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Cover image: Shutterstock
Gainesville Regional Manufacturers Association
Manufacturing Sector Profile

Introduction

As part of its mission, FloridaMakes is working to provide Florida’s regional manufacturers associations (RMAs) with actionable information that will help them support and increase the economic competitiveness of small- and medium-size manufacturers located in their service areas. Small and medium manufacturers are defined as companies having 500 or fewer workers at a single establishment with small manufacturers defined as those firms that have 50 or fewer employees. FloridaMakes has retained IHS to prepare an economic profile of the Gainesville economy, with a focus on the characteristics of the manufacturing sector. IHS defines the manufacturing sector as consisting of establishments assigned to North American Industry Classification System (NAICS) codes 31, 32, and 33.

The Gainesville region comprises five Florida counties: Alachua, Bradford, Columbia, Gilchrist, and Union1. Gainesville is the major city in the regional economy, situated within Alachua County, a part of the Gainesville, Florida, metropolitan statistical area (MSA). Gilchrist County is also in the Gainesville, Florida, MSA, whereas Columbia is in the Lake City, Florida, micropolitan statistical area and Bradford and Union counties are in the Northeast Florida nonmetropolitan area.

In the following sections, findings of potential interest to policymakers are presented in **bold**.

1 While data for this study are presented for the five-county study area, they are available by county upon client request.
Strategic Summary

What is the situation today?

- The 2015 population of the Gainesville RMA service area was 389,093 people, or less than 2 percent of the state of Florida.

- With a 4 percent unemployment rate in April 2016, the labor market in the Gainesville RMA has been tighter since 2011 than at the state and US levels.

- Local government, health care and social assistance, retail trade, state government, and accommodation and food services accounted for more than 60 percent of the Gainesville region’s total employment in 2015. The manufacturing sector comprises just over 6,800 jobs, 3.9 percent of the region’s total employment, which is less than the manufacturing sector’s share of employment in the state and the country overall.

- Due to the small relative and absolute size of the region’s manufacturing sector, the interindustry purchasing relationships between manufacturing subsectors are sparse and not fully developed, and activity is not present in many manufacturing subsectors. Miscellaneous, wood product, and machinery manufacturing currently offer the greatest number of manufacturing jobs in the region, together representing more than 3,700 jobs.

- Eight manufacturing subsectors (of 19 total) experienced positive employment, output, and productivity growth between 2000 and 2015. Subsectors with at least 200 jobs in 2015 are shown in bold and italics.
  - Leather and allied products
  - Miscellaneous
  - Beverage and tobacco products
  - Furniture and related products
  - Primary metals
  - Food
  - Plastics and rubber products
  - Nonmetallic minerals
The miscellaneous manufacturing sector, which includes the manufacture of medical equipment and supplies, office equipment, and sporting goods, grew 5.9 percent between 2000 and 2015 and had more than 1,850 employees in the Gainesville region in 2015.

The Gainesville region hosts the global headquarters of medical equipment manufacturer Exactech, Inc. and a few manufacturing facilities with 200 or more employees, such as Golden Aluminum Extrusion LLC, Eaton Corporation, Ball Corporation, and The Chemours Company TT LLC. However, the majority of manufacturers in the region (86.1 percent) employ fewer than 50 workers, and almost two-thirds have fewer than ten employees.

Durable\(^2\) manufacturing sectors employ nearly 83 percent of the region’s 2015 manufacturing workforce, a greater share than Florida’s durable manufacturing jobs share of less than 70 percent. Durable subsectors typically pay higher annual wages, require more highly skilled and educated workers, are slightly more labor intensive (i.e., generate more direct jobs per $1 million in additional output), and have higher levels of productivity (measured in output per worker) than in the nondurable sectors.

What are our advantages?

The Gainesville region’s manufacturing industry is primarily composed of high-performing and emerging sectors\(^3\) (which represent almost 80 percent of regional manufacturing employment).

The Gainesville region has an above-average share (47.5 percent) of advanced\(^4\) manufacturing employment when compared with the rest of the nation and boasts the second-highest average annual patent rate among Florida metropolitan statistical areas (MSAs). The five largest advanced manufacturing subsectors in 2015 were medical equipment; ship and boat building; other miscellaneous; other machinery and equipment; and agriculture, construction, and mining machinery.

Nine high-performing sectors outperformed the same sector nationally between 2000 and 2015 (in terms of their compound annual growth rate, or CAGR, for employment) and are highly concentrated in the Gainesville region. These sectors have national competitive advantages and currently account for more than three-fifths of regional employment.

\(^2\) Durables, or hard goods, are defined as those that are not totally consumed during their immediate or first use.

\(^3\) See the “Shift-share analysis” section for definitions used to categorize sectors as High Performing or Emerging, as well as other sector category classifications.

\(^4\) See definition in “Advanced Manufacturing” section.
manufacturing employment. High-performing sectors with more than 100 employees in 2015 are shown in bold and italics.

- Medical equipment
- Other wood products
- Cement and concrete products
- Architectural and structural metals
- Other miscellaneous

- Sawmills and wood preservation
- Animal food
- Other leather
- Reproducing magnetic and optical media

The Gainesville region has 18 emerging sectors that, while not highly concentrated, performed better than their peers nationally in terms of annual employment growth. The five largest include: printing; household and institutional furniture; plastics; navigational, measuring, electromedical, and control instruments; and converted paper products.

The region’s median annual wage levels in major occupations required by manufacturers tend to be at or slightly below those for Florida, and average between 80 percent and 90 percent of US median wages in the same occupations. Low labor costs provide Gainesville with a competitive advantage to the nation in all major manufacturing occupations apart from management.

None of the region’s top-five manufacturing sectors (by 2015 employment) had an IHS composite risk score above the US manufacturing industry average.

Where should we be concerned?

- The Gainesville region’s low unemployment rate is well below the traditional “full employment” rate, which increases the likelihood of upward pressure on wage levels, putting the region’s labor cost advantage at risk.

- The Gainesville region lost fewer manufacturing jobs per year, as a percentage, than Florida or the nation between 2000 and 2015. However, six subsectors experienced significant job losses between 2000 and 2015:
  - Electrical equipment declined from almost 1,200 jobs in 2000 to under 20 by 2015.
  - Wood products lost more than 700 jobs in the 15-year period.
  - Machinery had a decline of more than 200 jobs.
  - Transportation equipment witnessed a workforce reduction of more than 50 percent.
  - Chemicals more than halved its workforce size to employment of 271 in 2015.
  - Printing experienced a rate of decline of 2.6 percent annually.

- The region’s second-largest manufacturing sector, wood product manufacturing, and its third-largest, machinery manufacturing, are exposed to higher-than-average “profitability and pricing” and “growth” risks, respectively.

- There is a significant mismatch between the knowledge, skills, and abilities (KSA) of the current workforce in the Gainesville region and the needs of machine shops and manufacturers producing motor vehicles; machinery; transportation equipment; boilers and tanks; engines, turbines, and power equipment; and other appliances. Most of these subsectors fall within the broader category of advanced manufacturing, known for its high-skill, high-wage jobs.

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5 See "Wages in manufacturing occupations" section for more detail.
6 See definition in "Risk rating by industry sector" section.
7 Full employment is the condition in which all eligible people who want to work can find employment at prevailing wage rates.
8 See definition in "Risk rating by industry sector" section.
Where should we focus our efforts?

- Workforce training organizations and educational institutions can benefit from identifying the skills required by local employers and develop programs or talent recruitment strategies to meet the industry’s current and future needs for skilled workers.

- Given the relative lack of diversity in the Gainesville region’s manufacturing industry and large percentage of high-performing and growth sectors, workforce development programs can be narrowly tailored to meet the needs of the region’s highest-performing and growth industries. Local economic development programs and policies could be designed to capitalize on these sectors’ existing strengths or minimize growth barriers.

- Teaming with local educators could provide opportunities to improve productivity and increase opportunities for innovation. The University of Florida’s technology transfer office or other research and development programs could additionally benefit local companies and other regional planners to develop or attract a workforce with science, technology, engineering, and mathematics (STEM) occupational skills and experience.

- The relative proximity to the Port of Jacksonville, the Space Coast, the Capitol, and Florida State University in Tallahassee, and the Orlando metropolitan area offer additional benefits in trade.

- To increase manufacturing wages, the region should focus on advanced and durable manufacturing sectors, which have high payoffs in terms of worker skill levels, per capita incomes, and local job creation. For example, economic and workforce development practitioners in the Gainesville region might explore existing health care supply chains to see if equipment demand from the region’s healthcare industry might be parlayed into manufacturing sector opportunities, e.g., contribute to the growth of the medical equipment and supplies or electromedical and control instruments manufacturing sectors.

- Given the size of the Gainesville region’s manufacturers, sector development strategies should focus on adopting best practices that are relevant for small or very small manufacturing enterprises.
Explore what is driving the higher-than-average “profitability and pricing” and “growth” risks threatening two of the region’s largest manufacturing sectors, wood product and machinery manufacturing, to determine if there is a role local policymakers or economic development practitioners can play in mitigating these risks.\(^9\)

\(^9\) See definition in “Risk rating by industry sector” section.
Characteristics of the regional economy

Population
IHS estimates the 2015 population in the Gainesville region was 389,093 people, or 1.9 percent of the state of Florida. The population density was 145.0 persons per square mile, approximately two-fifths of the Florida density of 369.5 persons per square mile.

Unemployment rate
In April 2016, the region’s unemployment rate (not seasonally adjusted and based on workers’ place of residence rather than on workplace location), was 4.0 percent, below both the US and Florida rates of 4.7 percent and 4.5 percent, respectively, that month. The April 2016 unemployment rate was half a percentage point lower than in April 2015. Since 2011, the average annual unemployment rate in the Gainesville region has been 1.2 percentage points lower than the state rate and 0.9 percentage points lower than the national unemployment rate.

Labor force
In April 2016, Gainesville’s total labor force was 183,804 people, a 1.2 percent increase from April 2015. In the Gainesville region, 819 fewer people were unemployed in April 2016 than the year before, while the employment level increased by more than 2,939 workers (1.7 percent). The net effect was the labor force increased as workers, attracted by rising employment levels, reentered the labor force; since employment grew faster than the labor force, the unemployment rate fell. A similar story played out statewide as the number of unemployed persons in April 2016 was down 64,000 on a year-on-year basis. The positive growth of the labor force in the Gainesville region and the state of Florida is consistent with that of the United States where the labor force grew 1.2 percent and the unemployment rate (not seasonally adjusted) dropped 6.9 percent in the same period.

The key finding from the labor force analysis is the labor market in the Gainesville region is tighter than at either the state or US level. The tight labor market will likely eventually result in rising wage rates and could potentially indicate shortages of skilled workers, especially for skilled manufacturing occupations.

Economic structure
Employment by major economic sector, according to two-digit NAICS codes, is presented in the accompanying table in descending order by number of jobs. IHS estimates there were 6,828 jobs in 2015 in the Gainesville region’s manufacturing sector (NAICS codes 31–33). The share of the Gainesville region’s total 2015 employment in manufacturing is 3.9 percent, significantly below the US figure of 8.5 percent and slightly below the state of Florida, where 4.1 percent of total 2015 employment was in the manufacturing sector. The below-average share of 2015 manufacturing employment is reflected by the low employment location quotient (LQ) of 0.46.10

Of 22 major sectors in the Gainesville region, only five had employment LQs greater than one, and 17 had employment LQs less than one, meaning more than three-quarters of the region’s sectors are less concentrated, based on employment, than they are in the United States, while just under one-quarter are more concentrated. With an LQ of 2.51, state government (NAICS 900S) is especially highly concentrated, followed by federal government (NAICS 900F) and local government (NAICS 900L) with LQs of 1.78 and 1.70, respectively.

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10 An LQ score greater than 1 indicates a regional economy has a higher share of its total employment in an individual economic sector than the sector’s share of total US employment.
Because of its historical role as a center of tourism, transportation, and business and health services, Florida has an above-average concentration of its total employment in the private, services-providing (PSP) sectors. However, while PSP sectors still account for the majority (59.2 percent) of jobs in the Gainesville region, the PSP share of employment is much less than in Florida overall, where PSP sectors represented 75.9 percent of employment in 2015, and is lower than the US share of 68.9 percent. Almost one-third of the region’s employment is in government (29.1 percent), and goods-producing sectors (e.g., agriculture, mining, construction, and manufacturing) account for just 11.6 percent of regional employment.

**Structure diversity**

To evaluate the diversity of the Gainesville region’s industrial structure, IHS calculated the Hachman Index, which compares a regional economy’s distribution of economic activity by sector (in this case, employment) to that of the US economy. With the Hachman Index, the maximum value is 1.00, or in other words, the closer the region’s Hachman Index value is to 1.00, the more similar that region’s economic structure is to the US economy.

For the Gainesville region, the Hachman Index was 0.821, indicating the region’s economy is much less diverse than the Florida economy overall, which has a Hachman Index of 0.941. Since regional economies, especially smaller ones, are usually less diverse than larger state economies or the United States overall, this disparity is to be expected.

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11 The private, services-providing (PSP) sector consists of the following major sectors: trade, transportation, and utilities; information; financial activities; professional and business services; education and health care; leisure and hospitality; and other services. The PSP sector excludes employment in the private, goods-producing sectors—agriculture; natural resources and mining; construction; manufacturing; and government.

12 Calculate two-digit LQs by NAICS sector weighted by employment shares, and then invert the result.
Characteristics of the manufacturing sector

To provide a more accurate picture of the Gainesville region’s overall manufacturing industry, the following sections provide data on manufacturing subsectors’ growth, structure, diversity, and risk ratings. We conclude with a shift-share analysis to get a more detailed perspective on regional manufacturing sector performance in 2015.

Industry growth

As shown, the Gainesville region had 2015 employment in 19 three-digit manufacturing subsectors, with positive employment growth rates between 2000 and 2015 in only eight of them. Of these, leather and allied product manufacturing increased the most, with employment increasing from two people in 2000 to 47 in 2015. Meanwhile, the region’s largest three-digit manufacturing subsector, miscellaneous manufacturing, grew 5.9 percent, with more than 1,850 employees in 2015. Employment in the beverage and tobacco product manufacturing subsector also nearly doubled during the same period to reach a workforce of 60 people, experiencing a 4.5 percent CAGR since 2000. Despite these gains in a few subsectors, employment in six of the region’s manufacturing subsectors declined more than it did in the US manufacturing industry overall between 2000 and 2015, where the CAGR in this period was a decline of 2.3 percent, and the Gainesville region’s workforce shrank in more than half of its manufacturing subsectors. Overall, the Gainesville region’s CAGR for employment in manufacturing, a contraction of 1.9 percent, was less than the decline of the manufacturing sector in the United States in the same period.
Durables and nondurables

Additional insight into a region’s manufacturing sector can be obtained by analyzing the durable and nondurable sectors. Durables, or hard goods, are defined as those that are not totally consumed during their immediate or first use (i.e., used over an extended period of time, usually with a useful life of at least three years, and thus do not have to be purchased often). By contrast, nondurables, or soft or consumable goods, are immediately and totally consumed when initially used, have a useful life of less than three years, and need to be purchased frequently. The following charts present the employment trends in the Gainesville region for the individual three-digit NAICS code manufacturing subsectors that make up the durable and nondurable sectors. Each chart presents the CAGR in employment between 2000 and 2015 on the x axis, the 2015 employment LQ on the y axis, and the size of each bubble presents that sector’s total employment in 2015. Each chart provides a visual representation of the performance of the individual subsectors and the structure of the manufacturing economy. Approximately 82.6 percent and 17.4 percent of the Gainesville region’s manufacturing employment in 2015 was in the durable and nondurable sectors, respectively, with the Gainesville region’s durable manufacturing sector constituting a greater share of manufacturing jobs than in Florida overall, where durable manufacturing accounted for 67.9 percent of manufacturing employment.

Because of differences in the goods made and the production processes used, the durable and nondurable manufacturing sectors also differ from each other in terms of the mix of skilled workers required, level of wages paid, and productivity, all of which will determine appropriate economic and workforce development strategies. IHS analyzed detailed occupational employment and wage data for 2015 by four-digit manufacturing subsector for the United States, identifying the following differences between the durable and nondurable sectors:

- **Durable sectors require higher shares of skilled workers.** About 19.4 percent of the jobs, by detailed occupation, required a Bachelor’s degree or higher to obtain an entry-level position, compared with only 12.4 percent in the nondurable sectors. Similarly, 26.0 percent of durable jobs required some type of postsecondary education, compared with only 18.8 percent for the nondurable sector. By contrast, 58.2 percent of durable sector jobs required a high school diploma or equivalent for an entry-level position, compared with 60.9 percent for the nondurables. Interestingly, 1.1 percent of the nondurable jobs require an advanced degree for an entry-level position, compared with only 0.5 percent in the durable sectors, because of the high share of STEM occupations required by the chemicals sector, especially in pharmaceuticals due to its high level of research and development spending.

- **Durable jobs pay higher annual wages.** The average annual US wage in the durable sectors in 2015, based on a detailed analysis of occupations required, was $49,387 compared with $44,194 in the nondurable sectors.
• **Nondurable sectors have higher shares of their employment in traditional “blue-collar” occupations and lower shares in STEM occupations.** The nondurables had 63.3 percent of their total employment in production, transportation, and material handling occupations in 2015 compared with only 57.4 percent for durables. By contrast, durable sectors had 12.2 percent of their total employment in three high-skill, high-education STEM occupations: architecture and engineering; computer and math; and life, physical, and social sciences, well above the 5.2 percent share for the nondurables.

• **Durable sectors are slightly more labor intensive,** creating 2.7 direct jobs per $1 million in output compared with 1.6 in the nondurable sectors; the latter figure is low because of the high level of output per employee in the petroleum refining and chemical manufacturing subsectors; if they are excluded, the nondurable figure rises to 2.5 jobs per $1 million in output.

The difference between the durable and nondurable sectors indicates expanding the durable sector will require greater efforts to develop the supply of highly skilled workers in the local labor force. However, the generally lower entry-level education and training requirements for the nondurables, excluding chemicals, indicate these sectors have a greater potential to employ less-skilled workers, thus providing more opportunities for them to begin careers.

The first chart, durable manufacturing sector trends, shows the composition and performance of Gainesville’s durable sector between 2000 and 2015. Note the relatively large number of jobs, high concentration of employment, and positive employment growth rate of the miscellaneous manufacturing sector as well as the above-average employment concentration and positive CAGR of the nonmetallic minerals manufacturing sector. The second chart presents the composition and performance of the nondurable sectors. Although it employs just 47 people, the above-average concentration and high annual growth rate of the leather and allied product manufacturing sector is notable.

If one of the objectives of a region’s economic development plan is to increase employment in the traditional, “blue-collar” manufacturing occupations, then expansion of the nondurable sectors should be promoted, especially outside petroleum refining, plastics and rubber, and chemicals. By contrast, if the economic development objective is to attract higher-paying jobs in the STEM occupations that are often associated with nonproduction facilities such as research and development (R&D) centers, then policies and programs should be directed at the durable sectors. In adopting the latter strategy, complementary STEM programs to increase skills of the workforce will also have to be implemented.
Output and productivity

In addition to employment, it is helpful to consider output by sector and productivity (output per worker), to get a better sense of an individual manufacturing subsector’s contribution to a regional economy. For example, a capital-intensive (i.e., high levels and values of structures and equipment per worker) sector such as petroleum refining, chemicals, or primary metals may not employ a lot of workers (i.e., have high levels of output per worker), but could generate substantial increases in regional economic activity through either their backward linkages (i.e., they purchase large amounts of inputs from suppliers located in the region) or through their forward linkages (i.e., the products they make are in turn purchased by other firms in the region who use them as inputs in making other types of goods or services). In other words, when evaluating the manufacturing sector’s regional economic health, it is important to note that, based on changes in productivity, employment growth rates may differ significantly from output growth rates. For example, in the Gainesville region, while only eight manufacturing subsectors had a positive CAGR for employment between 2000 and 2015, 16 had a positive CAGR for output. As with employment growth, the most notable output gains were in the leather and allied product, miscellaneous, and beverage and tobacco product manufacturing subsectors.

Of the 16 manufacturing sectors with positive growth in output during this period, all also demonstrated growth in productivity (inflation-adjusted output per worker), with computer and electronic product manufacturing leading the pack with a CAGR in productivity of 3.8 percent. In fact, all eight Gainesville region manufacturing subsectors that experienced positive employment growth rates during the 15-year period also experienced positive growth in output and productivity. These include:

- Leather and allied product manufacturing
- Miscellaneous manufacturing
- Beverage and tobacco product manufacturing
- Furniture and related products
- Primary metal manufacturing
• Food manufacturing
• Plastics and rubber products manufacturing
• Nonmetallic mineral manufacturing

Interestingly, leather and allied product manufacturing, despite ranking first for output and employment growth, only increased productivity annually 2.3 percent during 2000–15, the tenth-highest productivity growth rate in the Gainesville region. Meanwhile, beverage and tobacco product manufacturing, which ranked third for output and employment, only increased productivity annually 0.8 percent in the 15-year period, the second-lowest productivity growth rate in the Gainesville region. Extending this report’s durable and nondurable analysis, output per worker in the durable manufacturing sector in the United States in 2015 was $375,043 compared with $619,325 in the nondurable sector. The nondurable sector’s level is greater because of the high level of productivity in the petroleum refining and chemical sectors.

The output-per-worker figures presented in the table on productivity growth rates in the manufacturing sector also show the direct increases in manufacturing employment that an increase in output would generate. For example, whereas leather and allied products manufacturing will produce more than six direct jobs per $1 million of new output, a sector such as chemical manufacturing with $1,566,258 of output per worker will not produce even one new job per each additional $1 million in output. Despite the relatively greater number of direct jobs that would be produced by additional investment in the leather manufacturing sector, new jobs in the chemical sector are likely to pay substantially more.

If a region’s economic development strategy is to maximize the direct increase in manufacturing employment, organizations should focus on those sectors with the lowest levels of worker productivity. However, there is an important caveat to this strategy: not all manufacturing jobs are equal; they differ widely based on their annual wage levels. Economic development agencies must consider the prevailing annual wage levels in the manufacturing subsectors they want to promote, which are a function of the types of occupations required, which in turn are determined by the types of manufacturing activities performed.
Establishment size

In addition to evaluating the Gainesville manufacturing sectors’ growth in the last 15 years, IHS assessed regional structure in terms of distribution of manufacturing establishments by employment size. In the five-county Gainesville region, the vast majority of manufacturers (86.1 percent, or 192 establishments) employ fewer than 50 workers, 12.6 percent (28 establishments) engage 50–499 employees, and there are only 3 manufacturing firms with 500 employees or more. Of the 223 manufacturing establishments in the region, almost two-thirds (63.7 percent) are “very small” employers (having fewer than 10 employees each).

The significance of the distribution of manufacturing establishments by employment size is that different types of strategies and accompanying services are required for small firms than for large ones. Small and medium manufacturing enterprises (SMEs), usually defined as those with fewer than 500 employees, are more vulnerable to changes in the business cycle, fluctuations in interest and currency rates, regulatory changes, may have more difficulty in accessing capital, and be less able to provide worker training. The RMAs need to be able to offer a broader range of services and supports to SMEs than to larger manufacturing firms. We note the proportion of total establishments accounted for by SMEs varies widely by subsector based on production processes used, barriers to entry, need to achieve economies of scale, capital intensity, etc. Some subsectors, such as fabricated metals, machinery, and printing, have traditionally had higher shares of SMEs, whereas others such as petroleum refining and chemicals have low shares.
Structure diversity

To evaluate the diversity of the region’s manufacturing sector, we again used the Hachman Index\(^\text{13}\) based on four-digit NAICS employment, with LQs based on employment in the manufacturing sectors, not total employment. For the five counties included in the Gainesville region, the Hachman Index of 0.232 shows the region’s manufacturing sector diversity is significantly lower than the manufacturing diversity of the state of Florida, which has a Hachman Index of 0.701.

Advanced manufacturing

With 3,244 people employed in the advanced manufacturing sectors, as defined either by researchers from the US Bureau of Labor Statistics (BLS) or the Brookings Institution\(^\text{14}\) think tank, the Gainesville region has just under half (47.5 percent) of its manufacturing industry employment in advanced manufacturing. This share is above the US share of 46.8 percent and below the statewide share of 49.7 percent. It is in these sectors we should expect the greatest innovation to occur (i.e., have higher patent rates), and they have higher growth rates in productivity, require more highly skilled workers, and pay higher wages than other manufacturing sectors. In fact, recent IHS analysis showed the Gainesville MSA ranked 53rd of 380 US metro areas based on its average annual patent rate (i.e., patents issued per 1,000 residents) between 2000 and 2013; that was the second-highest rate among Florida MSAs, behind only the Palm Bay-Melbourne-Titusville MSA, the home of Cape Canaveral and the Space Coast.

The criteria applied in the two studies we used to identify advanced manufacturing were:

- High levels of spending for R&D, including high intensity (i.e., above-average shares of R&D spending as a percentage of sales) and high levels per worker.
- The share of employment in the STEM occupations.

The BLS study also considered industries that use advanced manufacturing processes and that produced high-technology goods. The Brookings and BLS studies identified advanced and high-tech NAICS sectors at the four-digit level across the entire economy; for the purposes of this profile, we considered only the individual sectors that were part of the manufacturing sector.

Similar to the discussion for the durable and nondurable sectors, there are also differences between the advanced manufacturing subsectors and the entire manufacturing sector. Our analysis of detailed occupational employment and wage data for 2015 by four-digit manufacturing subsector for the United States found the following differences:

- **Advanced sectors require higher shares of skilled workers:** About 24.9 percent of the jobs required a Bachelor’s degree or higher to obtain an entry-level position, compared with only 16.9 percent for the entire manufacturing sector. Similarly, 32.7 percent of advanced manufacturing jobs required some type of post-secondary education, compared with only 23.5 percent for all of manufacturing. In contrast, 53.9 percent of advanced sector jobs required a high school diploma or equivalent for an entry-level position, compared with 59.2 percent for total manufacturing.

- **Advanced manufacturing jobs pay higher annual wages.** The average annual US wage in advanced manufacturing sectors in 2015, based on a detailed analysis of occupations required, was $52,635 compared with $47,505 across the entire manufacturing sector.

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13 See Footnote 11 regarding the Hachman Index calculation.
14 The definition of advanced manufacturing subsectors comes from two sources: 1) Daniel E. Hecker, “High-technology employment: A NAICS-based update,” Monthly Labor Review, July 2005. (Hecker is an economist in the Office of Occupational Statistics and Employment Projections, US Bureau of Labor Statistics) and 2) Muro, M., Jonathan Rothwell, et al. “America’s Advanced Industries: What They Are, Where They Are and Why They Matter,” Brookings Advanced Industries Project, February 2015. Both studies identified high-tech and advanced sectors across the entire economy at the four-digit NAICS level; we defined advanced manufacturing to consist of all the manufacturing subsectors that were identified in either study. The result was that 37 of the 86 four-digit NAICS manufacturing subsectors were defined as advanced manufacturing subsectors.
• **Advanced manufacturing requires fewer workers in traditional blue-collar occupations and more in STEM occupations.** Advanced manufacturing had 50.8 percent of its total employment in production, transportation, and material handling occupations in 2015 compared with 59.5 percent for the entire manufacturing sector. Similarly, 16.9 percent of advanced manufacturing employment was in three high-skill, high-education occupations: architecture and engineering; computer and math; and life, physical, and social sciences versus 9.7 percent in all of manufacturing.

• **Productivity in advanced manufacturing is high.** In 2015 output per worker in the US advanced manufacturing sector was $422,751 compared with $325,000 for all of manufacturing.

The key finding is that **policies and strategies directed at the advanced manufacturing sector will have to concentrate on increasing the skill levels of the region’s manufacturing labor force.** The training will have to be provided by a range of organizations, including the University of Florida, local community colleges, workforce development boards, secondary career and technical education (CTE) schools, the Gainesville RMA, labor union apprentice programs, and manufacturing companies themselves. IHS cautions that regions cannot be competitive in all advanced manufacturing sectors, so economic development policies should be designed for and targeted at those advanced manufacturing sectors where clear competitive advantages exist. Competitive sectors are identified in this report’s shift-share analysis, but **local sector development strategies might also further explore the relationship between the University of Florida and local manufacturing companies.** Major research universities typically have the potential to provide a breeding ground and test bed for new manufacturing products and processes, as well as yield STEM and management talent.
Risk rating by industry sector

IHS World Industry Service Sector Risk Ratings for each manufacturing sector in the United States use a proprietary methodology that calculates 40 individual risk factors for industrial sectors for most major industrialized countries including the United States. We consider the following major types of risk faced by firms in industrial sectors:

- **Composite sector risk**: A weighted average of 40 different risk components distributed among five major risk categories; 1) growth, 2) price and profitability, 3) supply, 4) industry structure, and 5) economic and commerce risk.

- **Growth risk**: Evaluates, for real revenue and nominal sales, the rate and volatility of growth in the sector and detects the presence of turning points and shifts in sales patterns.

- **Profitability and pricing risk**: Evaluates the sector's ability to pass on cost increases, its historical and forecast profits, and cash-flow growth and volatility, as well as operating efficiency.

- **Supply risk**: Evaluates risk accruing to capital usage, depreciation, and changes in productive capacity.

- **Industry-structure risk**: Evaluates the sector's exposure that results from competitive and structural characteristics (these include factors such as barriers to entry and exit).

- **Economic and commerce risk**: Evaluates the size of the cycle in the sector and sensitivity of output demand to interest rates and incorporates the specific macroeconomic risks related to currency, legal, financial, and tax initiatives.

The IHS risk ratings provide a broad perspective on the current and future risks in the industry sectors that state and local economic development organizations may consider assisting in terms of strategy development, technical assistance, workforce development, or the provision of economic development incentives such as loans, grants, and tax credits or deductions. The risk ratings are presented for International Standard Industrial Classification (ISIC) codes, which correspond closely with three-digit NAICS codes, and risk scores range between one (least risk) and ten (highest risk). In our April 2016 release, the minimum (e.g., low risk) and maximum (e.g., high risk) composite risk scores for the US manufacturing sectors were 5.0 and 8.1, compared with 6.9 for the entire manufacturing sector. The ranges of scores in the five subcategories are wider than for the composite risk, especially for the growth, profitability and pricing, and supply risk categories. The accompanying table presents the IHS industry risk ratings for the US manufacturing sector from April 2016, listed in ascending order of composite risk (i.e., low scores indicate lower levels of risk, and vice versa).

**IHS industry risk scores can assist state and local agencies in devising economic development strategies targeted at individual manufacturing subsectors.** The appropriate way to use the industry risk rating is to first identify a specific subsector of interest in the table, then read across its row to identify the different types and levels of risks the sector is facing. Informed policies can be developed then based on the potential risks. As some of the risks faced by an individual sector, such as pricing and profitability or industry structure, may not be able to be reduced through state or regional policies, economic development practitioners need to consider the risk factors facing an industry and their ability to lessen those risks when developing strategies for, or allocating scarce resources to, individual manufacturing sectors or companies.
Aside from miscellaneous manufacturing, the subsectors with the highest 2015 employment in the Gainesville region were wood products (NAICS 321, or ISIC code D20 in the accompanying table on industry risk ratings) and machinery manufacturing (NAICS 333 or D29), which had composite risk scores of 6.1 and 6.3, respectively, both below the overall US manufacturing sector’s risk score of 6.9. The most significant source of risk for the wood product manufacturing sector is profitability and pricing risk (in which this sector’s risk score exceeds the average for the manufacturing industry as a whole), and the machinery, equipment, and appliances manufacturing sector’s greatest risk is in the growth category. Also reassuring to economic and workforce development practitioners may be that none of the region’s top-five manufacturing sectors (by 2015 employment), had an IHS World Industry Service composite risk score above the US manufacturing industry average.
Shift-share analysis

Finally, to examine the performance of the four-digit manufacturing subsectors based on changes in employment between 2000 and 2015, IHS conducted a shift-share analysis of the manufacturing subsectors in the regional study area.¹⁵

Shift-share analysis is an analytical technique used to decompose changes in a variable, such as employment or income, which occurred in a regional economy during a historical period. It compares the performance of an individual economic sector over time within the regional economy of interest to that same sector’s performance in a larger reference economy, usually the United States, in the same time period. Shift-share analysis is based on the theory that an individual sector’s performance in a regional economy over time is due to four effects:

- **National**: The share of growth in the larger reference economy that was captured by the region.
- **Industry mix**: The shares of high-growth and low-growth sectors in the region and how they changed over time.
- **Competitive**: The extent to which an individual economic sector in the region outperformed or underperformed the same sector at the level of the reference economy over the analysis period (the United States is the reference economy for the shift-share analysis presented in this profile).
- **Allocation**: The extent to which a region has above-average shares of economic activity in those sectors where it has a competitive advantage.

Stated another way, shift-share analysis enables an analyst to determine how much of the change in a variable, such as employment, in an individual economic sector over time was due to growth in the US economy and how much was attributable to characteristics of the regional economy, such as competitive advantages or disadvantages, and the distribution of economic activity into competitive and noncompetitive sectors.

Employment is the variable most often used in a shift-share analysis because it is the most widely available, the most current, and is published at the detailed NAICS level. For this study, using employment data at the four-digit NAICS code level (86 manufacturing subsectors) from the IHS Business Market Insights database, we classify each sector that has more than 50 employees into one of four types based on its performance.

- **Type A (“High Performing”)**: The sector’s 2015 employment LQ is greater than 1.0, and its employment CAGR during the analysis period was greater than the sector’s employment CAGR for the United States in the same period.
- **Type B (“Emerging”)**: The sector’s 2015 LQ is less than 1.0, but its employment CAGR was greater than the sector’s employment CAGR for the United States during the same period.
- **Type C (“Legacy”)**: The sector’s 2015 LQ is greater than 1.0, but its employment CAGR was less than the sector’s employment CAGR for the United States in the same period.

¹⁵ See Appendix A for full results of shift-share analysis.
• **Type D (“Laggard”):** The sector’s 2015 LQ is less than 1.0 and its employment CAGR during the analysis period was less than the sector’s employment CAGR for the United States during the same period.

In the Gainesville region, there were nine high-performing manufacturing sectors classified as A that outperformed the United States and represented an above-average share of the region’s economy (i.e., had employment LQs above 1.0). A few that also had positive annual employment growth rates in the past 15 years include:

- Other leather and allied product manufacturing (23.4 percent CAGR)
- Medical equipment and supplies manufacturing (8.2 percent CAGR)
- Manufacturing and reproducing magnetic and optical media (5.2 percent CAGR)
- Other miscellaneous manufacturing (0.9 percent CAGR)
- Cement and concrete product manufacturing (0.9 percent CAGR)
- Animal food manufacturing (0.9 percent CAGR)

The nine high-performing sectors currently account for 61.2 percent of total manufacturing employment in the Gainesville region. Meanwhile, the region has 18 emerging or growth sectors, classified as B sectors, which are doing relatively well in terms of employment growth, but do not yet account for a large share of regional economic activity. Combined, the A and B sectors represent 78.5 percent of regional manufacturing employment, meaning state and local economic development organizations such as FloridaMakes have a significant opportunity to support sectors with existing strengths in the Gainesville region by researching these companies’ competitiveness drivers and designing programs or policies that capitalize on existing strengths and minimize growth barriers. A few of the notable B sectors providing more than 50 jobs in the region include:

- Printing and related support activities
- Household and institutional furniture and kitchen cabinet manufacturing
- Plastics product manufacturing
- Navigational, measuring, electromedical, and control instruments manufacturing
- Converted paper product manufacturing
- Bakeries and tortilla manufacturing
- Aerospace product and parts manufacturing
- Beverage manufacturing

For the traditionally important legacy industries in which the region still has above-average shares of economic activity, but, for a variety of reasons, the industries are underperforming their peers at the US level (the C sectors), we note four:

- Ship and boat building
- Agriculture, construction, and mining machinery manufacturing
• Basic chemical manufacturing
• Veneer, plywood, and engineered wood product manufacturing

Luckily, these four sectors only provide 876 manufacturing jobs in the region (12.8 percent of the region’s employment).

Finally, we find seven D sectors that are the lowest-performing in terms of relative importance to the regional economy (as compared with the nation as a whole) and with slower growth than the sector had at the US level in the analysis period. Given these sectors only represent just over 7 percent of the region’s employment, resources would be better spent supporting the A and B sectors described in this analysis.

The results of the shift-share analysis can be used for developing strategies in the following manner:

• Analyze the economic sectors classified as either A or B, as they are the highest performers, to identify the competitive advantages in the region that drive their performance. The B sectors should receive special attention because, while they currently account for below-average shares of economic activity, this is where growth opportunities are likely to be found. The economic development objective is to turn B sectors into A sectors.
• Identify the names of individual firms in each A and B sector and analyze them to determine why they are high performers. It is essential to determine the extent to which their high performances are due to:
  1) Firm-level factors such as excellent management, efficient operations, competitive prices, superior product quality, etc.
  2) Regional competitive advantages such as lower cost of doing business; high quality of labor; proximity to markets, suppliers, or both; lower tax rates; excellent transportation networks; favorable regulatory environment; etc.
• Analyze the C sectors and identify the factors that affect their competitiveness; they constitute traditional centers of manufacturing activity so helping them remain profitable also maintains manufacturing employment.
• Identify clusters of subsectors with similar needs that also interact with each other through buying and selling relationships.
• Identify those regional competitive advantages that apply across all the manufacturing subsectors and those that are uniquely important to a few specialized subsectors.
• Identify those regional competitive advantages where local actions can make a difference (i.e., increasing the supply of skilled workers needed by the advanced manufacturing sectors).
• Begin to develop strategies and programs that maintain and enhance regional competitive advantage in the targeted sectors.

Based on our experience in other studies, it is always valuable to have economic development professionals with detailed knowledge of the regional economy review the list of the subsectors assigned to each of the four shift-share types. Ideally, the distribution of subsectors by type should generally confirm their understanding of the region’s economic composition (i.e., the subsectors they expect to be classified as A or B sectors actually appear there).
Wages in manufacturing occupations

IHS estimated total annual wage payments for an individual company in selected manufacturing sectors using the US distribution of detailed occupational employment by four-digit NAICS code. Our analysis used 2015 annual wage rates, as published by the BLS for the Gainesville, Florida, MSA and the Northeast Florida nonmetropolitan area, because they are representative of labor market conditions in the Gainesville region. The purpose of the analysis was to compare the total annual wage cost for a manufacturing company located in the Gainesville region to the cost if it paid average annual US wages for the same occupational mix, keeping total employment the same.

A review of the major occupational categories involved in Florida’s manufacturing sector statewide shows 57.8 percent of all production workers in Florida are employed in the manufacturing sector, followed by 23.3 percent of all architects and engineers. As such, these are two of the most significant categories for evaluating manufacturing occupation wages in the Gainesville region. As shown by the table on manufacturing employment and wage levels in 2015, someone in either of these two occupations in the Gainesville region makes less than the average person in that occupation statewide or nationally, with architects and engineers earning almost one-quarter less annually than their peers in the same profession across the United States and production workers earning almost 15 percent less. We also note the Gainesville region has a competitive advantage nationally in terms of labor costs in all manufacturing occupations apart from management, where wages in that occupation (not necessarily only in manufacturing sectors) are 4.4 percent higher. While Gainesville also maintains this competitive advantage in wages for architecture and engineering and production occupations at the state level, local wages for those in installation, maintenance, and repair; transportation and material moving; and management occupations are between 1.8 percent and 8.5 percent higher.

Additional analysis showed the total annual wage costs for all manufacturing sectors in the Gainesville region range between 12.0 percent and 19.4 percent lower than the annual manufacturing industry wage bill in the United States, with the difference varying by manufacturing subsector, location within the Gainesville region, and occupation type. For example, while architects and engineers in the Gainesville, Florida, MSA’s basic chemical manufacturing industry (NAICS 325100) earn only 2.4 percent less than their national counterparts, production workers in the other nonmetallic mineral product manufacturing sector (NAICS 327900) in the Northeast Florida nonmetropolitan area earn 15.5 percent less in wages annually. Meanwhile, whereas wages in all production occupations are 7.4 percent lower in the Gainesville, Florida, MSA than they are nationally, wages in all architecture and engineering occupations in the Northeast Florida nonmetropolitan area (which includes Bradford and Union counties) are 28 percent below national wage averages for this sector.
One implication of these findings is the Gainesville RMA should encourage growth in manufacturing subsectors that pay above-average wages such as advanced and durable manufacturing (i.e., basic chemicals or metalworking machinery). However, if increasing the number of manufacturing jobs in the region, rather than increasing per capita incomes, is the desired goal, attracting manufacturing employers whose national competitive advantage is derived from being a low-cost producer may be an effective strategy.

Transferability of the Gainesville labor force’s core competencies

Understanding the core competencies of a region’s labor force, and the transferability of these competencies between industries, is an important aspect of any workforce development policy that aims to fill skill gaps and guide a region to become a high-skill, high-wage economy. Measures of the knowledge, skills, and abilities (KSA), as well as educational attainment of a region’s labor force can be used to estimate the workforce’s core competencies, as well as to evaluate the fit of a region’s core competencies in relation to a particular industry’s skill requirements.

The chart on the following page illustrates a relative correlation index between the knowledge competencies demanded by a selected set of industries and the knowledge competencies supplied by the labor force in the Gainesville region (including Alachua, Bradford, Columbia, Gilchrist, and Union counties). The comparison is made between the core competencies supplied by the labor force in Gainesville and the core competencies supplied by the US labor force more generally. Industries with a positive correlation index represent sectors for which the regional labor force is better suited to meet the industry’s knowledge requirement relative to the national labor force. Industries with a negative correlation index represent sectors for which the regional labor force is less well-suited to meet the industry’s knowledge requirement relative to the national labor force. Likewise, industries with a correlation index near zero are sectors for which the regional labor force is equally well-suited to meet the industry’s knowledge requirement relative to the national labor force.

For the top set of industries given in the chart (sectors with the most positive correlation index), economic development planning may be relatively straightforward because the labor force already has the knowledge required to fill jobs in those sectors. On the other hand, for the bottom set of industries in the chart (sectors with the most negative correlation index), workforce training, relocation incentives, or targeted educational programming may be required before the region’s labor force becomes competitive. (See Appendix B for more examples of practical applications of KSA analysis.)

According to the correlation indices in the top half of the chart, the Gainesville labor force is well-suited to fill jobs in health care industries that support state correctional facilities, such as outpatient mental health centers, substance abuse facilities, home health care services, ambulance services, and offices of physical and occupational therapists. Since firms within the Gainesville region have tended to concentrate in these industries over time, it is not surprising the region’s labor force has also concentrated around the core competencies required by these industries. On the other hand, the bottom half of this chart shows the Gainesville labor force is less well-suited to fill manufacturing industry jobs such as forestry and logging, construction machinery manufacturing, motor vehicle manufacturing, and machine shops. Since the core competencies required by these industries may be underrepresented in the Gainesville region, it may require a concerted workforce development effort over a sustained period to equip the labor force with the skills necessary to become competitive within these sectors. Rather than fight an uphill battle to attract a first of its kind manufacturing industry, economic and workforce development practitioners in the Gainesville region might explore existing healthcare supply chains to see if equipment demand from the region’s health care industry might be parlayed into manufacturing sector opportunities, e.g., contribute to the growth of the medical equipment and supplies or electromedical and control instruments manufacturing sectors.
Although not shown in the chart, there may still be other industries for which the local labor force is at least as well-equipped, if not better equipped than the national labor force to fulfill industry job requirements. These may represent feasible opportunities to nudge the region’s development path in a certain direction given an appropriate workforce development response. Thus, the full set of industry-labor force correlation indices (available upon request) can be used as a tool, within the context of a larger industry/workforce development strategy, to better understand the transferability of a region’s core competencies between a variety of prospective industries.
Appendix A: Results of the shift-share analysis

<table>
<thead>
<tr>
<th>NAICS sector</th>
<th>Description</th>
<th>Allocation code</th>
<th>Employment</th>
<th>LQ</th>
<th>% of Private Sector Employment</th>
<th>Employment CAGR 2000–15</th>
</tr>
</thead>
<tbody>
<tr>
<td>3391</td>
<td>Medical equipment and supplies manufacturing</td>
<td>A</td>
<td>1,468</td>
<td>4.57</td>
<td>1.17%</td>
<td>8.19%</td>
</tr>
<tr>
<td>3219</td>
<td>Other wood product manufacturing</td>
<td>A</td>
<td>895</td>
<td>3.94</td>
<td>0.71%</td>
<td>-1.54%</td>
</tr>
<tr>
<td>3273</td>
<td>Cement and concrete product manufacturing</td>
<td>A</td>
<td>529</td>
<td>2.94</td>
<td>0.42%</td>
<td>0.86%</td>
</tr>
<tr>
<td>3323</td>
<td>Architectural and structural metals manufacturing</td>
<td>A</td>
<td>517</td>
<td>1.44</td>
<td>0.41%</td>
<td>-1.03%</td>
</tr>
<tr>
<td>3399</td>
<td>Other miscellaneous manufacturing</td>
<td>A</td>
<td>389</td>
<td>1.38</td>
<td>0.31%</td>
<td>0.92%</td>
</tr>
<tr>
<td>3211</td>
<td>Sawmills and wood preservation</td>
<td>A</td>
<td>183</td>
<td>2.14</td>
<td>0.15%</td>
<td>-3.04%</td>
</tr>
<tr>
<td>3111</td>
<td>Animal food manufacturing</td>
<td>A</td>
<td>108</td>
<td>2.02</td>
<td>0.09%</td>
<td>0.86%</td>
</tr>
<tr>
<td>3169</td>
<td>Other leather and allied product manufacturing</td>
<td>A</td>
<td>47</td>
<td>4.19</td>
<td>0.04%</td>
<td>23.43%</td>
</tr>
<tr>
<td>3346</td>
<td>Manufacturing and reproducing magnetic and optical media</td>
<td>A</td>
<td>43</td>
<td>2.51</td>
<td>0.03%</td>
<td>5.24%</td>
</tr>
<tr>
<td>3231</td>
<td>Printing and related support activities</td>
<td>B</td>
<td>231</td>
<td>0.51</td>
<td>0.18%</td>
<td>-2.62%</td>
</tr>
<tr>
<td>3371</td>
<td>Household and institutional furniture and kitchen cabinet manufacturing</td>
<td>B</td>
<td>187</td>
<td>0.81</td>
<td>0.15%</td>
<td>1.85%</td>
</tr>
<tr>
<td>3261</td>
<td>Plastics product manufacturing</td>
<td>B</td>
<td>105</td>
<td>0.18</td>
<td>0.08%</td>
<td>0.60%</td>
</tr>
<tr>
<td>3345</td>
<td>Navigational, measuring, electromedical, and control instruments manufacturing</td>
<td>B</td>
<td>98</td>
<td>0.25</td>
<td>0.08%</td>
<td>-1.00%</td>
</tr>
<tr>
<td>3222</td>
<td>Converted paper product manufacturing</td>
<td>B</td>
<td>96</td>
<td>0.36</td>
<td>0.08%</td>
<td>-0.40%</td>
</tr>
<tr>
<td>3118</td>
<td>Bakeries and tortilla manufacturing</td>
<td>B</td>
<td>80</td>
<td>0.27</td>
<td>0.06%</td>
<td>8.06%</td>
</tr>
<tr>
<td>3364</td>
<td>Aerospace product and parts manufacturing</td>
<td>B</td>
<td>76</td>
<td>0.15</td>
<td>0.06%</td>
<td>NA</td>
</tr>
<tr>
<td>3121</td>
<td>Beverage manufacturing</td>
<td>B</td>
<td>60</td>
<td>0.29</td>
<td>0.05%</td>
<td>4.50%</td>
</tr>
<tr>
<td>3336</td>
<td>Engine, turbine, and power transmission equipment manufacturing</td>
<td>B</td>
<td>47</td>
<td>0.43</td>
<td>0.04%</td>
<td>3.27%</td>
</tr>
<tr>
<td>3334</td>
<td>Ventilation, heating, air-conditioning, and commercial refrigeration equipment manufacturing</td>
<td>B</td>
<td>45</td>
<td>0.35</td>
<td>0.04%</td>
<td>-1.08%</td>
</tr>
<tr>
<td>3332</td>
<td>Industrial machinery manufacturing</td>
<td>B</td>
<td>40</td>
<td>0.36</td>
<td>0.03%</td>
<td>-0.48%</td>
</tr>
<tr>
<td>3335</td>
<td>Metalworking machinery manufacturing</td>
<td>B</td>
<td>23</td>
<td>0.12</td>
<td>0.02%</td>
<td>17.68%</td>
</tr>
<tr>
<td>3326</td>
<td>Spring and wire product manufacturing</td>
<td>B</td>
<td>20</td>
<td>0.49</td>
<td>0.02%</td>
<td>NA</td>
</tr>
<tr>
<td>3372</td>
<td>Office furniture (including fixtures) manufacturing</td>
<td>B</td>
<td>18</td>
<td>0.14</td>
<td>0.01%</td>
<td>0.79%</td>
</tr>
<tr>
<td>3262</td>
<td>Rubber product manufacturing</td>
<td>B</td>
<td>17</td>
<td>0.13</td>
<td>0.01%</td>
<td>1.80%</td>
</tr>
<tr>
<td>3141</td>
<td>Textile furnishings mills</td>
<td>B</td>
<td>16</td>
<td>0.30</td>
<td>0.01%</td>
<td>NA</td>
</tr>
<tr>
<td>3271</td>
<td>Clay product and refractory manufacturing</td>
<td>B</td>
<td>14</td>
<td>0.39</td>
<td>0.01%</td>
<td>4.73%</td>
</tr>
<tr>
<td>3115</td>
<td>Dairy product manufacturing</td>
<td>B</td>
<td>10</td>
<td>0.07</td>
<td>0.01%</td>
<td>NA</td>
</tr>
<tr>
<td>3366</td>
<td>Ship and boat building</td>
<td>C</td>
<td>258</td>
<td>1.77</td>
<td>0.21%</td>
<td>-6.27%</td>
</tr>
<tr>
<td>3331</td>
<td>Agriculture, construction, and mining machinery manufacturing</td>
<td>C</td>
<td>252</td>
<td>1.02</td>
<td>0.20%</td>
<td>-3.32%</td>
</tr>
<tr>
<td>3251</td>
<td>Basic chemical manufacturing</td>
<td>C</td>
<td>203</td>
<td>1.31</td>
<td>0.16%</td>
<td>-5.58%</td>
</tr>
<tr>
<td>3212</td>
<td>Veneer, plywood, and engineered wood product manufacturing</td>
<td>C</td>
<td>163</td>
<td>2.36</td>
<td>0.13%</td>
<td>-7.94%</td>
</tr>
<tr>
<td>3339</td>
<td>Other general purpose machinery manufacturing</td>
<td>D</td>
<td>228</td>
<td>0.82</td>
<td>0.18%</td>
<td>-1.00%</td>
</tr>
<tr>
<td>3116</td>
<td>Animal slaughtering and processing</td>
<td>D</td>
<td>125</td>
<td>0.26</td>
<td>0.10%</td>
<td>-1.25%</td>
</tr>
<tr>
<td>3254</td>
<td>Pharmaceutical and medicine manufacturing</td>
<td>D</td>
<td>40</td>
<td>0.14</td>
<td>0.03%</td>
<td>-1.21%</td>
</tr>
<tr>
<td>3327</td>
<td>Machine shops; turned product; and screw, nut, and bolt manufacturing</td>
<td>D</td>
<td>37</td>
<td>0.09</td>
<td>0.03%</td>
<td>-3.98%</td>
</tr>
<tr>
<td>3324</td>
<td>Boiler, tank, and shipping container manufacturing</td>
<td>D</td>
<td>30</td>
<td>0.31</td>
<td>0.02%</td>
<td>-12.30%</td>
</tr>
<tr>
<td>3359</td>
<td>Other electrical equipment and component manufacturing</td>
<td>D</td>
<td>18</td>
<td>0.14</td>
<td>0.01%</td>
<td>-24.24%</td>
</tr>
<tr>
<td>3255</td>
<td>Paint, coating, and adhesive manufacturing</td>
<td>D</td>
<td>11</td>
<td>0.18</td>
<td>0.01%</td>
<td>-4.52%</td>
</tr>
</tbody>
</table>

Note: Only sectors with employment of 10 or more were considered;
CAGR stands for Compound Annual Growth Rate
CAGR of NA means 0 employment in 2000 for that sector.

Source: IHS Business Markets Insights © 2016 IHS
Appendix B: Knowledge, skills, and abilities (KSA) analysis methodology and applications

To facilitate industry-labor force matching, researchers at the Alward Institute for Collaborative Science have mapped occupations from IMPLAN’s industry employment onto BLS occupational categories and O*NET’s determined sets of KSA. In addition, they have also linked occupations to their necessary formal education and informal on-the-job training and work experience needed to acquire these KSAs. From here, the Alward Institute has developed data models that can:

- Estimate the core competencies for the total array of occupations employed in a region.
- Link these core competencies to region-specific levels of employment and wages.

For example, if there are 1,000 jobs in a region, then there will be 1,000 occupational equivalents each for knowledge, skills, and abilities with associated average wage and employment levels. The weighted average of the KSA occupational equivalents make up a region’s core competencies. These occupational equivalents and associated core competencies vary based on the region’s history and industrial mix.

An example of how KSA analysis can be applied: if a county government is looking to attract a new wind turbine manufacturing plant to the area, it might be beneficial not only to estimate the impact of that plant on the local economy, but also to understand the types of jobs and competencies that will be required to run the plant. This type of analysis can be accomplished by bridging between a sector’s occupational staffing pattern and regional measures of knowledge, skills, and abilities to illuminate the set of core competencies likely to be required by a given industry.

Alternatively, a correlation analysis can be used to identify which industries best fit the existing core competencies within a regional labor market. If significant skill gaps are identified, the local government can then be proactive in establishing workforce training and education. This type of analysis is crucial not only in helping economic developers target a range of industries, but also in helping workforce developers identify training and educational programming that can help fill skill gaps in the labor force. Such informed public policy can help guide an economy from a low-skill, low-wage commodity-based economy to a high-skill, high-wage niche-based economy.