaureate certificate programs that build on four-year degrees to better prepare graduates for emerging career opportunities.

Operationally, this effort would be a multi-institutional collaboration, established through an RFP process to identify the lead partner and “owners” for the various program offerings.

To illustrate the sorts of coursework available through “Bridges:” a graphic design graduate may pursue a certificate offered through Ball State to build on those skills to create interfaces and animation for mobile applications. An English major may pursue a technical writing certificate to prepare for copywriting positions with a high-tech or life sciences company. A biology undergrad may pursue a certificate in Clinical Trials Administration (an example from the University of California – San Diego extension program) to qualify for these careers.

Connecting Talent by enhancing career services to match college graduates with industry opportunities

Strategic Need for Indiana

The recent college graduate and employer surveys bring to light the critical importance of fostering relationships for students and recent college graduates with Indiana industry. The more college students participate in work experience that connects them with industry, the greater the likelihood of these students working in Indiana after graduation. This is not surprising. A 2010 survey of the 884 industry members of the National Association of Colleges and Employers revealed that 82.5 percent of employers surveyed have an internship or co-op program and that

more than 50 percent of interns accept full-time employment with the company for which they interned.¹⁸

With the support of the Lilly Endowment, Indiana already offers an online internship matching program offering a searchable database to link employers and students with added personal assistance services to address questions and provide guidance on internship approaches and resources. This effort, Indiana INTERNnet, is affiliated with the Indiana Chamber of Commerce, which facilitates its connections to industry. The database of students and employers is growing with nearly 6,500 students and 4,500 employers involved and nearly 1,000 positions available annually. This provides Indiana a key vehicle to grow the use of internships and other work experience activities.

But the surveys also demonstrate other key insights into the importance of fostering relationships between students and employers in Indiana. On one hand, employers place a high regard on getting to know students and finding the right fit in their job recruitment efforts, so more intensive and personalized career services are critical. Students are also making clear choices on career path and geographic preferences early in their job search, so increasing their awareness of the opportunities and range of employers in Indiana is important.

These findings point to the pivotal role for career services offices found at Indiana universities and colleges. These career service offices traditionally are involved in arranging employer recruitment visits to campus and job fairs as well as provide broader career counseling services to students. Battelle interviewed career services professionals at 13 four year institutions in the state, plus held a focus group discussion session at the Career Development Professionals of Indiana Fall Conference attended by 35 career service professionals.

We learned that there are positive trends, including an increased role of career services in advancing experiential learning and assisting students in connecting with alumni for mentoring, job shadowing, internships and other engagements. A number of universities and colleges are requiring internships and/or having students meet with career services by their junior years. There is also an increased emphasis on career services for graduates, though key differences persist among institutions as to whether these career services are available for extended periods or just a year or two after graduation.

But career services offices at universities and colleges are facing considerable constraints and challenges. The vast majority are facing increased demand for services with flat staffing and resources. This severely limits their ability to provide more customized, one-on-one counseling for students and alumni. Typically these career services offices are divorced from the academic affairs offices of universities and colleges and so have little influence to implement the feedback from industry regarding curriculum and work experience components of degree programs.

Building on the success of Indiana INTERNnet, Indiana now needs to turn its attention to innovations for advancing career services across its base of colleges and universities.

¹⁸ See web site for National Association of Colleges and Employers.

Objectives to be Pursued

- Raise awareness and relationships between Indiana companies and students.
- Offer students at least two independent work experience activities as part of each degree granted. These work experiences can range widely from internships to capstone projects to work study to job shadowing to career mentors, among other activities.

Proposed Actions

Action 17: Scale Up Internships in Indiana. Indiana INTERNnet offers the needed one-stop service for internships, providing the infrastructure for opportunities for students to be increased. An effective means is to scale up internships (and other work-related/experiential learning programs) by offering incentives and better targeting highly sought fields and occupational shortage areas.

Nebraska recently enacted InternNE internship grants providing a 40 percent match, up to \$3,500 per internship, for up to 10 interns per year (5 at a single location). Up to \$1.5 million is allocated for the Nebraska program and it is targeted to a certain set of eligible businesses. Ohio's Third Frontier Program has an internship program that reimburses up to 50 percent of the intern's wages, or no more than \$3,000 for a 12 month period. Ohio targets its internships to a set of high growth technology industries such as biosciences, information technology, instruments and controls, advanced materials and advanced energy, among others. Since 2002, more than 3,000 students have participated, and the Ohio Board of Regents recently announced another \$11M investment in matching grants for internships and co-op programs. Indiana should emulate such a consistent, sustained level of focus and investment in student in-state work experiences.

Action 18: Advance a statewide approach to career services. Indiana needs to take a national leadership role in career services for its students. Few other states have focused on this key intervention point, instead relying on individual universities and colleges to come up with their own approaches. This is particularly important for Indiana given the substantial base of college graduates being generated by in-state universities and colleges, and the identified need to create stronger relationships between industry and college students. If done well, it can be a critical step in winning the competition for talent.

There is no magic bullet, but a variety of services should be considered, including:

- Provide funding for dedicated career recruitment services for employers who commit to hiring Indiana graduates.
- Target career services and internship stipends to high performing Indiana college students in science, engineering, computer sciences and business fields.
- Advance alumni career services through a statewide consortium effort that creates a talent bank of alumni for Indiana employers and hosts young professional networking events in Indiana and key metropolitan areas outside of Indiana.

- Leverage the presence of industry cluster organizations found in Indiana to develop mentors, job shadowing, internships, job postings for alumni, etc.
- Work with cluster organizations, the Indiana Small Business Development Corporation and other partners to ensure connectivity with smaller, entrepreneurial firms in high-value industries.

Retaining Talent by creating tangible pathways to meaningful careers

Strategic Need for Indiana

The survey results point to the fact that jobs in Indiana are viewed by recent college graduates as lower quality than others outside the state and that the retention of existing college workers in Indiana depends upon providing them career pathways in their existing jobs. Salary levels are also an issue, but with a lower cost of living, Indiana employers may not have to fully match salaries found outside the state if they can promote career pathways.

Indiana needs a pro-active effort to raise awareness for employers of the importance of career pathways. It is not surprising that this might not be a particular focus for Indiana employers since most of the job openings for college educated workers are replacements for more experienced workers who are reaching the ends of their careers. However, pathways can provide a more systematic means for transferring knowledge from this older generation of workers to their younger counterparts, to the great benefit of the companies in question.

Objectives to be Pursued

- Raise the focus on career pathways for more high skilled positions requiring college education across Indiana employers.

Proposed Actions

Action 19: Set career pathway standards of excellence and recognize employers who excel in offering career pathways for high skilled positions requiring college education. Indiana needs to create a business culture that is concerned about career pathways. This can be developed by first identifying the best practices that are involved in career pathways and then recognize those Indiana employers who stand out. Similar to quality awards, such as the National Institute for Standards and Technology's Baldrige Award, these types of approaches can create a movement within industry to reach a new level of excellence.

Action 20: Provide tax credits for employers who establish and hire college graduates in certified career pathway positions. Many states have enacted "job credits" for employers who create high quality jobs, typically measured by salary level. Indiana needs a more deliberative focus on changing its image for college students as a high quality place to work. This can be done by tying job tax credits for filling jobs with recent college graduates from Indiana universities and colleges that offer defined pathways for advancement within the organization or the industry.

INDIANA'S COMPETITIVE ECONOMIC ADVANTAGE:

THE
OPPORTUNITY
TO WIN THE
GLOBAL
COMPETITION
FOR COLLEGE
EDUCATED
TALENT



Appendix A: Review of Prior Indiana and U.S. Talent Studies

The Battelle project team reviewed prior studies relating both specifically to Indiana and more generally to the U.S. on the issues relating to the supply and demand for the college educated workforce. The tables below summarize the studies reviewed.

Table A-1. Indiana-Focused Studies Reviewed

Title	Organization	Available online at	Year of Publication
Education Attainment in Indiana (Policy Brief)	Center for Business and Economic Research, Miller College of Business, Ball State University	http://cms.bsu.edu/Academics/CentersandInstitutes/BBR/CurrentStudiesandPublications.aspx	2011
New Day, New Rules: What Indiana Should Know and Do About Education in Hard Times (Power Point)	Georgetown University Center on Education and the Workforce	n/a	2011
Sustaining Indiana's Wealth Producing Economy: A Technically Skilled Workforce for the Future (Preliminary Report, Power Point)	FutureWorks	n/a	2011
Indiana's Forgotten Middle-Skill Jobs: Meeting the Demands of a 21st Century Economy	Skills2Compete	http://www.incap.org/documents/iwof/2010/Skills2Compete_ForgottenJobs_IN_WEB.pdf	2010
Indiana's Hot 50 Jobs of the Future	Indiana Department of Workforce Development	https://netsolutions.dwd.in.gov/hh50/downloads/HH50_Booklet_2010.pdf	2010
Skills2Compete-Indiana: Meeting the Demands of a 21st-Century Economy	Skills2Compete	http://www.nationalskillscoalition.org/assets/reports-/s2cindianaplatform_2010-10.pdf	2010
The Future of Work in Indiana: Job Migration and Industry Realignments	Kelly School of Business, Indiana University	http://www.incontext.indiana.edu/2007/november/1.asp	2007
Opportunity Varies by Geography: Long-Term Job Outlook in Indiana's Economic Growth Regions	Kelly School of Business, Indiana University	http://www.incontext.indiana.edu/2007/september/2.asp	2007
Data for Effective Policy and Decision-Making in Indiana: Assessing its Availability, Accessibility, and Analysis	Arizona State University	http://www.ibrc.indiana.edu/studies/Indiana_data_environment.pdf	2005
Discussion on Job Creation and Graduate Retention (Presentation)	Indiana Fiscal Policy Institute, Inc.	n/a	2002

The Indiana Workforce: An Employer's Perspective	Indiana Fiscal Policy Institute, Inc.	http://www.indianafiscal.org/docs/HCRP_report3.pdf	2000
Survey of Current Practices in Postsecondary Graduate Retention	Indiana Fiscal Policy Institute, Inc.	http://www.indianafiscal.org/docs/HCRP_report4.pdf	2000
Graduate Migration From Indiana's Postsecondary Institutions	Indiana Fiscal Policy Institute, Inc.	http://www.indianafiscal.org/docs/HCRP_Report2.pdf	1999

Table A-2. National Studies Reviewed

Title	Organization	Available online at	Year of Publication
What's it Worth: The Economic Value of College Majors	Center on Education and the Workforce, Georgetown University	http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/w hatsitworth-complete.pdf	2011
Degrees for What Jobs? Raising Expectations for Universities and Colleges in a Global Economy	The National Governors Association	http://www.nga.org/files/live/sites/NGA/files/pdf/1103DEGREESJOBS.PDF	2011
Help Wanted: Projections of Jobs and Education Requirements Through 2018	Center on Education and the Workforce, Georgetown University	http://www9.georgetown.edu/grad/gppi/hpi/cew/pdfs/F ullReport.pdf	2010
Aligning Workforce Development, Postsecondary Education and Economic Development: A National Perspective	John J. Heldrich Center for Workforce Development, Rutgers University	http://ccwa.vccs.edu/pdf/AligningWD.pdf	2010
Educational Attainment, "Brain Drain," and Self-employment: Examining the Interstate Mobility of Baccalaureate Graduates, 1993-2003	Small Business Administration	http://archive.sba.gov/advo/research/rs355tot.pdf	2009
Innovation America: A Compact for Postsecondary Education	The National Governors Association	http://www.nga.org/files/live/sites/NGA/files/pdf/0707INNOVATIONPOSTSEC.PDF	2007
Aligning Educational Preparation with Employer Needs: Lessons from the Career Connection Model	John J. Heldrich Center for Workforce Development, Rutgers University	http://www.heldrich.rutgers.edu/sites/default/files/content/Van_Horn_Presentation_Maine.pdf	2006
Migration of Recent College Graduates: Evidence from the National Longitudinal Survey of Youth	Federal Reserve Bank of Boston; New England Economic Review	http://www.bos.frb.org/economic/neer/neer2001/neer101b.pdf	2001

Appendix B: Occupational Groups that Usually Require a Bachelor's Degree or Higher Level of Education

The following is a list of the detailed occupations that were combined to form the major groups of high-skilled occupations and additional occupations that usually require an education level of a bachelor's degree or higher.

Table B-1. High-Skilled Occupational Groups Typically Employed by Traded Sector Industries and Requiring a Bachelor's Degree or Higher

SOC Code	Major Groupings & SOC Title
Business & Financial Operations	
13-1011	Agents and business managers of artists, performers, and athletes
13-1021	Purchasing agents and buyers, farm products
13-1022	Wholesale and retail buyers, except farm products
13-1023	Purchasing agents, except wholesale, retail, and farm products
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
13-1072	Compensation, benefits, and job analysis specialists
13-1073	Training and development specialists
13-1074	Farm Labor Contractors
13-1075	Labor Relations Specialists
13-1078	Human Resources, Training, and Labor Relations Specialists, All Other
13-1079	Human resources, training, and labor relations specialists, all other
13-1081	Logisticians
13-1111	Management analysts
13-1121	Meeting and convention planners
13-1131	Fundraisers
13-1141	Compensation, Benefits, and Job Analysis Specialists
13-1151	Training and Development Specialists
13-1161	Market Research Analysts and Marketing Specialists
13-1199	Business operations specialists, all other
13-2011	Accountants and auditors
13-2021	Appraisers and assessors of real estate
13-2031	Budget analysts
13-2041	Credit analysts
13-2051	Financial analysts
13-2052	Personal financial advisors
13-2053	Insurance underwriters
13-2061	Financial examiners
13-2071	Loan counselors
13-2072	Loan officers
13-2081	Tax examiners, collectors, and revenue agents
13-2082	Tax preparers

SOC Code	Major Groupings & SOC Title
13-2099	Financial specialists, all other
Computer-Related	
15-1111	Computer and Information Research Scientists
15-1121	Computer Systems Analysts
15-1122	Information Security Analysts
15-1131	Computer Programmers
15-1132	Software Developers, Applications
15-1133	Software Developers, Systems Software
15-1134	Web Developers
15-1141	Database Administrators
15-1142	Network and Computer Systems Administrators
15-1143	Computer Network Architects
15-1150	Computer Support Specialists
15-1151	Computer User Support Specialists
15-1152	Computer Network Support Specialists
15-1179	Information Security Analysts, Web Developers, and Computer Network Architects
15-1199	Computer Occupations, All Other
15-1799	Computer Occupations, All Other
Engineering Technicians	
17-3021	Aerospace engineering and operations technicians
17-3022	Civil engineering technicians
17-3023	Electrical and electronic engineering technicians
17-3024	Electro-mechanical technicians
17-3025	Environmental engineering technicians
17-3026	Industrial engineering technicians
17-3027	Mechanical engineering technicians
17-3029	Engineering technicians, except drafters, all other
Engineers	
17-2011	Aerospace engineers
17-2021	Agricultural engineers
17-2031	Biomedical engineers
17-2041	Chemical engineers
17-2051	Civil engineers
17-2061	Computer hardware 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
17-2141	Mechanical engineers
17-2151	Mining and geological engineers, including mining safety engineers
17-2161	Nuclear engineers
17-2171	Petroleum engineers
17-2199	Engineers, all other
Life Science Technicians	
19-4011	Agricultural and food science technicians

SOC Code	Major Groupings & SOC Title
19-4021	Biological technicians
Life Scientists	
19-1010	Agricultural and Food Scientists
19-1011	Animal scientists
19-1012	Food scientists and technologists
19-1013	Soil and plant scientists
19-1021	Biochemists and biophysicists
19-1022	Microbiologists
19-1023	Zoologists and wildlife biologists
19-1029	Biological scientists, all other
19-1031	Conservation scientists
19-1032	Foresters
19-1041	Epidemiologists
19-1042	Medical scientists, except epidemiologists
19-1099	Life scientists, all other
Management	
11-1011	Chief executives
11-1021	General and operations managers
11-1031	Legislators
11-2011	Advertising and promotions managers
11-2021	Marketing managers
11-2022	Sales managers
11-2031	Public relations managers
11-3011	Administrative services managers
11-3021	Computer and information systems managers
11-3031	Financial managers
11-3041	Compensation and benefits managers
11-3042	Training and development managers
11-3049	Human resources managers, all other
11-3051	Industrial production managers
11-3061	Purchasing managers
11-3071	Transportation, storage, and distribution managers
11-3111	Compensation and Benefits Managers
11-3121	Human Resources Managers
11-3131	Training and Development Managers
11-9011	Farm, ranch, and other agricultural managers
11-9012	Farmers and ranchers
11-9013	Farmers, Ranchers, and Other Agricultural Managers
11-9021	Construction managers
11-9031	Education administrators, preschool and child care center/program
11-9032	Education administrators, elementary and secondary school
11-9033	Education administrators, postsecondary
11-9039	Education administrators, all other
11-9041	Engineering managers
11-9051	Food service managers
11-9061	Funeral directors
11-9071	Gaming managers
11-9081	Lodging managers

SOC Code	Major Groupings & SOC Title
11-9111	Medical and health services managers
11-9121	Natural sciences managers
11-9131	Postmasters and mail superintendents
11-9141	Property, real estate, and community association managers
11-9151	Social and community service managers
11-9161	Emergency Management Directors
11-9199	Managers, all other
Medical & Clinical Lab Technicians	
29-2011	Medical and clinical laboratory technologists
29-2012	Medical and clinical laboratory technicians
29-2056	Veterinary technologists and technicians
51-9081	Dental laboratory technicians
51-9082	Medical appliance technicians
51-9083	Ophthalmic laboratory technicians
Physical Science Technicians	
19-4031	Chemical technicians
19-4041	Geological and petroleum technicians
19-4051	Nuclear technicians
Physical Scientists	
19-2011	Astronomers
19-2012	Physicists
19-2021	Atmospheric and space scientists
19-2031	Chemists
19-2032	Materials scientists
19-2041	Environmental scientists and specialists, including health
19-2042	Geoscientists, except hydrologists and geographers
19-2043	Hydrologists
19-2099	Physical scientists, all other

Note: SOC = Standard Occupational Classification System; occupations and corresponding SOC codes included here are under the new 2010 SOC system. The Bureau of Labor Statistics has developed some additional temporary SOC groups included in this table in order to bridge the gap to 2010 data under the new system. For trend analysis in the report, occupational groups were mapped back to the prior 2000 SOC system.

Table B-2. Additional Skilled Occupational Groups Typically Employed in Locally-Based Industries and Requiring a Bachelor's Degree or Higher

SOC Code	Major Groupings & SOC Title
Allied Health & Therapists	
29-1071	Physician assistants
29-1122	Occupational therapists
29-1123	Physical therapists
29-1125	Recreational therapists
29-1127	Speech-language pathologists
29-1128	Exercise Physiologists
29-1129	Therapists, all other
29-1131	Veterinarians
29-1181	Audiologists
29-1199	Health diagnosing and treating practitioners, all other
29-2091	Orthotists and prosthetists
29-9011	Occupational health and safety specialists
29-9091	Athletic trainers
29-9092	Genetic Counselors
29-9099	Healthcare practitioners and technical workers, all other
Counseling & Social Service	
19-3031	Clinical, counseling, and school psychologists
19-3032	Industrial-organizational psychologists
19-3039	Psychologists, all other
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
21-1019	Counselors, all other
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
21-1029	Social workers, all other
21-1091	Health educators
21-1092	Probation officers and correctional treatment specialists
21-1094	Community Health Workers
21-1099	Community and social service specialists, all other
21-2011	Clergy
21-2021	Directors, religious activities and education
21-2099	Religious workers, all other
Designers & Artists	
27-1011	Art directors
27-1014	Multi-media artists and animators
27-1021	Commercial and industrial designers
27-1024	Graphic designers
27-1027	Set and exhibit designers
27-1029	Designers, all other
27-2012	Producers and directors

SOC Code	Major Groupings & SOC Title
27-2041	Music directors and composers
K-12 Educators & Librarians	
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
25-2051	Special Education Teachers, Preschool
25-2052	Special Education Teachers, Kindergarten and Elementary School
25-2053	Special Education Teachers, Middle School
25-2054	Special Education Teachers, Secondary School
25-2059	Special Education Teachers, All Other
25-3011	Adult literacy, remedial education, and GED teachers and instructors
25-3099	Teachers and instructors, all other
25-4011	Archivists
25-4012	Curators
25-4013	Museum Technicians and Conservators
25-4021	Librarians
25-9011	Audio-visual collections specialists
25-9021	Farm and home management advisors
25-9031	Instructional coordinators
25-9099	Education, training, and library workers, all other
19-3093	Historians
Legal	
23-1011	Lawyers
23-1012	Judicial Law Clerks
23-1021	Administrative law judges, adjudicators, and hearing officers
23-1022	Arbitrators, mediators, and conciliators
23-1023	Judges, magistrate judges, and magistrates
23-2011	Paralegals and Legal Assistants
Media & Communications	
27-3021	Broadcast news analysts
27-3022	Reporters and correspondents
27-3031	Public relations specialists
27-3041	Editors
27-3042	Technical writers
27-3043	Writers and authors
27-4031	Camera operators, television, video, and motion picture
27-4032	Film and video editors
Pharmacists	
29-1051	Pharmacists
Physicians & Dentists	
29-1011	Chiropractors
29-1021	Dentists, general
29-1022	Oral and maxillofacial surgeons
29-1023	Orthodontists
29-1024	Prosthodontists

SOC Code	Major Groupings & SOC Title
29-1029	Dentists, all other specialists
29-1031	Dietitians and nutritionists
29-1041	Optometrists
29-1061	Anesthesiologists
29-1062	Family and General Practitioners
29-1063	Internists, General
29-1064	Obstetricians and Gynecologists
29-1065	Pediatricians, General
29-1066	Psychiatrists
29-1067	Surgeons
29-1069	Physicians and Surgeons, All Other
29-1081	Podiatrists
Social Science, Urban Planning, & Architects	
17-1011	Architects, except landscape and naval
17-1012	Landscape architects
17-1021	Cartographers and photogrammetrists
17-1022	Surveyors
19-3011	Economists
19-3022	Survey researchers
19-3041	Sociologists
19-3051	Urban and regional planners
19-3091	Anthropologists and archeologists
19-3092	Geographers
19-3094	Political scientists
19-3099	Social scientists and related workers, all other

Note: SOC = Standard Occupational Classification System; occupations and corresponding SOC codes included here are under the new 2010 SOC system. The Bureau of Labor Statistics has developed some additional temporary SOC groups included in this table in order to bridge the gap to 2010 data under the new system. For trend analysis in the report, occupational groups were mapped back to the prior 2000 SOC system.

Appendix C: Crosswalk of Degree Fields to Major Occupational Groups

To frame the supply context relating to Indiana college graduates with a Bachelor's degree or above and ability to fill job openings, the Battelle project team mapped key skilled occupational groups to relevant degree fields using a crosswalk from the Standard Occupational Classification system (SOC) for occupations to the Classification of Instructional Programs (CIP) for degrees conferred. The crosswalk was developed by the National Crosswalk Service Center (NCSC) with support from the U.S. Department of Labor.

The tables below show the CIP postsecondary degree programs mapped to each major occupational group used in this study. Degrees were limited to those at the Bachelor's level and above and generally did not include Professional Degrees (except among MD and JD degrees relevant to the clinical and legal groups). The mapping presented here is complete and inclusive across all CIP codes used by the NCSC; it is important to note, however, that not all degree programs listed here exist in Indiana or had graduates in the latest year available. There is limited double-counting across major occupational groups; however, there is significant double-counting of degree graduates when the Management occupational group is considered.

Table C-1. Major High-Skilled Occupational Groups and Relevant Postsecondary Degree Programs

CIP Codes	Major Occupational Groupings & Related CIP Titles
Business & Financial Operations	
010105	Agricultural/Farm Supplies Retailing and Wholesaling
141801	Materials Engineering
141901	Mechanical Engineering
143301	Construction Engineering
143601	Manufacturing Engineering
151001	Construction Engineering Technology/Technician
190905	Apparel and Textile Marketing Management
301601	Accounting and Computer Science
440201	Community Organization and Advocacy
440401	Public Administration
500704	Arts Management
510715	Health/Medical Claims Examiner
520101	Business/Commerce, General
520201	Business Administration and Management, General
520202	Purchasing, Procurement/Acquisitions and Contracts Management
520203	Logistics and Materials Management
520205	Operations Management and Supervision
520301	Accounting
520302	Accounting Technology/Technician and Bookkeeping
520303	Auditing
520304	Accounting and Finance
520305	Accounting and Business/Management
520801	Finance, General
520803	Banking and Financial Support Services

CIP Codes	Major Occupational Groupings & Related CIP Titles
520804	Financial Planning and Services
520809	Credit Management
520899	Finance and Financial Management Services, Other
521001	Human Resources Management/Personnel Administration, General
521002	Labor and Industrial Relations
521003	Organizational Behavior Studies
521099	Human Resources Management and Services, Other
521501	Real Estate
521601	Taxation
521701	Insurance
521801	Sales, Distribution, and Marketing Operations, General
521802	Merchandising and Buying Operations
521804	Selling Skills and Sales Operations
521902	Fashion Merchandising
521904	Apparel and Accessories Marketing Operations
529999	Business, Management, Marketing, and Related Support Services, Other
Computer-Related	
010106	Agricultural Business Technology
110101	Computer and Information Sciences, General
110102	Artificial Intelligence and Robotics
110103	Information Technology
110201	Computer Programming/Programmer, General
110202	Computer Programming, Specific Applications
110203	Computer Programming, Vendor/Product Certification
110301	Data Processing and Data Processing Technology/Technician
110401	Information Science/Studies
110501	Computer Systems Analysis/Analyst
110701	Computer Science
110801	Web Page, Digital/Multimedia and Information Resources Design
110802	Data Modeling/Warehousing and Database Administration
110803	Computer Graphics
110901	Computer Systems Networking and Telecommunications
111001	System Administration/Administrator
111002	System, Networking, and LAN/WAN Management/Manager
111003	Computer and Information Systems Security
111004	Web/Multimedia Management and Webmaster
119999	Computer and Information Sciences and Support Services, Other
140901	Computer Engineering, General
140903	Computer Software Engineering
151203	Computer Hardware Technology/Technician
151204	Computer Software Technology/Technician
151299	Computer Engineering Technologies/Technicians, Other
261103	Bioinformatics
261199	Biomathematics and Bioinformatics, Other
301601	Accounting and Computer Science
510709	Medical Office Computer Specialist/Assistant
512706	Medical Informatics
512799	Medical Illustration and Informatics, Other

CIP Codes	Major Occupational Groupings & Related CIP Titles
520208	E-Commerce/Electronic Commerce
521201	Management Information Systems, General
521299	Management Information Systems and Services, Other
Engineering Technicians	
150101	Architectural Engineering Technology/Technician
150201	Civil Engineering Technology/Technician
150303	Electrical, Electronic and Communications Engineering Technology/Technician
150304	Laser and Optical Technology/Technician
150305	Telecommunications Technology/Technician
150399	Electrical and Electronic Engineering Technologies/Technicians, Other
150503	Energy Management and Systems Technology/Technician
150505	Solar Energy Technology/Technician
150507	Environmental Engineering Technology/Environmental Technology
150599	Environmental Control Technologies/Technicians, Other
150607	Plastics Engineering Technology/Technician
150611	Metallurgical Technology/Technician
150612	Industrial Technology/Technician
150613	Manufacturing Technology/Technician
150699	Industrial Production Technologies/Technicians, Other
150704	Hazardous Materials Information Systems Technology/Technician
150801	Aeronautical/Aerospace Engineering Technology/Technician
150805	Mechanical Engineering/Mechanical Technology/Technician
150899	Mechanical Engineering Related Technologies/Technicians, Other
150901	Mining Technology/Technician
150999	Mining and Petroleum Technologies/Technicians, Other
151001	Construction Engineering Technology/Technician
151103	Hydraulics and Fluid Power Technology/Technician
151201	Computer Engineering Technology/Technician
151202	Computer Technology/Computer Systems Technology
151501	Engineering/Industrial Management
159999	Engineering Technologies/Technicians, Other
Engineers	
140101	Engineering, General
140201	Aerospace, Aeronautical and Astronautical Engineering
140301	Agricultural/Biological Engineering and Bioengineering
140401	Architectural Engineering
140501	Biomedical/Medical Engineering
140601	Ceramic Sciences and Engineering
140701	Chemical Engineering
140801	Civil Engineering, General
140804	Transportation and Highway Engineering
140805	Water Resources Engineering
140899	Civil Engineering, Other
140901	Computer Engineering, General
140902	Computer Hardware Engineering
141001	Electrical, Electronics and Communications Engineering
141101	Engineering Mechanics
141201	Engineering Physics

CIP Codes	Major Occupational Groupings & Related CIP Titles
141301	Engineering Science
141401	Environmental/Environmental Health Engineering
141801	Materials Engineering
141901	Mechanical Engineering
142001	Metallurgical Engineering
142101	Mining and Mineral Engineering
142201	Naval Architecture and Marine Engineering
142301	Nuclear Engineering
142401	Ocean Engineering
142501	Petroleum Engineering
142701	Systems Engineering
142801	Textile Sciences and Engineering
143201	Polymer/Plastics Engineering
143301	Construction Engineering
143401	Forest Engineering
143501	Industrial Engineering
143601	Manufacturing Engineering
143801	Surveying Engineering
143901	Geological/Geophysical Engineering
149999	Engineering, Other
512312	Assistive/Augmentative Technology and Rehabilitation Engineering
Life Science Technicians	
010302	Animal/Livestock Husbandry and Production
010304	Crop Production
010901	Animal Sciences, General
010902	Agricultural Animal Breeding
010904	Animal Nutrition
010905	Dairy Science
011001	Food Science
011102	Agronomy and Crop Science
410101	Biology Technician/Biotechnology Laboratory Technician
Life Scientists	
010000	Agriculture, General
010701	International Agriculture
010901	Animal Sciences, General
010902	Agricultural Animal Breeding
010903	Animal Health
010904	Animal Nutrition
010905	Dairy Science
010907	Poultry Science
010999	Animal Sciences, Other
011001	Food Science
011002	Food Technology and Processing
011101	Plant Sciences, General
011102	Agronomy and Crop Science
011103	Horticultural Science
011104	Agricultural and Horticultural Plant Breeding
011105	Plant Protection and Integrated Pest Management

CIP Codes	Major Occupational Groupings & Related CIP Titles
011106	Range Science and Management
011199	Plant Sciences, Other
011201	Soil Science and Agronomy, General
011202	Soil Chemistry and Physics
011203	Soil Microbiology
030101	Natural Resources/Conservation, General
030201	Natural Resources Management and Policy
030205	Water, Wetlands, and Marine Resources Management
030206	Land Use Planning and Management/Development
030299	Natural Resources Management and Policy, Other
030501	Forestry, General
030502	Forest Sciences and Biology
030506	Forest Management/Forest Resources Management
030508	Urban Forestry
030509	Wood Science and Wood Products/Pulp and Paper Technology
030510	Forest Resources Production and Management
030599	Forestry, Other
030601	Wildlife and Wildlands Science and Management
039999	Natural Resources and Conservation, Other
260101	Biology/Biological Sciences, General
260102	Biomedical Sciences, General
260202	Biochemistry
260203	Biophysics
260204	Molecular Biology
260205	Molecular Biochemistry
260206	Molecular Biophysics
260207	Structural Biology
260208	Photobiology
260209	Radiation Biology/Radiobiology
260210	Biochemistry/Biophysics and Molecular Biology
260301	Botany/Plant Biology
260305	Plant Pathology/Phytopathology
260307	Plant Physiology
260308	Plant Molecular Biology
260399	Botany/Plant Biology, Other
260401	Cell/Cellular Biology and Histology
260403	Anatomy
260404	Developmental Biology and Embryology
260405	Neuroanatomy
260406	Cell/Cellular and Molecular Biology
260407	Cell Biology and Anatomy
260499	Cell/Cellular Biology and Anatomical Sciences, Other
260502	Microbiology, General
260503	Medical Microbiology and Bacteriology
260504	Virology
260505	Parasitology
260506	Mycology
260507	Immunology

CIP Codes	Major Occupational Groupings & Related CIP Titles
260701	Zoology/Animal Biology
260702	Entomology
260707	Animal Physiology
260708	Animal Behavior and Ethology
260709	Wildlife Biology
260799	Zoology/Animal Biology, Other
260801	Genetics, General
260802	Molecular Genetics
260803	Microbial and Eukaryotic Genetics
260804	Animal Genetics
260805	Plant Genetics
260806	Human/Medical Genetics
260899	Genetics, Other
260901	Physiology, General
260902	Molecular Physiology
260903	Cell Physiology
260904	Endocrinology
260905	Reproductive Biology
260906	Neurobiology and Neurophysiology
260907	Cardiovascular Science
260908	Exercise Physiology
260909	Vision Science/Physiological Optics
260910	Pathology/Experimental Pathology
260911	Oncology and Cancer Biology
260999	Physiology, Pathology, and Related Sciences, Other
261001	Pharmacology
261002	Molecular Pharmacology
261003	Neuropharmacology
261004	Toxicology
261005	Molecular Toxicology
261006	Environmental Toxicology
261007	Pharmacology and Toxicology
261099	Pharmacology and Toxicology, Other
261101	Biometry/Biometrics
261102	Biostatistics
261201	Biotechnology
261301	Ecology
261302	Marine Biology and Biological Oceanography
261303	Evolutionary Biology
261304	Aquatic Biology/Limnology
261305	Environmental Biology
261306	Population Biology
261307	Conservation Biology
261308	Systematic Biology/Biological Systematics
261309	Epidemiology
261399	Ecology, Evolution, Systematics and Population Biology, Other
269999	Biological and Biomedical Sciences, Other
301701	Behavioral Sciences

CIP Codes	Major Occupational Groupings & Related CIP Titles
301801	Natural Sciences
301901	Nutrition Sciences
302401	Neuroscience
511401	Medical Scientist (MS, PhD)
Management	
010101	Agricultural Business and Management, General
010102	Agribusiness/Agricultural Business Operations
010104	Farm/Farm and Ranch Management
010199	Agricultural Business and Management, Other
010301	Agricultural Production Operations, General
010302	Animal/Livestock Husbandry and Production
010303	Aquaculture
010304	Crop Production
010306	Dairy Husbandry and Production
010307	Horse Husbandry/Equine Science and Management
010399	Agricultural Production Operations, Other
010603	Ornamental Horticulture
010604	Greenhouse Operations and Management
010606	Plant Nursery Operations and Management
010901	Animal Sciences, General
010902	Agricultural Animal Breeding
010904	Animal Nutrition
010905	Dairy Science
010906	Livestock Management
010907	Poultry Science
011101	Plant Sciences, General
011102	Agronomy and Crop Science
011103	Horticultural Science
011105	Plant Protection and Integrated Pest Management
011106	Range Science and Management
040201	Architecture (BArch, BA/BS, MArch, MA/MS, PhD)
040301	City/Urban, Community and Regional Planning
040401	Environmental Design/Architecture
040501	Interior Architecture
040601	Landscape Architecture (BS, BSLA, BLA, MSLA, MLA, PhD)
090902	Public Relations/Image Management
090903	Advertising
110101	Computer and Information Sciences, General
110401	Information Science/Studies
110701	Computer Science
111001	System Administration/Administrator
120301	Funeral Service and Mortuary Science, General
120302	Funeral Direction/Service
120504	Restaurant, Culinary, and Catering Management/Manager
129999	Personal and Culinary Services, Other
130401	Educational Leadership and Administration, General
130402	Administration of Special Education
130403	Adult and Continuing Education Administration

CIP Codes	Major Occupational Groupings & Related CIP Titles
130404	Educational, Instructional, and Curriculum Supervision
130406	Higher Education/Higher Education Administration
130407	Community College Education
130408	Elementary and Middle School Administration/Principalship
130409	Secondary School Administration/Principalship
130410	Urban Education and Leadership
130411	Superintendency and Educational System Administration
130499	Educational Administration and Supervision, Other
140101	Engineering, General
140201	Aerospace, Aeronautical and Astronautical Engineering
140301	Agricultural/Biological Engineering and Bioengineering
140401	Architectural Engineering
140501	Biomedical/Medical Engineering
140601	Ceramic Sciences and Engineering
140701	Chemical Engineering
140801	Civil Engineering, General
140802	Geotechnical Engineering
140803	Structural Engineering
140804	Transportation and Highway Engineering
140805	Water Resources Engineering
140899	Civil Engineering, Other
140901	Computer Engineering, General
140902	Computer Hardware Engineering
140903	Computer Software Engineering
140999	Computer Engineering, Other
141001	Electrical, Electronics and Communications Engineering
141101	Engineering Mechanics
141201	Engineering Physics
141301	Engineering Science
141401	Environmental/Environmental Health Engineering
141801	Materials Engineering
141901	Mechanical Engineering
142001	Metallurgical Engineering
142101	Mining and Mineral Engineering
142201	Naval Architecture and Marine Engineering
142301	Nuclear Engineering
142401	Ocean Engineering
142501	Petroleum Engineering
142701	Systems Engineering
142801	Textile Sciences and Engineering
143101	Materials Science
143201	Polymer/Plastics Engineering
143301	Construction Engineering
143401	Forest Engineering
143501	Industrial Engineering
143601	Manufacturing Engineering
143701	Operations Research
143801	Surveying Engineering

CIP Codes	Major Occupational Groupings & Related CIP Titles
143901	Geological/Geophysical Engineering
149999	Engineering, Other
151001	Construction Engineering Technology/Technician
190203	Consumer Merchandising/Retailing Management
190905	Apparel and Textile Marketing Management
260101	Biology/Biological Sciences, General
260202	Biochemistry
260203	Biophysics
260204	Molecular Biology
260209	Radiation Biology/Radiobiology
260301	Botany/Plant Biology
260305	Plant Pathology/Phytopathology
260307	Plant Physiology
260399	Botany/Plant Biology, Other
260401	Cell/Cellular Biology and Histology
260403	Anatomy
260499	Cell/Cellular Biology and Anatomical Sciences, Other
260502	Microbiology, General
260503	Medical Microbiology and Bacteriology
260504	Virology
260505	Parasitology
260507	Immunology
260701	Zoology/Animal Biology
260702	Entomology
260707	Animal Physiology
260799	Zoology/Animal Biology, Other
260804	Animal Genetics
260805	Plant Genetics
260910	Pathology/Experimental Pathology
261001	Pharmacology
261004	Toxicology
261101	Biometry/Biometrics
261102	Biostatistics
261201	Biotechnology
261301	Ecology
261302	Marine Biology and Biological Oceanography
261303	Evolutionary Biology
261399	Ecology, Evolution, Systematics and Population Biology, Other
269999	Biological and Biomedical Sciences, Other
270101	Mathematics, General
270102	Algebra and Number Theory
270103	Analysis and Functional Analysis
270104	Geometry/Geometric Analysis
270105	Topology and Foundations
270301	Applied Mathematics
270303	Computational Mathematics
270399	Applied Mathematics, Other
270501	Statistics, General

CIP Codes	Major Occupational Groupings & Related CIP Titles
279999	Mathematics and Statistics, Other
300101	Biological and Physical Sciences
300801	Mathematics and Computer Science
301001	Biopsychology
301501	Science, Technology and Society
301801	Natural Sciences
301901	Nutrition Sciences
302401	Neuroscience
380102	Logic
400101	Physical Sciences
400201	Astronomy
400202	Astrophysics
400203	Planetary Astronomy and Science
400401	Atmospheric Sciences and Meteorology, General
400402	Atmospheric Chemistry and Climatology
400403	Atmospheric Physics and Dynamics
400404	Meteorology
400499	Atmospheric Sciences and Meteorology, Other
400501	Chemistry, General
400502	Analytical Chemistry
400503	Inorganic Chemistry
400504	Organic Chemistry
400506	Physical and Theoretical Chemistry
400507	Polymer Chemistry
400508	Chemical Physics
400599	Chemistry, Other
400601	Geology/Earth Science, General
400602	Geochemistry
400603	Geophysics and Seismology
400604	Paleontology
400605	Hydrology and Water Resources Science
400606	Geochemistry and Petrology
400607	Oceanography, Chemical and Physical
400699	Geological and Earth Sciences/Geosciences, Other
400801	Physics, General
400802	Atomic/Molecular Physics
400804	Elementary Particle Physics
400805	Plasma and High-Temperature Physics
400806	Nuclear Physics
400807	Optics/Optical Sciences
400808	Solid State and Low-Temperature Physics
400809	Acoustics
400810	Theoretical and Mathematical Physics
400899	Physics, Other
409999	Physical Sciences, Other
440000	Human Services, General
440201	Community Organization and Advocacy
440401	Public Administration

CIP Codes	Major Occupational Groupings & Related CIP Titles
440501	Public Policy Analysis
449999	Public Administration and Social Service Professions, Other
490101	Aeronautics/Aviation/Aerospace Science and Technology, General
490104	Aviation/Airway Management and Operations
500508	Theatre/Theatre Arts Management
500704	Arts Management
510701	Health/Health Care Administration/Management
510702	Hospital and Health Care Facilities Administration/Management
510704	Health Unit Manager/Ward Supervisor
510706	Health Information/Medical Records Administration/Administrator
510711	Medical/Health Management and Clinical Assistant/Specialist
510717	Medical Staff Services Technology/Technician
510799	Health and Medical Administrative Services, Other
511602	Nursing Administration (MSN, MS, PhD)
512201	Public Health, General (MPH, DPH)
512208	Community Health and Preventive Medicine
512211	Health Services Administration
520101	Business/Commerce, General
520201	Business Administration and Management, General
520202	Purchasing, Procurement/Acquisitions and Contracts Management
520203	Logistics and Materials Management
520205	Operations Management and Supervision
520206	Non-Profit/Public/Organizational Management
520299	Business Administration, Management and Operations, Other
520304	Accounting and Finance
520305	Accounting and Business/Management
520701	Entrepreneurship/Entrepreneurial Studies
520702	Franchising and Franchise Operations
520703	Small Business Administration/Management
520799	Entrepreneurial and Small Business Operations, Other
520801	Finance, General
520806	International Finance
520808	Public Finance
520809	Credit Management
520899	Finance and Financial Management Services, Other
520901	Hospitality Administration/Management, General
520903	Tourism and Travel Services Management
520904	Hotel/Motel Administration/Management
520905	Restaurant/Food Services Management
520906	Resort Management
520999	Hospitality Administration/Management, Other
521001	Human Resources Management/Personnel Administration, General
521002	Labor and Industrial Relations
521004	Labor Studies
521005	Human Resources Development
521101	International Business/Trade/Commerce
521201	Management Information Systems, General
521206	Information Resources Management/CIO Training

CIP Codes	Major Occupational Groupings & Related CIP Titles
521207	Knowledge Management
521401	Marketing/Marketing Management, General
521402	Marketing Research
521403	International Marketing
521499	Marketing, Other
521501	Real Estate
521804	Selling Skills and Sales Operations
521910	Hospitality and Recreation Marketing Operations
529999	Business, Management, Marketing, and Related Support Services, Other
Medical & Clinical Lab Technicians	
510603	Dental Laboratory Technology/Technician
510802	Clinical/Medical Laboratory Assistant
510808	Veterinary/Animal Health Technology/Technician and Veterinary Assistant
511001	Blood Bank Technology Specialist
511002	Cytotechnology/Cytotechnologist
511003	Hematology Technology/Technician
511004	Clinical/Medical Laboratory Technician
511005	Clinical Laboratory Science/Medical Technology/Technologist
511006	Ophthalmic Laboratory Technology/Technician
511007	Histologic Technology/Histotechnologist
511008	Histologic Technician
511010	Cytogenetics/Genetics/Clinical Genetics Technology/Technologist
511011	Renal/Dialysis Technologist/Technician
511099	Clinical/Medical Laboratory Science and Allied Professions, Other
512307	Orthotist/Prosthetist
512312	Assistive/Augmentative Technology and Rehabilitation Engineering
Physical Science Technicians	
011001	Food Science
150903	Petroleum Technology/Technician
151401	Nuclear Engineering Technology/Technician
410204	Industrial Radiologic Technology/Technician
410205	Nuclear/Nuclear Power Technology/Technician
410299	Nuclear and Industrial Radiologic Technologies/Technicians, Other
410301	Chemical Technology/Technician
510916	Radiation Protection/Health Physics Technician
Physical Scientists	
030103	Environmental Studies
030104	Environmental Science
143101	Materials Science
301801	Natural Sciences
400201	Astronomy
400202	Astrophysics
400203	Planetary Astronomy and Science
400299	Astronomy and Astrophysics, Other
400401	Atmospheric Sciences and Meteorology, General
400402	Atmospheric Chemistry and Climatology
400403	Atmospheric Physics and Dynamics
400404	Meteorology

CIP Codes	Major Occupational Groupings & Related CIP Titles
400499	Atmospheric Sciences and Meteorology, Other
400501	Chemistry, General
400502	Analytical Chemistry
400503	Inorganic Chemistry
400504	Organic Chemistry
400506	Physical and Theoretical Chemistry
400507	Polymer Chemistry
400508	Chemical Physics
400599	Chemistry, Other
400601	Geology/Earth Science, General
400602	Geochemistry
400603	Geophysics and Seismology
400604	Paleontology
400605	Hydrology and Water Resources Science
400606	Geochemistry and Petrology
400607	Oceanography, Chemical and Physical
400699	Geological and Earth Sciences/Geosciences, Other
400801	Physics, General
400802	Atomic/Molecular Physics
400804	Elementary Particle Physics
400805	Plasma and High-Temperature Physics
400806	Nuclear Physics
400807	Optics/Optical Sciences
400808	Solid State and Low-Temperature Physics
400809	Acoustics
400810	Theoretical and Mathematical Physics
400899	Physics, Other
409999	Physical Sciences, Other
512205	Health/Medical Physics

Table C-2. Additional Skilled Occupational Groups and Relevant Postsecondary Degree Programs

CIP Codes	Major Occupational Groupings & Related CIP Titles
Allied Health & Therapists	
150701	Occupational Safety and Health Technology/Technician
150703	Industrial Safety Technology/Technician
150799	Quality Control and Safety Technologies/Technicians, Other
310505	Kinesiology and Exercise Science
510201	Communication Disorders, General
510202	Audiology/Audiologist and Hearing Sciences
510203	Speech-Language Pathology/Pathologist
510204	Audiology/Audiologist and Speech-Language Pathology/Pathologist
510299	Communication Disorders Sciences and Services, Other
510899	Allied Health and Medical Assisting Services, Other
510912	Physician Assistant
510913	Athletic Training/Trainer
510999	Allied Health Diagnostic, Intervention, and Treatment Professions, Other
511009	Phlebotomy/Phlebotomist
512202	Environmental Health
512206	Occupational Health and Industrial Hygiene
512301	Art Therapy/Therapist
512302	Dance Therapy/Therapist
512305	Music Therapy/Therapist
512306	Occupational Therapy/Therapist
512307	Orthotist/Prosthetist
512308	Physical Therapy/Therapist
512309	Therapeutic Recreation/Recreational Therapy
512311	Kinesiotherapy/Kinesiotherapist
512312	Assistive/Augmentative Technology and Rehabilitation Engineering
512399	Rehabilitation and Therapeutic Professions, Other
512401	Veterinary Medicine (DVM)
512501	Veterinary Sciences/Veterinary Clinical Sciences, General (Cert, MS, PhD)
512502	Veterinary Anatomy (Cert, MS, PhD)
512503	Veterinary Physiology (Cert, MS, PhD)
512504	Veterinary Microbiology and Immunobiology (Cert, MS, PhD)
512505	Veterinary Pathology and Pathobiology (Cert, MS, PhD)
512506	Veterinary Toxicology and Pharmacology (Cert, MS, PhD)
512507	Large Animal/Food Animal and Equine Surgery and Medicine (Cert, MS, PhD)
512508	Small/Companion Animal Surgery and Medicine (Cert, MS, PhD)
512509	Comparative and Laboratory Animal Medicine (Cert, MS, PhD)
512510	Veterinary Preventive Medicine Epidemiology and Public Health (Cert, MS, PhD)
512511	Veterinary Infectious Diseases (Cert, MS, PhD)
512599	Veterinary Biomedical and Clinical Sciences, Other (Cert, MS, PhD)
513301	Acupuncture
513302	Traditional Chinese/Asian Medicine and Chinese Herbology
513303	Naturopathic Medicine/Naturopathy (ND)
513304	Homeopathic Medicine/Homeopathy
513305	Ayurvedic Medicine/Ayurveda
513399	Alternative and Complementary Medicine and Medical Systems, Other

CIP Codes	Major Occupational Groupings & Related CIP Titles
513401	Direct Entry Midwifery (LM, CPM)
513601	Movement Therapy and Movement Education
513603	Hypnotherapy/Hypnotherapist
513701	Aromatherapy
513702	Herbalism/Herbalist
519999	Health Professions and Related Clinical Sciences, Other
600301	Veterinary Anesthesiology
600302	Veterinary Dentistry
600303	Veterinary Dermatology
600304	Veterinary Emergency and Critical Care Medicine
600305	Veterinary Internal Medicine
600306	Laboratory Animal Medicine
600307	Veterinary Microbiology
600308	Veterinary Nutrition
600309	Veterinary Ophthalmology
600310	Veterinary Pathology
600311	Veterinary Practice
600312	Veterinary Preventive Medicine
600313	Veterinary Radiology
600314	Veterinary Surgery
600315	Theriogenology
600316	Veterinary Toxicology
600317	Zoological Medicine
600399	Veterinary Residency Programs, Other
Counseling & Social Service	
090905	Health Communication
131101	Counselor Education/School Counseling and Guidance Services
131102	College Student Counseling and Personnel Services
301701	Behavioral Sciences
390201	Bible/Biblical Studies
390301	Missions/Missionary Studies and Missiology
390401	Religious Education
390601	Theology/Theological Studies
390602	Divinity/Ministry (BD, MDiv.)
390604	Pre-Theology/Pre-Ministerial Studies
390605	Rabbinical Studies
390699	Theological and Ministerial Studies, Other
390701	Pastoral Studies/Counseling
390702	Youth Ministry
390799	Pastoral Counseling and Specialized Ministries, Other
399999	Theology and Religious Vocations, Other
420101	Psychology, General
420201	Clinical Psychology
420301	Cognitive Psychology and Psycholinguistics
420401	Community Psychology
420501	Comparative Psychology
420601	Counseling Psychology
420701	Developmental and Child Psychology

CIP Codes	Major Occupational Groupings & Related CIP Titles
420801	Experimental Psychology
420901	Industrial and Organizational Psychology
421001	Personality Psychology
421101	Physiological Psychology/Psychobiology
421601	Social Psychology
421701	School Psychology
421801	Educational Psychology
421901	Psychometrics and Quantitative Psychology
422001	Clinical Child Psychology
422101	Environmental Psychology
422201	Geropsychology
422301	Health/Medical Psychology
422401	Psychopharmacology
422501	Family Psychology
422601	Forensic Psychology
429999	Psychology, Other
430110	Juvenile Corrections
440701	Social Work
440702	Youth Services/Administration
511501	Substance Abuse/Addiction Counseling
511503	Clinical/Medical Social Work
511504	Community Health Services/Liaison/Counseling
511505	Marriage and Family Therapy/Counseling
511506	Clinical Pastoral Counseling/Patient Counseling
511507	Psychoanalysis and Psychotherapy
511508	Mental Health Counseling/Counselor
511509	Genetic Counseling/Counselor
511599	Mental and Social Health Services and Allied Professions, Other
512207	Public Health Education and Promotion
512209	Maternal and Child Health
512210	International Public Health/International Health
512310	Vocational Rehabilitation Counseling/Counselor
512312	Assistive/Augmentative Technology and Rehabilitation Engineering
Designers & Artists	
010802	Agricultural Communication/Journalism
090701	Radio and Television
100304	Animation, Interactive Technology, Video Graphics and Special Effects
110801	Web Page, Digital/Multimedia and Information Resources Design
110803	Computer Graphics
390501	Religious/Sacred Music
500401	Design and Visual Communications, General
500402	Commercial and Advertising Art
500404	Industrial Design
500409	Graphic Design
500410	Illustration
500499	Design and Applied Arts, Other
500501	Drama and Dramatics/Theatre Arts, General
500502	Technical Theatre/Theatre Design and Technology

CIP Codes	Major Occupational Groupings & Related CIP Titles
500507	Directing and Theatrical Production
500508	Theatre/Theatre Arts Management
500599	Dramatic/Theatre Arts and Stagecraft, Other
500601	Film/Cinema Studies
500602	Cinematography and Film/Video Production
500705	Drawing
500706	Intermedia/Multimedia
500708	Painting
500710	Printmaking
500903	Music Performance, General
500904	Music Theory and Composition
500905	Musicology and Ethnomusicology
500906	Conducting
500908	Voice and Opera
500909	Music Management and Merchandising
500999	Music, Other
K-12 Educators & Librarians	
130201	Bilingual and Multilingual Education
130202	Multicultural Education
131001	Special Education and Teaching, General
131003	Education/Teaching of Individuals with Hearing Impairments, Including Deafness
131005	Education/Teaching of Individuals with Emotional Disturbances
131006	Education/Teaching of Individuals with Mental Retardation
131007	Education/Teaching of Individuals with Multiple Disabilities
131008	Education/Teaching of Individuals with Orthopedic and Other Physical Health Impairments
131009	Education/Teaching of Individuals with Vision Impairments, Including Blindness
131011	Education/Teaching of Individuals with Specific Learning Disabilities
131012	Education/Teaching of Individuals with Speech or Language Impairments
131013	Education/Teaching of Individuals with Autism
131016	Education/Teaching of Individuals with Traumatic Brain Injuries
131099	Special Education and Teaching, Other
131201	Adult and Continuing Education and Teaching
131202	Elementary Education and Teaching
131203	Junior High/Intermediate/Middle School Education and Teaching
131205	Secondary Education and Teaching
131206	Teacher Education, Multiple Levels
131209	Kindergarten/Preschool Education and Teaching
131210	Early Childhood Education and Teaching
131299	Teacher Education and Professional Development, Specific Levels and Methods, Other
131301	Agricultural Teacher Education
131302	Art Teacher Education
131303	Business Teacher Education
131304	Driver and Safety Teacher Education
131305	English/Language Arts Teacher Education
131306	Foreign Language Teacher Education
131307	Health Teacher Education
131308	Family and Consumer Sciences/Home Economics Teacher Education
131309	Technology Teacher Education/Industrial Arts Teacher Education

CIP Codes	Major Occupational Groupings & Related CIP Titles
131310	Sales and Marketing Operations/Marketing and Distribution Teacher Education
131311	Mathematics Teacher Education
131312	Music Teacher Education
131314	Physical Education Teaching and Coaching
131315	Reading Teacher Education
131316	Science Teacher Education/General Science Teacher Education
131317	Social Science Teacher Education
131318	Social Studies Teacher Education
131321	Computer Teacher Education
131322	Biology Teacher Education
131323	Chemistry Teacher Education
131324	Drama and Dance Teacher Education
131325	French Language Teacher Education
131326	German Language Teacher Education
131327	Health Occupations Teacher Education
131328	History Teacher Education
131329	Physics Teacher Education
131330	Spanish Language Teacher Education
131331	Speech Teacher Education
131332	Geography Teacher Education
131333	Latin Teacher Education
131399	Teacher Education and Professional Development, Specific Subject Areas, Other
131401	Teaching English as a Second or Foreign Language/ESL Language Instructor
131502	Adult Literacy Tutor/Instructor
139999	Education, Other
250101	Library Science/Librarianship
259999	Library Science, Other
301201	Historic Preservation and Conservation
301202	Cultural Resource Management and Policy Analysis
301299	Historic Preservation and Conservation, Other
301301	Medieval and Renaissance Studies
301401	Museology/Museum Studies
302101	Holocaust and Related Studies
302201	Ancient Studies/Civilization
302202	Classical, Ancient Mediterranean and Near Eastern Studies and Archaeology
500703	Art History, Criticism and Conservation
540101	History, General
540102	American History (United States)
540103	European History
540104	History and Philosophy of Science and Technology
540105	Public/Applied History and Archival Administration
540106	Asian History
540107	Canadian History
540199	History, Other
Legal	
220101	Law (LL.B., J.D.)
220201	Advanced Legal Research/Studies, General (LL.M., M.C.L., M.L.I., M.S.L., J.S.D./S.J.D.)
220202	Programs for Foreign Lawyers (LL.M., M.C.L.)

CIP Codes	Major Occupational Groupings & Related CIP Titles
220203	American/U.S. Law/Legal Studies/Jurisprudence (LL.M., M.C.J., J.S.D./S.J.D.)
220204	Canadian Law/Legal Studies/Jurisprudence (LL.M., M.C.J., J.S.D./S.J.D.).
220205	Banking, Corporate, Finance, and Securities Law (LL.M., J.S.D./S.J.D.).
220206	Comparative Law (LL.M., M.C.L., J.S.D./S.J.D.)
220207	Energy, Environment, and Natural Resources Law (LL.M., M.S., J.S.D./S.J.D.).
220208	Health Law (LL.M., M.J., J.S.D./S.J.D.)
220209	International Law and Legal Studies (LL.M., J.S.D./S.J.D.)
220210	International Business, Trade, and Tax Law (LL.M., J.S.D./S.J.D.).
220211	Tax Law/Taxation (LL.M., J.S.D./S.J.D.).
220299	Legal Research and Advanced Professional Studies, Other
220302	Legal Assistant/Paralegal
229999	Legal Professions and Studies, Other
Media & Communications	
010802	Agricultural Communication/Journalism
090101	Communication Studies/Speech Communication and Rhetoric
090102	Mass Communication/Media Studies
090401	Journalism
090402	Broadcast Journalism
090404	Photojournalism
090499	Journalism, Other
090701	Radio and Television
090902	Public Relations/Image Management
090904	Political Communication
090905	Health Communication
091001	Publishing
099999	Communication, Journalism, and Related Programs, Other
100105	Communications Technology/Technician
100202	Radio and Television Broadcasting Technology/Technician
100299	Audiovisual Communications Technologies/Technicians, Other
190202	Family and Consumer Sciences/Human Sciences Communication
230401	English Composition
230501	Creative Writing
231101	Technical and Business Writing
500504	Playwriting and Screenwriting
500602	Cinematography and Film/Video Production
520501	Business/Corporate Communications
Pharmacists	
512001	Pharmacy (PharmD [USA] PharmD, BS/BPharm [Canada])
512002	Pharmacy Administration and Pharmacy Policy and Regulatory Affairs (MS, PhD)
512003	Pharmaceutics and Drug Design (MS, PhD)
512004	Medicinal and Pharmaceutical Chemistry (MS, PhD)
512005	Natural Products Chemistry and Pharmacognosy (MS, PhD)
512006	Clinical and Industrial Drug Development (MS, PhD)
512007	Pharmacoeconomics/Pharmaceutical Economics (MS, PhD)
512008	Clinical, Hospital, and Managed Care Pharmacy (MS, PhD)
512009	Industrial and Physical Pharmacy and Cosmetic Sciences (MS, PhD)
512099	Pharmacy, Pharmaceutical Sciences, and Administration, Other
Physicians & Dentists	

CIP Codes	Major Occupational Groupings & Related CIP Titles
190501	Foods, Nutrition, and Wellness Studies, General
190504	Human Nutrition
190505	Foodservice Systems Administration/Management
190599	Foods, Nutrition, and Related Services, Other
301901	Nutrition Sciences
510101	Chiropractic (DC)
510401	Dentistry (DDS, DMD)
510501	Dental Clinical Sciences, General (MS, PhD)
510502	Advanced General Dentistry (Cert, MS, PhD)
510503	Oral Biology and Oral Pathology (MS, PhD)
510504	Dental Public Health and Education (Cert, MS/MPH, PhD/DPH)
510505	Dental Materials (MS, PhD)
510506	Endodontics/Endodontology (Cert, MS, PhD)
510507	Oral/Maxillofacial Surgery (Cert, MS, PhD)
510508	Orthodontics/Orthodontology (Cert, MS, PhD)
510509	Pediatric Dentistry/Pedodontics (Cert, MS, PhD)
510510	Periodontics/Periodontology (Cert, MS, PhD)
510511	Prosthodontics/Prosthodontology (Cert, MS, PhD)
510599	Advanced/Graduate Dentistry and Oral Sciences, Other
511201	Medicine (MD)
511701	Optometry (OD)
511901	Osteopathic Medicine/Osteopathy (DO)
512101	Podiatric Medicine/Podiatry (DPM)
513101	Dietetics/Dietitian (RD)
513102	Clinical Nutrition/Nutritionist
513199	Dietetics and Clinical Nutrition Services, Other
600101	Dental/Oral Surgery Specialty
600102	Dental Public Health Specialty
600103	Endodontics Specialty
600104	Oral Pathology Specialty
600105	Orthodontics Specialty
600106	Pedodontics Specialty
600107	Periodontics Specialty
600108	Prosthodontics Specialty
600199	Dental Residency Program, Other
600201	Aerospace Medicine
600202	Allergies and Immunology
600203	Anesthesiology
600204	Blood Banking
600205	Cardiology
600206	Chemical Pathology
600207	Child/Pediatric Neurology
600208	Child Psychiatry
600209	Colon and Rectal Surgery
600210	Critical Care Anesthesiology
600211	Critical Care Medicine
600212	Critical Care Surgery
600213	Dermatology

CIP Codes	Major Occupational Groupings & Related CIP Titles
600214	Dermatopathology
600215	Diagnostic Radiology
600216	Emergency Medicine
600217	Endocrinology and Metabolism
600218	Family Medicine
600219	Forensic Pathology
600220	Gastroenterology
600221	General Surgery
600222	Geriatric Medicine
600223	Hand Surgery
600224	Hematology
600225	Hematological Pathology
600226	Immunopathology
600227	Infectious Disease
600228	Internal Medicine
600229	Laboratory Medicine
600230	Musculoskeletal Oncology
600231	Neonatal-Perinatal Medicine
600232	Nephrology
600233	Neurological Surgery/Neurosurgery
600234	Neurology
600235	Neuropathology
600236	Nuclear Medicine
600237	Nuclear Radiology
600238	Obstetrics and Gynecology
600239	Occupational Medicine
600240	Oncology
600241	Ophthalmology
600242	Orthopedics/Orthopedic Surgery
600243	Otolaryngology
600244	Pathology
600245	Pediatric Cardiology
600246	Pediatric Endocrinology
600247	Pediatric Hemato-Oncology
600248	Pediatric Nephrology
600249	Pediatric Orthopedics
600250	Pediatric Surgery
600251	Pediatrics
600252	Physical and Rehabilitation Medicine
600253	Plastic Surgery
600254	Preventive Medicine
600255	Psychiatry
600256	Public Health Medicine
600257	Pulmonary Disease
600258	Radiation Oncology
600259	Radioisotopic Pathology
600260	Rheumatology
600261	Sports Medicine

CIP Codes	Major Occupational Groupings & Related CIP Titles
600262	Thoracic Surgery
600263	Urology
600264	Vascular Surgery
600265	Adult Reconstructive Orthopedics (Orthopedic Surgery)
600266	Child Neurology
600267	Cytopathology
600268	Geriatric Medicine (Internal Medicine)
600269	Pediatric Urology
600270	Physical Medical and Rehabilitation/Psychiatry
600271	Orthopedic Surgery of the Spine
600299	Medical Residency Programs, Other
Social Science, Urban Planning, & Architects	
010103	Agricultural Economics
040201	Architecture (BArch, BA/BS, MArch, MA/MS, PhD)
040301	City/Urban, Community and Regional Planning
040401	Environmental Design/Architecture
040601	Landscape Architecture (BS, BSLA, BLA, MSLA, MLA, PhD)
040801	Architectural History and Criticism, General
049999	Architecture and Related Services, Other
151102	Surveying Technology/Surveying
301101	Gerontology
301701	Behavioral Sciences
302001	International/Global Studies
450101	Social Sciences, General
450201	Anthropology
450202	Physical Anthropology
450301	Archeology
450401	Criminology
450501	Demography and Population Studies
450601	Economics, General
450602	Applied Economics
450603	Econometrics and Quantitative Economics
450604	Development Economics and International Development
450605	International Economics
450699	Economics, Other
450701	Geography
450702	Cartography
451001	Political Science and Government, General
451002	American Government and Politics (United States)
451003	Canadian Government and Politics
451099	Political Science and Government, Other
451101	Sociology
451201	Urban Studies/Affairs
459999	Social Sciences, Other
520601	Business/Managerial Economics
521402	Marketing Research