



Research & Policy INsights

People and Places:

The Nature and
Location of Talent in
Indiana¹

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■ Introduction

Reflected in a variety of metrics, such as low rates of unemployment and increased productivity evidenced by the expansion of the state's gross domestic product (GDP), Indiana's economy is continuing to show signs of strength. For example, Indiana's average unemployment rate of 3.4 percent in December 2017 placed it among the lowest in the nation and well below the national average of 4.1 percent³. As noted by U.S. Bureau of Labor Statistics, the state's unemployment rate is in continuous decline, as the December 2017 level is significantly lower than the 4.0⁴ unemployment rate in December 2016. Moreover, the annual rate of growth in GDP on a per job basis has been on a positive trajectory, reaching \$90,002 in 2016.⁵



Certainly, the improved economic climate has been instrumental in increasing the number of people now in the workforce. According to the Bureau of Labor Statistics, the employed labor force (seasonally adjusted) in the state stood at 2.85 million in November 2010. By November 2017, that number grew to nearly 3.2 million, a healthy expansion of 11.9 percent over the seven year period of time. Furthermore, the state's real gross domestic product (the most comprehensive measure of economic activity for states) approached \$301 billion⁶ in 2016 (adjusted to 2009 dollars), 16th best in the United States. The most significant contributor to the state's GDP was durable goods manufacturing, accounting for nearly 16 percent of Indiana's GDP.⁷ According to a recent estimate released by the Indiana Business Research Center, Indiana's GDP is expected to expand at a faster pace than the U.S. through 2018.⁸

While the state's overall economic picture continues to improve, other trends offer reasons for concern. The state's annual population growth rate, for example, has lagged behind that of the U.S. for the better part of 15 years. Even though Indiana experienced a 4 percent growth in its population between 2007 and 2016, the pace of growth was ranked 35th among the nation's 50 states. Its median household income (\$50,532) was 36th best in the nation and 14 percent in the state's population fell below the poverty line in 2016 (from the peak poverty rate of 15.8 percent in 2013). Nearly 19.1 percent of Indiana's children under 18 years of age were in poverty in 2016, a slight decline compared to the peak of 21.9 percent in 2013.⁹ On the education front, Indiana places 5th nationally when it comes to the proportion of adults (25+ years of age) with a high school degree (or equivalent), but the percent of the adult population with a bachelor's degree or higher stands at 25.6 percent, ranking 43rd among the nation's 50 states.¹⁰

It is this mix of statistics — some positive and some troubling — that prompted us to examine the state of education, talent and jobs in Indiana. Our focus was guided by two complementary strands of research. The first, advanced by a number of economic theorists over the years, suggest that investments made by individuals in their education and skills development can have profound positive impacts on their productivity and job-related earnings over their life course.¹¹ A second line of research notes that economic opportunities available to individuals are not solely the result of their human capital attributes (i.e., educational attainment, on-the-job training, or technical skills) but also on the quality of jobs that exist in the local labor market. As such, the ability of workers to realize economic gains is a consequence of the match (or mismatch) between their education/skills and the quality of jobs existing in their communities or counties.¹² Thus, where you live matters a good bit. This paper examines how the supply and demand for human capital might vary across different areas of Indiana, including among the state’s metropolitan and nonmetropolitan areas.¹³

Key Questions to Explore

With the advent of automation and computerization in industries, the technological know-how of workers is more important than ever. Certainly, Indiana is striving to be a major economic force on both the national and global stage, but a key issue is whether it has the requisite pipeline for the type of high skilled, technology-based workforce that is central to a 21st century economy. A related matter is whether all geographic areas of the state — be they metropolitan or nonmetropolitan — can be active contributors to the knowledge-based, technology-driven environment that the state is striving to achieve.

In an effort to begin examining these two critical issues, this report seeks to explore the following key questions:

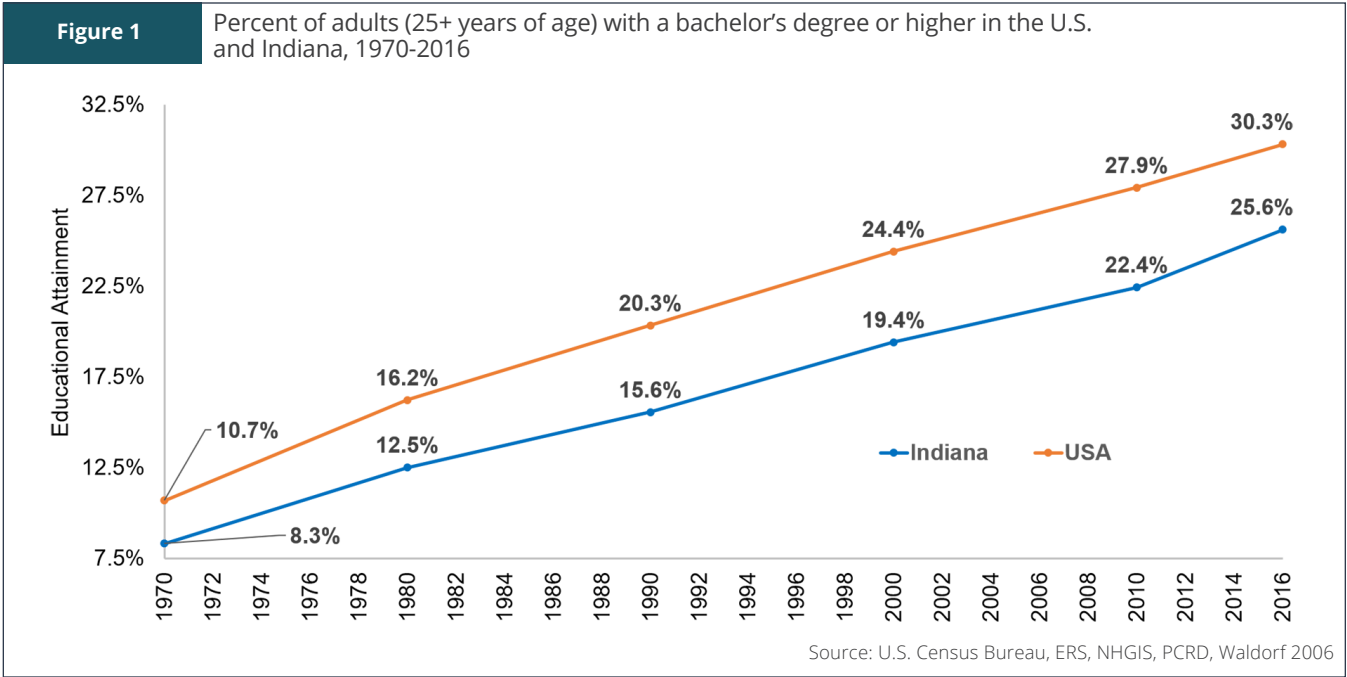
1. What is the state of Indiana’s human capital assets? Is the proportion of adults with post-secondary degrees increasing over time? Are the Indiana figures on par with national trends?
2. Are metropolitan and nonmetropolitan areas achieving comparable success in expanding their pool of educated adults?
3. Given their educational levels, what returns are working Hoosiers realizing in terms of employment and earnings?
4. What counties in the state are witnessing a brain “gain” at a pace that matches or exceeds the national rate; which ones are falling behind?
5. Are knowledge and STEM-based jobs increasing in Indiana and how are these jobs distributed across the state’s metropolitan and nonmetropolitan landscape?
6. How competitive are metropolitan and nonmetropolitan areas when it comes to the presence and strength of technology and production-oriented occupational clusters?

Questions 1 through 4 are intended to explore the “supply” side of the state’s human capital while questions 5 and 6 address the quality of jobs existing in the state, the so-called “demand” side of labor markets.

Educational Attainment: Indiana's Human Capital Assets

Human capital researchers have noted a link between earnings and the human capital attributes of individuals. The higher the educational attainment of individuals, the greater their lifetime earnings, the better their health, and the increased opportunities they have to move up the career ladder. The benefits associated with securing a good education, however, are not captured solely by individuals who have invested time in their human capital. Communities or counties that strengthen their human capital stocks are better able to improve their economic competitiveness and expand their local economies.¹⁴

With this research as a backdrop, the question is how has Indiana fared when it comes to the educational status of its adult residents over time? Figures 1 through 3 offer a profile of the educational trends for Indiana adults 25 years of age and older since 1970. For comparative purposes, trends for both U.S. and Indiana are included in this initial analysis.



According to Figure 1, Indiana had just over 8 percent of its adult population with a baccalaureate degree or higher in 1970, about 2.4 percentage points lower than the U.S. figure. Since that time, the U.S./Indiana gap has been slowly and consistently widening. For example, differences between the U.S. and Indiana expanded to 4.7 percent in 1990, to 5 percent in 2000, and to 5.5 percent in 2010, with a slight decrease to 4.7 percent by 2016. The message is clear; Indiana is not producing, retaining or attracting individuals with bachelor's degrees or higher at the same pace as the U.S. overall and has not done so for at least the past 4-5 decades.

A Look at the State's Best Educated Adults: Nonmetropolitan Areas Not Keeping Pace

We turn our attention to the distribution of Indiana's best-educated adults across its metropolitan and nonmetropolitan (micropolitan and noncore) areas of the state. In general, adults with higher levels of education are more inclined to reside in metropolitan areas since these locations offer a wider array of job opportunities,

better salaries/wages and greater amenities/services relative to nonmetropolitan-based jobs. Is this the case in Indiana? The simple answer is yes!

For purposes of our analysis, we adopt the 2013 definition of the United States Office of Management and Budget (OMB) with regard to counties designated as metropolitan (44 counties), micropolitan (25 counties) and noncore (23 counties) (see below for a description of the three county types). Analysis of the residential location of adult residents with a bachelor's degree or higher are displayed in Figure 2. It shows the following:

- The proportion and growth of metropolitan adults with a baccalaureate degree or higher in the state closely parallels the U.S. figure. While the percentage still lags behind the nation, the gap between the U.S. and the state's metropolitan counties has grown at a very modest pace over time -- from 2.3 percentage points in 1980 to 3 percentage points by 2016.
- The micropolitan-metropolitan education gap for Hoosiers with a bachelor's degree or higher has more than doubled between 1980 and 2016, from 4.7 to 10.9 percentage points. This has been driven by the relatively slow growth rate in the proportion of micropolitan adults with a bachelor's degree or higher.
- The proportion of noncore county-based adults with a baccalaureate degree or more is nearly half the percentage found in the state's metropolitan areas (13.9 percent for noncore counties versus 27.3 percent for metro counties in 2016).
- The gap in the proportion of adults with bachelors' degrees or more is smaller and more consistent between micropolitan and noncore counties of Indiana; 2.5 percentage points lower in noncore versus micropolitan counties in 2016. Correspondingly, the growth trend for noncore follows that of micropolitan counties.

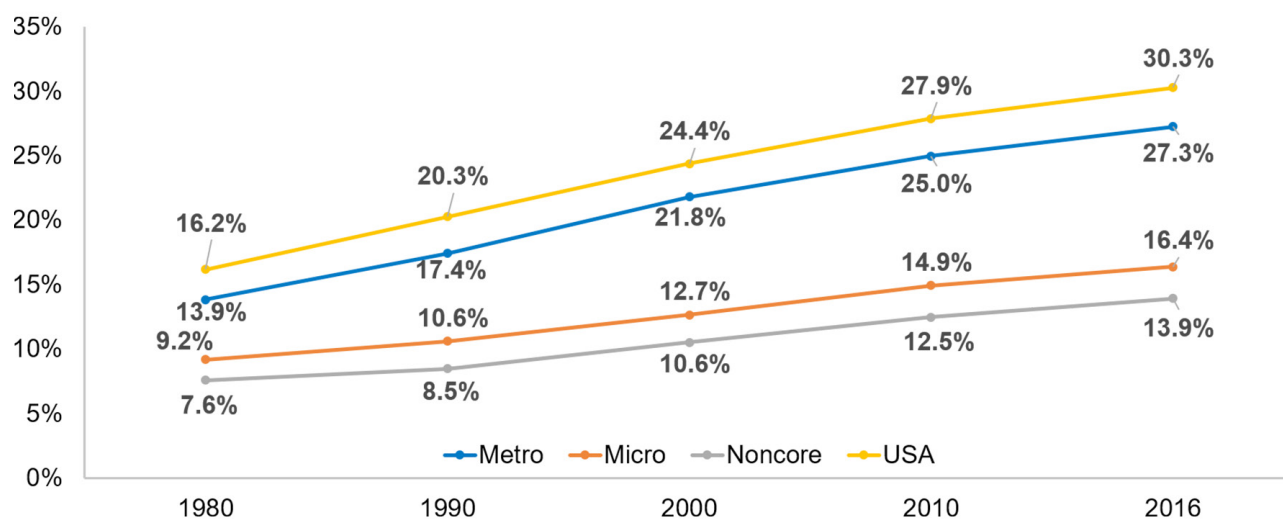
Defining Metropolitan & Nonmetropolitan Counties

Metropolitan (or metro) area refers to central counties with one or more "urbanized areas" of 50,000 persons or more, as well as outlying counties that have strong economic ties to the central counties. Outlying counties are deemed to be part of a metro area if they have 25 percent or more of their employed workforce commuting to the central county, or if 25 percent or more of the outlying county's employed labor force is made up of commuters from the central city.

Nonmetropolitan counties are classified into one of two groups – micropolitan or noncore. *Micropolitan* counties have one or more urban clusters of 10,000 to 49,999 persons, as well as outlying counties with 25 percent or more of their employed population commuting either to the central micropolitan county or from the micropolitan county to the outlying county. The *Noncore* label is assigned to nonmetropolitan counties that fail to meet the micropolitan definition. As such, these counties have no city, town or urban cluster of 10,000 residents or more.

Figure 2

Percent of adults (25+ years of age) with a bachelor's degree or higher, by metropolitan status, 1970-2015.



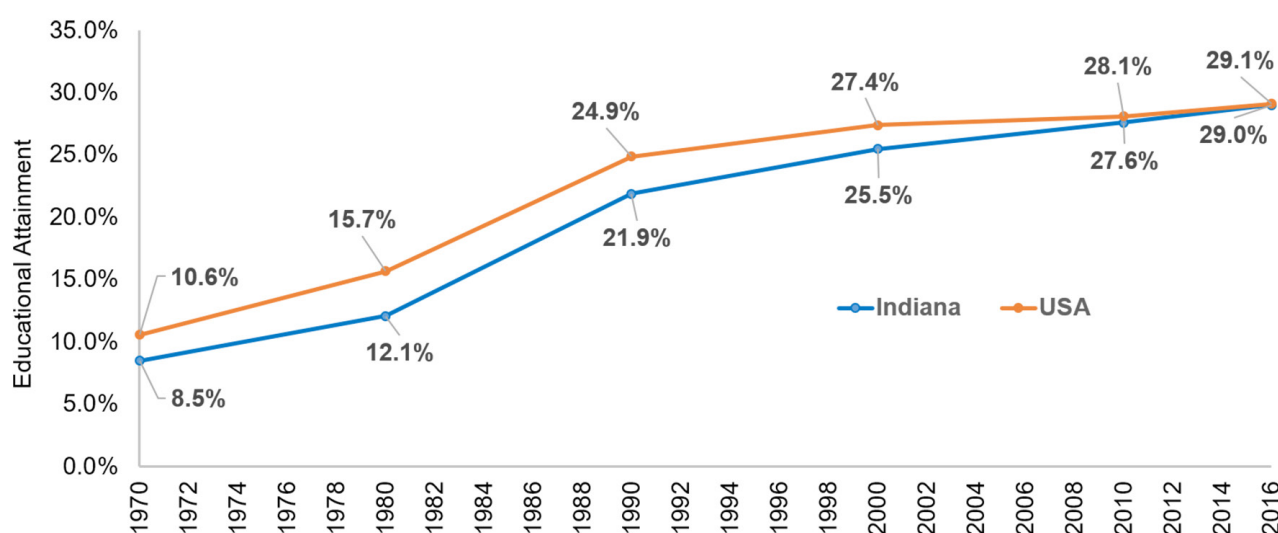
Source: U.S. Census Bureau, ERS, NHGIS, PCRD, Waldorf 2006

Important Note about Our Use of Harmonized Data

All tables and graphs that examine differences by metropolitan status (i.e., metropolitan, micropolitan, and noncore counties) underwent a spatial harmonization process. What this means is that the 2010 metropolitan status of Indiana's 92 counties was used as the reference point for our study and that classification was applied to all previous data points (i.e., 1970, 1980, 1990 and 2000). This is a critical step given that changes in the metropolitan status of various Indiana counties did occur over the course of 1970 to 2010. By undertaking a harmonization process, we are able to undertake more accurate assessments of changes that may have occurred in the educational and occupational profile of metropolitan, micropolitan and noncore counties in the state.

Figure 3

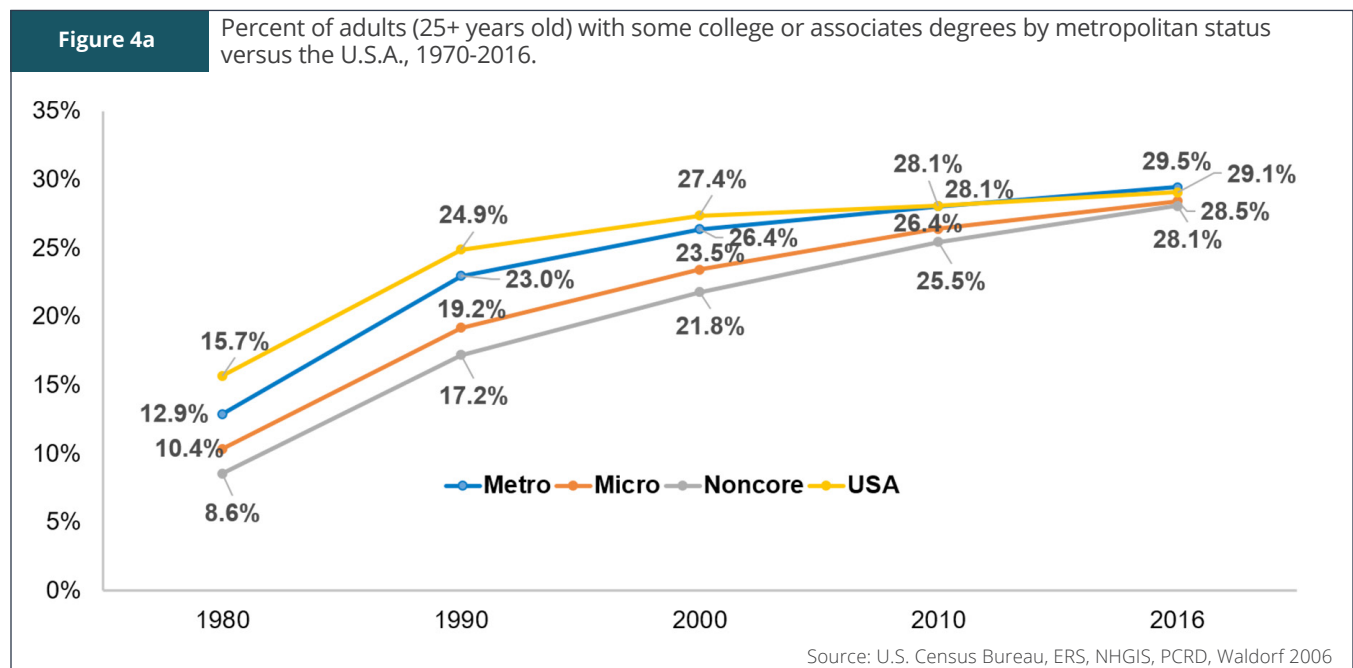
Percent of adults (25+ years old) with some college or associates degrees, 1970-2016.



Source: U.S. Census Bureau, ERS, NHGIS, PCRD, Waldorf 2006

Adults with Some College or Associates Degrees: A Brighter Picture for Indiana?

While the state has been unable to expand the cohort of higher educated Hoosiers at a rate comparable to that of the nation, its ability to grow or attract adults with “some college education or associates degrees” has improved significantly over time. As reported in Figure 3, Indiana was 2.1 percentage points behind the U.S. in 1970 when it came to adults with some college education or associates degrees. In fact, less than 9 percent of Hoosiers had achieved this level of education by 1970. Over time, the proportion of the state’s adults in this educational grouping has grown at a faster rate than the nation. As of 2016, the percentage of Indiana adults (25 years of age and older) with some college or a completed associates degree is on par with the U.S. rate of 29.1 percent. Worth noting, however, is that the lion’s share of adult Hoosiers falling into educational category enrolled in some type of post-secondary coursework but never completed an associates degree.¹⁵

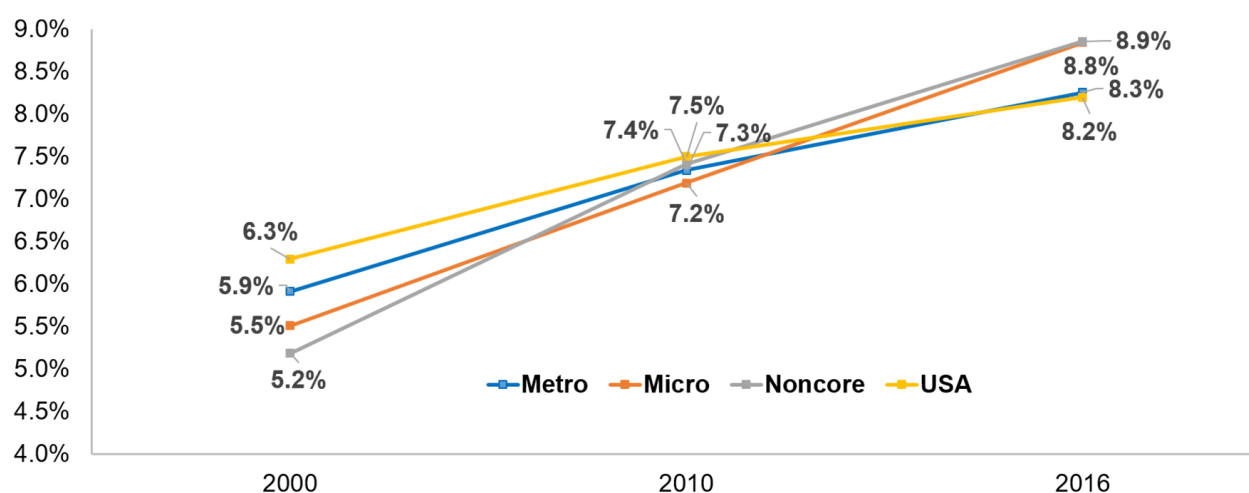


When it comes to the distribution of adults with some college education or associates degree across the state’s metropolitan/nonmetropolitan landscape, the situation for the two nonmetropolitan categories (micropolitan and noncore) appears more promising (see Figure 4a). Since 1990, the state’s micropolitan and noncore counties have been able to close the gap relative to their metropolitan counterparts when it comes to retaining and attracting adults with some college or associates degrees. For example, while noncore counties in the state were 4.3 percentage points behind metro areas in 1980 on this educational attainment metric, the difference fell to 1.4 percentage points by 2016.

Given that the proportion of adults with associates degrees was not reported prior to 2000, it would be instructive to examine trends in the percentage of adults with an associates degree between 2000 and 2016 -- especially among Hoosiers living in metropolitan, micropolitan and noncore areas of the state. Figure 4b presents the results of our analysis. It reveals that the share of adults with associates degrees has grown at a faster pace than in the U.S. since 2000. In fact, adults with associate’s degrees are expanding at a higher rate in Indiana’s nonmetropolitan (micropolitan and noncore) than in its metropolitan areas. There are a variety of factors that may be contributing to

Figure 4b

Percent of adults (25+ years old) with associates degrees by metropolitan status versus the USA, 2000-2016.



Source: U.S. Census Bureau, ERS, NHGIS, PCRD, Waldorf 2006

the uptick in community college completions in nonmetropolitan counties of the state. One is that Indiana has an extensive network of community colleges (i.e., Ivy Tech) that are within easy reach to many adult Hoosiers, including those living in nonmetropolitan areas. A second factor may be the shifting nature of work in nonmetropolitan areas, jobs that are accelerating their need for middle-skilled workers, requirements that community colleges are well positioned to address. A third factor is that metro area adults are far more likely to hold a bachelor's degree or higher since a larger share of jobs in these areas require people with highly educational credentials. Whatever the drivers, the result is that for every metropolitan adult earning an associates degree, there are nearly 2.6 adults that have some college, but never finished. In micropolitan areas the ratio is 2.24:1 and in noncore, 2.15:1, suggesting that there is a relatively higher proportion of adults that finished their associates degree, but they are still outnumbered by those that did not complete their college education.

Returns to Education

Studies have noted that individuals who invest in their formal education are able, over their careers, to increase their productivity and income.¹⁶ Figure 5 examines the median earnings of Hoosiers by their educational levels in 2010 and 2016 (note: all figures are adjusted to 2016 values).¹⁷ Without question, the income paid to adults with the best-education is considerably higher than those completing less education. In 2010, for example, adults with a graduate or professional degree garnered a median income of just over \$63,500 annually while those with a terminal high school education had median earnings nearly 53 percent lower. The pattern shown in Figure 5 makes clear that the higher a person's education, the greater their median earnings.

How do median earnings differ by gender and educational attainment? According to Table 1, regardless of one's educational level, median earnings for men 25 years of age and higher are consistently higher than those of women (as of 2016). The median earnings disparities are greater among those with a high school education or less, but smaller (although still sizable) for those with bachelors' degrees or graduate/professional degrees. The gap between men and women can be linked to a number of factors. For one, men and women in Indiana may be employed

in occupations that have different salaries/wages associated with them – with women being more likely to be employed in lower-paying occupations.¹⁸ Second, women are more likely to temporarily leave or reduce their hours in the workforce to take care of parenting or other family responsibilities (such as caring for elderly parents). When they opt to return to full time work, they face what some have labeled the “motherhood penalty.” A recent American Association of University Women (AAUW) study states that a third factor is gender bias and discrimination in some workplaces.¹⁹

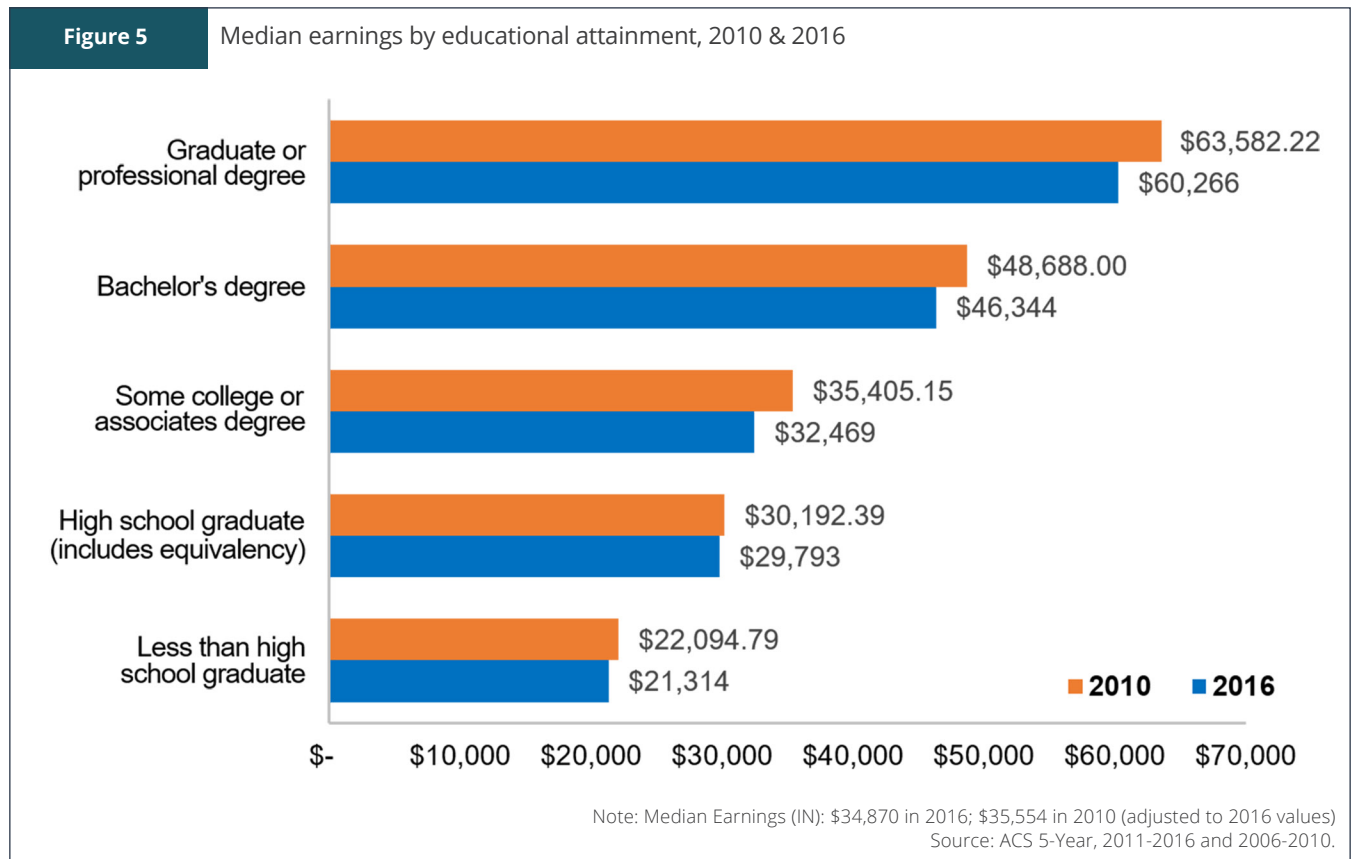


Table 1. Median earnings by educational attainment and gender, 2016

Education Level	Men	Women	Difference
Less than high school graduate	\$26,024	\$15,807	\$10,217 (39%)
High school graduate (includes equivalency)	\$36,211	\$22,233	\$13,978 (39%)
Some college or associate's degree	\$41,745	\$26,707	\$15,038 (36%)
Bachelor's degree	\$58,414	\$38,241	\$20,173 (35%)
Graduate or professional degree	\$72,333	\$51,907	\$20,426 (28%)

Source: ACS 5-Year, 2012-2016

Brain Gain Changes in Indiana

Brain drain, the outmigration of young educated talent to other places in the state or to other parts of the United States, remains a significant issue in many counties in Indiana. The factors motivating such moves vary, but include

a desire to live in places with stronger economies, greater job opportunities, higher earnings potential, a larger array of social and cultural amenities, and accessibility to a higher density of well-educated people.²⁰

To determine if counties in the state are making progress in retaining and attracting adults with some form of post-secondary education, we examined which Indiana counties are expanding their cohort of educated adults at a rate comparable to that of the nation, and which ones are failing to keep pace. Our analysis focuses on the two educational groupings that have served as the central focus of this paper, namely, adults 25 years of age or older with bachelors' degrees and higher, and those with some college education/associates degrees. We conducted a shift-share analysis to generate the information needed to examine how successful Indiana has been in strengthening its human capital resources over time vis-à-vis the United States.

Shift-share analysis typically disaggregates job changes in a region (such as jobs growth) into the national, sectoral, and regional effects. We employ a similar analysis but with educational attainment in Indiana as the central topic of interest. As such, we explore the extent to which changes in the two educational groups (bachelor's education or higher and those with some college/associates degrees) can be attributed to national trends (which refers to the expected change in Indiana) and which are due to county specific effects.

The results of our analysis are reported in Table 2 by the three Indiana county typologies – those classified as metropolitan, micropolitan and noncore. The top portion of Table 2 focuses on Hoosiers with the highest level of education while the bottom portion examines adult residents with some college/associates degrees. As shown in the table, over 567,000 metropolitan-based adult residents in the state now have bachelors' degrees or more (as of 2015). Had the adult educational attainment rate in Indiana grown at the same pace as that of the nation between 1990 and 2015 (+94.8 percent), Indiana's metropolitan areas would have increased its pool of best-educated Hoosiers by over 432,000. In reality, it added just under 112,000, resulting in a deficit of more than 320,000 adults with baccalaureate degrees or more. As for micropolitan counties, the actual growth of their best-educated adults is a fraction of what it would have been had it grown at the national rate. Moreover, noncore counties are nearly 19,000 short of what our shift-share analysis shows would be needed to remain on par with the national attainment rate.

The lower panel of Table 2 focuses on adult residents in the state with some college or associates degrees. Over the 1990-2015 span of time (25 years), the number of adults in the U.S. with this educational attainment expanded by 55.6 percent. How did Indiana perform relative to the nation on this metric? As of 2015, metropolitan areas of Indiana had nearly a million adults classified as having achieved this level of educational attainment. Metropolitan areas realized a gain of over 381,000 adults in this educational cohort between 1990 and 2015. The metropolitan figure is 47,374 higher than the national growth rate for this educational grouping. Similarly, micropolitan and noncore counties achieved gains in their "some college/associates degrees" groups at a rate higher than the U.S. trends. As such, there are forces at play in these counties that are helping them remain competitive when it comes to expanding the number of people with some college or associates degrees. These results lend further evidence to the trends highlighted earlier in Figure 4b.

Table 2. Shift-share analysis of Indiana's educational attainment by metropolitan status, 1990-2015

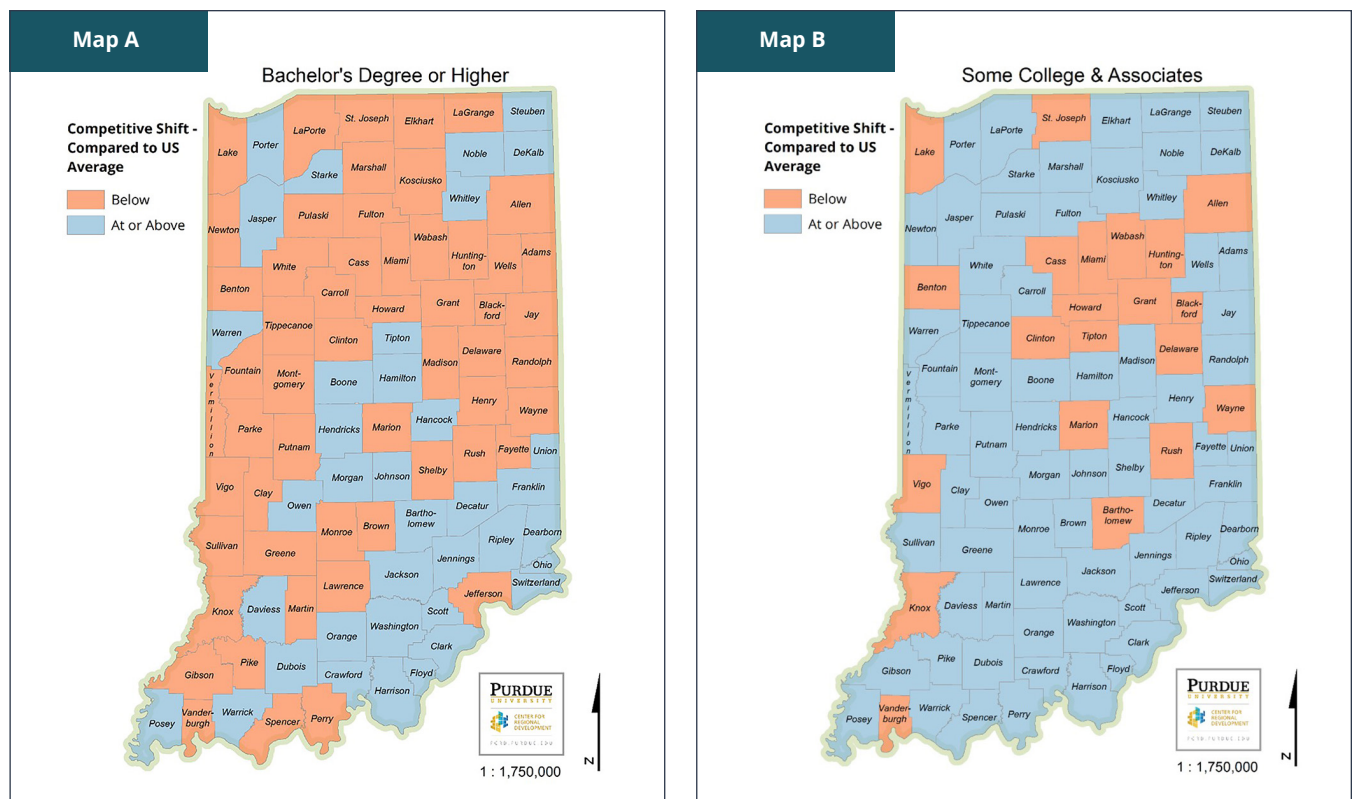
Metropolitan Status	Bachelor's or Higher, 2015	National Share	Expected Change	Actual Change	Competitive Shift
Metro	567,128	432,051	432,051	111,555	-320,496
Micro	70,254	60,304	60,304	6,667	-53,637
Noncore	27,365	22,553	22,553	3,584	-18,969

Metropolitan Status	Some College or Associates, 2015	National Share	Expected Change	Actual Change	Competitive Shift
Metro	981,462	333,629	333,629	381,003	47,374
Micro	188,984	63,822	63,822	74,118	10,296
Noncore	86,415	26,724	26,724	38,318	11,594

Source: U.S. Census Bureau and Purdue Center for Regional Development

To gain a better understanding of which counties exceeded the national rate on terms of the growth of adults with bachelors' degrees or more, or those with some college/associates degrees, we present results of the shift-share analysis for each of Indiana's 92 counties. Map A indicates which counties have met or exceeded the growth of the best educated in the nation between 1990 and 2015 as well as those that have fallen short. Map B profiles counties that met or exceeded the nation's growth rate for those with some college/associates degrees and which counties failed to match the national rate.

A visual assessment of the two maps indicate that a majority of Indiana counties (i.e., 59 percent) failed to produce, retain or attract the best educated adults at a pace that aligns with the U.S. pattern. Specifically, only 37 of Indiana's



92 counties were able to match or exceed the growth of adults with baccalaureate degrees or higher witnessed by the United States between 1990 and 2015 (see Map A). On the other hand, three of every four counties in the state matched or surpassed the U.S. growth of people with some college or associates degrees. Among counties that fell short on the baccalaureate degree or higher, several were clustered in the North Central, East Central and West Central regions of the state. Counties performing at or above the U.S. average were clustered in the southeast and Indianapolis metropolitan areas.

The expectation is that metropolitan areas would be the big winners when it comes to achieving an expansion of adults with bachelors' degrees or more, and the results of our analysis appear to lend some support to this argument. As Table 3 shows, over 48 percent of metropolitan counties matched or exceeded the U.S. rate in terms of growth of baccalaureate degree earners or more. This was followed by noncore counties at 34.8 percent, while micropolitan counties did the worst with 32 percent of these counties achieving or exceeding the national rate.

Table 3. Above and below U.S. rates in educational attainment by metropolitan status in Indiana, 1990-2015

Growth in Adults with Bachelors' Degrees +, 1990-2015	Metropolitan		Micropolitan		Noncore		Total	
	#	%	#	%	#	%	#	%
Below U.S. Rate	23	52.3	17	68.0	15	65.2	55	59.8
At/Above U.S. Rate	21	47.7	8	32.0	8	34.8	37	40.2
Growth in Adults with Some College or Associates Degrees, 1990-2015	Metropolitan		Micropolitan		Noncore		Total	
	#	%	#	%	#	%	#	%
Below U.S. Rate	10	22.7	8	32.0	3	13.0	21	22.8
At/Above U.S. Rate	34	77.3	17	68.0	20	87.0	71	77.2

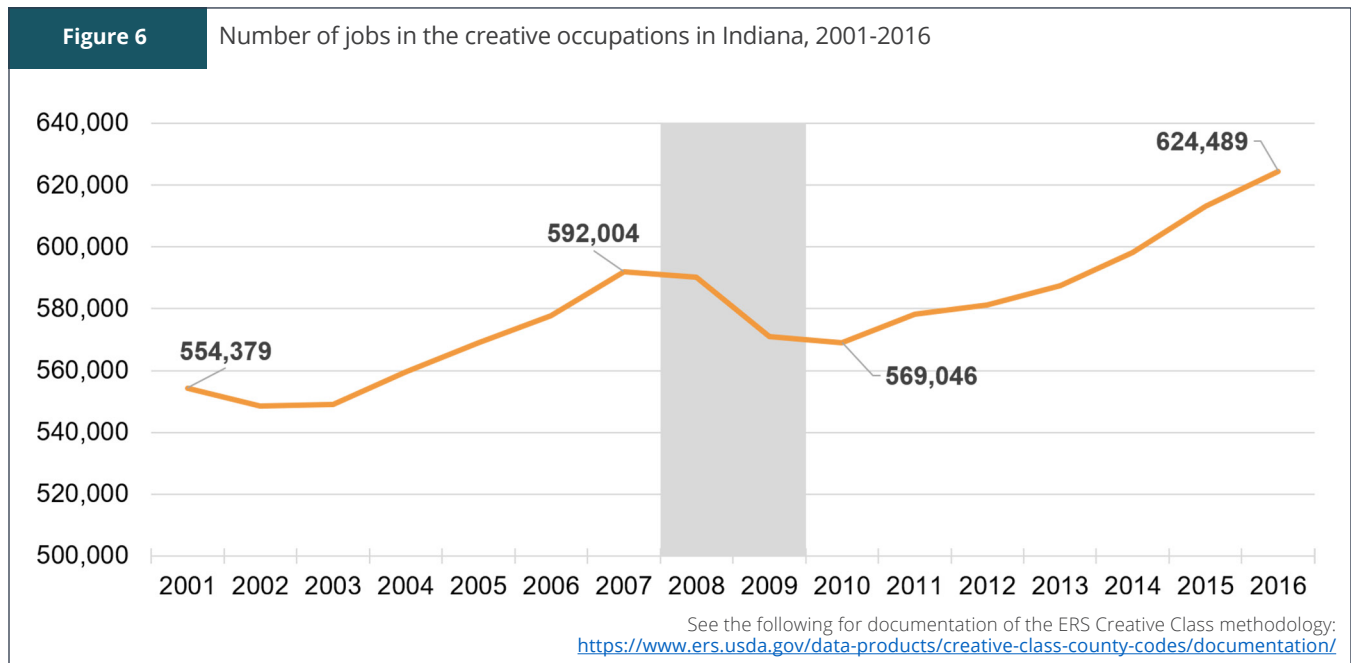
Source: U.S. Census Bureau and Purdue Center for Regional Development
Note: Based on shift-share analysis

When we shift to an examination in the growth of adults with some college or associates degrees, all counties, regardless of their metropolitan status, did better than the national growth rate of 55.6 percent. Overall, 87 percent of noncore counties met or exceeded the U.S. rate, closely followed by metropolitan (77.3 percent) and micropolitan (68 percent) counties. An important caveat is that given the smaller populations living in noncore counties, it would be easier to achieve a higher rate of growth than would be the case in metropolitan areas where the population of adults 25+ years of age would be far more sizable. One more aspect to make note of is that we have used the 2013 OMB classification mentioned earlier in the report for U.S. counties designated as metro, micropolitan and noncore, and then applied the same specification for the entire time period of 1990 through 2015.²¹

The Knowledge-Based Economy: The Demand for Creative and STEM Workers in Indiana

In his book, *The Rise of the Creative Class*, Richard Florida notes that knowledge and ideas serve as key catalysts for spurring economic growth. He argues that individuals employed in occupations that require a high level of creative

problem solving, along with those engaged in artistic, cultural, and designer goods and services,²² are part of what he labels the “creative class.” He identifies 22 major occupation categories as representing the core of the creative class. While his research gained favor with several state and local leaders across the nation, Florida’s argument that the creative class is, in large part, an attribute of the country’s metropolitan areas, generated considerable controversy. To determine the presence of creative workers in nonmetropolitan areas, researchers with USDA’s Economic Research Service (ERS) worked to fine-tune and expand Florida’s measure of creative occupations, combining a more extensive array of creative-type tasks. The result was the revision of the creative class measure that encompassed 165 five-digit Standard Occupational Classification (SOC) groups.²³ To assess the demand for creative/knowledge-based workers in Indiana, we adopted the ERS measure of the creative class.



The number of jobs tied to the creative class in Indiana is presented in Figure 6. Data are provided over a 16-year period (2001-2016). Over 554,000 jobs in 2001 were associated with creative occupations. This grew to more than 592,000 jobs by 2007. However, the Great Recession that affected the country over the course of the 2008-09 period resulted in the loss of nearly 23,000 creative-type jobs by 2010. Since that time, creative jobs have experienced steady growth, now exceeding the 624,000 mark (a 9.7 percent expansion over the past six years).

The information provided in Table 4 indicates that the largest share of creative jobs are located in Indiana’s metropolitan counties, consistent with Richard Florida’s assertion. On the other hand, over 96,000 creative jobs were uncovered in the state’s nonmetropolitan counties in 2016, primarily its micropolitan areas. This finding affirms the view of ERS researchers that the creative class is not an exclusive feature of metropolitan areas given that nearly 16 percent of Indiana’s creative jobs are located in its nonmetropolitan areas.

Two additional pieces of data presented in Table 4 are worthy of mention. The first number under each metro status category indicates the percent of creative jobs relative to all jobs in Indiana in that given year. For example, creative jobs in metro areas in 2001 accounted for 12.5 percent of all jobs in the state. That number grew just

slightly to 13.3 percent by 2015. The second figure in the parenthesis represents the percent of creative jobs existing in a specific metropolitan status category relative to all jobs in that specific geographic grouping. So in 2001, creative jobs in metropolitan areas constituted 16.4 percent of all jobs existing in metro Indiana in 2001. That proportion did not expand to any significant degree over the next 15 years. As for micropolitan and noncore counties, the results are not dramatically different from the pattern found in metro areas on these two metrics.

Table 4. Distribution of creative class jobs in Indiana by metropolitan status, 2001-2016

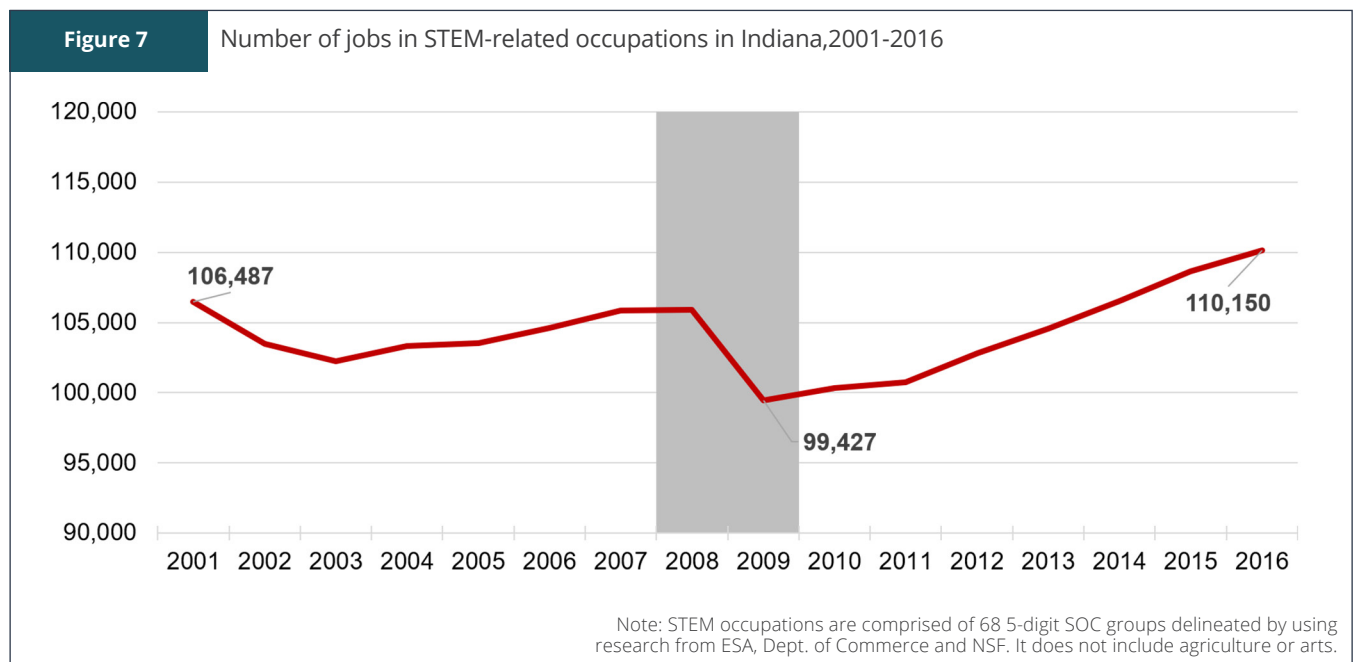
Metro Status	2001	2008	2016
Metropolitan	446,982 (12.5%; 16.4%)	482,731 (13.2%; 16.9%)	511,021 (13.3%; 16.9%)
Micropolitan	69,535 (2.0%; 12.7%)	68,294 (1.9%; 13%)	69,718 (1.8%; 13%)
Noncore	25,610 (0.7%; 12.4%)	26,421 (0.7%; 12.7%)	26,985 (0.7%; 12.6%)

Source: ERS, Purdue Center for Regional Development, Emsi 2017.4

Notes: The first number in parentheses indicates creative jobs as a proportion of total jobs in Indiana. The second number in parentheses indicates proportion to the total jobs associated with that specific metro status category. Also, some creative class jobs could not be distributed to counties by the Quarterly Census of Employment and Wages or by Economic Modeling Specialists International, the sources of our data. As a result, not all creative class jobs could be classified by their metro status. As such, the total number of jobs shown in this table will be less than the number reported in Figure 6.

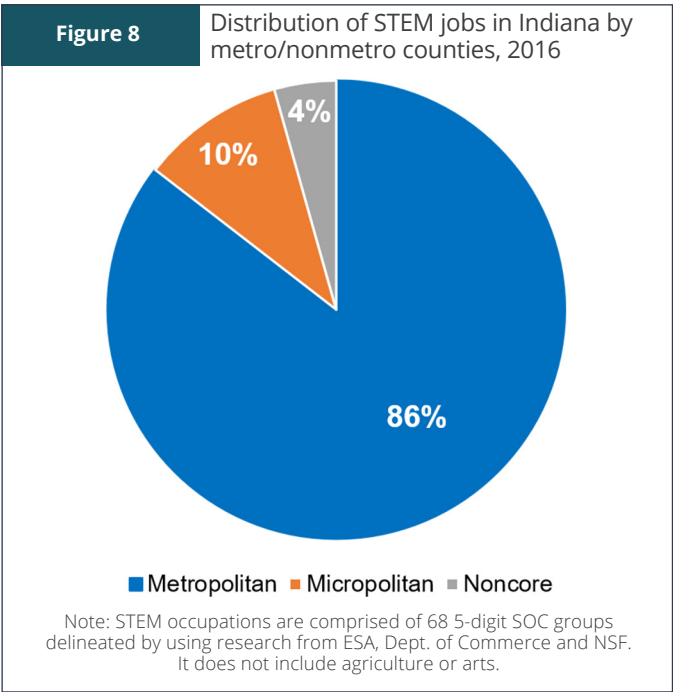
Drilling Down to STEM-Related Jobs

A smaller subset of jobs in the state are associated with occupations that are commonly referred to as “STEM-related” jobs. Both the Department of Commerce’s Economics and Statistical Administration (ESA), along with the National Science Foundation, have identified approximately 68 five-digit Standard Occupational Codes as being associated with science, technology, engineering, and mathematics (STEM) jobs. We adopt this classification system



for assessing the size of STEM-related jobs in Indiana. More than 90 percent of occupations defined as STEM also meet the Creative Class definition.

Figure 7 tracks the growth and decline of STEM-related jobs in the state over the period of 2001 through 2016. At the beginning of the new millennium (i.e., 2001), nearly 106,000 STEM jobs existed in the state. However, a decline in STEM positions occurred during the Great Recession, bottoming out to less than 100,000 jobs in 2009. Since that time, STEM jobs have been slowly increasing and have now surpassed the 110,000 mark. While the number of STEM-related jobs in Indiana is expanding, they currently represent about 3 percent of all jobs in the state. As for the geographic distribution of these jobs in 2016, nearly 86 percent are located in the state’s metro counties, with only 14 percent present in the nonmetropolitan (i.e., micropolitan and noncore) areas of the state (see Figure 8).



Technology-Related Occupational Clusters in Indiana

In this final section of paper, we examine a core set of “knowledge-intensive and technology-oriented” occupation clusters that demand a higher order of thinking, knowledge and skills, along with innovative capacity. We do so by creating a series of key occupational clusters, groups of occupations that share similar knowledge, skills and other important features, such as formal levels of education, knowledge domains, experience requirements, and salary/wage levels. Research has shown that occupation clusters are critical to the creation of a knowledge economy, so it is valuable to take a careful look at Indiana’s mix of occupational clusters that are reflective of high-tech, high-wage jobs.²⁴

Six technology-related clusters were defined by the Purdue Center for Regional Development as part of a grant supported by the U.S. Economic Development Administration and these six are the ones explored in this analysis. However, in light of the importance of the manufacturing sector to Indiana’s economy, a seventh cluster was produced, one that focuses on production-oriented workers. Whereas, six technology-oriented clusters contain jobs requiring a minimum of a bachelor’s degree, production-based occupation cluster are constituted of middle skill jobs requiring associates degrees or above, as well as on-the-job training.

Table 5 presents information on the number of people engaged in the seven occupation clusters at two points in time -- 2001 and 2016. The good news is that five of the six technology-oriented occupation clusters have experienced a healthy expansion over the past 15 years. The largest number of net new jobs were associated with the post-secondary education professional/knowledge creation cluster (+ 10,387 jobs), followed by doctors/surgeons (+ 6,769 jobs) and Information Technology (+ 6,348). Adding jobs at a smaller pace were the natural sciences professionals (+ 1,049) and mathematicians/statisticians (+ 3,203). The only technology-related cluster suffering a decline between 2001 and 2016 was the Engineering cluster, experiencing a loss of nearly 3,000 jobs.

Table 5. Number of workers associated with seven occupation clusters in Indiana ranked by percent change, 2001-2016

Metro Status	2001 Jobs	2016 Jobs	Change	% Change
Technology-Oriented Occupations				
Post-Secondary Education and Knowledge Creation	36,369	46,755	10,387	29%
Medical Scientists and Practitioners	29,695	36,464	6,769	23%
Information Technology	57,639	63,986	6,348	11%
Natural Sciences & Environmental Management	11,176	12,224	1,049	9%
Mathematics, Statistics, Data and Accounting	63,702	66,905	3,203	5%
Engineering	38,787	35,631	(3,087)	(8%)
Skilled Production-Based Occupation Cluster	299,138	281,055	-18,804	-6%

Source: Purdue Center for Regional Development, Emsi 2017.4

Note: Occupation cluster definitions are comprised of mutually exclusive occupations

The seventh occupational cluster we explored is the “Skilled Production-based Occupation Cluster” since it relates to jobs that are more oriented to Indiana’s middle-skilled workforce. As Table 5 reveals, this is a sizable cluster in terms of jobs, representing more employees than those associated with the technology-based occupational clusters combined. While the state has been a national leader when it comes to the health of its manufacturing and other production-related activities, the reality is that the number of people engaged in this work has declined over the course of the past 15 years by over 18,000 jobs. What factors are behind these declines? Is it global competition, is it displacement of workers due to automation, is it the inability to have a strong pipeline of skilled workers, or other factors? These are the key issues that warrant further attention if Indiana hopes to remain a national leader in manufacturing.

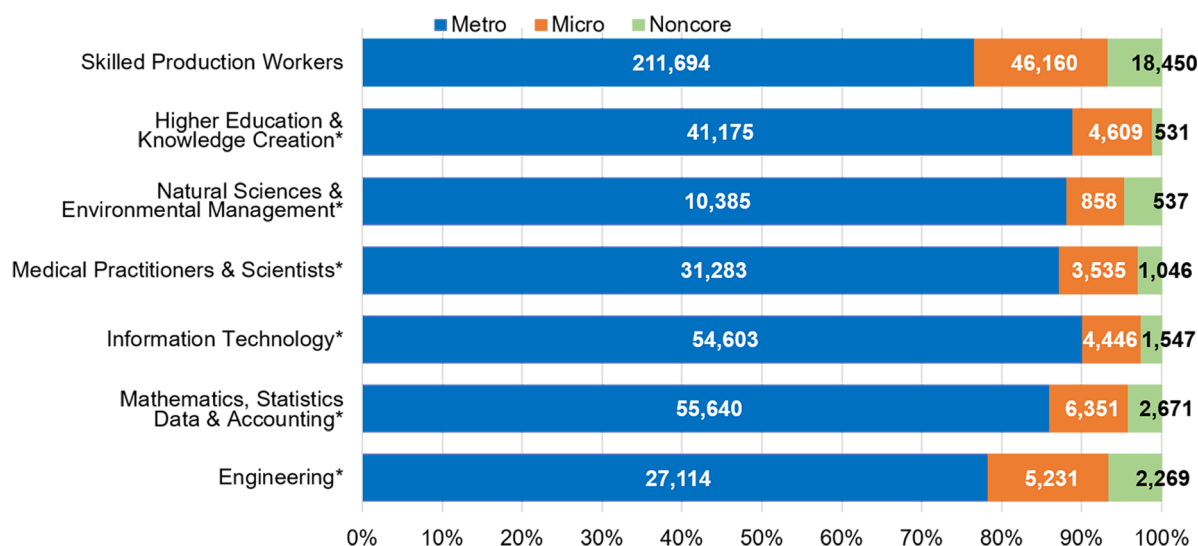
Occupational Clusters: Distribution by Metropolitan Status

Most people familiar with the technology-based jobs would note that the lion’s share of these jobs are likely to be located in major metropolitan areas of the country. Without question, high-tech, high growth jobs often cluster in larger cities since they provide companies with access to a larger pool of people with the requisite education, skills and experiences. At the same time, these places offer workers with the mix of services and amenities that they are looking for when it comes to a quality of place to live.

Figure 9 provides a snapshot of the distribution of the seven occupational clusters across the state’s metropolitan, micropolitan and noncore counties. Overall, it is clear that Indiana’s metropolitan areas serve as the hub for the six technology-based occupation clusters, as well as the skilled production-based occupation cluster. But worth noting is that nonmetropolitan areas of the state – be they micropolitan or noncore counties – have been also able to capture their share of workers with the requisite education, knowledge and skills to be gainfully employed in some of the technology and production-oriented jobs.

Figure 9

Distribution of jobs across technology and skill-based occupation clusters by metro, micro and noncore status, 2016



Note: Some jobs could not be distributed to specific counties either by the Quarterly Census of Employment and Wages or by Economic Modeling Specialists International. As such, these jobs could not be assigned metro, micro or noncore status. These jobs vary by as many as 4,750 jobs for skilled production workers to 371 jobs in higher education and knowledge creation occupation clusters.

Three technology-based clusters appear to be based primarily in metropolitan areas of Indiana – Higher Education & Knowledge Creation, Information Technology and Natural Sciences and Environmental Management. Some of the state’s major public and private institutions are located in larger populated areas of the state, so the results of this cluster should not be surprising. Nor should anyone be shocked by the dominance of Information Technology cluster in metropolitan-based counties given that the infrastructure needed to support these jobs are more likely to be found in more populated, higher density areas. What may be confusing to some is the sizable number of jobs in metropolitan areas of the state associated with Natural Science and Environmental Management. Certainly, some of these jobs are more likely to be found in less populated areas of the state, but the bulk of positions associated with environmental management are likely to be present in larger, more metropolitan-based counties.

While still largely confined to metropolitan counties, Medical Practitioners and Scientists, along with Mathematicians, Statistics Data & Accounting occupations, are found in nonmetropolitan areas of the state as well, although the tendency is for these jobs to be located in Indiana’s micropolitan rather than noncore counties. Where micropolitan and noncore counties tend to have a more sizable role is in the Engineering and Skilled-Production occupational clusters. Better than 20 percent of all jobs associated with these two clusters are located in the nonmetropolitan areas of Indiana – both in micropolitan and noncore counties. These results affirm the fact that nonmetropolitan areas of the state are important players when it comes to production-oriented jobs – especially those associated with the manufacturing sector. Furthermore, production-oriented work requires access to engineers and that is why the engineering cluster has such a significant presence in these less populated areas of the state.

It is important to make note of the continued significance of production-oriented jobs in the state. Despite the decline in jobs related to this occupational cluster since 2001, the fact remains that over 281,000 jobs are part of this cluster, more than the six technology-oriented clusters combined. Furthermore, nearly 65,000 production-based workers are located in micropolitan and noncore counties of the state, more than the total jobs in micropolitan and noncore counties in 2016 associated with the six technology-oriented occupational clusters in Figure 9.

■ ■ **Concluding Comments**

Recent economic data show that Indiana has made significant strides in rebounding from the economic woes that beset the state during the Great Recession of 2007-2009. With a December 2017 unemployment rate of 3.4 percent and more than 20,000 Hoosiers being added to the employment force over the past 12 months, there is reason to be optimistic about the health of the state's economy. What this report has tried to do, however, is examine a core set of data that might provide valuable insights into the troubles that may lie ahead in Indiana's quest to be a major national and global economic player. The ability of the state to achieve social and economic progress over the long-term will rest, in part, on its capacity to produce, retain and attract talent. Nevertheless, ramping up its supply of educated and skilled workers will not be enough. Of equal importance will be the need to accelerate the number of quality jobs that can help stem the outflow of talent to the other parts of the U.S. and beyond.

Though it was never our intent to pursue an exhaustive examination of talent and jobs in the state, our analysis does provide an opportunity to outline the challenges that lie with regard to talent and jobs in Indiana. They include the following:

- **Best Educated Adults Hoosiers: Falling Behind the Nation:** In a globally competitive marketplace, having a growing number of adults in the state with bachelors' degrees or higher will be important, especially if it hopes to expand the number of high-tech, high-skilled jobs. Unfortunately, the state continues to lose ground in terms of keeping pace with the U.S. in terms of the proportion of adults with baccalaureate degrees or higher.
- **The Number of "Some College/Associates Degree Holders" is Large. . . But Deceptive:** While Indiana lagged behind the nation by 3 percentage points in 1990 in terms of the proportion of adult Hoosiers with some college education or a completed associates degree, it has now matched the national figure of 29 percent. However, these gains can be misleading. The reality is that the percent of adults in the state with an associates degree stands at 8.5 percent (as of 2016). Thus, most adults that fall into the educational category of "some college/associates degree" are comprised of individuals who have completed some college or technical education courses, but have no formal associates degree. In order to meet the needs of employers who are seeking workers with middle-to-higher order skills, it will be essential to expand the number of adult Hoosiers with the associates degree credential.
- **Knowledge/Creative Workforce is Expanding:** Over 624,000 adults in the state are employed in knowledge/creative-based occupations as defined by the ERS, representing about 16 percent of the total employed workforce in 2016. While most are located in the state's metropolitan areas, about one in six persons engaged in knowledge/creative occupations in the state is employed in nonmetropolitan areas of the state. It will be important for state, regional and local economic development leaders and agencies to recognize that a knowledge/creative workforce is not confined to metropolitan areas of the state.
- **STEM-Related Occupations: Growing, But Still Limited in Size:** Several STEM education-related initiatives are being advanced by school systems, higher education institutions and state government agencies in Indiana for the purpose of expanding the pipeline of youth and young adults pursuing STEM-related programs and careers. Such investments make sense in light of a 2015 report by the National Science Foundation that states,

“To ensure continued U.S. competitiveness and prosperity, our Nation must foster a strong, STEM-capable workforce.”²⁵ Our analysis shows that just over 110,000 jobs in Indiana are associated with the 68 occupations that the Economic and Statistics Administration/U.S. Department of Commerce and National Science Foundation have identified as STEM-related jobs. Expanding the number of people with STEM-related training will be a key factor in positioning the state to be an active player in the 21st century economy. However, the ability to retain these STEM graduates will be dependent upon Indiana’s capacity to accelerate the number of STEM-related jobs available to these graduates.

- **Returns to Education: Gender Disparities across the Board:** It is a well-established fact that one’s educational status has a direct bearing on his/her lifetime earnings. As our report affirms, education matters when it comes to the median earnings captured by employed Hoosiers. Median earnings for men with graduate or professional degrees in 2016 were found to be two times higher than those for men with terminal high school degrees. The differential was nearly 2.3 times higher for women with graduate/professional degrees versus women with high school degrees only. Worth noting, however, is the sizable disparity in median earnings between men and women -- irrespective of the level of education completed. For example, employed women in the state with bachelors’ degrees had median earnings that were 35 percent lower than that of men with the same level of education. The disparity for men versus women with graduate or professional degrees was 28 percent. While there are many factors that could be contributing to the median earnings gap, it is an issue that employers will need to address if they hope to attract and retain women to be part of their workforce.
- **Technology-Based vs. Production-Based Jobs: Balanced Investment Essential:** While the cry for a STEM and knowledge/creative-based workforce continues to be heard, it is important to keep sight of the fact that Indiana remains tied to manufacturing and other production-based activities. While some of these jobs require people with four-year college degrees or higher, many demand individuals with strong middle-skilled training and experiences. It will be important for the state to pursue a balanced portfolio of economic development activities, one designed to grow STEM and other technology-based jobs, while simultaneously investing in innovative strategies to keep its production-based industries globally competitive.²⁶
- **Nonmetropolitan Indiana Must Not be Forgotten:** Our report paints a mixed picture regarding the state of Indiana’s nonmetropolitan (micropolitan and noncore) counties. On a positive note, about 15 percent of STEM jobs and 16 percent of knowledge/creative positions are located in the nonmetropolitan areas of the state – facts that go unnoticed on the part of state economic development agencies and leaders. Moreover, nearly 1 in 4 skilled production jobs are located in nonmetropolitan areas, and 21 percent of PCRD’s engineering cluster jobs are held by people working in nonmetropolitan areas. Of concern, however, is the lower educational attainment among adults living in nonmetropolitan Indiana. Our data show that the gap between metropolitan and nonmetropolitan counties in terms of the proportion of adults with a bachelors’ degree or higher is sizable. Although nonmetropolitan areas have achieved some success in increasing the proportion of adults with some college or associates degrees, only a fraction of these individuals are associates degree completers. As such, it will be important that the state pursue efforts to expand economic development investments in nonmetropolitan areas of Indiana, but the long-term success of these efforts will depend on growing the number of adults in these counties with formal associates and baccalaureate degrees.

■ ■ **Data Sources for Figures:**

Figure 1: U.S. Census Bureau, Economic Research Service (ERS), USDA; National Historical Geographic Information System (NHGIS), Purdue Center for Regional Development (PCRD), and Waldorf 2006 (B. Waldorf, "No County Left Behind? The Persistence of Educational Deprivation." Research Report, Purdue Center for Regional Development, PCRD-R-2. <http://www.ces.purdue.edu/extbusiness/pcrd/PCRD-R-2LR.pdf>).

Figure 2: Ibid.

Figure 3: Ibid.

Figure 4: Ibid.

Figure 6: ERS, PCRD, Emsi (Economic Modeling Specialists International) 2017.4

Figure 7: ERS, PCRD, Emsi 2017.4

Figure 8: PCRD, Economics and Statistics Administration (ESA), National Science Foundation (NSF), Emsi 2017.4

Figure 9: PCRD, Emsi 2017.4

Endnotes

1. This article is as a product of the Purdue University/Ball State University Joint EDA University Center. The study was funded, in part, by the EDA University Grant No. ED16CHI3030033. Support was also provided from Purdue University's Transforming Indiana into a Magnet for High Technology Jobs initiative, funded by the Lilly Endowment as part of its "Round Three: Initiative to Promote Opportunities through Educational Collaborations."
2. Beaulieu is Director of the Purdue Center for Regional Development (PCRD) and Professor in the Department of Agricultural Economics. Kumar is Regional Planner/GIS & Spatial Analysis with PCRD, while Wilcox is Senior Associate with PCRD and Assistant Program Leader of the Purdue Extension Community Development Program. To contact the senior author, write to: ljb@purdue.edu.
3. U.S. Bureau of Labor Statistics: <https://www.bls.gov/eag/eag.in.htm>
4. U.S. Bureau of Labor Statistics: <https://www.bls.gov/eag/eag.us.htm>
5. PCRD analysis of BEA (GDP, population and employment) and BLS (Midwest CPI) data
6. StatsAmerica figures for 2016: <http://www.statsamerica.org/sip/Economy.aspx?page=gsp&ct=S18>. According to the Bureau of Economic Analysis, the GDP for Indiana in current dollars in 2016 was \$256.4 billion. See: <https://www.bea.gov/regional/bearfacts/pdf.cfm?fips=18000&areatype=STATE&geotype=3>
7. Data were drawn from a number of sources, including Hoosiers by the Numbers, StatsAmerica and the Bureau of Economic Analysis. Another resource tapped was the January 2017 report by Todd P. Siebeneck and Albert H. Yoon titled, *Gross Domestic Product by State* (https://faq.bea.gov/scb/pdf/2017/01%20January/0117_gdp_by_state.pdf).

8. See Indiana's Outlook for 2017 report published in the Indiana Business Review and authored by Timothy F. Slaper and Ryan M. Brewer, 91 (4) Winter 2016. <http://www.ibrc.indiana.edu/ibr/2016/outlook/indiana.html>
9. PCRD analysis of SAIPE, U.S. Census Bureau Data.
10. Data reported in this paragraph were drawn from StatsAmerica and the U.S. Census Bureau's American Fact Finder. Education is an estimate over a five-year period of 2012-16. See: <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=CF>.
11. For a more extensive examination of these theories, see *Investing in People: The Human Capital Needs of Rural America*, by Lionel J. Beaulieu and David Mulkey, Westview Press. 1995.
12. This study employs the official Office of Management and Budget definition for metropolitan and nonmetropolitan counties. For purposes of this article, nonmetropolitan is disaggregated into micropolitan and noncore counties. For more information on this typology, check the Rural Indiana Stats site: <https://pcrd.purdue.edu/ruralindianastats/geographic-classifications.php#first>
13. See "Education and Lifetime Earnings in the United States" by C.R. Tamborini, C. Kim and A. Sakamoto. *Demography* (52): 1383-1407, 2015. <https://doi.org/10.1007/s13524-015-0407-0>; "The Relationship between Education and Adult Mortality in the United States" by Adriana Lleras-Muney, *The Review of Economic Studies*, 72 (1): 189-221. January 2005. <https://doi.org/10.1111/0034-6527.00329>; and *Rural Education at a Glance*, 2017, by Alexander Marre, Economic Information Bulletin No. (EIB-171), Economic Research Service/USDA. April 2017. <https://www.ers.usda.gov/webdocs/publications/83078/eib-171.pdf?v=42830>.
14. The U.S. Census did not report "associates degree" completers separate from the "some college" grouping until 2000. As of 2016, the percent of adults with an associates degree in Indiana was 8.5 percent.
15. Andrew Weiss, "Human Capital and Signalling Explanations of Wages." *Journal of Economic Perspectives*. 9: 133-154. Fall 1995; Ludger Wobmann, "Specifying Human Capital." *Journal of Economic Surveys*. 17 (3): 239-270. July 2003.
16. Median earnings reflects that 50 percent of the people in this education category earned more than this amount and 50 percent earned less.
17. K.A. Shauman, "Occupational Sex Segregation and the Earnings of Occupations: What Causes the Link Among College-educated Workers?" *Social Science Research*. 35 (3): 577-619. September 2006. <http://dx.doi.org/10.1016/j.ssresearch.2004.12.001>
18. See "The Simple Truth about the Gender Pay Gap", American Association of University Women. (Spring 2017) at: http://www.aauw.org/aauw_check/pdf_download/show_pdf.php?file=The-Simple-Truth
19. See Ann Marie Fiore and associates, "Will They Stay or Will They Go? Community Features Important in Migration Decisions of Recent University Graduates." *Economic Development Quarterly*. 29 (1): 23-37 February 2015; Anil Rupasingha, Yongzheng Liu and Mark Partridge. "Rural Bound: Determinants of Metro-to-Nonmetro Migration in the United States." *American Journal of Agricultural Economics*. 97 (3): 680-700. January 2015; and Junjie Wu and Munisamy Gopinath; "What Causes Spatial Variations in Economic Development in the United States?" *American Journal of Agricultural Economics*. 90 (2): 392-408. May 2008. <https://doi.org/10.1111/j.1467-8276.2007.01126.x>

20. The approach for fixing definitions at one end and applying consistently to the entire longitudinal period is known as harmonization of definitions and is applied frequently in socioeconomic research. One merit of this approach is that differences because of definitional changes, such as a county being noncore in one period versus micropolitan in another period, are accounted for. One weakness of this approach is that it fails to account for dynamic changes over the decades, such as a particular county changing from noncore in 1990 to other categories and vice versa.
21. Richard Florida. *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community, and Everyday Life*. New York: Basis Books. 2002.
22. This study gives central attention to the importance of arts, crafts, and cultural activities as key components of the creative economy. For more information, see Stuart Rosenfeld, *The Art of Economic Development: Community Colleges for Creative Economies*. Regional Technology Strategies. March 2005. http://www.michigan.gov/documents/hal/ced_art_econ_dev_179033_7.pdf
23. See McGranahan and Wojan for a more thorough discussion of the methodology employed by ERS in the development of a more comprehensive measure of creative occupations. Five-digit SOC is the maximum granular classification for the occupations. Their work can be found at: David McGranahan and Timothy Wojan. "Recasting the Creative Class to Examine Growth Processes in Rural and Urban Counties." *Regional Studies*. 41 (2): 197–216. April 2007.
24. Occupation cluster definitions are available at, <http://statsamerica.org/innovation/reports/sections2/H.pdf>.
25. See Revisiting the STEM Workforce. Report of the National Science Board of the National Science Foundation. February 4, 2015. <https://www.nsf.gov/nsb/publications/2015/nsb201510.pdf>
26. The STEM occupations that we include in our analysis is based on a stringent list of occupations delineated by the U.S. Department of Commerce and the National Science Foundation. The Brookings Institution has made the case that STEM jobs should not be limited to occupations requiring people with bachelors or higher levels of education. It notes that several jobs requiring technical skills involve the application of STEM knowledge. Furthermore, many of these positions require individuals with technical training and associates degrees. There is also an emphasis to include arts and agriculture into STEM and hence the new acronym of STEAAM (Science, Technology, Engineering, Arts, Agriculture, and Mathematics).



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