



OHIO
UNIVERSITY

Voinovich School of
Leadership and Public Service

RISE Ohio Task 3

Core Competencies Assessment of Coal and Petrochemical Supply Chain AND Diversification of the Regional Economy

November 2023

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Part A.

SWOT analysis for OMEGA and Buckeye Hills regions

I. Strengths

Manufacturing is one of the largest industries in Ohio, even though its share of total Ohioan employment has declined. As of 2019, the manufacturing industry employed 12.56% of the Ohioan workforce (The National Association of Manufacturers, 2019a)¹, significantly higher than the US share of manufacturing jobs (8.51%) (The National Association of Manufacturers, 2019b)².

Although the coal mining industry has declined across the state of Ohio, the mining sector in the OMEGA and Buckeye Hills regions has consistently accounted for around 2% of the region's workforce (Figure 1). Mining for oil and gas remained the region's top industry by location quotient. Since natural gas is the primary raw material used by American chemical manufacturers, regions with a vast amount of natural oil and gas, like the OMEGA and Buckeye Hills regions, have a competitive advantage over other regions in chemical and plastic manufacturing.

OMEGA Region

In the OMEGA region, manufacturing has been the highest employing sector (Figure 3). In 2001, the manufacturing sector accounted for 23.8% of the region's employment. Although the manufacturing sector's employment declined nationally and regionally, the sector still accounted for 18.8% of the OMEGA region's total employment in 2019 (Figure 2).

As manufacturing employment declined in Ohio, manufacturing's share of total employment remained high in seven out of ten counties in the OMEGA region, i.e., Carroll, Columbiana, Coshocton, Guernsey, Harrison, Holmes, and Tuscarawas. In Holmes County, the manufacturing sector accounted for 38.8% of the county's total employment in 2019. In Columbiana, Coshocton, and Harrison counties, the employment share of the manufacturing sector also began to increase in the 2010s (Figure 4).

Because of the region's advantages in natural resources, some of the largest manufacturing industries are chemical manufacturing, plastics and rubber products manufacturing, and primary metal manufacturing. These three industries together account for over 25% of the whole manufacturing sector in the OMEGA region (Figure 5).

¹ The National Association of Manufacturers (2019a). 2019 Ohio Manufacturing Facts. <https://www.nam.org/state-manufacturing-data/2019-ohio-manufacturing-facts/>.

² The National Association of Manufacturers (2019b). 2019 United States Manufacturing Facts. <https://www.nam.org/state-manufacturing-data/2019-united-states-manufacturing-facts/>.

Figure 1: The employment share of the Mining sector in Ohio, OMEGA, and Buckeye Hills regions 2001-2019

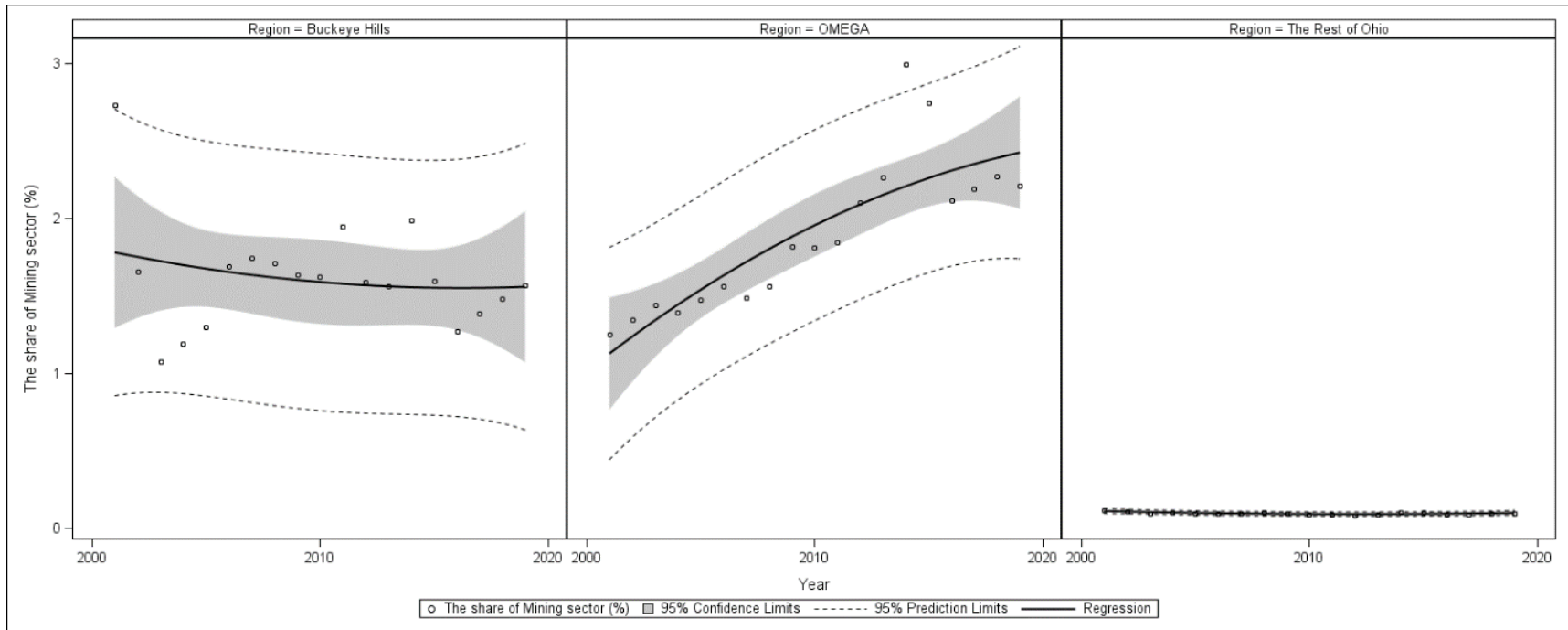


Figure 2: The employment share of the Manufacturing sector in Ohio, OMEGA, and Buckeye Hills regions 2001-2019

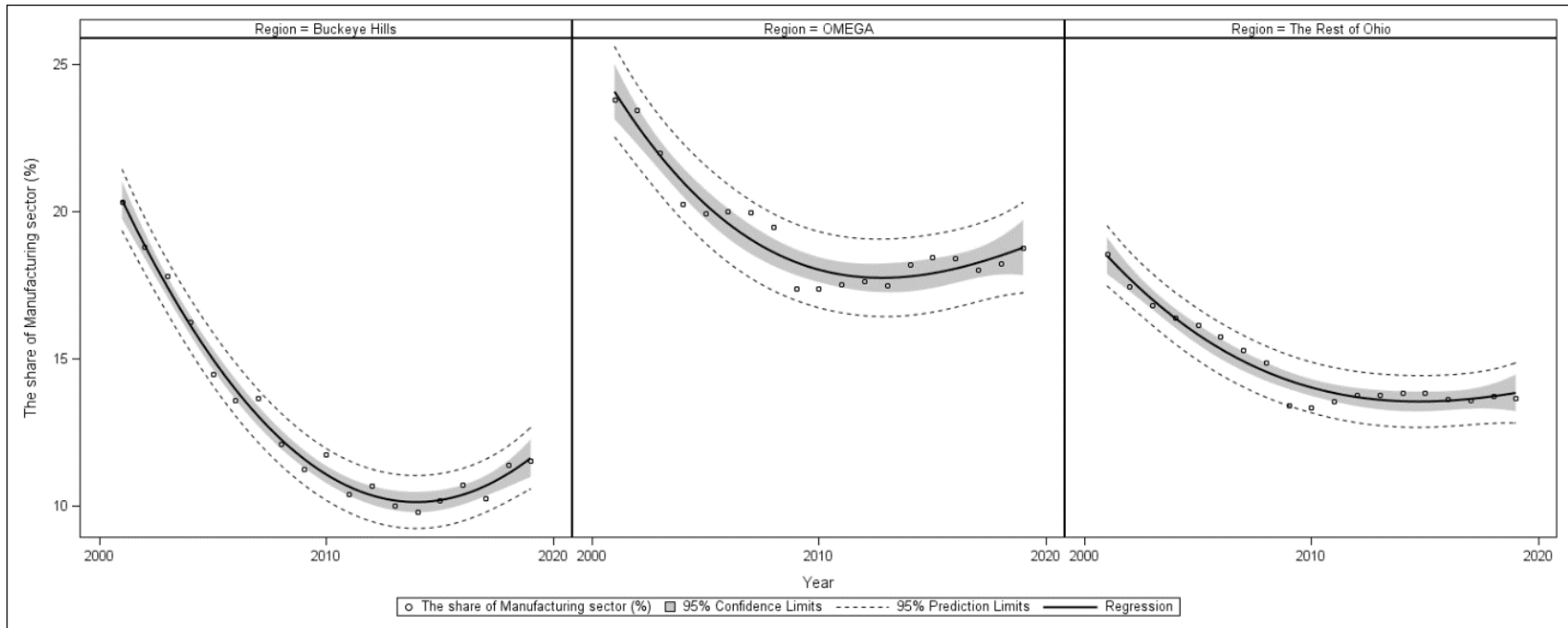


Figure 3: Employment by industry in the OMEGA region in 2019

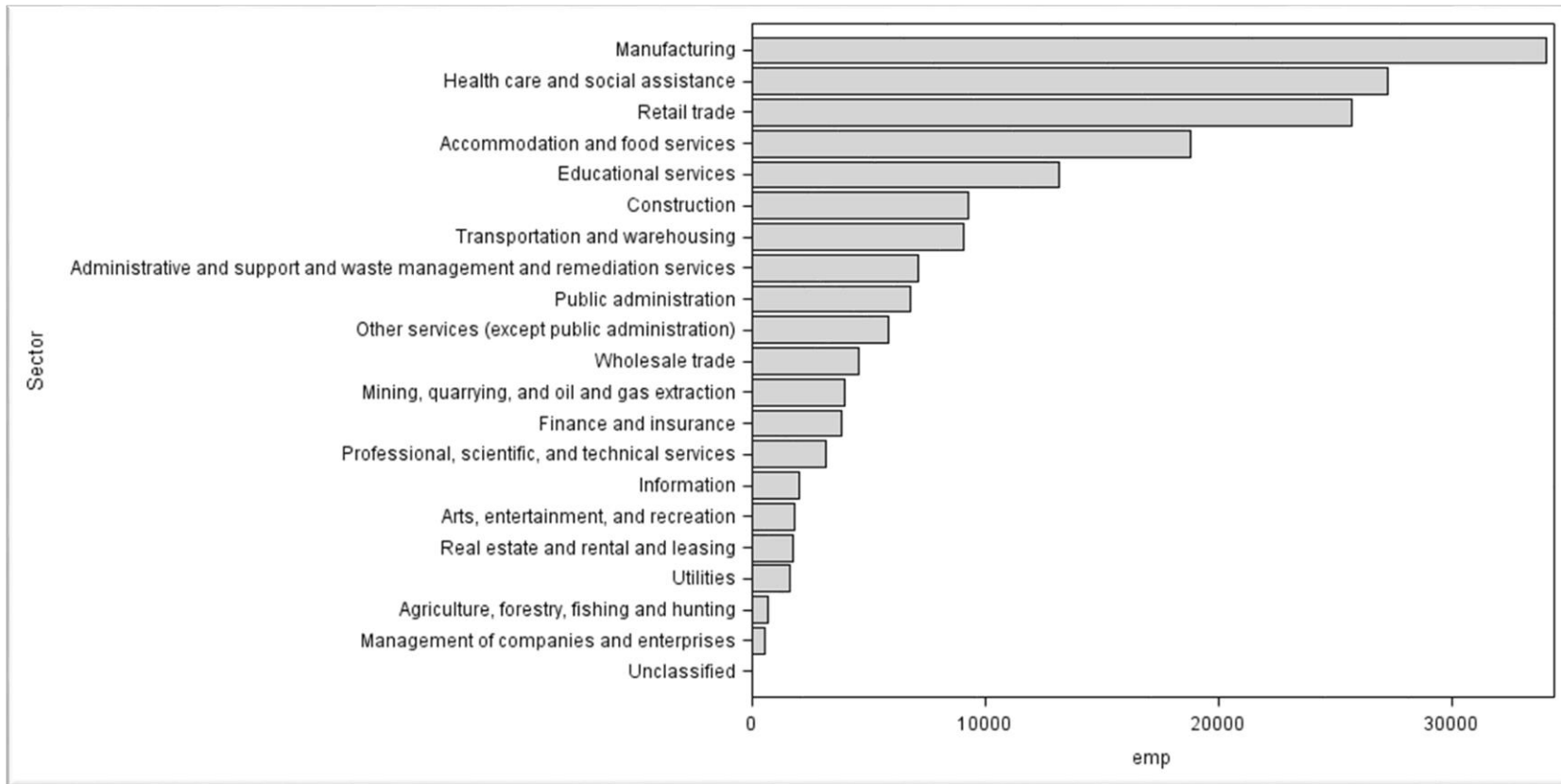


Figure 4: The employment share of the Manufacturing sector in the OMEGA region by county, 2001-2019

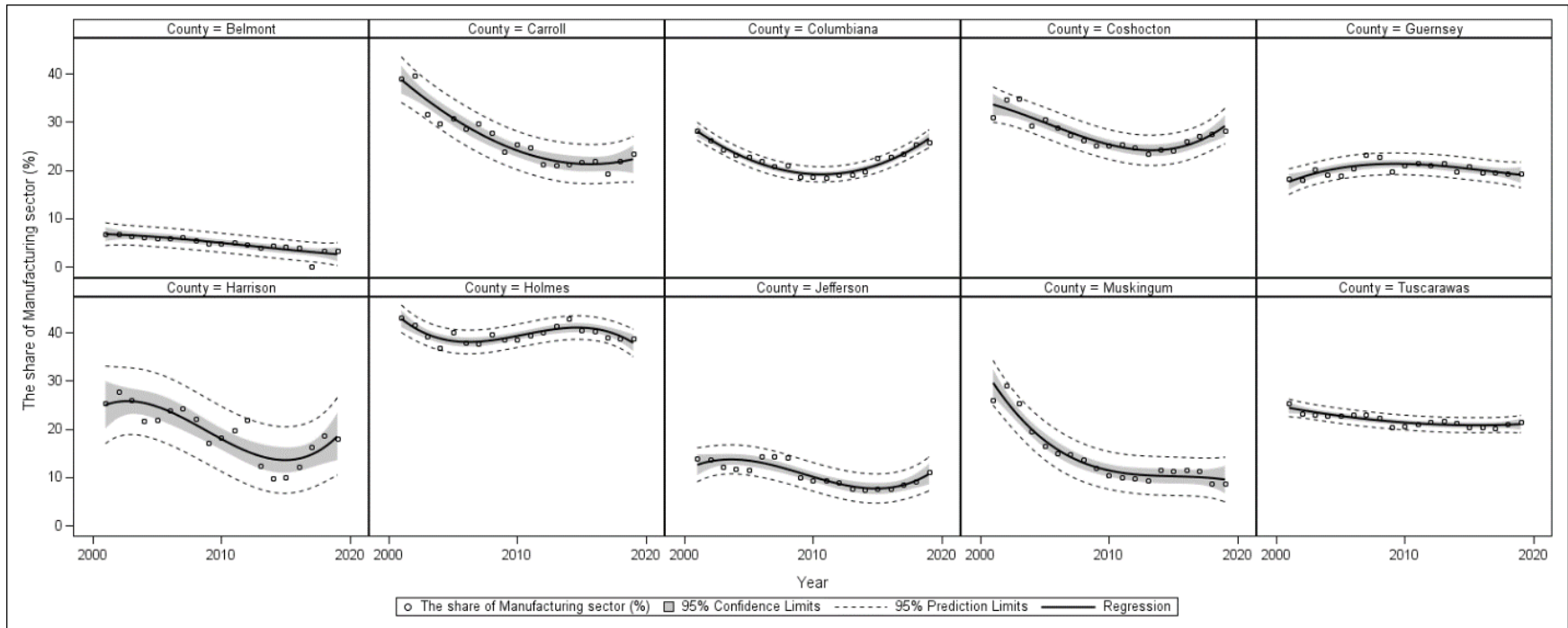
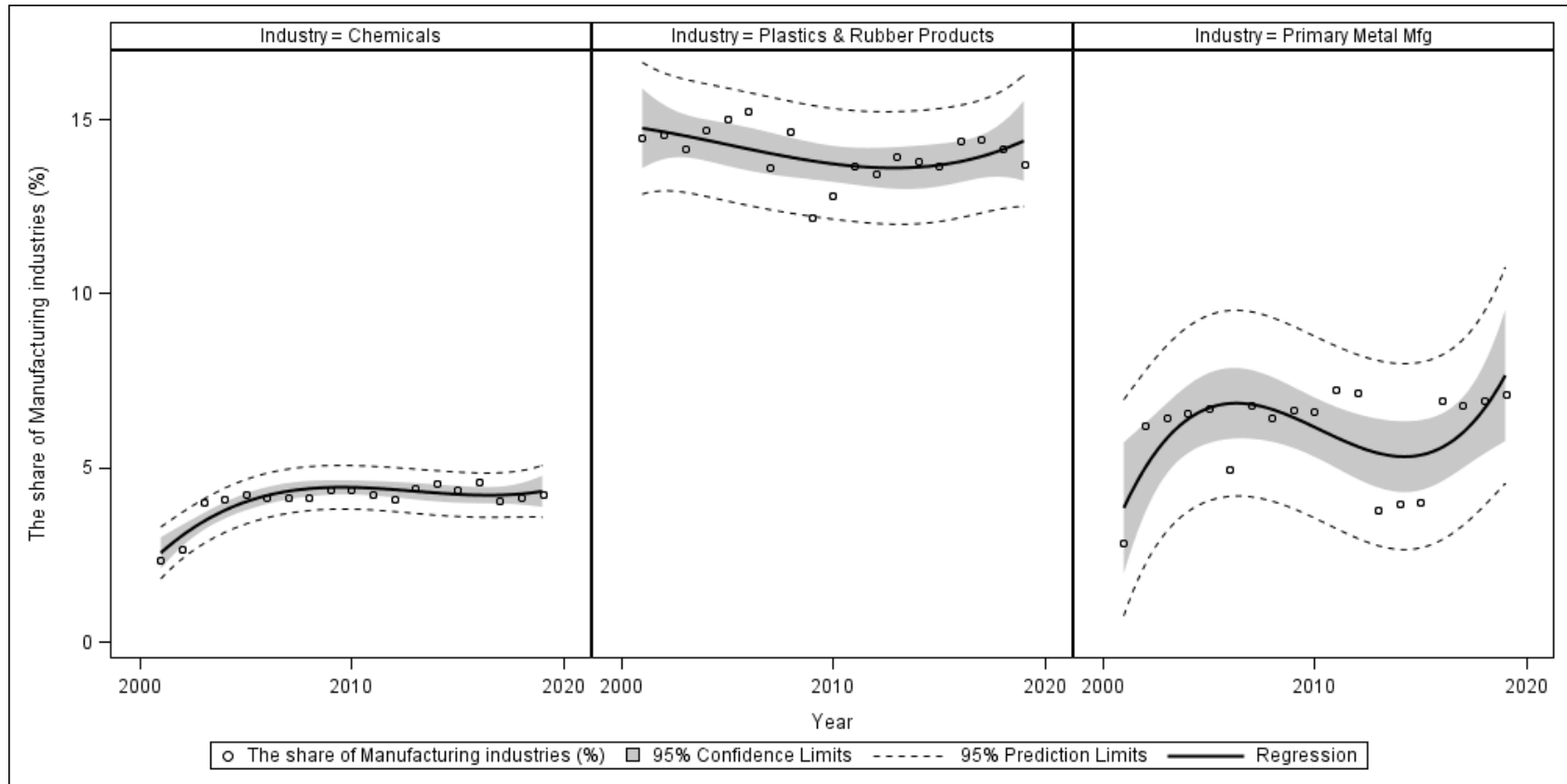


Figure 5: The employment share of the large manufacturing industries in the OMEGA region 2001-2019



Buckeye Hills region

Manufacturing in the Buckeye Hills region was the fourth largest employing sector as of 2019 (Figure 6). In 2001, the manufacturing sector used to account for 20.3% of the region’s employment. The share of manufacturing employment in the region declined steadily until it reached the lowest level of 10.4% in 2014. Since 2014, the region’s manufacturing sector has started to regain its share in terms of employment. In 2019, manufacturing employment accounted for 11.5% of the region’s total employment (Figure 2).

The share of manufacturing employment remained high in four out of eight counties in the Buckeye Hills region, i.e., Hocking County, Morgan County, Noble County, and Perry County. In 2019, the manufacturing sector employed 26.29% of all Morgan County’s workforce (Figure 7). In the same year, the manufacturing sector accounted for 17.9%, 15.88%, and 14.8% of Perry County’s, Hocking County’s, and Noble County’s workforces, respectively (Figure 7).

Similar to the OMEGA region, the Buckeye Hills region’s vast amount of natural oil and gas boosts its chemical and plastic manufacturing industries. From 2001 to 2019, the share of the chemical manufacturing industry in the Buckeye Hills region rose from 16.7% of total manufacturing employment to 25.7% of total manufacturing employment (Figure 8). The percentage of the plastic and rubber manufacturing industry also increased from 6% of total manufacturing employment in 2001 to 15.8% of total manufacturing employment in 2019 (Figure 8). Besides chemical and plastics manufacturing, primary metal manufacturing and fabricated metal product manufacturing are two of the top manufacturing industries in the Buckeye Hills Region; these two industries accounted for 24.4% of the region’s manufacturing workforce in 2019 (Figure 8).

Figure 6: Employment by industry in the Buckeye Hills region in 2019

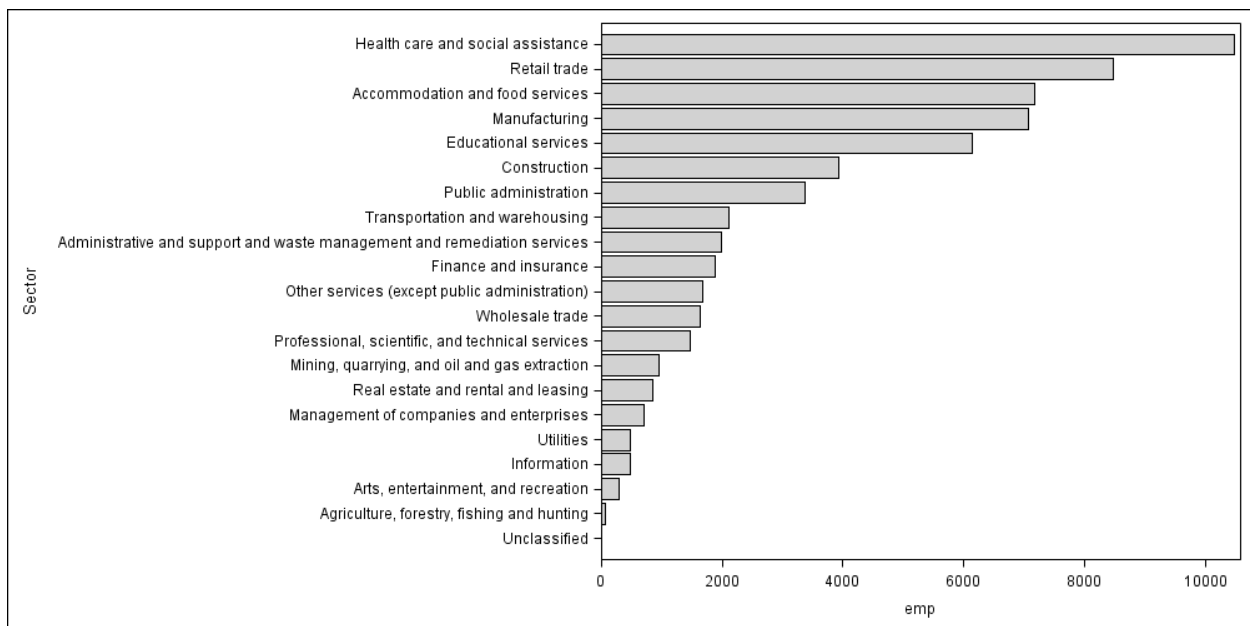


Figure 7: The employment share of the Manufacturing sector in the Buckeye Hills region by county, 2001-2019

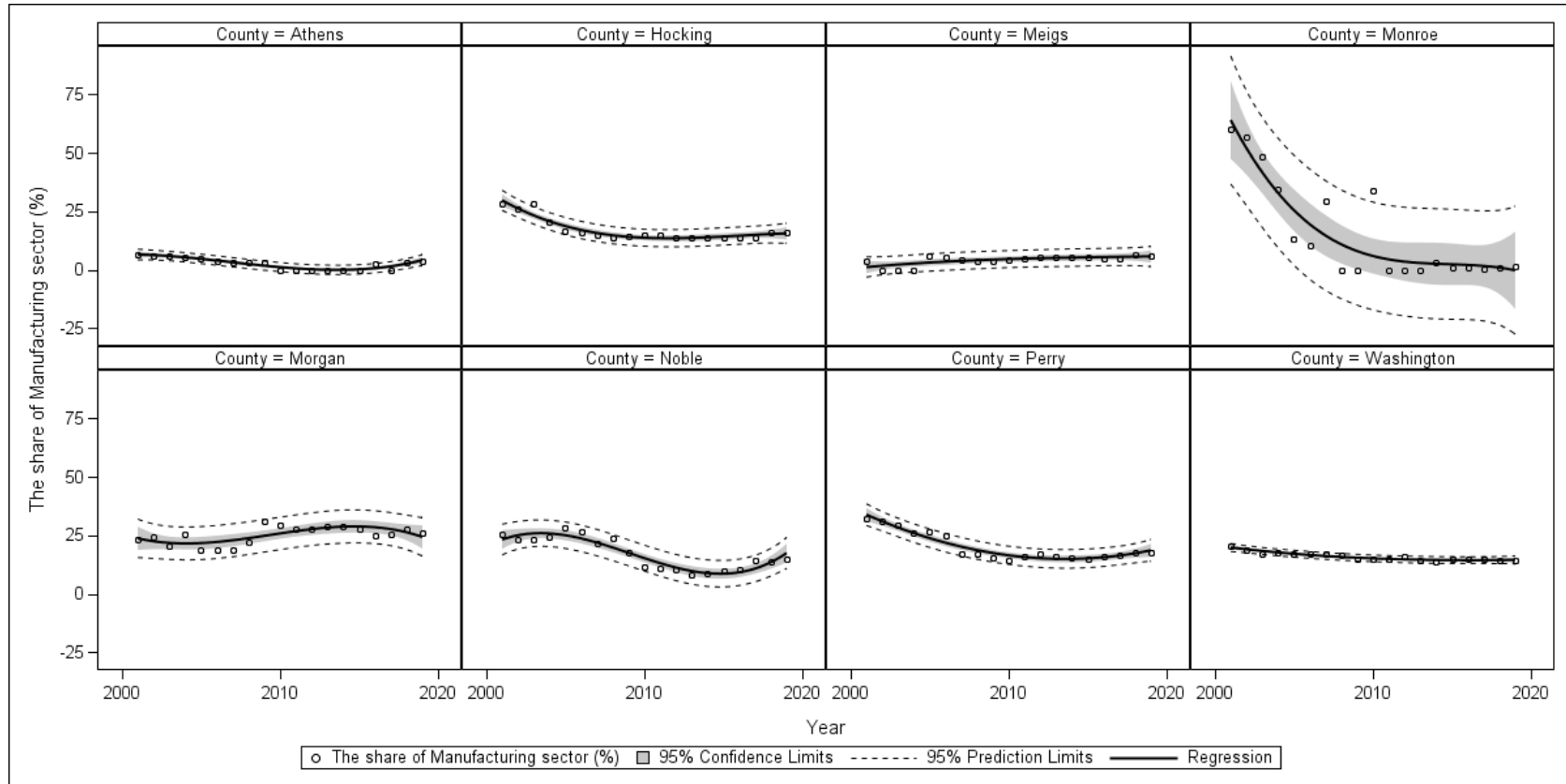
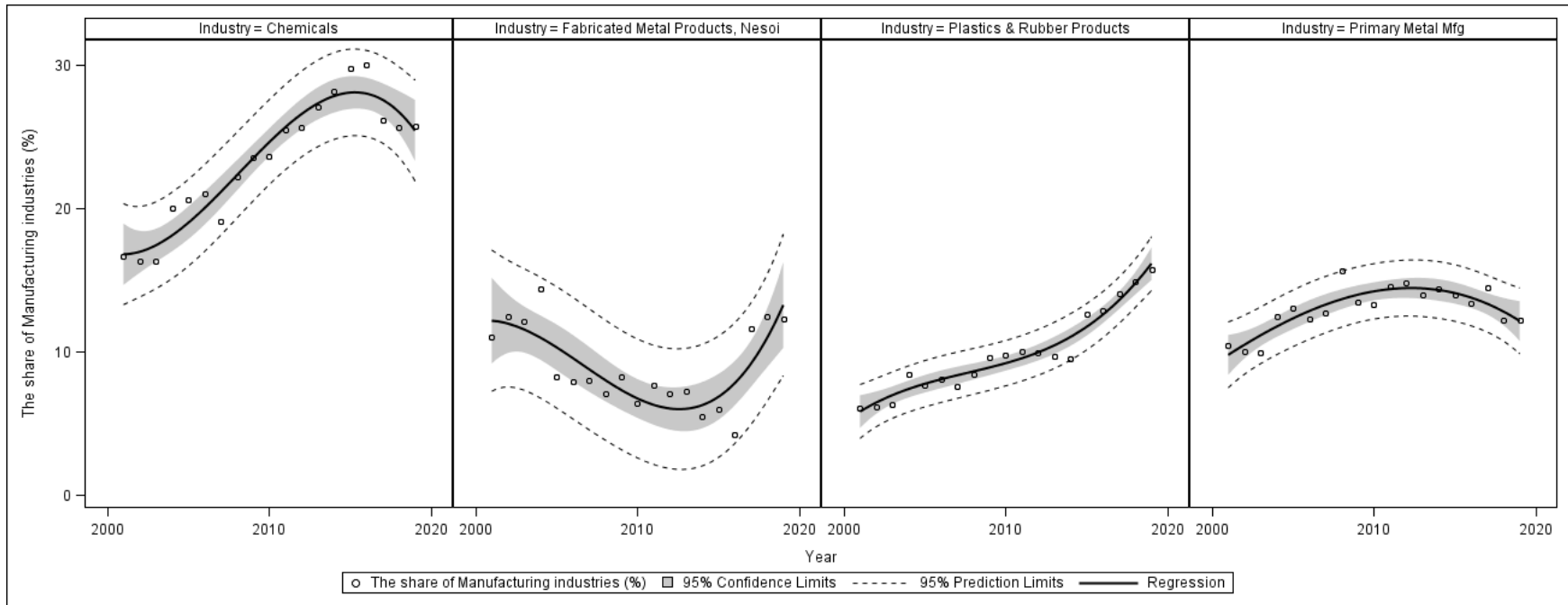


Figure 8: The employment share of the large manufacturing industries in the Buckeye Hills region 2001-2019



II. Weaknesses

Regarding secondary education, Ohio is comparable to the national average. Currently, 90% of American adults over 25 years old have at least a high school degree or equivalent³. In Ohio, 89.9% of the state's population over 25 years old have a high school degree (Figure 9a). However, Ohio still lags behind the national level regarding post-secondary education. While 62% of U.S. adults have some level of college education³, only 58.28% of Ohioan adults have some level of college education (Figure 9a), which is almost four percentage points lower than the national average.

In the Appalachian Ohio region, only 86.7% of adults 25 years or older hold a high school degree or equivalent (Figure 9a), 3.3% lower than the state and national averages. Only 51.09% of the adults in Appalachian Ohio have some post-secondary education (Figure 9a), which is 11 percentage points and seven percentage points lower than the national and state levels, respectively.

Regarding education attainment, the OMEGA region is behind the state and the Appalachian Ohio region. Only 85.7% of the region's adults hold a high school degree or equivalent (Figure 9a), which is 1% lower than Appalachian Ohio's average. Regarding post-secondary educational attainment, only 48.84% of the region's adults have some college education, which is 2.2% lower than Appalachian Ohio as a whole (Figure 9a).

With the existing post-secondary education network in the Buckeye Hills region, the region enjoys a higher educational attainment than its neighboring regions in Appalachian Ohio. 88% of the region's adults hold at least a high school degree, 2.3% higher than Appalachian Ohio's secondary educational attainment and 3.3% higher than its neighboring region, OMEGA (Figure 9a). 52.83% of the region's adult population have some college education, over 1% higher than Appalachian Ohio (Figure 9a). However, the Buckeye Hills region still falls below the state and national educational attainment levels.

Figure 9a: Educational attainment in Ohio, OMEGA, and Buckeye Hills regions

³ According to the 2023 Census Bureau Releases New Educational Attainment Data. <https://www.census.gov/newsroom/press-releases/2023/educational-attainment-data.html>.

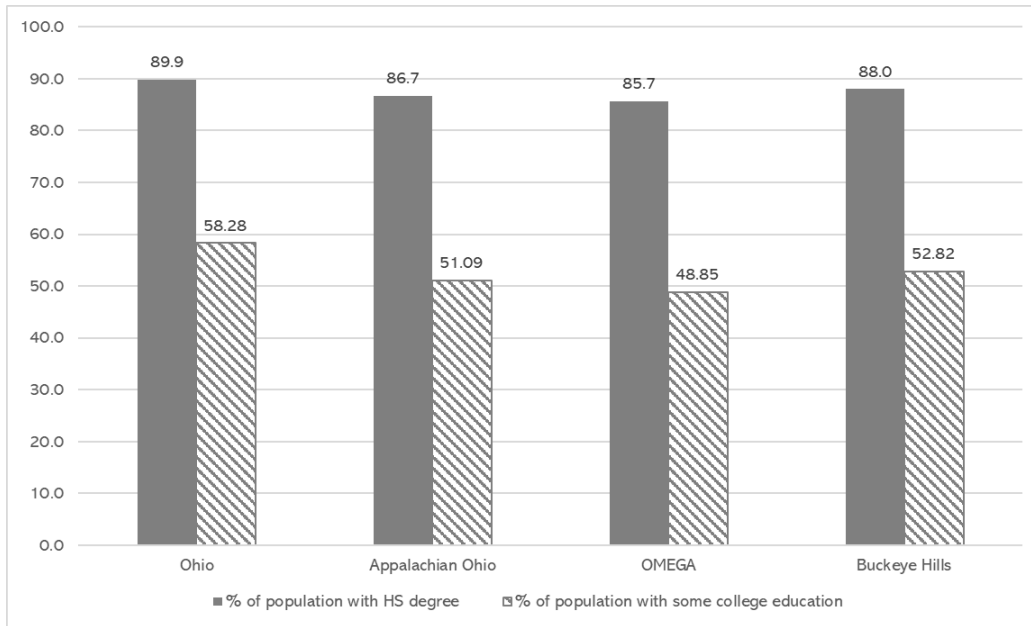
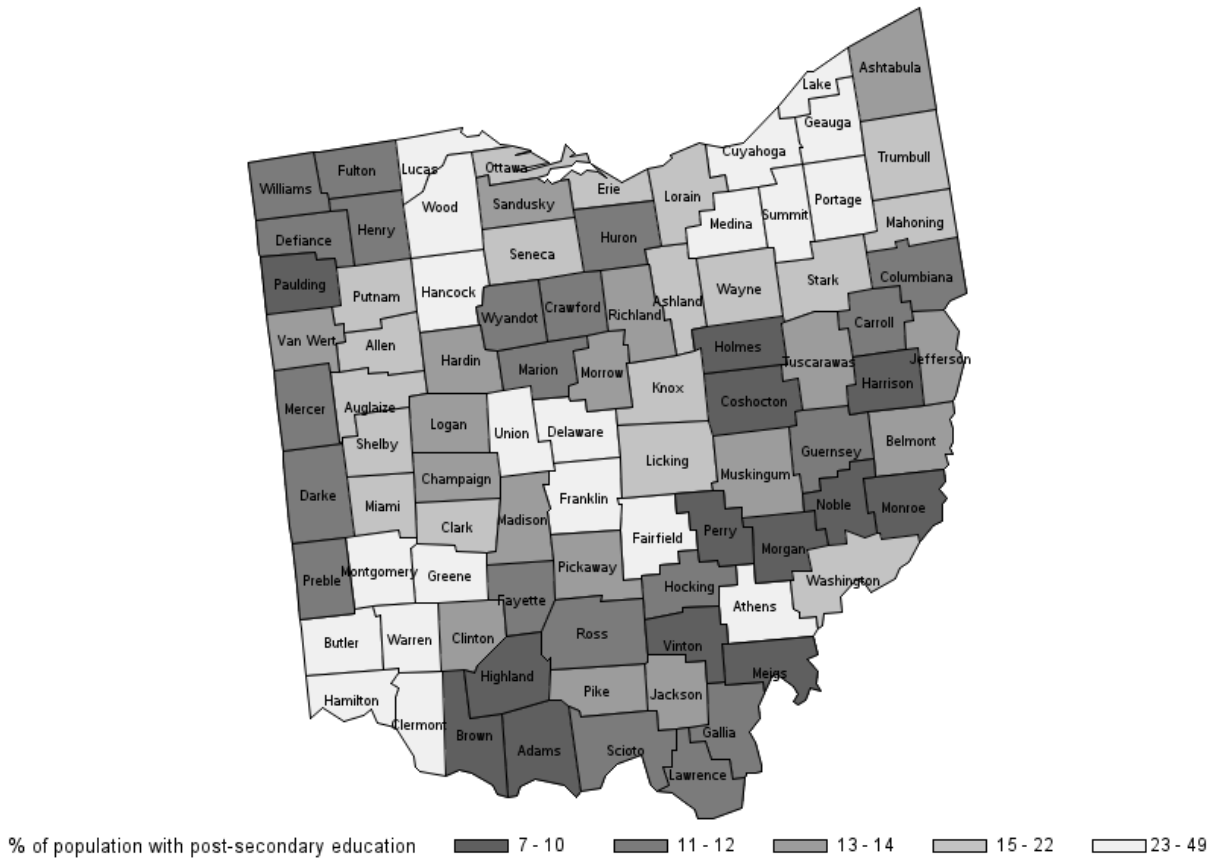


Figure 9b shows the fraction of adults 25 or older with post-secondary degrees in Ohioan counties. Although there are many post-secondary institutions in the region, Southeast Ohio counties have much lower levels of post-secondary educational attainment compared to their neighboring urban counties, such as those in the Columbus and Cleveland metropolitan areas. This implies that the educated population is leaving rural southeast Ohio for neighboring metropolitan counties like Knox, Licking, and Fairfield Counties. Athens is the only county in Southeastern Ohio with a high level of post-secondary educational attainment because Ohio University is located within the county.

Figure 9b: Fraction of population over 25 years with a post-secondary degree in Ohio by county



III. Opportunities

According to Energy In Depth (EID), Ohio ranked 11th in the nation for oil and gas production due to its increased production⁴. Ohio remained the largest oil-producing state in the Appalachian Basin⁴. Although most of the state’s oil and gas fields are in Northeast and Southeast Ohio (Figure 10a), most of the producing wells are primarily located in the Southeast Ohio regions, namely, OMEGA and Buckeye Hills regions (Figure 10b).

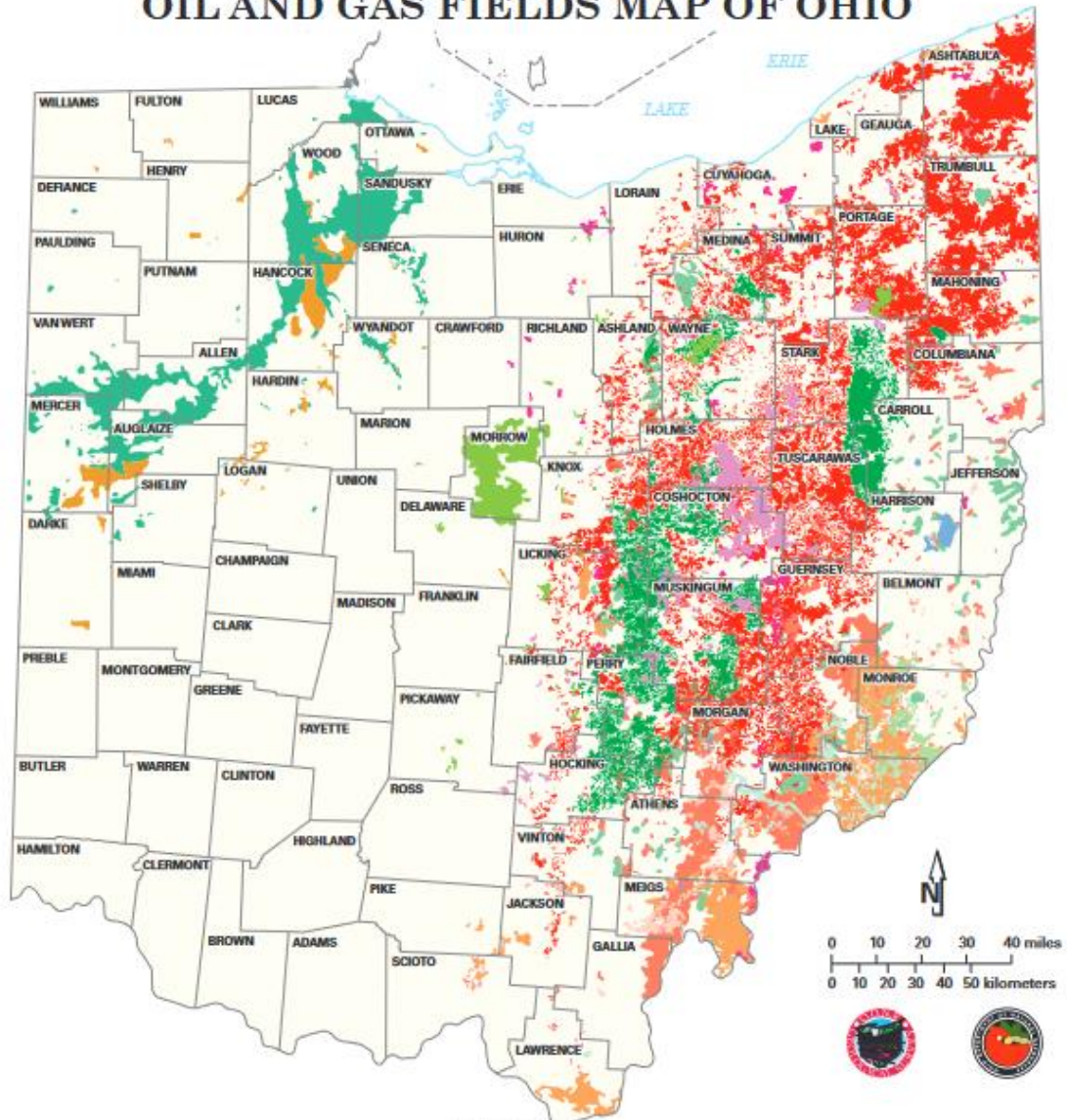
The region’s vast natural oil and gas resources and the high oil and gas production level in Southeast Ohio give the region opportunities for cheaper and cleaner energy production (compared to the former coal-fueled electricity) and comparative advantages in the petrochemicals and plastics manufacturing industries.

Figure 10a: Oil and gas field map Ohio⁵

⁴ Energy In Depth (EID). Retrieved from <https://www.energyindepth.org/ohio-jumps-to-11th-largest-u-s-oil-producer/>.

⁵ Ohio Division of Geological Survey, 2004, Oil and gas fields map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map PG-1, generalized page-size version with text, 2 p., scale 1:2,000,000. [Updated 2014.]

OIL AND GAS FIELDS MAP OF OHIO

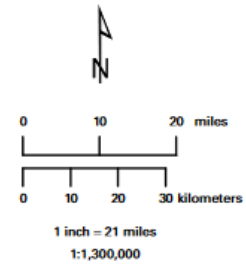
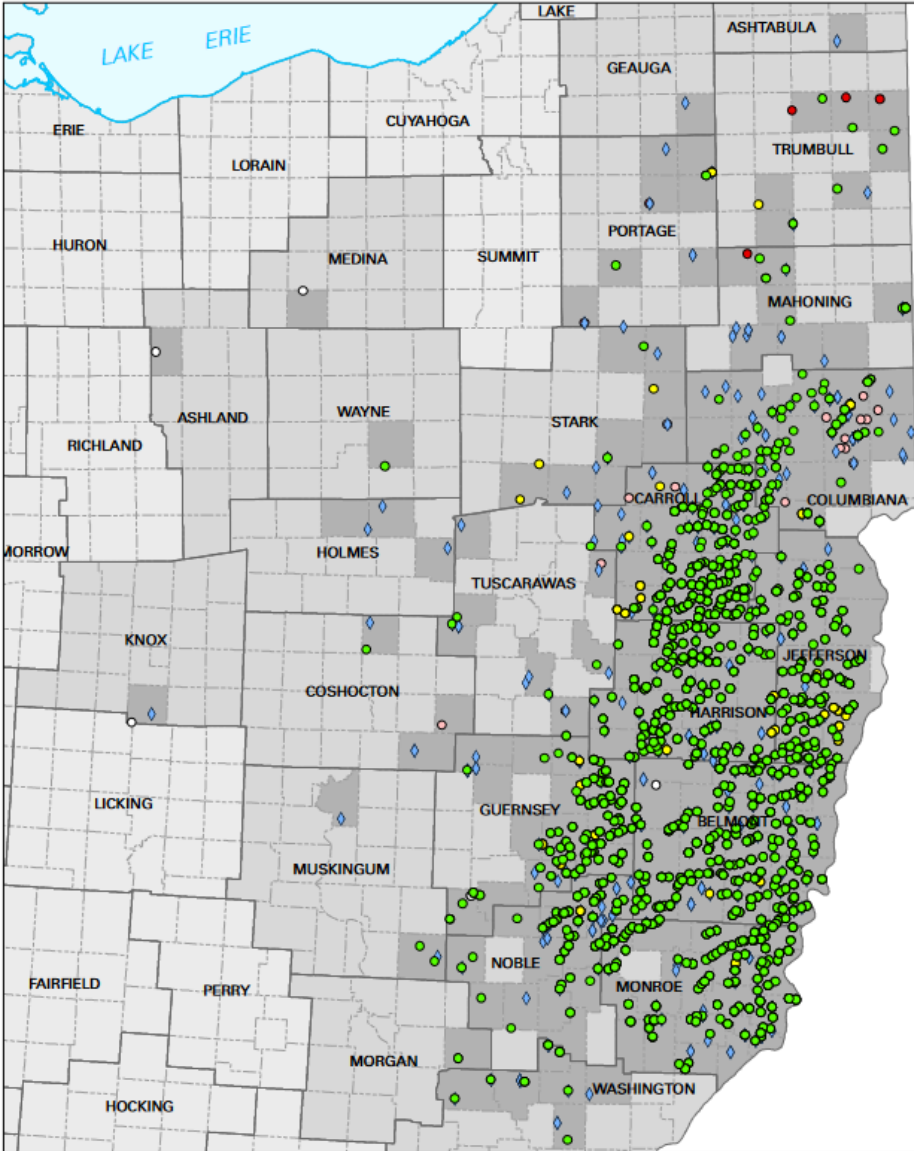


EXPLANATION

| OIL FIELD | GAS FIELD | COALBED METHANE | PRODUCING HORIZON(S) GROUPED BY STRATIGRAPHIC INTERVAL |
|-----------|-----------|-----------------|---------------------------------------------------------------------------------------------|
| | | | Pennsylvanian undifferentiated sandstones and coals |
| | | | Mississippian undifferentiated sandstones and Maxville Limestone |
| | | | Devonian Berea Sandstone and Cussewago Sandstone |
| | | | Devonian Ohio Shale and siltstones |
| | | | Silurian-Devonian "Big Lime" interval |
| | | | Silurian "Clinton/Medina" sandstone and "Packer Shell" |
| | | | Ordovician fractured shale, Trenton Limestone, Black River Group, and Wells Creek Formation |
| | | | Cambrian-Ordovician Knox Dolomite |

Figure 10: Horizontal Utica - Pt. Pleasant Well Activity in Ohio⁶

⁶ Ohio Department of Natural Resources, 2022, Horizontal Utica-point Pleasant Well Activity in Ohio.



| OPERATOR | COUNT |
|------------------------------------|--------------|
| AMERICAN ENERGY UTICA LLC | 2 |
| AMERICAN PETROLEUM PRTR OH LLC | 2 |
| ANADARKO E & P ONSHORE LLC | 4 |
| ANTERO RESOURCES CORPORATION | 266 |
| ARSENAL RESOURCES LLC | 2 |
| ARTEX ENERGY GROUP LLC | 9 |
| ASCENT RESOURCES UTICA LLC | 787 |
| BEUSA ENERGY LLC | 1 |
| BP AMERICA PRODUCTION COMPANY | 1 |
| BRAMMER ENGINEERING INC | 2 |
| CARRIZO (UTICA) LLC | 3 |
| CHESAPEAKE EXPLORATION LLC | 111 |
| CHEVRON APPALACHA LLC | 2 |
| CNX GAS COMPANY LLC | 58 |
| DEVON ENERGY PRODUCTION CO LP | 9 |
| DIVERSIFIED PRODUCTION LLC | 31 |
| EAP OHIO LLC | 964 |
| ECLIPSE RESOURCES LP | 44 |
| EM ENERGY OHIO LLC | 7 |
| ENERVEST OPERATING LLC | 20 |
| EOG RESOURCES INC | 6 |
| EQT PRODUCTION COMPANY | 2 |
| EQUINOR USA ONSHORE PROPERTIES INC | 45 |
| GEOPETRO LLC | 17 |
| GULFPORT APPALACHA LLC | 451 |
| GULFPORT ENERGY CORPORATION | 49 |
| HALCON OPERATING COMPANY INC | 4 |
| HESS OHIO DEVELOPMENTS LLC | 24 |
| HESS OHIO RESOURCES LLC | 1 |
| HG ENERGY LLC | 2 |
| HILCORP ENERGY COMPANY | 109 |
| INR OHIO LLC | 47 |
| NORTHWOOD ENERGY CORP | 6 |
| POC ENERGY INC | 8 |
| PIN OAK ENERGY PARTNERS LLC | 33 |
| PROTEGE ENERGY III LLC | 1 |
| R E GAS DEVELOPMENT LLC | 9 |
| RICE DRILLING D LLC | 149 |
| SERRA RESOURCES LLC | 3 |
| STATOIL USA ONSHORE PROPERTIES INC | 5 |
| SUMMIT PETROLEUM INC | 6 |
| SWEPI LP | 1 |
| SWN Production (Ohio) LLC | 215 |
| TRIAD HUNTER LLC | 6 |
| UTICA RESOURCE OPERATING LLC | 49 |
| XTO ENERGY INC | 80 |
| TOTAL | 3,660 |



EXPLANATION

Horizontal well status as of 7/2/2022

- ◆ PERMITTED-(Permitted; Not Drilled; Canceled)
- DRILLED-(Drilling; Well Drilled)
- PRODUCING-(Producing; Plugged Back)
- INACTIVE-(Drilled Inactive; Shut in)
- Lost Hole or Final Restoration
- Dry and Abandoned
- Plugged and Abandoned



Well permit information from the ODNR Division of Oil and Gas Resources Management
Recommended citation:
 Ohio Department of Natural Resources, 2022, Horizontal Utica-Point Pleasant Well Activity in Ohio: Columbus, scale 1:1,300,000, revised 7/8/2022.

IV. Threats

According to the United States Census Bureau, the US population increased by 17.8%, from 281,421,906 in 2000 to 331,449,281 in 2020⁷. Ohio's population increased by 2.58% from 2001 to 2019 (Figure 11a). Differing from the state and the national levels, Appalachian Ohio suffered from population loss. From 2001 to 2019, Appalachian Ohio lost 0.72% of its population (Figure 11a). Following Appalachian Ohio's trend, the OMEGA region lost 1.87% of its population in the same time frame (Figure 11a). The Buckeye Hills region enjoyed a 0.05% increase in its population; however, the increase is marginal compared to the state and national levels of population growth.

Figure 11b shows the change in population in Ohio by county from 2001 to 2019. Rural Ohioan counties generally experienced population loss or small population growth rates compared to urban and suburban counties in the major metropolitan areas, such as Columbus, Cincinnati, and Cleveland.

In the OMEGA and Buckeye Hills regions, the easternmost counties, such as Carrol, Columbiana, Jefferson, Harrison, Guernsey, Belmont, Monroe, and Washington Counties, suffered the highest levels of population loss (from 2% to 11% of population loss). Counties in the western side of the OMEGA and Buckeye Hills regions, which are closer to the major Columbus metropolitan area, such as Holmes, Muskingum, Perry, and Athens Counties, experienced some gains in their population (Figure 11b).

Figure 11a: The changes in population in Ohio, OMEGA, and Buckeye Hills Regions 2001-2019.

⁷ Historical Population Change Data, United States Census Bureau. Retrieved from: <https://www.census.gov/data/tables/time-series/dec/popchange-data-text.html>.

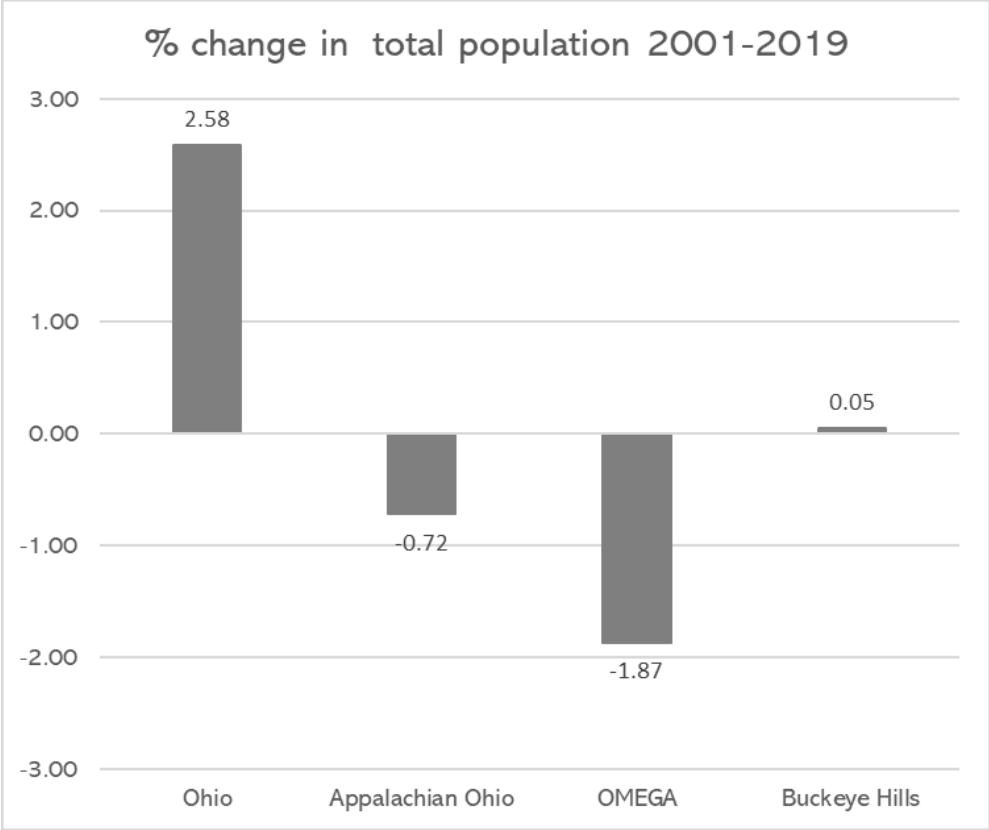
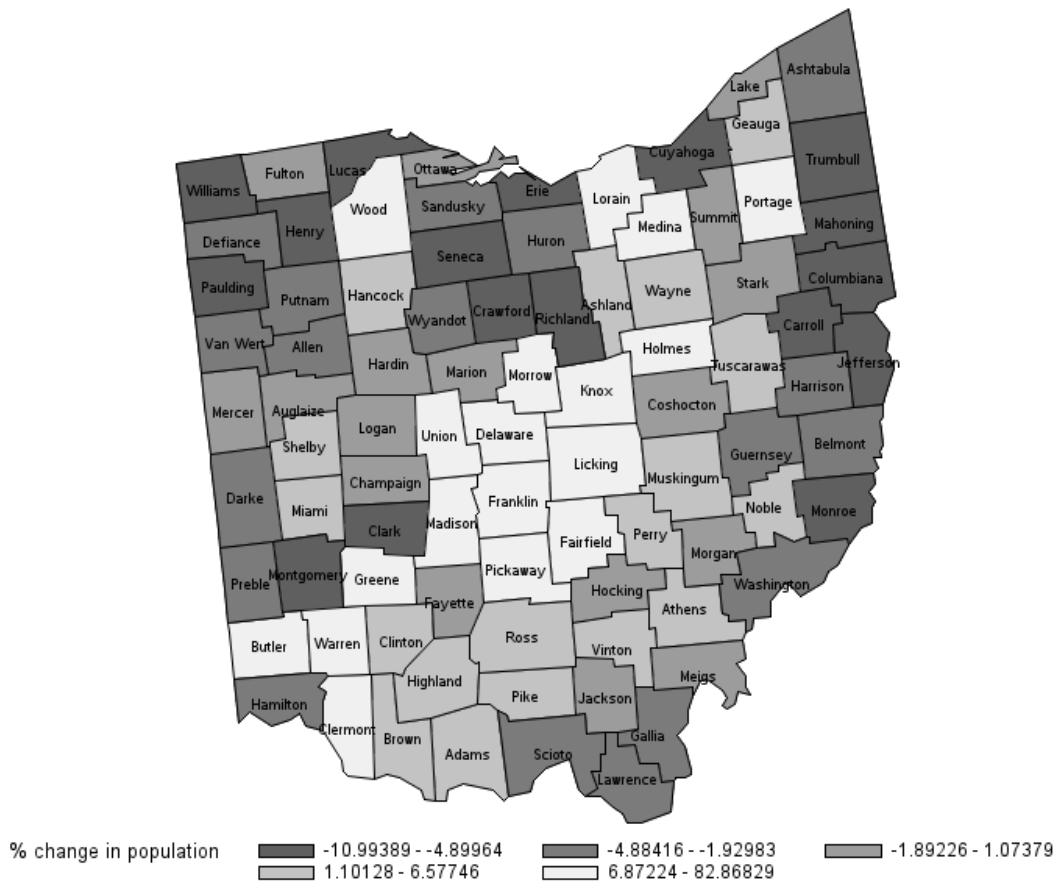


Figure 11b: Percentage change in population from 2001 to 2019 in Ohio by county.



Ohio's median age is 40.9 years, which is two years higher than the median age in the US, 38.9 years⁸. Appalachian Ohio's median age is 42, 1.1 years older than the state's median age. The median age in the OMEGA region is 42.1 years, marginally higher than in Appalachian Ohio. The median age in the Buckeye Hills region is 42.8 years, 0.8 years older than the median age in Appalachian Ohio.

Figure 12b shows the median age in Ohioan counties. Rural eastern Ohioan counties generally have much higher median ages than metropolitan Ohioan counties such as Franklin and Delaware Counties. This further implies that the younger and more educated population is leaving rural Appalachia and Southeast Ohio for urban counties, thus resulting in a region with an older population. Losing the younger and more educated population is the region's biggest threat.

Figure 12a: Median age in Ohio, OMEGA, and Buckeye Hills Regions.

⁸ United States Census Bureau (<https://www.census.gov/newsroom/press-releases/2023/population-estimates-characteristics.html>)

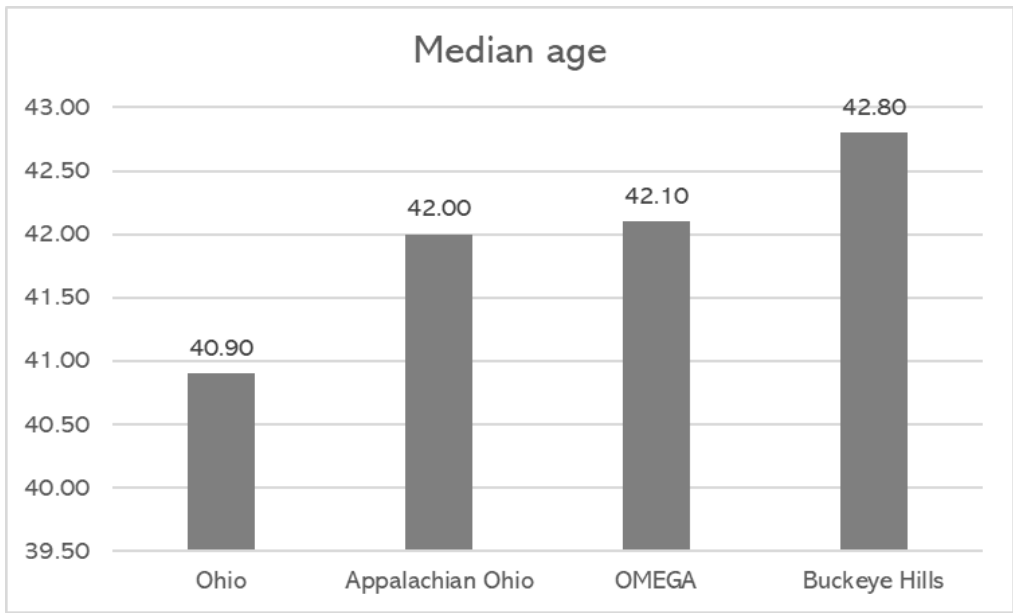
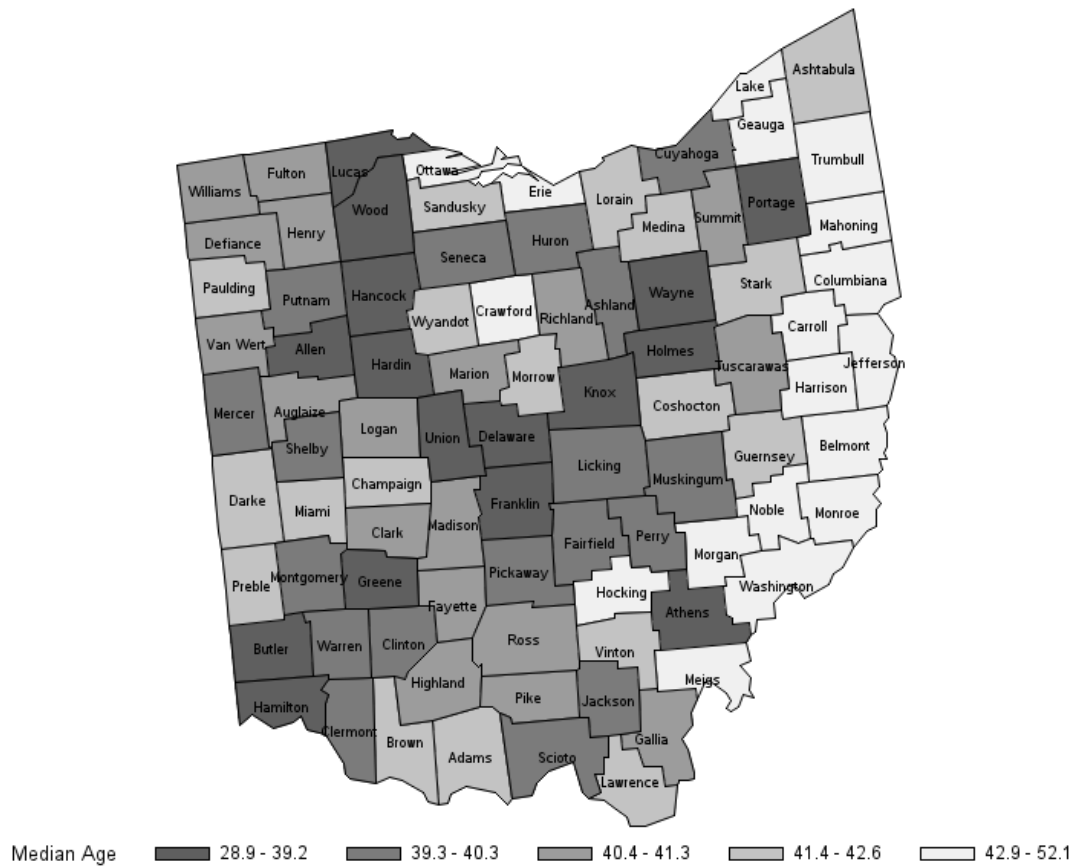


Figure 12b: Median age by county in Ohio



Part B.

Workforce's core competencies and transitions to new non-coal opportunities

The SWOT analysis from section A shows that the OMEGA and Buckeye Hills regions have a competitive advantage in manufacturing, especially petrochemicals and plastics manufacturing, because of the regions' vast amount of natural oil and gas, their long history of oil and gas mining, and their high regional location quotations in manufacturing industries.

As the demand for coal declined, jobs in the coal mining cluster also declined in the last two decades. Since more coal mines and coal-fired power plants are also planned to close in the near future, people who are currently employed in the coal mining cluster still face the risk of losing their jobs. In this section, we underline the core competencies of workers in the coal mining cluster in the OMEGA and Buckeye Hills regions and identify their possible job transitions to new occupations in the petrochemical manufacturing industry, the fastest-growing industry in the regions. For each possible transition, we also identify the essential training workers need to prepare them for new opportunities.

For each region, we identify the “at risk” or “declining” occupations and “growing” occupations. “Declining” occupations are jobs within the coal mining cluster that experienced a decline in employment between 2001 and 2019 and are projected to continue to decline over the next decade. “Growing” occupations are jobs in the rapidly increasing petrochemical manufacturing industry and are projected to keep growing over the next decade⁹. We then pool the growing and declining occupations into the “occupations of interest” pool. From this pool, we group the occupations of interest into five different clusters based on the occupations' required knowledge, skills, and level of education. Occupations in each cluster are similar in work performance and knowledge, skills, and education requirements. After grouping the growing and declining occupations into clusters, we examine if workers in each declining occupation can transition into growing occupations within the same cluster, how complicated the transitions are, and what training is necessary for the transition.

Although transitioning from a declining occupation to a growing occupation in the same cluster is usually easier and requires less training, we acknowledge that this type of transition may result in the same risk of job loss in the future as technology continues to develop and replace the demand for human work. To address this issue, we also identify out-of-cluster job transitions for each declining occupation. These out-of-cluster transitions require more training; however, they give workers substantially higher wages and better job security in the future.

We use the U.S. Department of Labor's O*NET database to determine the level of skills, knowledge, and education required to perform a job. The O*NET database assigns a numeric value to each skill and knowledge area. We use these numeric values to calculate the differences in skills and knowledge between occupations and determine how much training in each skill and knowledge area one needs to transition to a new job. All occupations are classified following the federal Standard Occupational Classification system (SOC).

⁹ An occupation is classified as a growing occupation if it satisfies two conditions: 1) has a positive projected employment growth in the next ten years, and 2) the employment growth is at least 30 jobs.

OMEGA REGION

In the Omega region, we identify 43 growing occupations in the petrochemical manufacturing cluster. Of these 43 occupations, 13 occupations do not require post-secondary education, and 30 occupations require post-secondary education (table 1). We also identify 33 declining occupations in the coal mining cluster; 16 of these 33 occupations do not require higher education, while the remaining 17 require post-secondary education.

As in the SWOT analysis, the OMEGA region lags behind the state and the nation regarding educational attainment. More than half of the region's adult population of 25 years old or over do not have post-secondary education. These workers are most at risk of losing their jobs since the numbers of mining and coal-fueled electricity jobs, jobs that pay well and do not require higher education, are declining. Workers who do not have post-secondary education also face more difficulties finding new opportunities. Therefore, we need to pay attention to and prioritize the resources to help them prepare for new non-coal job opportunities.

Table 3a shows the core competencies in terms of knowledge of workers employed in the OMEGA region's coal mining cluster's declining occupations. The second and third columns in Table 3a show the workers' knowledge compared to a general worker and a worker of a similar education level, respectively. Compared to an average worker in the U.S. with the same education level, workers in the OMEGA region coal mining cluster have better knowledge of administrative, production, processing, language, computer, electronics, mechanicals, public safety, and security. These skills will help them when transitioning to petrochemical industry cluster occupations. However, compared to an average American worker of the same education level, they lack other knowledge, such as engineering, technology, sciences, management, and telecommunication.

Table 3b shows the core competencies in terms of skills of workers who are employed in the OMEGA region's coal mining cluster's declining occupations. The second and third columns in Table 3a show the workers' skills compared to a general worker and a worker of a similar education level, respectively. Compared to an average worker in the U.S. of the same education level, workers in the coal mining cluster in the OMEGA region have better skills in literacy, critical thinking, strategies, problem-solving, system analysis, and management of time and personnel resources. These skills are essential in manufacturing industries. However, compared to an average American worker of the same education level, they lack other skills, such as operation analysis, operation monitoring and control, equipment maintenance, troubleshooting, repairing, and managing financial and material resources.

After pooling 43 growing occupations and 33 declining occupations in the OMEGA region into the occupations of interest pool, we employed the WARD clustering method to group them into five different clusters using the occupations' required level of skills, knowledge, and education. Figure 1 shows the OMEGA region's 5 clusters. Each point in the figure represents an occupation. The closer the occupations are in the graph, the easier the transitions between them are. The further the occupations are in the graph, the more difficult the transitions between them are. Each bubble represents an occupation cluster. Cluster 1 includes middle-paying white-collar jobs. Cluster 2 includes higher-paying white-collar and top-manager jobs. Cluster 3 includes middle-paying blue-collar jobs. Cluster 4 includes higher-paying blue-collar jobs. Cluster 5 includes engineers and specialists. Suppose two clusters are joined or close to each other. In that case, it means there are possibilities for workers in one cluster to transition into a different occupation cluster with some marginal training needed. If two clusters are far away from each other, it means the job transitions between them require a lot of training.

Figure 1 shows that the OMEGA region's workers in middle-paying blue-collar jobs, cluster 3, can transition into the closed cluster, cluster 4, higher-paying blue-collar jobs, with some necessary training.

Transitions from middle-paying blue-collar jobs to higher-paying white-collar and top-manager jobs (cluster 2) or middle-paying white-collar jobs are complex and require a substantial amount of training and education.

Table 1: Emerging occupations in the Petrochemical cluster

| SOC Code | Occupation | Require higher education |
|-----------------|--------------------------------------------------------------------------|---------------------------------|
| 47-2061.00 | Construction Laborers | No |
| 53-3032.00 | Heavy and Tractor-Trailer Truck Drivers | No |
| 51-9198.00 | Helpers--Production Workers | No |
| 53-7051.00 | Industrial Truck and Tractor Operators | No |
| 37-2011.00 | Janitors and Cleaners, Except Maids | No |
| 53-7062.00 | Laborers and Freight, Stock, and Material Movers, Hand | No |
| 37-3011.00 | Landscaping and Groundskeeping Work | No |
| 53-3033.00 | Light Truck Drivers | No |
| 51-4081.00 | Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic | No |
| 47-2073.00 | Operating Engineers and Other Construction Equipment Operators | No |
| 43-5061.00 | Production, Planning, and Expediting Clerk | No |
| 43-4171.00 | Receptionists and Information Clerk | No |
| 51-4121.00 | Welders, Cutters, Solderers, and Brazers | No |
| 13-2011.00 | Accountants and Auditors | Yes |
| 43-3021.00 | Billing and Posting Clerks | Yes |
| 49-3031.00 | Bus and Truck Mechanics and Diesel | Yes |
| 13-1041.00 | Compliance Officers | Yes |
| 11-3021.00 | Computer and Information Systems Managers | Yes |
| 15-1231.00 | Computer Network Support Specialist | Yes |
| 15-1211.00 | Computer Systems Analysts | Yes |
| 15-1232.00 | Computer User Support Specialists | Yes |
| 11-9021.00 | Construction Managers | Yes |
| 13-1051.00 | Cost Estimators | Yes |
| 17-2071.00 | Electrical Engineers | Yes |
| 47-2111.00 | Electricians | Yes |
| 11-3031.00 | Financial Managers | Yes |
| 47-1011.00 | First-line supervisors of Construction Trades and Extraction Workers | Yes |
| 49-1011.00 | First-Line Supervisors of Mechanics | Yes |
| 11-1021.00 | General and Operations Managers | Yes |
| 13-1071.00 | Human Resources Specialists | Yes |
| 17-2112.00 | Industrial Engineers | Yes |
| 49-9041.00 | Industrial Machinery Mechanics | Yes |
| 51-4041.00 | Machinists | Yes |
| 49-9071.00 | Maintenance and Repair Workers, General | Yes |
| 13-1111.00 | Management Analysts | Yes |
| 13-1161.00 | Market Research Analysts and Market | Yes |
| 11-2021.00 | Marketing Managers | Yes |
| 17-2141.00 | Mechanical Engineers | Yes |
| 15-2031.00 | Operations Research Analysts | Yes |
| 47-2152.00 | Plumbers, Pipefitters, and Steamfitters | Yes |
| 29-1141.00 | Registered Nurses | Yes |
| 11-2022.00 | Sales Managers | Yes |
| 13-1151.00 | Training and Development Specialist | Yes |
| 11-3071.00 | Transportation, Storage, and Distribution Managers | Yes |

Table 2: Declining occupations in the OMEGA region

| SOC Code | Occupation | Median Wage (2019 \$) | Require higher education |
|-----------------|---------------------------------------------------------------------------------|------------------------------|---------------------------------|
| 43-3011 | Bill and Account Collectors | 16.95 | No |
| 47-5041 | Continuous Mining Machine Operators | 26.68 | No |
| 53-7011 | Conveyor Operators and Tenders | 19.6 | No |
| 51-9021 | Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders | 19.11 | No |
| 43-4051 | Customer Service Representatives | 16.7 | No |
| 51-9061 | Inspectors, Testers, Sorters, Samplers, and Weighers | 18.97 | No |
| 43-5041 | Meter Readers, Utilities | 19.52 | No |
| 43-9061 | Office Clerks, General | 16.49 | No |
| 51-8013 | Power Plant Operators | 39.5 | No |
| 43-3061 | Procurement Clerks | 20.36 | No |
| 47-5043 | Roof Bolters, Mining | 28.95 | No |
| 43-6014 | Secretaries and Administrative Assistants, Except Legal, Medical, and Executive | 17.42 | No |
| 33-9032 | Security Guards | 13.75 | No |
| 43-5071 | Shipping, Receiving, and Inventory Clerks | 16.27 | No |
| 53-7065 | Stockers and Order Fillers | 12.57 | No |
| 53-7121 | Tank Car, Truck, and Ship Loaders | 18.05 | No |
| 17-3011 | Architectural and Civil Drafters | 26.4 | Yes |
| 49-3023 | Automotive Service Technicians and Mechanics | 18.52 | Yes |
| 43-3031 | Bookkeeping, Accounting, and Auditing Clerks | 18.75 | Yes |
| 11-1011 | Chief Executives | 88.94 | Yes |
| 15-1251 | Computer Programmers | 37.02 | Yes |
| 17-3023 | Electrical and Electronic Engineering Technologists and Technicians | 29.87 | Yes |
| 43-6011 | Executive Secretaries and Executive Administrative Assistants | 27.59 | Yes |
| 43-1011 | First-line supervisors of Office and Administrative Support Workers | 26.43 | Yes |
| 51-1011 | First-line supervisors of Production and Operating Workers | 29.27 | Yes |
| 43-4161 | Human Resources Assistants, Except Payroll and Timekeeping | 18.8 | Yes |
| 23-1011 | Lawyers | 49.02 | Yes |
| 17-2161 | Nuclear Engineers | 58.89 | Yes |
| 19-4051 | Nuclear Technicians | 36.65 | Yes |
| 43-3051 | Payroll and Timekeeping Clerks | 21.38 | Yes |
| 51-8012 | Power Distributors and Dispatchers | 42.41 | Yes |
| 51-8021 | Stationary Engineers and Boiler Operators | 27.92 | Yes |
| 51-8031 | Water and Wastewater Treatment Plant and System Operators | 23.87 | Yes |

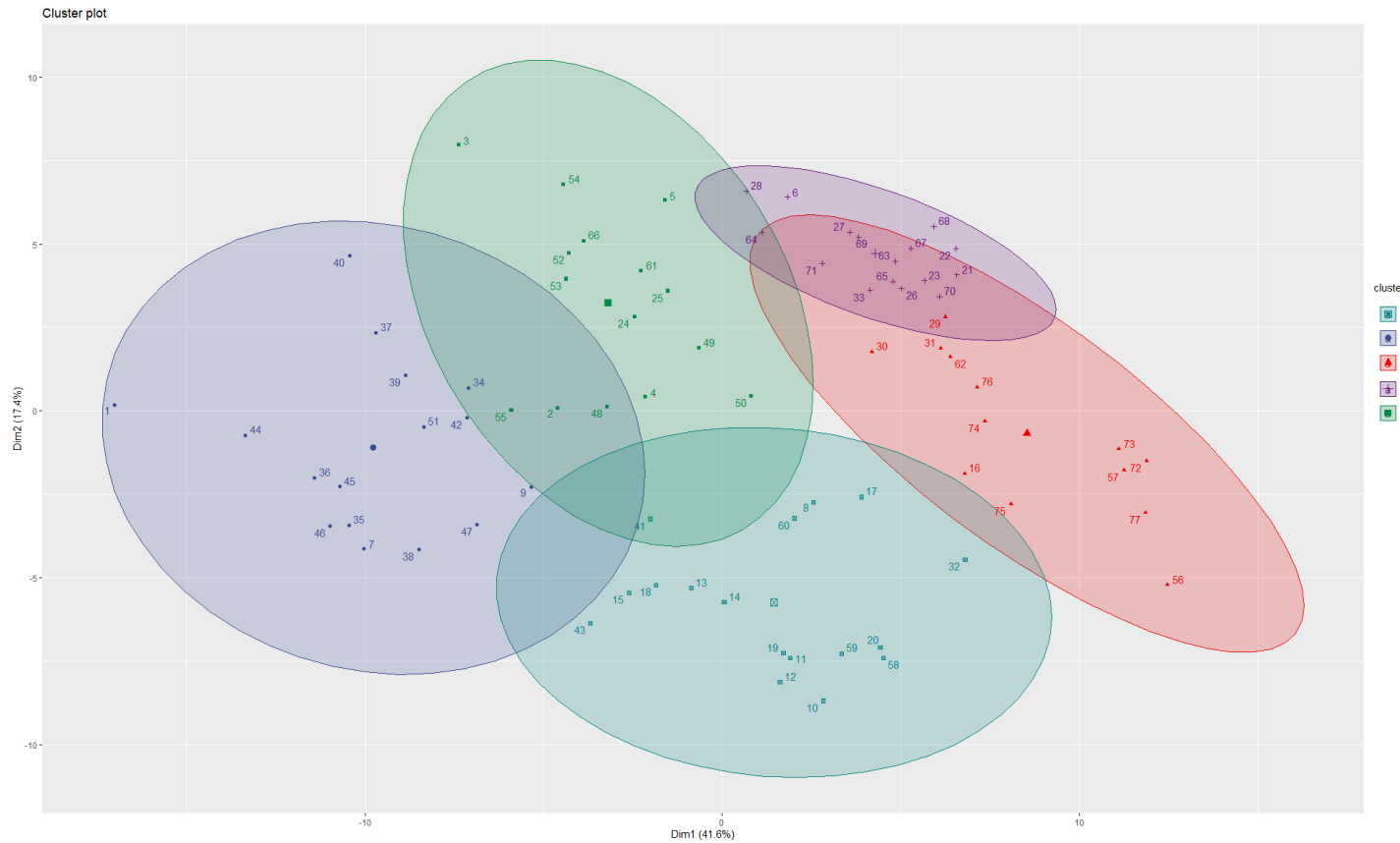
Table 3a: Core competencies of the labor force in the declining occupations that require a high school degree or less - Knowledge.

| Knowledge | Compared to general workers | Compared to workers with the same education level |
|-------------------------------|------------------------------------|----------------------------------------------------------|
| Administration and Management | No | No |
| Administrative | No | Yes |
| Economics and Accounting | No | No |
| Sales and Marketing | No | No |
| Customer and Personal Service | No | No |
| Personnel and Human Resources | No | No |
| Production and Processing | Yes | No |
| Food Production | No | No |
| Computers and Electronics | No | Yes |
| Engineering and Technology | No | No |
| Design | No | No |
| Building and Construction | No | No |
| Mechanical | No | No |
| Mathematics | No | Yes |
| Physics | No | No |
| Chemistry | No | No |
| Biology | No | No |
| Psychology | No | No |
| Sociology and Anthropology | No | No |
| Geography | No | No |
| Medicine and Dentistry | No | No |
| Therapy and Counseling | No | No |
| Education and Training | No | No |
| English Language | No | Yes |
| Foreign Language | No | No |
| Fine Arts | No | No |
| History and Archeology | No | No |
| Philosophy and Theology | No | No |
| Public Safety and Security | Yes | Yes |
| Law and Government | No | Yes |
| Telecommunications | No | No |
| Communications and Media | No | Yes |
| Transportation | No | Yes |

Table 3b: Core competencies of the labor force in the declining occupations that require a high school degree or less - Skills.

| Skills | Compared to general workers | Compared to workers with the education level |
|-----------------------------------|-----------------------------|----------------------------------------------|
| Reading Comprehension | No | Yes |
| Active Listening | No | Yes |
| Writing | No | Yes |
| Speaking | No | Yes |
| Science | No | No |
| Critical Thinking | No | Yes |
| Active Learning | No | Yes |
| Learning Strategies | No | Yes |
| Monitoring | No | Yes |
| Social Perceptiveness | No | Yes |
| Coordination | No | Yes |
| Persuasion | No | Yes |
| Negotiation | No | Yes |
| Instructing | No | Yes |
| Service Orientation | No | Yes |
| Complex Problem Solving | No | Yes |
| Operations Analysis | No | No |
| Technology Design | No | No |
| Equipment Selection | No | No |
| Installation | No | No |
| Programming | No | No |
| Operations Monitoring | Yes | No |
| Operation and Control | No | No |
| Equipment Maintenance | No | No |
| Troubleshooting | No | No |
| Repairing | No | No |
| Quality Control Analysis | No | No |
| Judgment and Decision Making | No | Yes |
| Systems Analysis | No | Yes |
| Systems Evaluation | No | No |
| Time Management | No | Yes |
| Management of Financial Resources | No | No |
| Management of Material Resources | No | No |
| Management of Personnel Resources | No | Yes |

Figure 1: OMEGA REGION CLUSTER PLOT



Cluster 1: Middle-paying white-collar jobs.

Cluster 2: Higher-paying white-collar and top-manager jobs.

Cluster 3: Middle-paying blue-collar jobs.

Cluster 4: Higher-paying blue-collar jobs.

Cluster 5: Engineers and Specialists.

Table 4a: OMEGA Region – COAL to PETROCHEMICAL Skillshed Table

| Title | CLUSTER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| | 1 | | | | | 2 | | | | | 3 | | | | | 4 | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | |
| | Wage | \$17.89 | \$30.67 | \$27.95 | \$22.92 | \$13.36 | \$31.65 | \$31.58 | \$40.72 | \$61.65 | \$45.10 | \$31.15 | \$58.23 | \$46.81 | \$39.45 | \$29.18 | \$60.39 | \$39.29 | \$59.70 | \$27.17 | \$41.35 | \$21.66 | \$15.17 | \$12.52 | \$14.43 | \$14.07 | \$15.27 | \$19.20 | \$22.48 | \$20.04 | \$25.66 | \$17.32 | \$20.46 | \$19.32 | \$17.15 | \$24.79 | \$28.26 | \$23.15 | \$40.78 | \$25.43 | \$31.91 | \$30.99 | \$38.77 | \$39.23 | \$26.58 |
| Bill and Account Collectors | \$16.95 | 0.9 | 13.7 | 11.0 | 6.0 | -3.6 | 14.7 | 14.6 | 23.8 | 44.7 | 26.2 | 14.2 | 41.3 | 29.9 | 22.5 | 12.2 | 43.4 | 22.3 | 42.8 | 10.2 | 24.4 | 4.7 | -1.8 | -4.4 | -2.5 | -2.9 | -1.7 | 2.3 | 5.5 | 3.1 | 8.7 | 0.4 | 3.5 | 2.4 | 0.2 | 7.8 | 11.3 | 6.2 | 23.8 | 8.5 | 15.0 | 14.0 | 21.8 | 22.3 | 9.6 |
| Bookkeeping, Accounting, and Auditing Clerks | \$18.75 | -0.9 | 11.9 | 9.2 | 4.2 | -5.4 | 12.9 | 12.8 | 22.0 | 42.9 | 24.4 | 12.4 | 39.5 | 28.1 | 20.7 | 10.4 | 41.6 | 20.5 | 41.0 | 8.4 | 22.6 | 2.9 | -3.6 | -6.2 | -4.3 | -4.7 | -3.5 | 0.4 | 3.7 | 1.3 | 6.9 | -1.4 | 1.7 | 0.6 | -1.6 | 6.0 | 9.5 | 4.4 | 22.0 | 6.7 | 13.2 | 12.2 | 20.0 | 20.5 | 7.8 |
| Customer Service Representatives | \$16.70 | 1.2 | 14.0 | 11.3 | 6.2 | -3.3 | 14.9 | 14.9 | 24.0 | 45.0 | 26.4 | 14.5 | 41.5 | 30.1 | 22.8 | 12.5 | 43.7 | 22.6 | 43.0 | 10.5 | 24.7 | 5.8 | 3.3 | 9.0 | 0.6 | 3.8 | 2.6 | 0.4 | 8.1 | 11.6 | 6.5 | 24.1 | 8.7 | 15.2 | 14.3 | 22.1 | 22.5 | 9.9 | | | | | | | |
| Executive Secretaries and Executive Human Resources Assistants, Except Payroll and Timekeeping | \$27.59 | -9.7 | 3.1 | 0.4 | -4.7 | -14.2 | 4.0 | 4.0 | 13.1 | 34.1 | 15.5 | 3.6 | 30.6 | 19.2 | 11.9 | 1.6 | 32.8 | 11.7 | 32.1 | -0.4 | 13.8 | -5.9 | -12.4 | -15.1 | -13.2 | -13.5 | -12.3 | -8.4 | -5.1 | -7.6 | -1.9 | -10.3 | -7.1 | -8.3 | -10.4 | -2.8 | 0.7 | -4.4 | 13.2 | -2.2 | 4.3 | 3.4 | 11.2 | 11.6 | -1.0 |
| Office Clerks, General | \$18.80 | -0.9 | 11.9 | 9.2 | 4.1 | -5.4 | 12.8 | 12.8 | 21.9 | 42.9 | 24.3 | 12.4 | 39.4 | 28.0 | 20.7 | 10.4 | 41.6 | 20.5 | 40.9 | 8.4 | 22.6 | 2.9 | -3.6 | -6.3 | -4.4 | -4.7 | -3.5 | 0.4 | 3.7 | 1.2 | 6.9 | -1.5 | 1.7 | 0.5 | -1.7 | 6.0 | 9.5 | 4.4 | 22.0 | 6.6 | 13.1 | 12.2 | 20.0 | 20.4 | 7.8 |
| Payroll and Timekeeping Clerks | \$16.49 | 1.4 | 14.2 | 11.5 | 6.4 | -3.1 | 15.1 | 15.1 | 24.2 | 45.2 | 26.6 | 14.7 | 41.7 | 30.3 | 23.0 | 12.7 | 43.9 | 22.8 | 43.2 | 10.7 | 24.9 | 5.2 | -1.3 | -4.0 | -2.1 | -2.4 | -1.2 | 2.7 | 6.0 | 3.6 | 9.2 | 0.8 | 4.0 | 2.8 | 0.7 | 8.3 | 11.8 | 6.7 | 24.3 | 8.9 | 15.4 | 14.5 | 22.3 | 22.7 | 10.1 |
| Procurement Clerks | \$20.36 | -2.5 | 10.3 | 7.6 | 2.6 | -7.0 | 11.3 | 11.2 | 20.4 | 41.3 | 22.7 | 10.8 | 37.9 | 26.5 | 19.1 | 8.8 | 40.0 | 18.9 | 39.3 | 6.8 | 21.0 | 1.3 | -5.2 | -7.8 | -5.9 | -6.3 | -5.1 | -1.2 | 2.1 | -0.3 | 5.3 | -3.0 | 0.1 | -1.0 | -3.2 | 4.4 | 7.9 | 2.8 | 20.4 | 5.1 | 11.6 | 10.6 | 18.4 | 18.9 | 6.2 |
| Secretaries and Administrative Assistants, Except Security Guards | \$17.42 | 0.5 | 13.3 | 10.5 | 5.5 | -4.1 | 14.2 | 14.2 | 23.3 | 44.2 | 25.7 | 13.7 | 40.8 | 29.4 | 22.0 | 11.8 | 43.0 | 21.9 | 42.3 | 9.8 | 23.9 | 4.2 | -2.3 | -4.9 | -3.0 | -3.4 | -2.2 | 1.8 | 5.1 | 2.6 | 8.2 | -0.1 | 3.0 | 1.9 | -0.3 | 7.4 | 10.8 | 5.7 | 23.4 | 8.0 | 14.5 | 13.6 | 21.4 | 21.8 | 9.2 |
| Architectural and Civil Drafters | \$13.75 | -4.1 | 16.9 | 14.2 | 9.2 | -0.4 | 17.9 | 17.8 | 27.0 | 47.9 | 29.4 | 17.4 | 44.5 | 33.1 | 25.7 | 15.4 | 46.6 | 25.5 | 46.0 | 13.4 | 27.6 | 7.9 | 1.4 | -1.2 | 0.7 | 0.3 | 1.5 | 5.5 | 8.7 | 6.3 | 11.9 | 3.6 | 6.7 | 5.6 | 3.4 | 11.0 | 14.5 | 9.4 | 27.0 | 11.7 | 18.2 | 17.2 | 25.0 | 25.5 | 12.8 |
| Chief Executives | \$26.40 | -8.5 | 4.3 | 1.6 | -3.5 | -13.0 | 5.2 | 5.2 | 14.3 | 35.3 | 16.7 | 4.8 | 31.8 | 20.4 | 15.1 | 2.8 | 34.0 | 12.9 | 33.3 | 0.8 | 15.0 | -4.7 | -11.2 | -13.9 | -12.0 | -12.3 | -11.1 | -7.2 | -3.9 | -6.4 | -0.7 | -9.1 | -5.9 | -7.1 | -9.3 | -1.6 | 1.9 | -3.3 | 14.4 | -1.0 | 5.5 | 4.6 | 12.4 | 12.8 | 0.2 |
| Computer Programmers | \$88.94 | -71.1 | -58.3 | -61.0 | -66.0 | -75.6 | -57.3 | -57.4 | -48.2 | -27.3 | -45.8 | -57.8 | -30.7 | -42.1 | -49.5 | -59.8 | -28.6 | -49.7 | -29.2 | -61.8 | -47.6 | -67.3 | -73.8 | -76.4 | -74.5 | -74.9 | -73.7 | -69.7 | -66.5 | -68.9 | -63.3 | -71.6 | -68.5 | -69.6 | -71.8 | -64.2 | -60.7 | -65.8 | -48.2 | -63.5 | -57.0 | -58.0 | -50.2 | -49.7 | -62.4 |
| First-Line Supervisors of Office and Administrative Support Workers | \$37.02 | -19.1 | -6.4 | -9.1 | -14.1 | -23.7 | -5.4 | -5.4 | 3.7 | 24.6 | 6.1 | -5.9 | 21.2 | 9.8 | 2.4 | -7.8 | 23.4 | 2.3 | 22.7 | -9.9 | 4.3 | -15.4 | -21.9 | -24.5 | -22.6 | -23.0 | -21.8 | -17.8 | -14.5 | -17.0 | -11.4 | -19.7 | -16.6 | -17.7 | -19.9 | -12.2 | -8.8 | -13.9 | 3.8 | -11.6 | -5.1 | -6.0 | 1.8 | 2.2 | -10.4 |
| Lawyers | \$27.82 | -9.9 | 2.9 | 0.1 | -4.9 | -14.5 | 3.8 | 3.8 | 12.9 | 33.8 | 15.3 | 3.3 | 30.4 | 19.0 | 11.6 | 1.4 | 32.6 | 11.5 | 31.9 | -0.6 | 13.5 | -6.2 | -12.7 | -15.3 | -13.4 | -13.8 | -12.6 | -8.6 | -5.3 | -7.8 | -2.2 | -10.5 | -7.4 | -8.5 | -10.7 | -3.0 | 0.4 | -4.7 | 13.0 | -2.4 | 4.1 | 3.2 | 11.0 | 11.4 | -1.2 |
| Meter Readers, Utilities | \$49.02 | -31.1 | -18.4 | -21.1 | -26.1 | -35.7 | -17.4 | -17.4 | -8.3 | 12.6 | -5.9 | -17.9 | 9.2 | -2.2 | -9.6 | -19.8 | 11.4 | -9.7 | 10.7 | -21.9 | -7.7 | -27.4 | -33.9 | -36.5 | -34.6 | -35.0 | -33.8 | -29.8 | -26.5 | -29.0 | -23.4 | -31.7 | -28.6 | -29.7 | -31.9 | -24.2 | -20.8 | -25.9 | -8.2 | -23.6 | -17.1 | -18.0 | -10.3 | -9.8 | -22.4 |
| Shipping, Receiving, and Inventory | \$19.52 | -1.6 | 11.2 | 8.4 | 3.4 | -6.2 | 12.1 | 12.1 | 21.2 | 42.1 | 23.6 | 11.6 | 38.7 | 27.3 | 19.9 | 9.7 | 40.9 | 19.8 | 40.2 | 7.7 | 21.8 | 2.1 | -4.4 | -7.0 | -5.1 | -5.5 | -4.3 | -0.3 | 3.0 | 0.5 | 6.1 | -2.2 | 0.9 | -0.2 | -2.4 | 5.3 | 8.7 | 3.6 | 21.3 | 5.9 | 12.4 | 11.5 | 19.3 | 19.7 | 7.1 |
| Stockers and Order Fillers | \$16.27 | 1.6 | 14.4 | 11.7 | 6.7 | -2.9 | 15.4 | 15.3 | 24.5 | 45.4 | 26.8 | 14.9 | 42.0 | 30.5 | 23.2 | 12.9 | 44.1 | 23.0 | 43.4 | 10.9 | 25.1 | 5.4 | -1.1 | -3.8 | -1.8 | -2.2 | -1.0 | 2.9 | 6.2 | 3.8 | 9.4 | 1.1 | 4.2 | 3.1 | 0.9 | 8.5 | 12.0 | 6.9 | 24.5 | 9.2 | 15.6 | 14.7 | 22.5 | 23.0 | 10.3 |
| Automotive Service Technicians and Mechanics | \$12.57 | 5.3 | 18.1 | 15.4 | 10.4 | 0.8 | 19.1 | 19.0 | 28.2 | 49.1 | 30.5 | 18.6 | 45.7 | 34.2 | 26.9 | 16.6 | 47.8 | 26.7 | 47.1 | 14.6 | 28.8 | 9.1 | 2.6 | -0.1 | 1.9 | 1.5 | 2.7 | 6.6 | 9.9 | 7.5 | 13.1 | 4.8 | 7.9 | 6.8 | 4.6 | 12.2 | 15.7 | 10.6 | 28.2 | 12.9 | 19.3 | 18.4 | 26.2 | 26.7 | 14.0 |
| Continuous Mining Machine Operators | \$18.52 | -0.6 | 12.2 | 9.4 | 4.4 | -5.2 | 13.1 | 13.1 | 22.2 | 43.1 | 24.6 | 12.6 | 39.7 | 28.3 | 20.9 | 10.7 | 41.9 | 20.8 | 41.2 | 8.7 | 22.8 | 3.1 | -3.4 | -6.0 | -4.1 | -4.5 | -3.3 | 0.7 | 4.0 | 1.5 | 7.1 | -1.2 | 1.9 | 0.8 | -1.4 | 6.3 | 9.7 | 4.6 | 22.3 | 6.9 | 13.4 | 12.5 | 20.3 | 20.7 | 8.1 |
| Conveyor Operators and Tenders | \$26.68 | -8.8 | 4.0 | 1.3 | -3.8 | -13.3 | 5.0 | 4.9 | 14.0 | 35.0 | 16.4 | 4.5 | 31.6 | 20.1 | 12.8 | 2.5 | 33.7 | 12.6 | 33.0 | 0.5 | 14.7 | -5.0 | -11.5 | -14.2 | -12.3 | -12.6 | -11.4 | -7.5 | -4.2 | -6.6 | -1.0 | -9.4 | -6.2 | -7.4 | -9.5 | -1.9 | 1.6 | -3.5 | 14.1 | -1.3 | 5.2 | 4.3 | 12.1 | 12.6 | -0.1 |
| Crushing, Grinding, and Polishing Machine Operators, and Tenders | \$19.60 | -1.7 | 11.1 | 8.4 | 3.3 | -6.2 | 12.0 | 12.0 | 21.1 | 42.1 | 23.5 | 11.6 | 38.6 | 27.2 | 19.9 | 9.6 | 40.8 | 19.7 | 40.1 | 7.6 | 21.8 | 2.1 | -4.4 | -7.1 | -5.2 | -5.5 | -4.3 | -0.4 | 2.9 | 0.4 | 6.1 | -2.3 | 0.9 | -0.3 | -2.5 | 5.2 | 8.7 | 3.6 | 21.2 | 5.8 | 12.3 | 11.4 | 19.2 | 19.6 | 7.0 |
| Inspectors, Testers, Sorters, Samplers, and Weighers | \$19.11 | -1.2 | 11.6 | 8.8 | 3.8 | -5.8 | 12.5 | 12.5 | 21.6 | 42.5 | 24.0 | 12.0 | 39.1 | 27.7 | 20.3 | 10.1 | 41.3 | 20.2 | 40.6 | 8.1 | 22.2 | 2.6 | -3.9 | -6.6 | -4.7 | -5.0 | -3.8 | 0.1 | 3.4 | 0.9 | 6.6 | -1.8 | 1.4 | 0.2 | -2.0 | 5.7 | 9.2 | 4.0 | 21.7 | 6.3 | 12.8 | 11.9 | 19.7 | 20.1 | 7.5 |
| Plant Operators | \$18.97 | -1.1 | 11.7 | 9.0 | 4.0 | -5.6 | 12.7 | 12.6 | 21.8 | 42.7 | 24.1 | 12.2 | 39.3 | 27.8 | 20.5 | 10.4 | 41.4 | 20.3 | 40.7 | 8.2 | 22.4 | 2.7 | -3.8 | -6.5 | -4.5 | -4.9 | -3.7 | 0.2 | 3.5 | 1.1 | 6.7 | -1.7 | 1.5 | 0.4 | -1.8 | 5.8 | 9.3 | 4.2 | 21.8 | 6.5 | 12.9 | 12.0 | 19.8 | 20.3 | 7.6 |
| Roof Bolters, Mining | \$39.96 | -21.6 | -8.8 | -11.6 | -16.6 | -26.1 | -7.9 | -7.9 | 1.2 | 22.2 | 3.6 | -8.4 | 18.7 | 7.3 | 0.0 | -10.3 | 20.9 | -0.2 | 20.2 | -12.3 | 1.9 | -17.8 | -24.3 | -27.0 | -25.1 | -25.4 | -24.2 | -20.3 | -17.0 | -19.5 | -13.8 | -22.2 | -19.0 | -20.2 | -22.4 | -14.7 | -11.2 | -16.4 | 1.3 | -14.1 | -7.6 | -8.5 | -0.7 | -0.3 | -12.9 |
| Stationary Engineers and Boiler Operators | \$28.95 | -11.1 | 1.7 | -1.0 | -6.0 | -15.6 | 2.7 | 2.6 | 11.8 | 32.7 | 14.2 | 2.2 | 29.3 | 17.9 | 10.5 | 0.2 | 31.4 | 10.3 | 30.8 | -1.8 | 12.4 | -7.3 | -13.8 | -16.4 | -14.5 | -14.9 | -13.7 | -9.8 | -6.5 | -8.9 | -3.3 | -11.6 | -8.5 | -9.6 | -11.8 | -4.2 | -0.7 | -5.8 | 11.8 | -3.5 | 3.0 | 2.0 | 9.8 | 10.3 | -2.4 |
| Tank Car, Truck, and Ship Loaders | \$27.92 | -10.0 | 2.8 | 0.0 | -5.0 | -14.6 | 3.7 | 3.7 | 12.8 | 33.7 | 15.2 | 3.2 | 30.3 | 18.9 | 11.5 | 1.3 | 32.5 | 11.4 | 31.8 | -0.8 | 13.4 | -6.3 | -12.8 | -15.4 | -13.5 | -13.9 | -12.7 | -8.7 | -5.4 | -7.9 | -2.3 | -10.6 | -7.5 | -8.6 | -10.8 | -3.1 | 0.3 | -4.8 | 12.9 | -2.5 | 4.0 | 3.1 | 10.9 | 11.3 | -1.3 |
| Electrical and Electronic Engineering Technologists and Technicians | \$18.05 | -0.2 | 12.6 | 9.9 | 4.9 | -4.7 | 13.6 | 13.5 | 22.7 | 43.6 | 25.1 | 13.1 | 40.2 | 28.8 | 21.4 | 11.1 | 42.3 | 21.2 | 41.7 | 9.1 | 23.3 | 3.6 | -2.9 | -5.5 | -3.6 | -4.0 | -2.8 | 1.2 | 4.4 | 2.0 | 7.6 | -0.7 | 2.4 | 1.3 | -0.9 | 6.7 | 10.2 | 5.1 | 22.7 | 7.4 | 13.9 | 12.9 | 20.7 | 21.2 | 8.5 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 4b: OMEGA Region – COAL to PETROCHEMICAL Skillshed Table with positive net wage transitions

| Title | CLUSTER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------------------------------------------------------|-----------------------------|----------------------------------------------|----------------------------------|-------------------------------------|------------------------------------------------------------|------------------------|--------------------------------|--------------------|---------------------------------------------------|-----------------|----------------------------------|------------------|----------------------|---------------------------------------------------------------------|---------|--------------------------|------------------------------------|----------------------------|----------------------------------------------|-------------------------------------|--------------------------------|---------------------------------------------------|------------------------------------------------------|-----------------------|----------------------|-------------------------------------------|-----------------------------------|---------------------------------------------------------------------|------------------------------------------------------------|-------------------|---------------------|------------------------------------|-----------------------------------------------------------|----------------------------|----------------------|----------------------|----------------------------------------------------------------------|--------------|----------------------|-----------------------------------|--------------------------------------|----------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------|------------|----------------------------------------|--------------------------------|-----------------------|----------------------------------------|------------------------------------------|---------------------|-------------------------------------|--------------------------------------------------------|---------------------------------------------------------------|-----------------------------|-----------------------------------------|----------------------------------------------------|--------------------------------------|----------------|------------------------------|--------------------|----------------------------------------|---------------------|---------------------------------|--------------------|-----------------|-----------------------|-------------------------------------------|--------------------------|-------------------|-----------------------------------|---------------------------------------------|-----------------------------|---------------------|
| | 1 | | | | | | | | | | 2 | | | | | | | | | | 3 | | | | | | | | | | 4 | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Bill and Account Collectors | Bookkeeping, Accounting, and Auditing Clerks | Customer Service Representatives | Executive Secretaries and Executive | Human Resources Assistants, Except Payroll and Timekeeping | Office Clerks, General | Payroll and Timekeeping Clerks | Procurement Clerks | Secretaries and Administrative Assistants, Except | Security Guards | Architectural and Civil Drafters | Chief Executives | Computer Programmers | First-Line Supervisors of Office and Administrative Support Workers | Lawyers | Meter Readers, Utilities | Shipping, Receiving, and Inventory | Stockers and Order Fillers | Automotive Service Technicians and Mechanics | Continuous Mining Machine Operators | Conveyor Operators and Tenders | Crushing, Grinding, and Polishing Machine Setters | Inspectors, Testers, Sorters, Samplers, and Weighers | Power Plant Operators | Roof Bolters, Mining | Stationary Engineers and Boiler Operators | Tank Car, Truck, and Ship Loaders | Electrical and Electronic Engineering Technologists and Technicians | First-Line Supervisors of Production and Operating Workers | Nuclear Engineers | Nuclear Technicians | Power Distributors and Dispatchers | Water and Wastewater Treatment Plant and System Operators | Pharmaceutical Preparators | Mechanical Engineers | Industrial Engineers | First-Line Supervisors of Construction Trades and Extraction Workers | Electricians | Electrical Engineers | Computer User Support Specialists | Computer Network Support Specialists | Operating Engineers and Other Construction Equipment Operators | Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic | Maintenance and Repair Workers, General | Machinists | Industrial Truck and Tractor Operators | Industrial Machinery Mechanics | Construction Laborers | Brick and Block Masons and Bricklayers | Welders, Cutters, Solderers, and Brazers | Light Truck Drivers | Landscaping and Groundskeeping Work | Laborers and Freight, Stock, and Material Movers, Hand | Janitors and Cleaners, Except Maids and Housekeeping Cleaners | Holers - Production Workers | Heavy and Tractor-Trailer Truck Drivers | Transportation, Storage, and Distribution Managers | Training and Development Specialists | Sales Managers | Operations Research Analysts | Marketing Managers | Market Research Analysts and Marketing | Management Analysts | General and Operations Managers | Financial Managers | Cost Estimators | Construction Managers | Computer and Information Systems Managers | Accountants and Auditors | Registered Nurses | Respiratory and Information Clerk | Production, Planning, and Expediting Clerks | Human Resources Specialists | Compliance Officers |
| Wage | \$17.80 | \$30.67 | \$27.95 | \$22.92 | \$13.36 | \$31.63 | \$31.58 | \$40.72 | \$61.65 | \$43.10 | \$31.15 | \$58.23 | \$46.81 | \$39.45 | \$29.18 | \$60.39 | \$39.29 | \$59.70 | \$27.17 | \$41.33 | \$21.66 | \$15.17 | \$12.52 | \$14.43 | \$14.07 | \$15.27 | \$19.20 | \$22.48 | \$20.04 | \$25.66 | \$17.37 | \$20.46 | \$19.32 | \$17.15 | \$24.79 | \$28.26 | \$23.15 | \$40.78 | \$25.43 | \$31.91 | \$30.99 | \$38.77 | \$39.23 | \$36.58 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bill and Account Collectors | \$16.95 | 0.9 | 13.7 | 11.0 | 6.0 | -3.4 | 14.7 | 14.6 | 23.8 | 44.7 | 26.2 | 14.2 | 41.3 | 29.9 | 22.5 | 12.2 | 43.4 | 22.3 | 42.8 | 10.2 | 24.4 | 4.7 | -1.8 | -4.4 | -2.5 | -2.9 | -1.7 | 2.3 | 5.5 | 3.1 | 8.7 | 0.4 | 3.5 | 2.4 | 0.2 | 7.8 | 11.3 | 6.2 | 23.8 | 8.5 | 15.0 | 14.0 | 21.8 | 22.3 | 9.4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bookkeeping, Accounting, and Auditing Clerks | \$18.75 | -0.9 | 11.9 | 9.2 | 4.2 | -5.4 | 12.9 | 12.8 | 22.0 | 42.9 | 24.4 | 12.4 | 39.5 | 30.1 | 20.7 | 10.4 | 41.6 | 20.5 | 41.0 | 8.4 | 22.6 | 2.9 | -3.6 | -6.2 | -4.3 | -4.7 | -3.5 | 0.4 | 3.7 | 1.3 | 6.9 | -1.4 | 1.7 | 0.6 | -1.8 | 6.0 | 9.5 | 4.4 | 22.0 | 6.7 | 13.2 | 12.2 | 20.0 | 20.5 | 7.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Customer Service Representatives | \$16.70 | 1.2 | 14.0 | 11.3 | 6.2 | -3.3 | 14.9 | 14.9 | 24.0 | 45.0 | 26.4 | 14.5 | 41.5 | 30.1 | 22.8 | 12.5 | 43.7 | 22.6 | 43.0 | 10.5 | 24.7 | 5.0 | -1.5 | -4.2 | -2.3 | -2.6 | -1.4 | 2.5 | 5.8 | 3.3 | 9.0 | 0.6 | 3.8 | 2.6 | 0.4 | 8.1 | 11.6 | 6.5 | 24.1 | 8.7 | 15.2 | 14.3 | 22.1 | 22.5 | 9.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Executive Secretaries and Executive | \$27.59 | -9.7 | 3.1 | 0.4 | -4.7 | -14.2 | 4.0 | 4.0 | 13.1 | 34.1 | 15.5 | 3.6 | 30.6 | 19.2 | 11.9 | 1.6 | 32.8 | 11.7 | 32.1 | -0.4 | 13.8 | -5.9 | -12.4 | -15.1 | -13.2 | -13.3 | -12.3 | -8.4 | -5.1 | -7.6 | -1.9 | -10.3 | -7.1 | -8.3 | -10.4 | -2.8 | 0.7 | 4.4 | 13.2 | -2.2 | 4.3 | 3.4 | 11.2 | 11.6 | -1.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Human Resources Assistants, Except Payroll and Timekeeping | \$18.80 | -0.9 | 11.9 | 9.2 | 4.1 | -5.4 | 12.8 | 12.8 | 21.9 | 42.9 | 24.3 | 12.4 | 39.4 | 30.0 | 20.7 | 10.4 | 41.6 | 20.5 | 40.9 | 8.4 | 22.6 | 2.9 | -3.6 | -6.3 | -4.4 | -4.7 | -3.5 | 0.4 | 3.7 | 1.2 | 6.9 | -1.5 | 1.7 | 0.5 | -1.7 | 6.0 | 9.5 | 4.4 | 22.0 | 6.6 | 13.1 | 12.2 | 20.0 | 20.4 | 7.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Office Clerks, General | \$16.49 | 1.4 | 14.2 | 11.5 | 6.4 | -3.1 | 15.1 | 15.1 | 24.2 | 45.2 | 26.6 | 14.7 | 41.7 | 30.3 | 23.0 | 12.7 | 43.9 | 22.8 | 43.2 | 10.7 | 24.9 | 5.2 | -1.3 | -4.0 | -2.1 | -2.4 | -1.2 | 2.7 | 6.0 | 3.6 | 9.2 | 0.8 | 4.0 | 2.8 | 0.7 | 8.3 | 11.8 | 6.7 | 24.3 | 8.9 | 15.4 | 14.5 | 22.3 | 22.7 | 10.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Payroll and Timekeeping Clerks | \$21.38 | -3.5 | 9.3 | 6.6 | 1.5 | -8.0 | 10.3 | 10.2 | 19.3 | 40.3 | 21.7 | 9.8 | 36.9 | 25.4 | 18.1 | 7.8 | 39.0 | 17.9 | 38.3 | 5.8 | 20.0 | 0.3 | -6.2 | -8.9 | -7.0 | -7.3 | -6.1 | -2.2 | 1.1 | -1.3 | 4.3 | -4.1 | -0.9 | -2.1 | -4.2 | 3.4 | 6.9 | 1.8 | 19.4 | 4.1 | 10.5 | 9.6 | 17.4 | 17.9 | 5.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Procurement Clerks | \$20.36 | -2.5 | 10.3 | 7.6 | 2.6 | -7.0 | 11.3 | 11.2 | 20.4 | 41.3 | 22.7 | 10.8 | 37.9 | 26.5 | 19.1 | 8.8 | 40.0 | 18.9 | 39.3 | 6.8 | 21.0 | 1.3 | -5.2 | -7.8 | -5.9 | -6.3 | -5.1 | -1.2 | 2.1 | -0.3 | 5.3 | -3.0 | 0.1 | -1.0 | -3.7 | 4.4 | 7.9 | 2.8 | 20.4 | 5.1 | 11.6 | 10.6 | 18.4 | 18.9 | 6.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Secretaries and Administrative Assistants, Except | \$17.42 | 0.5 | 13.3 | 10.5 | 5.5 | -4.1 | 14.2 | 14.2 | 23.3 | 44.2 | 25.7 | 13.7 | 40.8 | 29.4 | 22.0 | 11.8 | 43.0 | 21.9 | 42.3 | 9.8 | 23.9 | 4.2 | -2.3 | -4.9 | -3.0 | -3.4 | -2.2 | 1.8 | 5.1 | 2.6 | 8.2 | -0.1 | 3.0 | 1.9 | -0.8 | 7.4 | 10.8 | 5.7 | 23.4 | 8.0 | 14.5 | 13.6 | 21.4 | 21.8 | 9.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Security Guards | \$13.75 | 4.1 | 16.9 | 14.2 | 9.2 | -0.4 | 17.9 | 17.8 | 27.0 | 47.9 | 29.4 | 17.4 | 44.5 | 33.1 | 25.7 | 15.4 | 46.6 | 25.5 | 46.0 | 13.4 | 27.6 | 7.9 | 1.4 | -1.2 | 0.7 | 0.3 | 1.5 | 5.5 | 8.7 | 6.3 | 11.9 | 3.6 | 6.7 | 5.6 | 3.4 | 11.0 | 14.5 | 9.4 | 27.0 | 11.7 | 18.2 | 17.2 | 25.0 | 25.5 | 12.8 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Architectural and Civil Drafters | \$26.40 | -8.5 | 4.3 | 1.6 | -3.3 | -13.0 | 5.2 | 5.2 | 14.3 | 35.3 | 16.7 | 4.8 | 31.8 | 20.4 | 13.1 | 2.8 | 34.0 | 12.9 | 33.3 | 0.8 | 15.0 | -4.7 | -11.2 | -13.9 | -12.0 | -12.3 | -11.1 | -7.2 | -3.9 | -6.4 | -0.7 | -6.1 | -5.9 | -7.1 | -9.3 | -1.6 | 1.9 | 3.3 | 14.4 | -1.6 | 5.5 | 4.6 | 12.4 | 12.8 | 0.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chief Executives | \$88.94 | -71.1 | -88.3 | -61.0 | -66.0 | -75.6 | -57.3 | -57.4 | -82.2 | -27.3 | -45.8 | -57.8 | -30.7 | -42.1 | -49.5 | -59.8 | -28.6 | -49.7 | -29.2 | -61.8 | -47.6 | -67.3 | -73.8 | -76.4 | -74.5 | -74.9 | -73.7 | -69.7 | -66.5 | -68.8 | -63.3 | -71.6 | -68.5 | -69.6 | -71.8 | -64.2 | -60.7 | -65.3 | -48.2 | -63.5 | -57.0 | -58.0 | -50.2 | -61.7 | -62.4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Computer Programmers | \$37.02 | -19.1 | -6.4 | -9.1 | -14.1 | -23.7 | -5.4 | -5.4 | 3.7 | 24.6 | 6.1 | -5.9 | 21.2 | 9.8 | 2.4 | -7.8 | 23.4 | 2.3 | 22.7 | -9.9 | 4.3 | -15.4 | -21.9 | -24.5 | -22.6 | -23.0 | -21.8 | -17.8 | -14.5 | -17.0 | -11.4 | -19.7 | -16.6 | -17.7 | -19.9 | -12.2 | -8.8 | -13.9 | 3.8 | -11.6 | -5.1 | -6.0 | 1.8 | 2.2 | -10.4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| First-Line Supervisors of Office and Administrative Support Workers | \$27.82 | -9.9 | 2.9 | 0.1 | -4.9 | -14.5 | 3.8 | 3.8 | 12.9 | 33.8 | 15.3 | 3.3 | 30.4 | 19.0 | 11.6 | 1.4 | 32.6 | 11.5 | 31.9 | -0.6 | 13.5 | -6.2 | -12.7 | -15.3 | -13.4 | -13.8 | -12.6 | -8.6 | -5.3 | -7.8 | -2.2 | -10.5 | -7.4 | -8.5 | -10.7 | -3.0 | 0.4 | -4.7 | 13.0 | -2.4 | 4.1 | 3.2 | 11.0 | 11.4 | -1.2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lawyers | \$49.02 | -31.1 | -18.4 | -21.1 | -26.1 | -35.7 | -17.4 | -17.4 | -8.3 | 12.6 | -5.9 | -17.9 | 9.2 | -2.2 | -9.6 | -19.8 | 11.4 | -9.7 | 10.7 | -21.9 | -7.7 | -27.4 | -33.9 | -36.5 | -34.6 | -35.0 | -33.8 | -29.8 | -26.5 | -29.0 | -23.4 | -31.7 | -28.6 | -29.7 | -31.9 | -24.2 | -20.8 | -25.9 | -8.2 | -23.6 | -17.1 | -18.0 | -10.3 | -9.8 | -22.4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Meter Readers, Utilities | \$19.52 | -1.6 | 11.2 | 8.4 | 3.4 | -6.2 | 12.1 | 12.1 | 21.2 | 42.1 | 23.6 | 11.6 | 38.7 | 27.3 | 19.9 | 9.7 | 40.9 | 19.8 | 40.2 | 7.7 | 21.8 | 2.1 | -4.4 | -7.0 | -5.1 | -5.5 | -4.3 | -0.3 | 3.0 | 0.5 | 6.1 | -2.2 | 0.9 | -0.2 | -2.4 | 5.3 | 8.7 | 3.6 | 21.3 | 5.9 | 12.4 | 11.5 | 19.3 | 19.7 | 7.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Shipping, Receiving, and Inventory | \$16.27 | 1.6 | 14.4 | 11.7 | 6.7 | -2.9 | 15.4 | 15.3 | 24.5 | 45.4 | 26.8 | 14.9 | 42.0 | 30.5 | 23.2 | 12.9 | 44.1 | 23.0 | 43.4 | 10.9 | 25.1 | 5.4 | -1.1 | -3.8 | -1.8 | -2.2 | -1.0 | 2.9 | 6.2 | 3.8 | 9.4 | 1.1 | 4.2 | 3.1 | 0.9 | 8.5 | 12.0 | 6.9 | 24.5 | 9.2 | 15.6 | 14.7 | 22.5 | 23.0 | 10.3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Stockers and Order Fillers | \$12.57 | 5.3 | 18.1 | 15.4 | 10.4 | 0.8 | 19.1 | 19.0 | 28.2 | 49.1 | 30.5 | 18.6 | 45.7 | 34.2 | 26.9 | 16.6 | 47.8 | 26.7 | 47.1 | 14.6 | 28.8 | 9.1 | 2.6 | -0.1 | 1.9 | 1.5 | 2.7 | 6.6 | 9.9 | 7.5 | 13.1 | 4.8 | 7.9 | 6.8 | 4.6 | 12.2 | 15.7 | 10.6 | 28.2 | 12.9 | 19.3 | 18.4 | 26.2 | 26.7 | 14.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Automotive Service Technicians and Mechanics | \$18.52 | -0.6 | 12.2 | 9.4 | 4.4 | -3.2 | 13.1 | 13.1 | 22.2 | 43.1 | 24.6 | 12.6 | 39.7 | 28.3 | 20.9 | 10.7 | 41.9 | 20.8 | 41.2 | 8.7 | 22.8 | 3.1 | -3.4 | -6.0 | -4.1 | -4.5 | -3.3 | 0.7 | 4.0 | 1.5 | 7.1 | -3.2 | 1.9 | 0.8 | -1.4 | 6.3 | 9.7 | 4.6 | 22.3 | 6.9 | 13.4 | 12.5 | 20.3 | 20.7 | 8.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Continuous Mining Machine Operators | \$26.68 | -8.8 | 4.0 | 1.3 | -3.8 | -13.3 | 5.0 | 4.9 | 14.0 | 35.0 | 16.4 | 4.5 | 31.6 | 20.1 | 12.8 | 2.5 | 33.7 | 12.6 | 33.0 | 0.5 | 14.7 | -3.0 | -11.5 | -14.2 | -12.3 | -12.6 | -11.4 | -7.5 | -4.2 | -6.6 | -1.6 | -9.4 | -6.2 | -7.4 | -9.1 | -1.9 | 1.6 | 3.8 | 14.1 | -1.3 | 5.2 | 4.3 | 12.1 | 12.6 | -0.3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Conveyor Operators and Tenders | \$19.60 | -1.7 | 11.1 | 8.4 | 3.3 | -6.2 | 12.0 | 12.0 | 21.1 | 42.1 | 23.5 | 11.6 | 38.6 | 27.2 | 19.9 | 9.6 | 40.8 | 19.7 | 40.1 | 7.6 | 21.8 | 2.1 | -4.4 | -7.1 | -5.2 | -5.5 | -4.3 | -0.4 | 2.9 | 0.4 | 6.1 | -2.3 | 0.9 | -0.3 | -2.5 | 5.2 | 8.7 | 3.6 | 21.2 | 5.8 | 12.3 | 11.4 | 19.2 | 19.6 | 7.0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Crushing, Grinding, and Polishing Machine Setters | \$19.11 | -1.2 | 11.6 | 8.8 | 3.8 | -5.8 | 12.5 | 12.5 | 21.6 | 42.5 | 24.0 | 12.0 | 39.1 | 27.7 | 20.3 | 10.1 | 41.3 | 20.2 | 40.6 | 8.1 | 22.2 | 2.6 | -3.9 | -6.6 | -4.7 | -5.0 | -3.8 | 0.1 | 3.4 | 0.9 | 6.6 | -1.8 | 1.4 | 0.2 | -2.0 | 5.7 | 9.2 | 4.0 | 21.7 | 6.3 | 12.8 | 11.9 | 19.7 | 20.1 | 7.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Inspectors, Testers, Sorters, Samplers, and Weighers | \$18.97 | -1.1 | 11.7 | 9.0 | 4.0 | -5.6 | 12.7 | 12.6 | 21.8 | 42.7 | 24.1 | 12.2 | 39.3 | 27.8 | 20.5 | 10.2 | 41.4 | 20.3 | 40.7 | 8.2 | 22.4 | 2.7 | -3.8 | -6.3 | -4.3 | -4.9 | -3.7 | 0.2 | 3.5 | 1.1 | 6.7 | -1.7 | 1.5 | 0.4 | -1.8 | 5.8 | 9.3 | 4.2 | 21.8 | 6.5 | 12.9 | 12.0 | 19.8 | 20.3 | 7.6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Power Plant Operators | \$39.50 | -2.6 | -8.8 | -11.4 | -16.6 | -26.1 | -7.9 | -7.9 | 1.2 | 22.2 | 3.6 | -8.4 | 18.7 | 7.3 | 0.0 | -10.3 | 20.9 | -0.2 | 20.2 | 12.3 | 1.9 | -17.8 | -24.3 | -27.0 | -25.1 | -25.4 | -24.2 | -20.3 | -17.0 | -19.3 | -13.8 | -22.2 | -19.0 | -20.2 | -22.4 | -14.7 | -11.2 | -16.4 | 1.3 | -14.1 | -7.6 | -8.5 | -0.7 | -0.3 | 12.9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 4a shows the transitions from declining occupations in the coal mining cluster to growing occupations in the petrochemical manufacturing industry. The number in each cell represents the net income change when transitioning from declining occupations to growing occupations. The cells' color represents how easy or difficult the transitions are. The greener the color, the easier the transition; the redder the color, the more difficult the transition. In Table 4b, we eliminate any job transitions that result in a decline in workers' income.

Transitions within the same cluster are usually easier than out-of-cluster transitions. However, there are possible out-of-cluster transitions. For example, transitions between clusters 3 and 4 or between clusters 1 and 2 are possible with some necessary training.

In the following section, we determine possible within-cluster transitions and out-of-cluster transitions for each declining occupation in the OMEGA region and identify the necessary training for each transition.

Feasible job transitions out of declining occupations.

This section illustrates the ability of an employee to transfer from a job in a declining economic sector to a demanding job. We will highlight what jobs are at risk and give recommendations on potential occupations employees working in these fields can transfer into. The data is divided into clusters. Jobs in a specific cluster are similar to one another regarding task performance and knowledge and skill requirements. Our recommendations for job transfers include options within the declining jobs cluster and outside of its cluster. Along with our recommendations, the main goal of our report is to highlight what skills training is needed for these transitions. The declining occupations in this report are those that do not require a college degree.

For each declining occupation, we provide two tables. The first table represents the within-cluster occupation transitions we recommend for the given declining job. The second table represents the out-of-cluster occupation transitions we recommend for the given declining job. Within each of these tables, we share the skills training required for a transition from the declining occupation to the emerging occupation. The page index for each declining occupation's recommended transitions is as follows:

| Declining occupation | Page |
|------------------------------------------------------|-------------|
| Bill and Account Collectors | 35 |
| Continuous Mining and Machine Operators | 36 |
| Conveyor Operators and Tenders | 38 |
| Crushing, Grinding, and Polishing | 39 |
| Customer Service Representative | 40 |
| Inspectors, Testers, Sorters, Samplers, and Weighers | 41 |
| Meter Readers, Utilities | 43 |
| Office Clerks, General | 44 |
| Powerplant Operators | 45 |
| Procurement Clerks | 46 |
| Roof Bolters, Mining | 48 |
| Secretaries and Administrative Assistants | 49 |
| Stockers and Order Fillers | 50 |
| Tank Car, Truck, and Ship Loaders | 51 |

Bill and Account Collectors

| Within Cluster Transition | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Billing and posting clerk | Compliance Officer | Human Resource Specialist |
| <ul style="list-style-type: none"> • Administrative • Biology, • Psychology • Medicine and Dentistry • Public Safety • Security • Transportation | <ul style="list-style-type: none"> • Biology • Psychology • Sociology and anthropology • Medicine and dentistry • Therapy and counseling • Education and training • Philosophy and theology • Public safety and security • Law and government • Operations monitoring • Operation and control • Quality control analysis | <ul style="list-style-type: none"> • Administrative • Personnel and human resources • Psychology • Therapy and counseling • Education and training • Philosophy and theology • Public safety and security • Learning strategies |

| Out of Cluster Transition | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accountants and Auditors | Financial Manager |
| <ul style="list-style-type: none"> • Economics and accounting • Personnel and human resources • Mathematics • Education and training • Science • Operations analysis • Systems analysis • Systems evaluation • Management of financial resources • Management of material resources | <ul style="list-style-type: none"> • Administration and management • Economics and accounting • Sales and marketing • Personnel and human services • Psychology • Geography • Education and training • Philosophy and theology • Public safety and security • Law and government • Active learning • Learning strategies • Monitoring • Programming • Judgement and decision making • Systems evaluation • Management of financial resources • Management of material resources |

People who work as billing and account collectors earn \$16.95 an hour on average. As employment in the occupation declines in the OMEGA region, people in this occupation can easily transfer to jobs such as billing and posting clerks, compliance officer, and human resource specialist because they are in the same occupational cluster. Transferring to a billing and posting clerk will give them an increased income of \$0.90 an hour on average; however, they need critical training in

administrative skills, biology, psychology, medicine and dentistry, public safety and security, and transportation. Transferring to a compliance officer will give employees an increased income of \$13.70 an hour on average; however, they need critical training in biology, psychology, sociology and anthropology, medicine and dentistry, therapy and counseling, education and training, philosophy and theology, public safety and security, law and government, operations monitoring, operation and control, and quality control analysis. Transferring to the occupation of human resource specialist will give them an increased income of \$11.00 an hour on average; however, they need critical training in administrative skills, personnel and human resources, psychology, therapy and counselling, education and training, philosophy and theology, public safety and security, and learning strategies.

Besides these easy within-cluster transfers, bill and account collectors can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay significantly higher wages and give workers much greater job security in the future. Transferring to an accountant and auditor would increase income by \$14.60 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to an accountant and auditor include economics and accounting, personnel and human resources, mathematics, education and training, science, operations analysis, systems analysis, systems evaluation, management of financial resources, management of material resources. Transferring to become a financial manager would increase income by \$41.30 an hour on average; however, critical training is needed in sales and marketing, economics and accounting, personnel and human resources, education and training, management of financial resources, and more.

Continuous Mining and Machine Operators

| Within Cluster Transition | |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating engineers and other construction | Industrial machinery mechanics |
| <ul style="list-style-type: none"> • Customer and personal service | <ul style="list-style-type: none"> • Computers and electronics • Mathematics • Technology design • Installation • Programming • Quality control analysis |

| Out of Cluster Transition |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First-line supervisor of construction |
| <ul style="list-style-type: none"> • Administration and management • Administrative • Economics and accounting • Sales and marketing • Customer and personal service • Engineering and technology • Design • Building and construction • Mathematics • Psychology • Reading and comprehension • Writing • Speaking • Social perceptiveness • Operations analysis • Management of financial resources • Management of material resources |

People who work in continuous mining and machine operations earn \$26.68 an hour on average. As employment in the occupation declines in the OMEGA region, workers in this occupation can easily transfer to jobs such as operating engineer (and other construction) and industrial machinery mechanics because they are in the same occupational cluster. Transferring to an operating engineer (and other construction) will give them a decreased income of \$1.90 an hour on average; however, they only need critical training in one area, customer and personal service. Transferring to a career in industrial machinery mechanics will give them a decreased income of \$1.00 an hour on average; and they need critical training in computers and electronics, mathematics, technology design, installation, programming, and quality control analysis. Although within cluster occupational transitions for continuous mining and machine operators resulted in a wage loss, these two choices represent the lowest decrease in income while maintaining the least amount of critical training needed for transition.

Besides these within-cluster transfers, continuous mining and machine operators can also transition into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay higher wages and give workers much greater job security in the future. Transferring to a first-line supervisor of construction would increase income by \$5.20 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to a first-line supervisor of construction include administration and management, administrative skills, customer and personal service, building and construction, management of material resources, mathematics, and more.

Conveyor Operators and Tenders

| Within Cluster Transition | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating engineers and other construction | Machinist |
| <ul style="list-style-type: none"> • Administration and management • Engineering and technology • Building and construction • Mechanical • Geography | <ul style="list-style-type: none"> • Computers and electronics • Engineering and technology • Design • Physics • Installation |

| Out of Cluster Transition |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and tractor-trailer truck driver |
| <ul style="list-style-type: none"> • Administrative and management • Economic and accounting • Sales and marketing • Customer and personal service • Geography • Telecommunications • Transportation |

People who work as conveyor operators and tenders earn \$19.60 an hour on average. As employment in the occupation declines in the OMEGA region, employees can easily transfer to jobs such as operating engineers (and other construction) and machinists because they are in the same occupational cluster. Transferring to an operating engineer (and other construction) will give them an increased income of \$5.20 an hour on average; however, they need critical training in administration and management, engineering, and technology, building and construction, mechanical, and geography. Transferring to a machinist will give them an increased income of \$0.90 an hour on average; however, they need critical training in computers and electronics, engineering and technology, design, physics, and installation.

Besides these easy within-cluster transfers, conveyor operators and tenders can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they give workers job security in the future as well. Transferring to a heavy and tractor-trailer truck driver would increase income by \$2.10 an hour on average; however, they need critical training in more areas than those within the same cluster. Areas of critical training for a transition to a heavy and tractor-trailer truck driver include administrative and management, economics and accounting, sales and marketing, customer and personal service, geography, telecommunications, and transportation.

Crushing, Grinding, and Polishing

| Within Cluster Transition | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Industrial machinery mechanics | Operating engineers and other construction | Machinist |
| <ul style="list-style-type: none"> • Computers and electronics • Engineering and technology • Design • Physics • Operations analysis • Technology design • Installation • Programming • Equipment maintenance • Repairing | | <ul style="list-style-type: none"> • Design • Operations analysis • Technology design • Installation |

| Out of Cluster Transition | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and tractor-trailer truck driver | Plumbers, pipefitters, and steamfitter |
| <ul style="list-style-type: none"> • Customer and personal service • Geography • Law and government • Telecommunications • Transportation | <ul style="list-style-type: none"> • Administration and management • Sales and marketing • Customer and personal service • Engineering and technology • Design • Building and construction • Physics • Installation |

People who work in crushing, grinding, and polishing earn \$19.11 an hour on average. As employment in the occupation declines in the OMEGA region, employees can easily transfer to jobs such as industrial machinery mechanics, operating engineers (and other construction), and machinists because they are in the same occupational cluster. Transferring to an industrial machinery mechanic will give them an increased income of \$6.60 an hour on average; however, they need critical training in computers and electronics, engineering and technology, design, physics, operations analysis, technology design, installation, programming, equipment maintenance, and repairing. Transferring to an operating engineer (and other construction) will give them an increased income of \$5.70 an hour on average and requires no critical training. Transferring to the occupation of machinist will give them an increased income of \$1.40 an hour on average; however, they need critical training in design, operations analysis, technology design, and installation.

Besides these easy within-cluster transfers, people working in crushing, grinding, and polishing can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they also give workers job security in the future. Transferring to a heavy and tractor-trailer truck driver would increase income by \$2.60 an hour on average; however, they need critical training in customer and personal service, geography, law and

government, telecommunications, and transportation. Transferring to become a plumber, pipefitter, and steamfitter would increase income by \$7.50 an hour on average; however, critical training is needed in administration and management, sales and marketing, customer and personal service, engineering and technology, design, building and construction, physics, and installation.

Customer Service Representative

| Within Cluster Transition | | | |
|--------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Billing and posting clerk | Compliance officer | Human Resource Specialist | Production, planning, and expediting |
| <ul style="list-style-type: none"> • Administrative • Economics and accounting • Law and government | <ul style="list-style-type: none"> • Therapy and counseling • Education and training • Public safety and security • Law and government • Operations monitoring • Operation and control • Troubleshooting • Quality control analysis | <ul style="list-style-type: none"> • Administrative • Personnel and human resources • Therapy and counseling • Education and training • Philosophy and theology • Public safety and security | <ul style="list-style-type: none"> • Production and processing • Mechanical • English language • Transportation • Troubleshooting • Quality control analysis • Management of financial resources • Management of material resources |

| Out of Cluster Transition |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accountant and auditor |
| <ul style="list-style-type: none"> • Economics and accounting • Personnel and human resources • Mathematics • Education and training • Law and government • Science • Operations analysis • Systems analysis • Systems evaluation • Management of financial resources • Management of material resources |

People who work as customer service representatives earn \$16.70 an hour on average. As employment in this occupation declines in the OMEGA region, employees can easily transfer to jobs such as billing and posting clerks, compliance officers, human resource specialists, and in production, planning, and expediting because they are in the same occupational cluster. Transferring to billing and posting clerk will give them an increased income of \$1.20 an hour on average; however, they need critical training in administrative tasks, economics and accounting, and law and government. Transferring to

compliance officer will give them an increased income of \$14.00 an hour on average; however, they need critical training in therapy and counseling, education and training, public safety and security, law and government, operations monitoring, operation and control, troubleshooting, and quality control analysis. Transferring to the occupation of human resource specialist will give them an increased income of \$11.30 an hour on average; however, they need critical training in administrative tasks, personnel and human resources, therapy and counseling, education and training, philosophy and theology, and public safety and security. Transferring to production, planning, and expediting will give them an increased income of \$6.20 an hour on average; however, they need critical training in production and processing, mechanical, English language, transportation, troubleshooting, quality control analysis, management of financial resources, and management of material resources.

Besides these within-cluster transfers, customer service representatives can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay higher wages and give workers much greater job security in the future. Transferring to an accountant and auditor would increase income by \$14.90 an hour on average; however, they need critical training in more areas than those within the same cluster. Critical training is needed in economics and accounting, personnel and human resources, mathematics, education and training, law and government, science, operations analysis, systems analysis, systems evaluation, management of financial resources, and management of material resources.

Inspectors, Testers, Sorters, Samplers, and Weighers

| Within Cluster Transition | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Machinist | Industrial machinery mechanic |
| <ul style="list-style-type: none"> • Technology design • Equipment selection • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Mechanical • Technology design • Equipment selection • Installation • Operation and control • Equipment maintenance • Troubleshooting • Repairing |

| Out of Cluster Transition | |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Welders, cutters, solderers | First-line supervisor of construction |
| No Skills Training Required | <ul style="list-style-type: none"> • Administration and management • Personnel and human resources • Engineering and technology • Design • Building and construction • Mechanical • Geography • Public safety and security • Law and government • Social perceptiveness • Equipment selection • Management of financial resources • Management of material resources |

People who work as an inspector, tester, sorter, sampler, and weigher earn \$18.97 an hour on average. As employment in the occupation declines in the OMEGA region, people in this occupation can easily transfer to jobs such as machinist and industrial machinery mechanic because they are in the same occupational cluster. Transferring to a machinist will give them an increased income of \$1.50 an hour on average; however, they need critical training in technology design, equipment selection, equipment maintenance, and repairing. Transferring to an industrial machinery mechanic will give them an increased income of \$6.70 an hour on average; however, they need critical training in mechanics, technology design, equipment selection, installation, operation and control, equipment maintenance, troubleshooting, and repairing.

Besides these easy within-cluster transfers, inspectors, testers, sorters, samplers, and weighers can also transfer into other possible out-of-cluster occupations. Transferring to a welder, cutter, and solderer would increase income by only \$0.20 an hour on average; and, no additional critical training is required. Transferring to become a first-line supervisor of construction would result in a significant increase in income by \$12.90 an hour on average; however, this transition requires more areas of critical training than those in the same cluster. Areas of critical training needed for this transition are in administration and management, personnel and human resources, engineering and technology, design, building and construction, mechanical, geography, public safety and security, law and government, social perceptiveness, equipment selection, management of financial resources, and management of material resources.

Meter Readers, Utilities

| Within Cluster Transition | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Heavy and tractor-trailer truck driver | |
| <ul style="list-style-type: none"> • Geography • Education and training • Transportation • Operation and control • Equipment maintenance • Repairing | |

| Out of Cluster Transition | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| Compliance Officer | Operating engineer and other construction | Construction laborer |
| <ul style="list-style-type: none"> • Administrative • Psychology • Sociology and anthropology • Medicine and dentistry • Therapy and counseling • Education and training • English language • Philosophy and theology • Law and government • Reading comprehension • Critical thinking • Social perceptiveness • Judgement and decision making | <ul style="list-style-type: none"> • Mechanical • Operation and control • Equipment and maintenance • Troubleshooting • Repairing | <ul style="list-style-type: none"> • Building and construction • Coordination |

People who work as meter readers earn \$19.52 an hour on average. As employment in the occupation declines in the OMEGA region, workers in this occupation can easily transfer to jobs such as heavy and tractor-trailer truck drivers because it is in the same occupational cluster. Transferring to a heavy and tractor-trailer truck driver will give them an increased income of \$2.10 an hour on average; however, they need critical training in geography, education and training, transportation, operation and control, equipment maintenance, and repairing.

Besides these easy within-cluster transfers, meter readers can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and may require even more training; however, they pay higher wages and give workers job security in the future. Transferring to a compliance officer would increase income by \$11.20 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to a compliance officer include administrative skills, psychology, sociology and anthropology, medicine and dentistry, therapy and counseling, education and training, English language, philosophy and theology, law and government, reading comprehension, critical thinking, social

perceptiveness, and judgement and decision making. Transferring to become an operating engineer would increase income by \$5.30 an hour on average; however, a few areas of critical training are mechanics, operation and control, equipment and maintenance, troubleshooting, and repairing, which is significantly less than transferring to a compliance officer. Transferring to a construction laborer would increase income by only \$0.50 an hour on average; however, the transition only requires two areas of critical training in building and construction and coordination.

Office Clerks, General

| Within Cluster Transition | | |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Billing and posting clerk | Compliance officer | Production, planning and expediting |
| <ul style="list-style-type: none"> • Economics and accounting • Psychology | <ul style="list-style-type: none"> • Customer and personal services • Psychology • Medicine and dentistry • Therapy and counseling • Education and training • Public safety and security • Law and government • Operation and control • Quality control analysis • Judgement and decision making | <ul style="list-style-type: none"> • Administration and management • Production and processing • Engineering and technology • English language • Transportation • Systems analysis • Management of financial resources |

| Out of Cluster Transition |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accountant and Auditor |
| <ul style="list-style-type: none"> • Administration and management • Economics and accounting • Mathematics • Education and training • Law and government • Science • Persuasion • Complex problem solving • Operations analysis • Judgement and decision making • Systems analysis • Systems evaluation • Management of financial resources |

People who work as office clerks earn \$16.49 an hour on average. As employment in the occupation declines in the OMEGA region, employees in this occupation can easily transfer to jobs such as billing and posting clerks, compliance officers, and in production, planning, and expediting because they are in the same occupational cluster. Transferring to a billing and posting clerk will give them an increased income of \$1.40 an hour on average; however, they only need critical training in economics and

accounting and psychology. Transferring to compliance officer will give them an increased income of \$14.20 an hour on average; however, they need critical training in customer and personal service, psychology, medicine and dentistry, therapy and counseling, education and training, public safety and security, law and government, operation and control, quality control analysis and judgement and decision making. Transferring to production, planning, and expediting will give them an increased income of \$6.40 an hour on average; however, they need critical training in Administration and management, production and processing, engineering and technology, English language, transportation, systems analysis, management of financial resources.

Besides these easy within-cluster transfers, office clerks can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay higher wages and give workers much greater job security in the future. Transferring to an accountant and auditor would increase income by \$15.10 an hour on average; however, they need critical training in more areas than those within the same cluster. Critical training needed for a transfer to become an accountant and auditor are administration and management, economics and accounting, mathematics, education and training, law and government, science, persuasion, complex problem solving, operations analysis, judgement and decision making, systems analysis, systems evaluation, and management of financial resources.

Powerplant Operators

| Out of Cluster Transition | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First-line supervisor of construction | Electrical Engineer |
| <ul style="list-style-type: none"> • Administration and management • Sales and marketing • Customer and personal service • Personnel and human resources • Engineering and technology • Design • Building and construction • Mechanical • Mathematics • Psychology • Sociology and anthropology • Geography • Therapy and counseling • Communications and media • Persuasion • Negotiation • Operations analysis • Management of financial resources • Management of material resources | <ul style="list-style-type: none"> • Administration and management • Administrative • Sales and marketing • Customer and personal service • Computers and electronics • Engineering and technology • Design • Building and construction • Mathematics • Physics • Geography • Education and training • English language • Science • Negotiation • Operations analysis • Systems evaluation • Management of financial resources • Management of material resources |

People who work as powerplant operators earn \$39.50 an hour on average. There are no within-cluster transitional jobs available to those transferring out of the powerplant operating field because they result in significant wage losses. Powerplant operators can transfer into possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they result in a lower wage loss than within-cluster transitions and give workers job security in the future. Transferring to an electrical engineer would increase income by \$1.30 an hour on average; however, they need critical training in more areas than those would within the same cluster. Some of the most significant critical training areas for a transition to an electrical engineer include computers and electronics, engineering and technology, design, mathematics, operations analysis, management of material resources, customer and personal services, and more. Another out-of-cluster transition is becoming a first-line supervisor of construction. This transfer would decrease income by \$7.60 an hour on average. Although this transition results in a wage loss, the loss is less than many other demanding job options. Critical training areas for a transition to become a first-line supervisor of construction include Administration and management, sales and marketing, customer and personal service, personnel and human resources, engineering and technology, design, building and construction, mechanical, mathematics, psychology, sociology and anthropology, geography, therapy and counseling, communications and media, persuasion, negotiation, operations analysis, management of financial resources, management of material resources.

Procurement Clerks

| Within Cluster Transition | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Compliance officer | Production, planning, and expediting |
| <ul style="list-style-type: none"> • Psychology • Law and government • Operations monitoring • Operation and control • Troubleshooting • Quality control analysis | <ul style="list-style-type: none"> • Production and processing • Operations monitoring • Troubleshooting |

| Out of Cluster Transition | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General and operations manager | Accountant and auditor | Marketing manager |
| <ul style="list-style-type: none"> • Administration and management • Sales and marketing • Personnel and human resources • Production and processing • Design • Building and construction • Psychology • Education and training • Science • Persuasion • Operations analysis • Operations monitoring • Operation and control • Troubleshooting • Quality control analysis • Systems evaluation • Management of material resources | <ul style="list-style-type: none"> • Economics and accounting • Mathematics • Law and government • Science • Operations analysis • Operations monitoring • Systems analysis • Systems evaluation | <ul style="list-style-type: none"> • Administration and management • Sales and marketing • Personnel and human resources • Design • Psychology • Sociology and anthropology • Education and training • Communications and media • Science • Learning strategies • Monitoring • Persuasion • Instructing • Operations analysis • Systems analysis • Systems evaluation • Management of financial resources |

People who work as procurement clerks earn \$20.36 an hour on average. As employment in the occupation declines in the OMEGA region, workers in this occupation can easily transfer to jobs such as compliance officers and production, planning, and expediting because they are in the same occupational cluster. Transferring to a compliance officer will give them an increased income of \$10.30 an hour on average; however, they need critical training in psychology, law and government, operations monitoring, operation and control, troubleshooting, and quality control analysis. Transferring to production, planning, and expediting will give them an increased income of \$2.60 an hour on average, and they need critical training in only production and processing, operations monitoring, and troubleshooting.

Besides these easy within-cluster transfers, procurement clerks can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay significantly higher wages and give workers much greater job security in the future. Transferring to a general and operations manager would increase income by \$26.50 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to a general and operations manager include sales and marketing, personnel and human resources, operations monitoring, operation and control, operations analysis, psychology, production and processing, and more. Transferring to become an accountant and auditor would increase income by \$11.20 an hour on average; however, areas of critical training are in economics and accounting, mathematics, law and government, science, operations analysis, operations monitoring, systems analysis, and systems evaluation. Transferring to become a marketing manager would increase income by \$40.00; however, they need critical training in many areas including

sales and marketing, design, operations analysis, persuasion, psychology, communications and media, science, and more.

Roof Bolters, Mining

| |
|--------------------------------------------|
| Within Cluster Transition |
| Operating engineers and other construction |
| No Skills Training Required |

| |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Out of Cluster Transition |
| First-line supervisors of construction |
| <ul style="list-style-type: none"> • Administration and management • Administrative • Customer and personal service • Personnel and human resources • Engineering and technology • Design • Building and construction • Mechanical • Mathematics • Physics • Psychology • Reading comprehension • Speaking • Social perceptiveness • Operations analysis • Management of material resources |

People who work as roof bolters (mining) earn \$28.95 an hour on average. As employment in the occupation declines in the OMEGA region, people in this occupation can easily transfer to become an operating engineer because they are in the same occupational cluster. Transferring to an operating engineer will give them a decreased income of \$4.20 an hour on average; however, they don't need any critical training for the transition. This job transition was also the within-cluster occupation with the one of lowest wage losses and most skill similarities.

Besides these easy within-cluster transfers, roof bolters (mining) can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they give workers much greater job security in the future. Transferring to a first-line supervisor of construction would increase income by \$3.00 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to a first-line supervisor of construction include administration and management, administrative, customer and personal service, personnel and human resources, engineering

and technology, design, building and construction, mechanical, mathematics, physics, psychology, reading comprehension, speaking, social perceptiveness, operations analysis, and management of material resources.

Secretaries and Administrative Assistants

(Except Legal, medical, and executive)

| Within Cluster Transition | | |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Billing and posting clerks | Compliance officers | Human resource specialists |
| <ul style="list-style-type: none"> • Economics and accounting • Mathematics | <ul style="list-style-type: none"> • Public safety and security • Law and government • Operations monitoring • Operation and control • Troubleshooting | <ul style="list-style-type: none"> • Personnel and human resources • Education and training • Learning strategies • Systems evaluation |

| Out of Cluster Transition |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accountants and auditors |
| <ul style="list-style-type: none"> • Economics and accounting • Mathematics • Law and government • Science • Learning strategies • Persuasion • Operations analysis • Judgement and decision making • Systems analysis • Systems evaluation • Management of financial resources |

People who work as secretaries and administrative assistants (except legal, medical, and executive) earn \$17.42 an hour on average. As employment in this occupation declines in the OMEGA region, employees can easily transfer to jobs such as billing and posting clerks, compliance officer, and human resource specialist because they are in the same occupational cluster. Transferring to a billing and posting clerk will give them an increased income of \$0.50 an hour on average; however, they need critical training in only economics and accounting, and mathematics. Transferring to compliance officer will give them an increased income of \$13.30 an hour on average; however, they need critical training in public safety and security, law and government, operations monitoring, operation and control, and troubleshooting. Transferring to the occupation of human resource specialist will give them an increased income of \$10.50 an hour on average; however, they need critical training in personnel and human resources, education and training, learning strategies, and systems evaluation.

Besides these easy within-cluster transfers, secretaries and administrative assistants can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more

challenging and require even more training; however, they pay higher wages and give workers much greater job security in the future. Transferring to an accountant and auditor would increase income by \$14.20 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to an accountant and auditor include economics and accounting, mathematics, law and government, science, learning strategies, persuasion, operations analysis, judgement and decision making, systems analysis, systems evaluation, and management of financial resources.

Stockers and Order Fillers

| Within Cluster Transition | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Light truck driver | Production workers | Laborers and freight, stock |
| <ul style="list-style-type: none"> • Mechanical • Law and government • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Engineering and technology • Mechanical • Equipment selection • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Equipment selection • Equipment maintenance • Repairing |

| Out of Cluster Transition | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Industrial truck and tractor operator | Receptionist and information clerk |
| <ul style="list-style-type: none"> • Production and processing • Building and construction • Equipment selection • Operations monitoring • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Administrative • Computers and electronics |

People who work as stockers and order fillers earn \$12.57 an hour on average. As employment in the occupation declines in the OMEGA region, people in this occupation can easily transfer to jobs such as light truck driver, helpers-production workers, and laborers and freight because they are in the same occupational cluster. Transferring to a light truck driver will give them an increased income of \$2.70 an hour on average; however, they need critical training in mechanics, law and government, equipment maintenance, and repairing. Transferring to a production worker will give them an increased income of \$2.60 an hour on average; however, they need critical training in engineering and technology, mechanical, equipment selection, equipment maintenance, and repairing. Transferring to the occupation of laborer and freight will give them an increased income of \$1.90 an hour on average; however, they need critical training in equipment selection, equipment maintenance, and repairing.

Besides these easy within-cluster transfers, stockers and order fillers can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they give workers job security in the future. Transferring to an industrial truck and tractor operator would increase income by \$4.80 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to an industrial truck and tractor operator include production and processing, building and construction, equipment selection, operations monitoring, equipment maintenance, and repairing. Transferring to become a receptionist and information clerk would slightly increase income by

\$0.80 an hour on average; however, it only requires two areas of critical training in administrative tasks and computers and electronics.

Tank Car, Truck, and Ship Loaders

| Within Cluster Transition | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating engineers and other construction | Machinists |
| <ul style="list-style-type: none"> • Engineering and technology • Building and construction • Mechanical • Operations analysis • Equipment maintenance | <ul style="list-style-type: none"> • Engineering and technology • Design • Operations analysis • Technology design • Installation |

| Out of Cluster Transition | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and tractor-trailer truck driver | Bus and truck mechanics and diesel |
| <ul style="list-style-type: none"> • Customer and personal service • Geography • Law and government • Telecommunications • Transportation | <ul style="list-style-type: none"> • Customer and personal service • Computers and electronics • Engineering and technology • Design • Building and construction • Mechanical • Physics • Chemistry • Biology • Psychology • Education and training • Transportation • Operations analysis • Installation • Equipment maintenance • Troubleshooting • Repairing |

People who work as tank car, truck, and ship loaders earn \$18.05 an hour on average. As employment in the occupation declines in the OMEGA region, people in this occupation can easily transfer to jobs such as operating engineers and machinists because they are in the same occupational cluster. Transferring to an operating engineer will give them an increased income of \$6.70 an hour on average; however, they need critical training in engineering and technology, building and construction, mechanical, operations analysis, and equipment maintenance. Transferring to a machinist will give employees an increased income of \$2.40 an hour on average; however, they need critical training in engineering and technology, design, operations analysis, technology design, and installation.

Besides these easy within-cluster transfers, tank car, truck, and ship loaders can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay higher wages and give workers greater job security in the future.

Transferring to a heavy and tractor-trailer truck driver would increase income by \$3.60 an hour on average; however, they need critical training in customer and personal service, geography, law and government, telecommunications, and transportation. Transferring to become a bus and truck mechanic would increase income by \$4.40 an hour on average; however, they need critical training in more areas. A few of these critical training categories are engineering and technology, design, building and construction, mechanics, physics, installation, and many more.

BUCKEYE HILLS REGION

In the Buckeye Hills region, we identified 43 growing occupations in the petrochemical manufacturing cluster. Of these 43 occupations, 13 occupations do not require post-secondary education, and 30 occupations require post-secondary education (table 5). We also identify 21 declining occupations in the coal mining cluster; 10 which do not require higher education, while the remaining 11 require post-secondary education (table 6).

Table 7a shows the core competencies in terms of knowledge of workers who are employed in the Buckeye Hills region's coal mining cluster's declining occupations. The second and third columns in Table 3a show the workers' knowledge compared to a general worker and a worker of a similar education level, respectively. Compared to an average American worker of the same education level, they lack knowledge in categories such as languages, engineering, technology, sciences, management, transportation, and telecommunication.

Table 7b shows the core competencies in terms of skills of workers who are employed in the Buckeye Hills region's coal mining cluster's declining occupations. The second and third columns in Table 3a show the workers' skills compared to a general worker and a worker of a similar education level, respectively. Even though workers in the coal mining industry cluster in the Buckeye Hills region lack knowledge compared to an average American worker of the same education level, they have better skills when it comes to job performance. Compared to an average worker in the U.S. of the same education level, workers in the coal mining cluster in the Buckeye Hills region have better skills in literacy, critical thinking, strategies, problem-solving, coordination, technology design, equipment selection, system analysis, and management of time and personnel resources. These skills are essential in manufacturing industries. However, compared to an average American worker of the same education level, they lack other skills, such as persuasion, service orientation, operation analysis, and installation.

After pooling 43 growing occupations and 21 declining occupations in the Buckeye Hills region into the occupations of interest pool, we employed the WARD clustering method to group them into five different clusters using the occupations' required level of skills, knowledge, and education. Figure 1 shows the OMEGA region's 5 clusters. Each point in the figure represents an occupation. The closer the occupations are in the graph, the easier the transitions between them are. The further the occupations in the graph, the more difficult the transitions between them are. Each bubble represents an occupation cluster. Cluster 1 includes higher-paying white-collar and top-manager jobs. Cluster 2 includes middle-paying blue-collar jobs. Cluster 3 includes higher-paying blue-collar jobs. Cluster 4 includes engineers, machinists, and electricians. Cluster 5 includes officers and specialists. Suppose two clusters are joined or close to each other. In that case, it means there are possibilities for workers in one cluster to transition into a different occupation cluster with some marginal training needed. If two clusters are far away from each other, it means the job transitions between them require a lot of training.

Figure 2 shows that the Buckeye Hills region's workers in middle-paying blue-collar jobs, cluster 2, can transition into the closest clusters, clusters 3 and 5, higher-paying blue-collar jobs, and officers and specialists, respectively. Transitions from middle-paying blue-collar jobs (cluster 2) to higher-paying white-collar and top-manager jobs (cluster 1) are complex and require a substantial amount of training and education.

Table 5: Emerging occupations in the Petrochemical cluster

| SOC Code | Occupation | Require higher education |
|-----------------|--------------------------------------------------------------------------|---------------------------------|
| 47-2061.00 | Construction Laborers | No |
| 53-3032.00 | Heavy and Tractor-Trailer Truck Drivers | No |
| 51-9198.00 | Helpers--Production Workers | No |
| 53-7051.00 | Industrial Truck and Tractor Operators | No |
| 37-2011.00 | Janitors and Cleaners, Except Maids | No |
| 53-7062.00 | Laborers and Freight, Stock, and Material Movers, Hand | No |
| 37-3011.00 | Landscaping and Groundskeeping Work | No |
| 53-3033.00 | Light Truck Drivers | No |
| 51-4081.00 | Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic | No |
| 47-2073.00 | Operating Engineers and Other Construction Equipment Operators | No |
| 43-5061.00 | Production, Planning, and Expediting Clerk | No |
| 43-4171.00 | Receptionists and Information Clerk | No |
| 51-4121.00 | Welders, Cutters, Solderers, and Brazers | No |
| 13-2011.00 | Accountants and Auditors | Yes |
| 43-3021.00 | Billing and Posting Clerks | Yes |
| 49-3031.00 | Bus and Truck Mechanics and Diesel | Yes |
| 13-1041.00 | Compliance Officers | Yes |
| 11-3021.00 | Computer and Information Systems Managers | Yes |
| 15-1231.00 | Computer Network Support Specialist | Yes |
| 15-1211.00 | Computer Systems Analysts | Yes |
| 15-1232.00 | Computer User Support Specialists | Yes |
| 11-9021.00 | Construction Managers | Yes |
| 13-1051.00 | Cost Estimators | Yes |
| 17-2071.00 | Electrical Engineers | Yes |
| 47-2111.00 | Electricians | Yes |
| 11-3031.00 | Financial Managers | Yes |
| 47-1011.00 | First-line supervisors of Construction Trades and Extraction Workers | Yes |
| 49-1011.00 | First-Line Supervisors of Mechanics | Yes |
| 11-1021.00 | General and Operations Managers | Yes |
| 13-1071.00 | Human Resources Specialists | Yes |
| 17-2112.00 | Industrial Engineers | Yes |
| 49-9041.00 | Industrial Machinery Mechanics | Yes |
| 51-4041.00 | Machinists | Yes |
| 49-9071.00 | Maintenance and Repair Workers, General | Yes |
| 13-1111.00 | Management Analysts | Yes |
| 13-1161.00 | Market Research Analysts and Market | Yes |
| 11-2021.00 | Marketing Managers | Yes |
| 17-2141.00 | Mechanical Engineers | Yes |
| 15-2031.00 | Operations Research Analysts | Yes |
| 47-2152.00 | Plumbers, Pipefitters, and Steamfitters | Yes |
| 29-1141.00 | Registered Nurses | Yes |
| 11-2022.00 | Sales Managers | Yes |
| 13-1151.00 | Training and Development Specialist | Yes |
| 11-3071.00 | Transportation, Storage, and Distribution Managers | Yes |

Table 6: Declining occupations in the Buckeye Hills region

| SOC Code | Occupation | Require higher education |
|-----------------|---------------------------------------------------------------------------|---------------------------------|
| 47-5041.00 | Continuous Mining Machine Operators | No |
| 53-7011.00 | Conveyor Operators and Tenders | No |
| 51-9021.00 | Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders | No |
| 53-7071.00 | Gas Compressor and Gas Pumping Stat | No |
| 51-9061.00 | Inspectors, Testers, Sorters, Samplers, and Weighers | No |
| 51-8013.00 | Power Plant Operators | No |
| 43-3061.00 | Procurement Clerks | No |
| 47-5043.00 | Roof Bolters, Mining | No |
| 43-5071.00 | Shipping, Receiving, and Inventory | No |
| 53-7065.00 | Stockers and Order Fillers | No |
| 53-7121.00 | Tank Car, Truck, and Ship Loaders | No |
| 17-3011.00 | Architectural and Civil Drafters | Yes |
| 49-3023.00 | Automotive Service Technicians and Mechanics | Yes |
| 17-3023.00 | Electrical and Electronic Engineers | Yes |
| 51-1011.00 | First-line supervisors of Production and Operating Workers | Yes |
| 51-8092.00 | Gas Plant Operators | Yes |
| 23-1011.00 | Lawyers | Yes |
| 19-4051.00 | Nuclear Technicians | Yes |
| 51-8012.00 | Power Distributors and Dispatchers | Yes |
| 51-8021.00 | Stationary Engineers and Boiler Operators | Yes |
| 49-9081.00 | Wind Turbine Service Technicians | Yes |

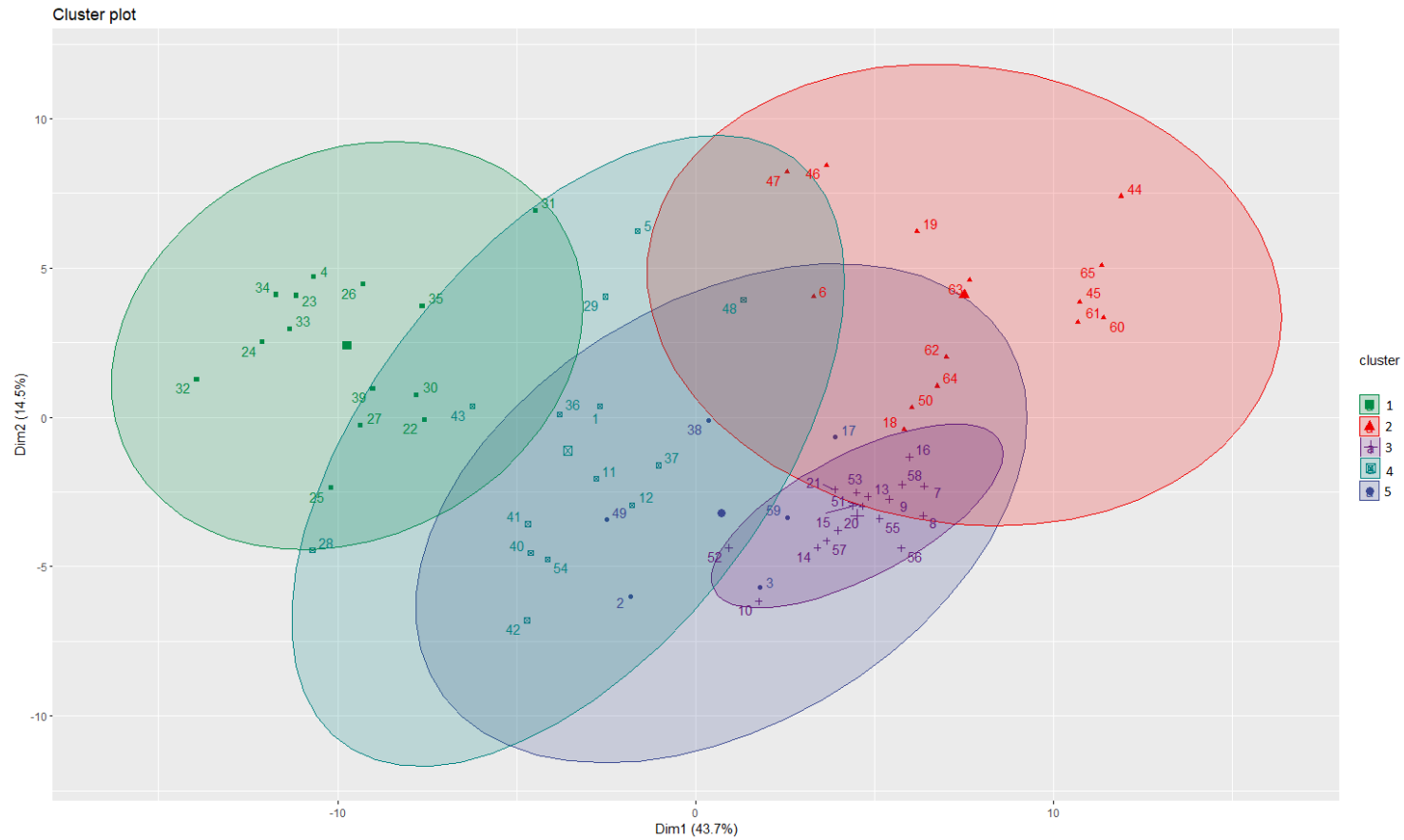
Table 7a: Core competencies of the labor force in the declining occupations that require a high school degree or less - Knowledge.

| Occupations that require a high school degree or less | | |
|-------------------------------------------------------|------------------------------------|-----------------------------------------------------|
| Knowledge | Compared to general workers | Compared to workers with the education level |
| Administration and Management | No | No |
| Administrative | No | No |
| Economics and Accounting | No | No |
| Sales and Marketing | No | No |
| Customer and Personal Service | No | No |
| Personnel and Human Resources | No | No |
| Production and Processing | Yes | No |
| Food Production | No | No |
| Computers and Electronics | No | No |
| Engineering and Technology | No | No |
| Design | No | No |
| Building and Construction | No | No |
| Mechanical | Yes | No |
| Mathematics | No | No |
| Physics | No | No |
| Chemistry | Yes | No |
| Biology | No | No |
| Psychology | No | No |
| Sociology and Anthropology | No | No |
| Geography | No | No |
| Medicine and Dentistry | No | No |
| Therapy and Counseling | No | No |
| Education and Training | No | No |
| English Language | No | No |
| Foreign Language | No | No |
| Fine Arts | No | No |
| History and Archeology | No | No |
| Philosophy and Theology | No | No |
| Public Safety and Security | Yes | No |
| Law and Government | No | No |
| Telecommunications | No | No |
| Communications and Media | No | No |
| Transportation | Yes | No |

Table 7b: Core competencies of the labor force in the declining occupations that require a high school degree or less - Skills.

| Occupations that require A high school degree or less | | |
|-------------------------------------------------------|-----------------------------|----------------------------------------------|
| Skills | Compared to general workers | Compared to workers with the education level |
| Reading Comprehension | No | Yes |
| Active Listening | No | Yes |
| Writing | No | Yes |
| Speaking | No | Yes |
| Science | No | Yes |
| Critical Thinking | No | Yes |
| Active Learning | No | Yes |
| Learning Strategies | No | Yes |
| Monitoring | No | Yes |
| Social Perceptiveness | No | No |
| Coordination | No | Yes |
| Persuasion | No | No |
| Negotiation | No | Yes |
| Instructing | No | Yes |
| Service Orientation | No | No |
| Complex Problem Solving | No | Yes |
| Operations Analysis | No | No |
| Technology Design | No | Yes |
| Equipment Selection | Yes | Yes |
| Installation | No | No |
| Programming | No | Yes |
| Operations Monitoring | Yes | Yes |
| Operation and Control | Yes | Yes |
| Equipment Maintenance | Yes | Yes |
| Troubleshooting | Yes | Yes |
| Repairing | Yes | Yes |
| Quality Control Analysis | Yes | Yes |
| Judgment and Decision Making | No | Yes |
| Systems Analysis | No | Yes |
| Systems Evaluation | No | Yes |
| Time Management | No | Yes |
| Management of Financial Resources | No | Yes |
| Management of Material Resources | No | Yes |
| Management of Personnel Resources | No | Yes |

Figure 2: BUCKEYE HILLS REGION CLUSTER PLOT



Cluster 1: Higher-paying white-collar and top-manager jobs.

Cluster 2: Middle-paying blue-collar jobs.

Cluster 3: Higher-paying blue-collar jobs.

Cluster 4: Engineers, machinists, electricians.

Cluster 5: Officers and specialists.

Table 8a: Buckeye Hills Region – COAL to PETROCHEMICAL Skillshed table

| CLUSTER | | CLUSTER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------|-------------------------------------|---------|----------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| | | 1 | | | | | | | | | | | 2 | | | | | | | | | | | 3 | | | | | 4 | | | | 5 | | | | | | | | | | | | | |
| Title | | \$31.6 | \$61.7 | \$43.1 | \$31.2 | \$58.2 | \$46.8 | \$39.5 | \$29.2 | \$60.4 | \$39.3 | \$59.7 | \$27.2 | \$41.4 | \$21.7 | \$15.2 | \$12.5 | \$14.4 | \$14.1 | \$15.3 | \$19.2 | \$22.5 | \$20.0 | \$25.7 | \$17.3 | \$20.5 | \$19.3 | \$17.2 | \$24.8 | \$40.8 | \$25.4 | \$31.9 | \$31.0 | \$38.8 | \$39.2 | \$26.6 | \$17.9 | \$30.7 | \$28.3 | \$40.7 | \$23.2 | \$28.0 | \$22.9 | \$13.4 | \$31.6 | |
| | | 1 | Architectural and Civil Drafters | \$26.4 | 5.2 | 35.3 | 16.7 | -4.8 | 31.8 | 20.4 | 13.1 | 2.8 | 34.0 | 12.9 | 33.3 | 0.8 | 15.0 | -4.7 | -11.2 | -13.9 | -12.0 | -12.3 | -11.1 | -7.2 | -3.9 | -6.4 | -0.7 | -9.1 | -5.9 | -7.1 | -9.3 | -1.6 | 14.4 | -1.0 | 5.5 | 4.6 | 12.4 | 12.8 | 0.2 | -8.5 | 4.3 | 1.9 | 14.3 | -3.3 | 1.6 | -3.5 |
| | Lawyers | \$49.0 | -17.4 | 12.6 | -5.9 | -17.9 | 9.2 | -2.2 | -9.6 | -19.8 | 11.4 | -9.7 | 10.7 | -21.9 | -7.7 | 27.4 | -33.9 | -36.5 | -34.6 | -35.0 | -33.8 | -29.3 | -26.5 | -29.0 | -23.4 | -31.7 | -28.6 | -29.7 | -31.9 | -24.2 | -8.2 | -23.6 | -17.1 | -18.0 | -10.3 | -9.8 | -22.1 | -31.1 | -18.4 | -20.8 | 8.3 | -25.9 | -21.1 | -26.1 | -35.7 | -17.4 |
| 2 | Shipping, Receiving, and Inventory | \$16.3 | 15.3 | 45.4 | 26.8 | 14.9 | 42.0 | 30.5 | 23.2 | 12.9 | 44.1 | 23.0 | 43.4 | 10.9 | 25.1 | 5.4 | -1.1 | -3.8 | -1.8 | -2.2 | -1.0 | 2.9 | 6.2 | 3.8 | 9.4 | 1.1 | 4.2 | 3.1 | 0.9 | 8.5 | 24.5 | 9.2 | 15.6 | 14.7 | 22.5 | 23.0 | 10.3 | 1.6 | 14.4 | 12.0 | 24.5 | 6.9 | 11.7 | 6.7 | -2.9 | 15.4 |
| | Stockers and Order Fillers | \$12.6 | 19.0 | 49.1 | 30.5 | 18.6 | 45.7 | 34.2 | 26.9 | 16.6 | 47.8 | 26.7 | 47.1 | 14.6 | 28.8 | 9.1 | 2.6 | -0.1 | 1.9 | 1.5 | 2.7 | 6.6 | 9.9 | 7.5 | 13.1 | 4.8 | 7.9 | 6.8 | 4.6 | 12.2 | 28.2 | 12.9 | 19.3 | 18.4 | 26.2 | 26.7 | 14.0 | 5.3 | 18.1 | 15.7 | 28.2 | 10.6 | 15.4 | 10.4 | 0.8 | 19.1 |
| 3 | Automotive Service Technicians and | \$18.5 | 13.1 | 43.1 | 24.6 | 12.6 | 39.7 | 28.3 | 20.9 | 10.7 | 41.9 | 20.8 | 41.2 | 8.7 | 22.8 | 3.1 | -3.4 | -6.0 | -4.1 | -4.5 | -3.3 | 0.7 | 4.0 | 1.5 | 7.1 | -1.2 | 1.9 | 0.8 | -1.4 | 6.3 | 22.3 | 6.9 | 13.4 | 12.5 | 20.3 | 20.7 | 8.1 | -0.6 | 12.2 | 9.7 | 22.2 | 4.6 | 9.4 | 4.4 | -5.2 | 13.1 |
| | Continuous Mining Machine Operators | \$26.7 | 4.9 | 35.0 | 16.4 | 4.5 | 31.6 | 20.1 | 12.8 | 2.5 | 33.7 | 12.6 | 33.0 | 0.5 | 14.7 | -5.0 | -11.5 | -14.2 | -12.3 | -12.6 | -11.4 | -7.5 | -4.2 | -6.6 | -1.0 | -9.4 | -6.2 | -7.4 | -9.5 | -1.9 | 14.1 | -1.3 | 5.2 | 4.3 | 12.1 | 12.6 | -0.1 | -8.8 | 4.0 | 1.6 | 14.0 | -3.5 | 1.3 | -3.8 | -13.3 | 5.0 |
| | Conveyor Operators and Tenders | \$19.6 | 12.0 | 42.1 | 23.5 | 11.6 | 38.6 | 27.2 | 19.9 | 9.6 | 40.8 | 19.7 | 40.1 | 7.6 | 21.8 | 2.1 | -4.4 | -7.1 | -5.2 | -5.5 | -4.3 | -0.4 | 2.9 | 0.4 | 6.1 | -2.3 | 0.9 | -0.3 | -2.5 | 5.2 | 21.2 | 5.8 | 12.3 | 11.4 | 19.2 | 19.6 | 7.0 | -1.7 | 11.1 | 8.7 | 21.1 | 3.6 | 8.4 | 3.3 | -6.2 | 12.0 |
| | Crushing, Grinding, and Polishing M | \$19.1 | 12.5 | 42.5 | 24.0 | 12.0 | 39.1 | 27.7 | 20.3 | 10.1 | 41.3 | 20.2 | 40.6 | 8.1 | 22.2 | 2.6 | -3.9 | -6.6 | -4.7 | -5.0 | -3.8 | 0.1 | 3.4 | 0.9 | 6.6 | -1.8 | 1.4 | 0.2 | -2.0 | 5.7 | 21.7 | 6.3 | 12.8 | 11.9 | 19.7 | 20.1 | 7.5 | -1.2 | 11.6 | 9.2 | 21.6 | 4.0 | 8.8 | 3.8 | -5.8 | 12.5 |
| | Gas Compressor and Gas Pumping Sta | \$38.5 | -4.9 | 25.2 | 6.6 | -5.3 | 21.8 | 10.4 | 3.0 | -7.3 | 23.9 | 2.8 | 23.2 | -9.3 | 4.9 | -14.8 | -21.3 | -23.9 | -22.0 | -22.4 | -21.2 | -17.3 | -14.0 | -16.4 | -10.8 | -19.1 | -16.0 | -17.1 | -19.3 | -11.7 | 4.3 | -11.0 | -4.6 | -5.5 | 2.3 | 2.8 | -9.9 | -18.6 | -5.8 | -8.2 | 4.3 | -13.3 | -8.5 | -13.5 | -23.1 | -4.8 |
| | Gas Plant Operators | \$38.0 | -6.4 | 23.6 | 5.1 | -6.9 | 20.2 | 8.8 | 1.4 | -8.8 | 22.4 | 1.3 | 21.7 | -10.9 | 3.3 | -16.4 | -22.9 | -25.5 | -23.6 | -24.0 | -22.8 | -18.8 | -15.5 | -18.0 | -12.4 | -20.7 | -17.6 | -18.7 | -20.9 | -13.2 | 2.8 | -12.6 | -6.1 | -7.0 | 0.8 | 1.2 | -11.4 | -20.1 | -7.4 | -9.8 | 2.7 | -14.9 | -10.1 | -15.1 | -24.7 | -6.4 |
| | Inspectors, Testers, Sorters, Sampl | \$19.0 | 12.6 | 42.7 | 24.1 | 12.2 | 39.3 | 27.8 | 20.5 | 10.2 | 41.4 | 20.3 | 40.7 | 8.2 | 22.4 | 2.7 | -3.8 | -6.5 | -4.5 | -4.9 | -3.7 | 0.2 | 3.5 | 1.1 | 6.7 | -1.7 | 1.5 | 0.4 | -1.8 | 5.8 | 21.8 | 6.5 | 12.9 | 12.0 | 19.8 | 20.3 | 7.4 | -1.1 | 11.7 | 9.3 | 21.8 | 4.2 | 9.0 | 4.0 | -5.6 | 12.7 |
| | Nuclear Technicians | \$36.7 | -5.1 | 25.0 | 6.5 | -5.5 | 21.6 | 10.2 | 2.8 | -7.5 | 23.7 | 2.6 | 23.1 | -9.5 | 4.7 | -15.0 | -21.5 | -24.1 | -22.2 | -22.6 | -21.4 | -17.5 | -14.2 | -16.6 | -11.0 | -19.3 | -16.2 | -17.3 | -19.5 | -11.9 | 4.1 | -11.2 | -4.7 | -5.7 | 2.1 | 2.6 | -10.1 | -18.8 | -6.0 | 8.4 | 4.1 | -13.5 | -8.7 | -13.7 | -23.3 | -5.6 |
| | Power Distributors and Dispatchers | \$42.4 | -10.8 | 19.2 | 0.7 | -11.3 | 15.8 | 4.4 | -3.0 | -13.2 | 18.0 | -3.1 | 17.3 | -15.2 | -1.1 | -20.8 | -27.2 | -29.9 | -28.0 | -28.3 | -27.1 | -23.2 | -19.9 | -22.4 | -16.8 | -25.1 | -22.0 | -23.1 | -25.3 | -17.6 | -1.6 | -17.0 | -10.5 | -11.4 | -3.6 | -3.2 | -15.8 | -24.5 | -11.7 | -14.2 | -1.7 | -19.3 | -14.5 | -19.5 | -29.1 | -10.8 |
| | Power Plant Operators | \$39.5 | -7.9 | 22.2 | 3.6 | -8.4 | 18.7 | 7.3 | 0.0 | -10.3 | 20.9 | -0.2 | 20.2 | -12.3 | 1.9 | -17.8 | -24.3 | -27.0 | -25.1 | -25.4 | -24.2 | -20.3 | -17.0 | -19.5 | -13.8 | -22.2 | -19.0 | -20.2 | -22.4 | -14.7 | 1.3 | -14.1 | -7.6 | -8.5 | -0.7 | -0.3 | -12.9 | -21.6 | -8.8 | -11.2 | 1.2 | -16.4 | -11.6 | -16.6 | -26.1 | -7.9 |
| | Roof Bolters, Mining | \$28.95 | 2.6 | 32.7 | 14.2 | 2.2 | 29.3 | 17.9 | 10.5 | 0.2 | 31.4 | 10.3 | 30.8 | -1.8 | 12.4 | -7.3 | -13.8 | -16.4 | -14.5 | -14.9 | -13.7 | -9.8 | -6.5 | -8.9 | -3.3 | -11.6 | -8.5 | -9.6 | -11.8 | -4.2 | 11.8 | -3.5 | 3.0 | 2.0 | 9.8 | 10.3 | -2.4 | -11.1 | 1.7 | -0.7 | 11.8 | -5.8 | -1.0 | -6.0 | -15.6 | 2.7 |
| | Stationary Engineers and Boiler Ope | \$27.9 | 3.7 | 33.7 | 15.2 | 3.2 | 30.3 | 18.9 | 11.5 | 1.3 | 32.5 | 11.4 | 31.8 | -0.8 | 13.4 | -6.3 | -12.8 | -15.4 | -13.5 | -13.9 | -12.7 | -8.7 | -5.4 | -7.9 | -2.3 | -10.6 | -7.5 | -8.6 | -10.8 | -3.1 | 12.9 | -2.5 | 4.0 | 3.1 | 10.9 | 11.3 | -1.3 | -10.0 | 2.8 | 0.3 | 12.8 | -4.8 | 0.0 | -5.0 | -14.6 | 3.7 |
| | Tank Car, Truck, and Ship Loaders | \$18.1 | 13.5 | 43.6 | 25.1 | 13.1 | 40.2 | 28.8 | 21.4 | 11.1 | 42.3 | 21.2 | 41.7 | 9.1 | 23.3 | 3.6 | -2.9 | -5.5 | -3.6 | -4.0 | -2.8 | 1.2 | 4.4 | 2.0 | 7.6 | -0.7 | 2.4 | 1.3 | -0.9 | 6.7 | 22.7 | 7.4 | 13.9 | 12.9 | 20.7 | 21.2 | 8.5 | -0.2 | 12.6 | 10.2 | 22.7 | 5.1 | 9.9 | 4.9 | -4.7 | 13.6 |
| | Wind Turbine Service Technicians | \$27.6 | 4.0 | 34.1 | 15.5 | 3.6 | 30.7 | 19.3 | 11.9 | 1.6 | 32.8 | 11.7 | 32.1 | -0.4 | 13.8 | -5.9 | -12.4 | -15.0 | -13.1 | -13.5 | -12.3 | -8.4 | -5.1 | -7.5 | -1.9 | -10.2 | -7.1 | -8.2 | -10.4 | -2.8 | 13.2 | -2.1 | 4.4 | 3.4 | 11.2 | 11.7 | -1.0 | -9.7 | 3.1 | 0.7 | 13.2 | -4.4 | 0.4 | -4.6 | -14.2 | 4.1 |
| 4 | Electrical and Electronic Engineeri | \$29.9 | 1.7 | 31.8 | 13.2 | 1.3 | 28.4 | 16.9 | 9.6 | -0.7 | 30.5 | 9.4 | 29.8 | -2.7 | 11.5 | -8.2 | -14.7 | -17.4 | -15.4 | -15.8 | -14.6 | -10.7 | -7.4 | -9.8 | -4.2 | -12.6 | -9.4 | -10.6 | -12.7 | -5.1 | 10.9 | -4.4 | 2.0 | 1.1 | 8.9 | 9.4 | -3.3 | -12.0 | 0.8 | -1.6 | 10.9 | -6.7 | -1.9 | -7.0 | -16.5 | 1.8 |
| | First-Line Supervisors of Productio | \$30.5 | 1.1 | 31.1 | 12.6 | 0.6 | 27.7 | 16.3 | 8.9 | -1.4 | 29.9 | 8.8 | 29.2 | -3.4 | 10.8 | -8.9 | -15.4 | -18.0 | -16.1 | -16.5 | -15.3 | -11.3 | -8.1 | -10.5 | -4.9 | -13.2 | -10.1 | -11.2 | -13.4 | -5.7 | 10.3 | -5.1 | 1.4 | 0.5 | 8.2 | 8.7 | -4.0 | -12.6 | 0.1 | -2.3 | 10.2 | -7.4 | -2.6 | -7.6 | -17.2 | 1.1 |
| 5 | Procurement Clerks | \$20.4 | 11.2 | 41.3 | 22.7 | 10.8 | 37.9 | 26.5 | 19.1 | 8.8 | 40.0 | 18.9 | 39.3 | 6.8 | 21.4 | 1.3 | -5.2 | -7.8 | -5.9 | -6.3 | -5.1 | -1.2 | 2.1 | -0.3 | 5.3 | -3.0 | 0.1 | -1.0 | -3.2 | 4.4 | 20.4 | 5.1 | 11.6 | 10.6 | 18.4 | 18.9 | 6.2 | -2.5 | 10.3 | 7.9 | 20.4 | 2.8 | 7.6 | 2.6 | -7.0 | 11.3 |

Table 8a shows the transitions from declining occupations from coal mining cluster to growing occupations in the petrochemical manufacturing industry. The number in each cell represents the net income change when transitioning from declining occupations to growing occupations. The cells' color represents how easy or difficult the transitions are. The greener the color, the easier the transition; the redder the color, the more difficult the transition. In Table 8b, we eliminate any job transitions that result in a decline in workers' income.

Transitions within the same cluster are usually easier than out-of-cluster transitions. However, there are possible out-of-cluster transitions. For example, transitions between clusters 2 and 3 are possible with some necessary training. In the case of the Buckeye Hills region, workers employed in middle-paying blue-collar jobs (cluster 2) have limited options to transition to other jobs in the same cluster because these transitions will result in declines in their income. Therefore, having the option to be trained to transition to other jobs out of their cluster is important. Table 8b shows that middle-paying blue-collar workers can be trained to work in higher-paying blue-collar jobs or become engineers, machinists, or electricians with the necessary training.

In the following section, we determine possible within-cluster transitions and out-of-cluster transitions for each declining occupation in the OMEGA region and identify the necessary training for each transition.

Feasible job transitions out of declining occupations.

This report illustrates the ability of an employee to transfer from a job in a declining economic sector to a demanding job. We will highlight what jobs are at risk and give recommendations on potential occupations employees working in these fields can transfer into. The data is divided into clusters. Jobs in a specific cluster share closely related characteristics. Our recommendations for job transfers include options within the declining jobs cluster and outside of its cluster. Along with our recommendations, the main goal of our report is to highlight what skills training is needed for these transitions. The declining occupations in this report are those that do not require a college degree.

For each occupation, we provide two tables. The first table represents the within-cluster occupation transitions we recommend for the given declining job. The second table represents the out-of-cluster occupation transitions we recommend for the given declining job. Within each of these tables, we share the skills training required for a transition from the declining occupation to the emerging occupation. The page index for each declining occupation's recommended transitions is as follows:

| Declining occupation | Page |
|------------------------------------|-------------|
| Procurement Clerk | 63 |
| Shipping, Receiving, and Inventory | 64 |
| Continuous Mining Machine Operator | 65 |
| Roof Bolters, Mining | 67 |
| Powerplant operators | 68 |
| Crushing, Grinding, and Polishing | 69 |
| Inspectors, Testers, and Sorters | 70 |
| Conveyor Operators and Tenders | 71 |
| Stockers and Order Fillers | 72 |
| Gas Compressor and Gas Pumping | 73 |
| Tank Car, Truck, and Ship Loader | 74 |

Procurement Clerk

| Within Cluster Transition | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| Compliance Officer | Production, Planning, and Expediting | Human Resources Specialist |
| <ul style="list-style-type: none"> • Psychology, • Law and government • Operations monitoring • Operations control • Troubleshooting • Quality control analysis | <ul style="list-style-type: none"> • Production and Processing • Operations monitoring • Troubleshooting | <ul style="list-style-type: none"> • Personnel and human resources • Psychology • Education and training |

| Out of Cluster Transition | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| General Operations Manager | Transportation, Storage, and Distribution |
| <ul style="list-style-type: none"> • Administration and management • Sales and marketing • Personnel and human resources • Production and processing • Design • Building and construction • Psychology • Education and training • Science • Persuasion • Operations analysis • Operations monitoring • Operations control • Troubleshooting • Quality control analysis • Systems evaluation • Management of material resources | <ul style="list-style-type: none"> • Administration and Management • Sales and marketing • Personnel and human resources • Production and processing • Food production • Design • Psychology • Geography • Therapy and counseling • Education and training • Foreign language • Public safety and security • Transportation • Monitoring • Coordination • Persuasion • Operations analysis • Operations monitoring • Operation and control • Quality control analysis • Systems analysis • Systems evaluation • Management of material resources |

People who work as procurement clerks earn \$20.40 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as compliance officers, production, planning, and expediting, and human resource specialists because they are in the same occupational cluster. Transferring to a compliance officer will give them an increased income of \$10.30 an hour on average; however, they need critical training in psychology, law and government,

operations monitoring, operations control, troubleshooting, and quality control analysis. Transferring to production, planning, and expediting will give them an increased income of \$2.60 an hour on average; however, they need critical training in production and processing, operations monitoring, and troubleshooting. Transferring to the occupation of human resource specialist will give them an increased income of \$7.60 an hour on average; however, they need critical training in Personnel and human resources, psychology, and education and training.

Besides these easy within-cluster transfers, procurement clerks can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay significantly higher wages and give workers much greater job security in the future. Transferring to a general operations manager would increase income by \$26.50 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to general operations manager include personnel and human resources, operations monitoring, operations analysis, psychology, administration and management, and more. Transferring to transportation, storage, and distribution would increase income by \$21 an hour on average; however, a few areas of critical training are in personnel and human resources, psychology, operations and control, operations monitoring, operations analysis, production and processing, sales and marketing, and more.

Shipping, Receiving, and Inventory

| Within Cluster Transition | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and tractor-trailer truck driver | Welders, cutters, solderers |
| <ul style="list-style-type: none"> • Customer and personal services • Geography • Law and government • Equipment selection • Operation and control • Equipment maintenance • Troubleshooting • Repairing | <ul style="list-style-type: none"> • Design • Equipment selection • Equipment maintenance • Repairing |

| Out of Cluster Transition | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Billing and Posting Clerk | Production, planning, and expediting | Compliance officer |
| <ul style="list-style-type: none"> • Administrative, • Economics and accounting • Customer and personal services • Law and government | <ul style="list-style-type: none"> • Administration and management • Customer and personal services • Production and processing • English language • Time management • Management of material resources | <ul style="list-style-type: none"> • Customer and personal services • Medicine and dentistry • Philosophy and theology • Law and government • Social perceptiveness • Systems evaluation |

People who work in shipping, receiving, and inventory earn \$16.30 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as heavy and tractor-trailer truck driver and welders, cutters, and solderers because they are in the same occupational cluster. Transferring to a heavy and tractor-trailer truck driver will give them an increased income of \$5.40 an hour on average; however, they need critical training in customer and personal services, geography, law and government, equipment selection, operation and control, equipment maintenance, troubleshooting, and repairing. Transferring to become a welder, cutter, and solderer will give them an increased income of \$2.60 an hour on average; however, they need critical training in design, equipment selection, equipment maintenance, and repairing.

Besides these easy within-cluster transfers, those working in shipping, receiving, and inventory can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging, and some require even more training. Transferring to a billing and posting clerk would increase income by \$1.60 an hour on average; however, they need critical training in administrative tasks, economics and accounting, customer and personal services, and law and government. Transferring to production, planning, and expediting would increase income by \$6.70 an hour on average; however, a few areas of critical training are in administration and management, customer and personal services, production and processing, English language, time management, and management of material resources. A transition to the occupation of compliance officer would significantly increase income by 14.40 an hour on average; however, critical training would be needed in customer and personal services, medicine and dentistry, philosophy and theology, law and government, social perceptiveness, and systems evaluation.

Continuous Mining Machine Operator

| Within Cluster Transition | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Industrial Machinery Mechanic | Operating engineer and other construction |
| <ul style="list-style-type: none"> • Computers and electronics • Mathematics • Technology design • Installation • Programming • Quality control analysis | <ul style="list-style-type: none"> • Customer and personal service |

| Out of Cluster Transition |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First-line supervisor of construction |
| <ul style="list-style-type: none"> • Administration and management • Administrative • Economics and accounting • Sales and marketing • Customer and personal service • Engineering and technology • Design • Building and construction • Mathematics • Psychology • Reading comprehension • Writing • Speaking • Social perceptiveness • Operations analysis • Management of financial resources • Management of material resources |

People who work as continuous mining machine operators earn \$26.70 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as industrial machinery mechanics and operating engineers (and other construction) because they are in the same occupational cluster. Transferring to an industrial machinery mechanic will give them a decreased income of \$1.00 an hour on average; however, they only need critical training in computers and electronics, mathematics, technology design, installation, programming, quality control analysis. Transferring to operating engineer (and other construction) will give them a decreased income of \$1.90 an hour on average; and they need critical training in only customer and personal services. Although these job transitions result in decreases in income, they required only a few areas of critical training. There were no within-cluster transitions that resulted in an increased income.

Besides these easy within-cluster transfers, continuous mining machine operators can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay higher wages and give workers much greater job security in the future. Transferring to a first-line supervisor of construction would increase income by \$5.20 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for this transition include administration and management, administrative tasks, design, management of financial resources, management of material resources, and more.

Roof Bolters, Mining

| Within Cluster Transition | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
| Industrial Machinery Mechanic | Operating engineers and other construction |
| <ul style="list-style-type: none"> • Food production • Computers and electronics • Engineering and technology • Physics • Operations analysis • Technology design • Installation • Programming • Equipment maintenance • Repairing | <p>No Skills Training Required</p> |

| Out of Cluster Transition |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| First-line supervisor of construction |
| <ul style="list-style-type: none"> • Administration and management • Administrative • Customer and personal service • Personnel and human resources • Engineering and technology • Design • Building and construction • Mechanical • Mathematics • Physics • Psychology • Reading comprehension • Speaking • Social perceptiveness • Operations analysis • Management of material resources |

People who work in roof bolting and mining earn \$28.95 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as industrial machinery mechanic and operating engineers (and other construction) because they are in the same occupational cluster. Transferring to an industrial machinery mechanic will give them a decreased income of \$3.30 an hour on average; and they need critical training in food production, computers and electronics, engineering and technology, physics, operations analysis, technology design, installation, programming, equipment maintenance, and repairing. Transferring to operating engineer (and other construction) will give them a decreased income of \$4.20 an hour on average; however, there is no critical training necessary for the transition. Although these job transitions result in decreases in income, they required only a few areas of critical training. There were no within-cluster transitions that resulted in an increased income.

Besides these easy within-cluster transfers, roof bolting and mining employees can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they pay higher wages and give workers much greater job security in the future. Transferring to a first-line supervisor of construction would increase income by \$3.00 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for this transition include administration and management, administrative tasks, customer and personal service, personnel and human resources, engineering and technology, design, building and construction, mechanical, mathematics, physics, psychology, reading comprehension, speaking, social perceptiveness, operations analysis, and management of material resources.

Powerplant operators

| Out of Cluster Transition | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Computer systems analyst | Electrical Engineer |
| <ul style="list-style-type: none"> • Customer and personal service • Computers and electronics • Mathematics • English language • Reading comprehension • Writing • Active learning • Instructing • Operations analysis • Technology design • Programming • Systems analysis • Systems evaluation • Management of financial resources | <ul style="list-style-type: none"> • Administration and management • Administrative • Sales and marketing • Customer and personal service • Computers and electronics • Engineering and technology • Design • Building and construction • Mathematics • Physics • Geography • Education and training • English language • Science • Negotiation • Operations analysis • Systems evaluation • Management of financial resources • Management of material resources |

People who work as powerplant operators earn \$39.50 an hour on average. As employment in the occupation declines in the Buckeye Hills region, people in this occupation can transfer to jobs such as computer systems analyst and electrical engineer. Neither of these jobs are in the same occupational cluster as Powerplant Operators. These two jobs were also the only options that did not result in a wage loss. Transferring to a computer systems analyst will give employees an increased income of \$1.20 an hour on average; however, they need critical training in many skills areas. Some of the most important training areas include computers and electronics, customer and personal services, English language, operations analysis, technology design, programming, systems evaluation, and more. Transferring to electrical engineering would give the employees an increased income of \$1.30 an hour on average; however, they would also need critical training in many skills areas. These include computers and

electronics, engineering and technology, design, mathematics, English language, operations analysis, management of material resources, and more. Despite the increased areas of training, other occupations that may require less critical training result in a significant loss of income.

Crushing, Grinding, and Polishing

| Within Cluster Transition | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| Industrial Machinery Mechanics | Operating Engineers and Other Construction | Machinists |
| <ul style="list-style-type: none"> • Computers and electronics • Engineering and technology • Design • Physics • Operations analysis • Technology design • Installation • Programming • Equipment maintenance • Repairing | <p>No Skills Training Required</p> | <ul style="list-style-type: none"> • Design • Operations analysis • Technology design • Installation |

| Out of Cluster Transition |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and Tractor-Trailer Truck Drivers |
| <ul style="list-style-type: none"> • Customer and personal service • Geography • Law and government • Telecommunication • Transportation |

People who work in crushing, grinding, and polishing earn \$19.10 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as industrial machinery mechanics, operating engineers (and other construction), and machinists because they are in the same occupational cluster. Transferring to an industrial machinery mechanic will give them an increased income of \$6.60 an hour on average; however, they need critical training in computers and electronics, engineering and technology, design, physics, operations analysis, technology design, installation, programming, equipment maintenance, and repairing. Transferring to an operating engineer (and other construction) will give them an increased income of \$5.70 an hour on average; and there are no areas where critical training is required. Transferring to the occupation of machinist will give them an increased income of \$1.40 an hour on average; however, they need critical training in design, operations analysis, technology design, and installation.

Besides these easy within-cluster transfers, those in crushing, grinding, and polishing can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training; however, they can offer workers job security in the future.

Transferring to a heavy and tractor-trailer truck driver would increase income by \$2.60 an hour on average; however, they need critical training in Customer and personal service, geography, law and government, telecommunications, and transportation.

Inspectors, Testers, and Sorters

| Within Cluster Transition | |
|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating engineers and other construction | Machinists |
| <ul style="list-style-type: none"> • Operations and control • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Technology design • Equipment selection • Installation • Equipment maintenance • Repairing |

| Out of Cluster Transition | |
|------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Welders, cutters, solderers, | Heavy and tractor-trailer truck drivers |
| <ul style="list-style-type: none"> • Installation | <ul style="list-style-type: none"> • Geography • Law and government • Telecommunication • Transportation • Equipment maintenance • Repairing |

People who work as inspectors, testers, and sorters earn \$19.00 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as operating engineers (and other construction) and machinists because they are in the same occupational cluster. Transferring to an operating engineer (and other construction) will give them an increased income of \$5.80 an hour on average; however, they need critical training in operations and control, equipment maintenance, and repairing. Transferring to becoming a machinist will give them an increased income of \$1.50 an hour on average; however, they need critical training in technology design, equipment selection, installation, equipment maintenance, and repairing.

Besides these easy within-cluster transfers, inspectors, testers, and sorters can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and can require more training; however, they can provide job security in the future. Transferring to a welder, cutter, and solderer would increase income by \$0.20 an hour on average; and they only need critical training in installation. Transferring to become a heavy and tractor-trailer truck driver would increase income by \$2.70 an hour on average; however, critical training is needed in geography, law and government, telecommunications, transportation, equipment maintenance, and repairing.

Conveyor Operators and Tenders

| Within Cluster Transition | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating engineers and other construction | Machinists |
| <ul style="list-style-type: none"> • Administration management • Engineering and technology • Building and construction • Mechanical • Geography | <ul style="list-style-type: none"> • Computers and electronics • Engineering and technology • Design • Physics • Installation |

| Out of Cluster Transition |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and Tractor-trailer truck driver |
| <ul style="list-style-type: none"> • Administration and management • Economics and accounting • Sales and marketing • Customer and personal services • Computers and electronics • Engineering and technology • Geography • Telecommunications • Transportation |

People who work as conveyor operators and tenders earn \$19.60 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as operating engineers (and other construction) and machinists because they are in the same occupational cluster. Transferring to operating engineers (and other construction) will give them an increased income of \$5.20 an hour on average; however, they need critical training in administration management, engineering and technology, building and construction, mechanical, and geography. Transferring to becoming a machinist will give them an increased income of \$0.90 an hour on average; however, they need critical training in computers and electronics, engineering and technology, design, physics, and installation.

Besides these easy within-cluster transfers, conveyor operators and tenders can also transfer into other possible out-of-cluster occupations. These cross-cluster transitions are more challenging and require even more training. Transferring to a heavy and tractor-trailer truck driver would increase income by \$2.10 an hour on average; however, they need critical training in more areas than those within the same cluster. Some of the most significant critical training areas for a transition to heavy and tractor-trailer truck driver include administration and management, economics and accounting, sales and marketing, customer and personal services, computers and electronics, engineering and technology, geography, telecommunications, and transportation.

Stockers and Order Fillers

| Within Cluster Transition | | |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| Heavy and Tractor-trailer truck driver | Light Truck Drivers | Laborers and Freight Stock |
| <ul style="list-style-type: none"> • Mechanical • Geography • Public safety and security • Law and government • Transportation • Equipment selection • Operations and monitoring • Operations and control • Equipment maintenance • Troubleshooting • Repairing | <ul style="list-style-type: none"> • Mechanical • Law and government • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Equipment selection • Equipment maintenance • Repairing |

| Out of Cluster Transition | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Industrial truck and trailer operator | Billing and Posting Clerk |
| <ul style="list-style-type: none"> • Production and processing • Building and construction • Equipment selection • Operations monitoring • Equipment maintenance • Repairing | <ul style="list-style-type: none"> • Administration and management • Administrative • Economics and accounting • Customer and personal service • Personnel and human resources • Computers and electronics • Mathematics • Psychology |

People who work as stockers and order fillers earn \$12.60 an hour on average. As employment in this occupation declines in the Buckeye Hills region, people in this occupation can easily transfer to jobs such as heavy and tractor-trailer truck driver, light truck driver, and laborer and freight stocker because they are in the same occupational cluster. Transferring to become a heavy and tractor-trailer truck driver will give them an increased income of \$9.10 an hour on average; however, they need critical training in mechanical, geography, public safety and security, law and government, transportation, equipment selection, operations and monitoring, operations and control, equipment maintenance, troubleshooting, and repairing. Transferring to light truck driver will give them an increased income of \$2.70 an hour on average; however, they need critical training in mechanics, law and government, equipment maintenance, and repairing. Transferring to the occupation of laborer and freight stocker will give them an increased income of \$1.90 an hour on average; however, they need critical training in equipment selection, equipment maintenance, and repairing.

Besides these easy within-cluster transfers, procurement clerks can also transfer into other possible out-of-cluster occupations. Transferring to an industrial truck and trailer operator would increase income by \$4.80 an hour on average; however, they need critical training in production and processing, building and construction, equipment selection, operations monitoring, equipment maintenance, and repairing. Transferring to become a billing and posting clerk would increase income by \$5.30 an hour on average; however, critical training would be needed in administration and management, administrative tasks, economics and accounting, customer and personal service, personnel and human resources, computers and electronics, mathematics, and psychology.

Gas Compressor and Gas Pumping

| Out of Cluster transition | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrical Engineer | General Operations Manager | First-line supervisor of construction |
| <ul style="list-style-type: none"> • Computers and electronics • Engineering and technology • Design • Mathematics • Physics • Reading comprehension • Science • Operations analysis • System evaluation • Management of financial resources • Management of material resources | <ul style="list-style-type: none"> • Administration and management • Economics and accounting • Sales and marketing • Customer and personal service • Personnel and human resources • Psychology • Sociology and anthropology • Law and government • Telecommunications • Communications and media • Active learning • Social perceptiveness • Persuasion and negotiation • Operations analysis • Management of financial resources • Management of material resources | <ul style="list-style-type: none"> • Customer and personal service • Personnel and human resources • Design • Building and construction • Psychology • Operations analysis • Management of financial resources |

People who work in gas compressing and gas pumping earn \$36.50 an hour on average. As employment in this occupation declines in the Buckeye Hills region employees can transfer to jobs such as electrical engineer, general operations manager, or first-line supervisor of construction. None of these jobs were in the same occupational cluster as gas compressing and gas pumping. Two of the three job transitions did not result in a wage loss. Transferring to an electrical engineer will give them an increased income of \$4.30 an hour on average; however, they need critical training in many skills areas. Some of the most important training areas include design, engineering and technology, mathematics, science, operations analysis, and more. Transferring occupations to become a general operations manager would give the employee an increased income of \$10.40 an hour on average; however, they would also need

critical training in a significant number of skills areas. Some of these include economics and accounting, customer and personal services, personnel and human resources, psychology, management of financial resources, management of material resources, and more. Transitioning to a career as a first-line supervisor of construction would decrease the employee's income by \$4.6 an hour on average but requires less skills training. The critical skills it would require is customer and personal service, personnel and human resources, design, building and construction, psychology, operations analysis, and management of financial resources. Despite the increased areas of training, other occupations that may require less training result in a more significant loss of income.

Tank Car, Truck, and Ship Loader

| Within Cluster Transition | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating engineers and other construction | Industrial machinery mechanics |
| <ul style="list-style-type: none"> • Engineering and technology • Building and construction • Mechanical • Operations analysis • Equipment maintenance | <ul style="list-style-type: none"> • Computers and electronics • Engineering and technology • Design • Building and construction • Mechanical • Physics • Operations analysis • Technology design • Installation • Programming • Equipment maintenance • Troubleshooting • Repairing |

| Out of Cluster Transition | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Heavy and tractor-trailer truck driver | Welders, cutters, solderers |
| <ul style="list-style-type: none"> • Customer and personal service • Geography • Law and government • Telecommunication • Transportation | <ul style="list-style-type: none"> • Engineering and technology • Design • Building and construction • Operations analysis |

People who work as tank car, truck, and ship loaders earn \$18.10 an hour on average. As employment in this occupation declines in the Buckeye Hills region, employees can easily transfer to jobs such as operating engineers (and other construction) and industrial machinery mechanics because they are in the same occupational cluster. Transferring to an operating engineer (and other construction) will give them an increased income of \$6.70 an hour on average; however, they need critical training in engineering and technology, building and construction, mechanical, operations analysis, and equipment maintenance. Transferring to industrial machinery mechanics will give them an increased income of \$7.60 an hour on average; however, they need critical training in computers and electronics, engineering

and technology, design, building and construction, mechanical, physics, operations analysis, technology design, installation, programming, equipment maintenance, troubleshooting, and repairing.

Besides these easy within-cluster transfers, tank, car, truck, and ship loaders can also transfer into other possible out-of-cluster occupations. Transferring to a heavy and tractor-trailer truck driver would increase income by \$3.60 an hour on average; however, they need critical training in customer and personal service, geography, law and government, telecommunications, and transportation. Transferring to an occupation as a welder, cutter, or solderer would increase income by \$1.20 an hour on average; however, critical training is needed in engineering and technology, design, building and construction, and operations analysis.

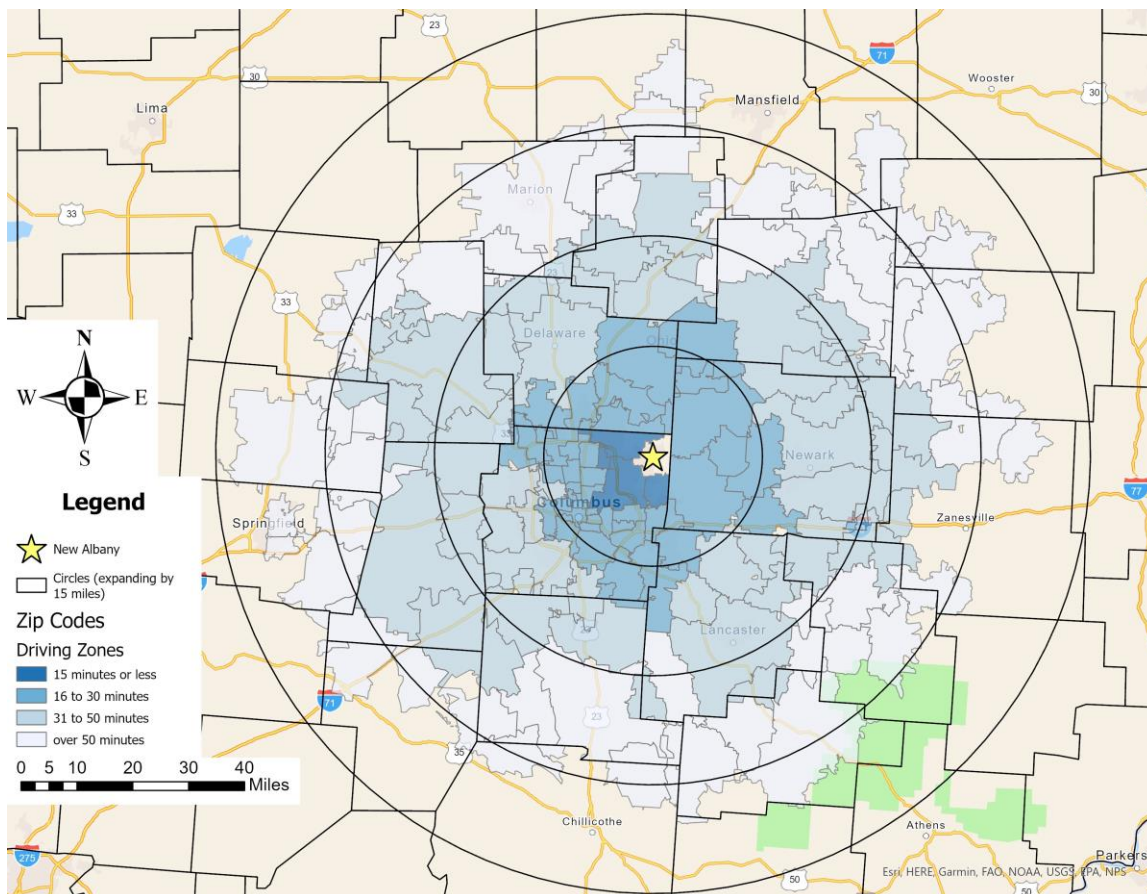
Part C. Intel Semiconductor Plant's Impacts on the US Economy

In January of 2022, Intel announced an investment of more than \$20 billion in two semiconductor factories in Licking County, Ohio. When finished, these factories will be Intel’s newest U.S. manufacturing site in 40 years. This investment will boost production to meet the increasing demand for advanced semiconductors. This \$20 billion investment from Intel is the largest single private-sector investment in Ohio history. Intel started its new site construction in Ohio in September 2022, and the project is expected to be completed in 2025.

According to an Intel report, the company's initial \$20 billion investment in its two new factories is expected to bring more than 7,000 construction jobs to Ohioans during the construction phase and create over 3,000 new high-wage and high-tech jobs during the operation phase¹⁰.

The new semiconductor factories are located in New Albany, Licking County, Ohio. They are expected to bring new job opportunities to their neighboring counties and regions, including the OMEGA and Buckeye Hills regions. In the OMEGA region, Holmes County, Hocking County, and Muskingum County are within 50 miles of the Intel factories, or 30 to 60 minutes of driving time. In the Buckeye Hills region, Hocking County and Perry County are also within 50 miles of the Intel factories, or 30 to 60 minutes of driving time (Figure 1).

Figure 1: Driving zones from the Intel manufacturing site in New Albany, Licking County, Ohio.



¹⁰ Intel Ohio: By the Numbers - A new epicenter for advanced chipmaking in the Midwest. <https://download.intel.com/newsroom/2022/manufacturing/ohio-by-the-numbers-080322.pdf>.

Image 1: A rendering shows early plans for two new leading-edge intel processor factories in Licking County, Ohio.¹¹



Image 2: Intel's Ohio One construction teams begin to pour concrete in May 2023.¹²



¹¹ Source: <https://www.intel.com/content/www/us/en/newsroom/news/intel-announces-next-us-site-landmark-investment-ohio.html#gs.03zr7d>.

¹² Source: <https://www.intel.com/content/www/us/en/newsroom/resources/intel-invests-ohio.html#gs.03zwag>.

I. Estimated numbers of jobs by occupations in the semiconductor manufacturing industry.

In this report, we use the **National Industry-Specific Occupational Employment and Wage Estimates** data for the Semiconductor and Other Electronic Component Manufacturing industry (NAICS 334400) to estimate the number of jobs for each occupation in the semiconductor manufacturing industry cluster (Table 1).

Of the total projected 3,000 high-tech semiconductor manufacturing jobs needed for the new Intel manufacturing site, 443 jobs (14.77%) include Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers, 176 jobs (5.86%) are Semiconductor Processing Technicians, 137 jobs (4.57%) include Inspectors, Testers, Sorters, Samplers, and Weighers, 125 jobs (4.18%) are Industrial Engineers and 106 jobs (3.53%) are Software Developers (Table 1).

Table 1: Emerging jobs for Semiconductor Manufacturing

| SOC code | Occupation title (click on the occupation title to view an occupational profile) | Projected Employment | Percent of total employment | Median hourly wage (\$) |
|-----------------|------------------------------------------------------------------------------------------------------|-----------------------------|------------------------------------|--------------------------------|
| 51-2028 | Electrical, Electronic, and Electromechanical Assemblers, Except Coil Winders, Tapers, and Finishers | 443 | 14.77% | 17.49 |
| 51-9141 | Semiconductor Processing Technicians | 176 | 5.87% | 21.51 |
| 51-9061 | Inspectors, Testers, Sorters, Samplers, and Weighers | 137 | 4.57% | 20.11 |
| 17-2112 | Industrial Engineers | 125 | 4.18% | 47.56 |
| 15-1252 | Software Developers | 106 | 3.53% | 66.1 |
| 17-2072 | Electronics Engineers, Except Computer | 95 | 3.17% | 61.37 |
| 17-2061 | Computer Hardware Engineers | 95 | 3.16% | 63.44 |
| 17-3023 | Electrical and Electronic Engineering Technologists and Technicians | 93 | 3.11% | 29.62 |
| 51-1011 | First-line supervisors of Production and Operating Workers | 87 | 2.89% | 31.06 |
| 11-9041 | Architectural and Engineering Managers | 65 | 2.17% | 82.53 |
| 17-2071 | Electrical Engineers | 61 | 2.02% | 59.32 |
| 17-3026 | Industrial Engineering Technologists and Technicians | 58 | 1.92% | 29.43 |
| 49-9041 | Industrial Machinery Mechanics | 54 | 1.81% | 30.16 |
| 11-1021 | General and Operations Managers | 52 | 1.73% | 75.88 |
| 17-2141 | Mechanical Engineers | 43 | 1.44% | 49.2 |
| 11-3051 | Industrial Production Managers | 40 | 1.32% | 59.4 |
| 43-5071 | Shipping, Receiving, and Inventory Clerks | 39 | 1.31% | 18.43 |
| 43-5061 | Production, Planning, and Expediting Clerks | 38 | 1.27% | 26.48 |
| 49-9071 | Maintenance and Repair Workers, General | 34 | 1.14% | 29.8 |

Table 1 - Continue

| SOC code | Occupation title (click on the occupation title to view an occupational profile) | Projected Employment | Percent of total employment | Median hourly wage (\$) |
|-----------------|----------------------------------------------------------------------------------------------|-----------------------------|------------------------------------|--------------------------------|
| 13-2011 | Accountants and Auditors | 30 | 0.99% | 46.36 |
| 11-3021 | Computer and Information Systems Managers | 28 | 0.92% | 89.71 |
| 17-2199 | Engineers, All Other | 28 | 0.92% | 59.27 |
| 53-7062 | Laborers and Freight, Stock, and Material Movers, Hand | 27 | 0.91% | 18.33 |
| 41-4012 | Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products | 26 | 0.88% | 39.12 |
| 13-1082 | Project Management Specialists | 26 | 0.86% | 63.09 |
| 51-9199 | Production Workers, All Other | 25 | 0.84% | 21.97 |
| 51-4041 | Machinists | 25 | 0.83% | 22.71 |

II. Economic impacts of Intel semiconductor factories.

In this section, we examine the economic impacts of the new Intel semiconductor factories on Ohio's economy during their construction and operation phases using the IMPLAN input-output model¹³.

1. Construction phase

We estimate the economic impact of the construction phase using Intel's estimated 7,000 construction jobs needed to build their new Ohio semiconductor factories. Table 2 shows the direct, indirect, and induced impacts of the construction phase on Ohio's economy. The construction phase is expected to bring over 7,000 direct construction jobs, support another 1,597.45 jobs through indirect effects, and 3,224.49 jobs through induced effects. In total, the construction phase of the Intel semiconductor factories supports 11,821.94 Ohioan jobs with total earnings of \$801,847,469 (Table 2). The construction phase of the Intel semiconductor factories is expected to contribute \$1.07 billion to Ohio's gross state product (GSP) (Table 2).

Table 2: The economic impact of the construction phase.

| Impact | Employment | Labor Income | Value Added | Output |
|--------------|------------|------------------|--------------------|--------------------|
| 1 - Direct | 7,000.00 | \$504,544,452.70 | \$541,756,288.00 | \$983,822,218.11 |
| 2 - Indirect | 1,597.45 | \$118,595,833.11 | \$201,919,796.74 | \$399,243,940.76 |
| 3 - Induced | 3,224.49 | \$178,707,183.18 | \$324,243,117.90 | \$565,401,884.35 |
| Total | 11,821.94 | \$801,847,468.99 | \$1,067,919,202.64 | \$1,948,468,043.23 |

Table 3 and Figure 2 show the top 10 industries by employment impact during the construction phase. Besides 7,000 direct construction jobs created, the construction phase of the Intel factories is also expected to support 233 jobs in hospitals, 192 jobs in employment services, 341 jobs in limited-service

¹³ Further information about IMPLAN's model, data, and methodology can be found on IMPLAN's website at <https://support.implan.com/hc/en-us/articles/360044985833-About-IMPLAN>.

and full-service restaurants, 163 jobs in real estate, 140 jobs in truck transportation, 122 jobs in offices of physicians, 203 jobs in wholesale, and thousands of jobs in other industries.

Table 4 and Figure 3 show the top 10 industries by estimated growth in the construction phase of the Intel chip factories. These industries include construction industries, manufacturing industries, mining industries, and rental and leasing industries. For example, the construction of new manufacturing structure in Ohio is expected to grow by 33.61%, ready-mix concrete manufacturing is expected to grow by 1.77%, other concrete product manufacturing is expected to grow by 1.25%, and cement manufacturing is expected to grow by 1.02% (Table 4).

Table 5 and Figure 4 show the top 10 industries by impact output in the construction phase of the intel chip factories. These industries include construction industries, real estate industries, wholesale industries, transportation industries, and finance and insurance industries. For example, the construction of new manufacturing structures is expected to gain \$983,822,218 in output, the owner-occupied dwellings industry is expected to gain \$53,689,714 in output, and the hospitals industry is expected to gain \$43,643,788 in output (Table 5).

Table 3: Top 10 industries by employment impact.

| Industry | Employment Impact |
|------------------------------------------------------|-------------------|
| Construction of new manufacturing structures | 7,000 |
| Hospitals | 233 |
| Employment services | 192 |
| Limited-service restaurants | 171 |
| Full-service restaurants | 170 |
| Other real estate | 163 |
| Truck transportation | 140 |
| Offices of physicians | 122 |
| Wholesale - Other durable goods merchant wholesalers | 109 |
| Wholesale - Machinery, equipment, and supplies | 94 |

Figure 2: Top 10 industries by employment impact

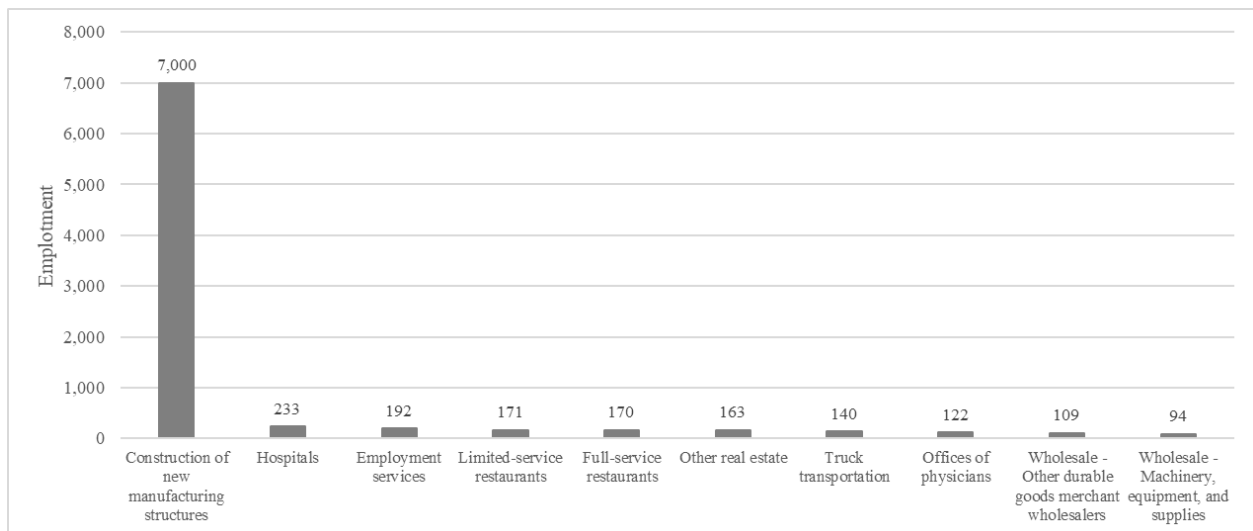


Table 4: Top 10 industries by estimated growth.

| Industry | Estimated Growth Percentage |
|----------------------------------------------------------------------|-----------------------------|
| Construction of new manufacturing structures | 33.61% |
| Ready-mix concrete manufacturing | 1.77% |
| Other concrete product manufacturing | 1.25% |
| Cement manufacturing | 1.02% |
| Sand and gravel mining | 0.76% |
| Stone mining and quarrying | 0.73% |
| Fabricated pipe and pipe fitting manufacturing | 0.62% |
| Prefabricated wood building manufacturing | 0.60% |
| Concrete pipe manufacturing | 0.49% |
| Commercial and industrial machinery and equipment rental and leasing | 0.45% |

Figure 3: Top 10 industries by estimated growth.

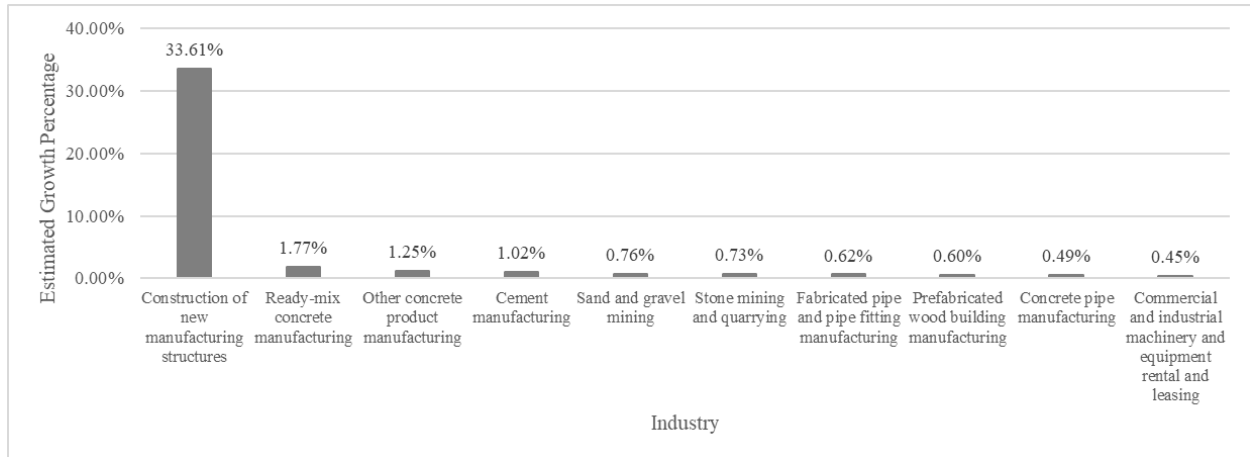
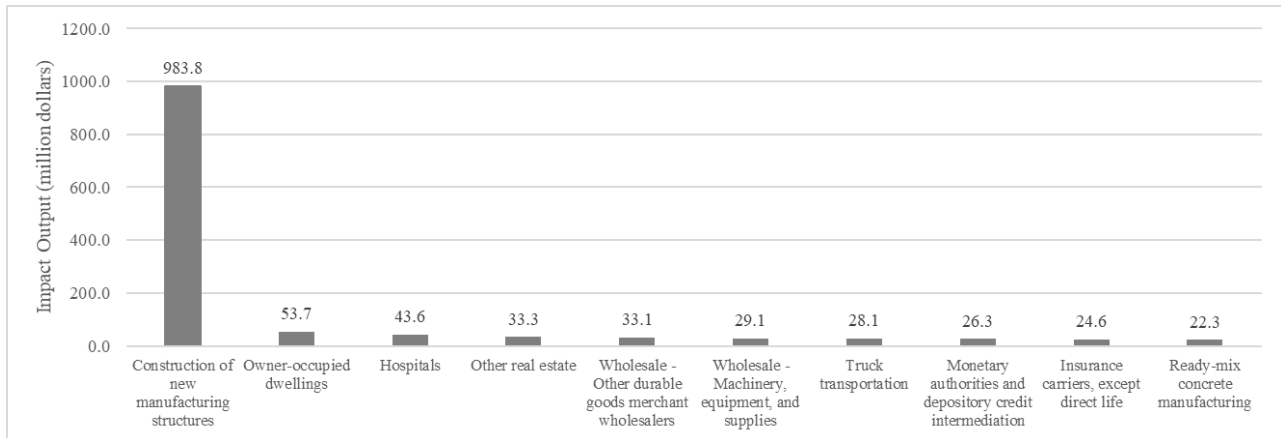


Table 5: Top 10 industries by estimated impact output.

| Industry | Impact Output |
|-----------------------------------------------------------|------------------|
| Construction of new manufacturing structures | \$983,822,218.11 |
| Owner-occupied dwellings | \$53,689,714.32 |
| Hospitals | \$43,643,788.27 |
| Other real estate | \$33,340,248.74 |
| Wholesale - Other durable goods merchant wholesalers | \$33,115,659.36 |
| Wholesale - Machinery, equipment, and supplies | \$29,146,325.17 |
| Truck transportation | \$28,054,897.78 |
| Monetary authorities and depository credit intermediation | \$26,262,593.17 |
| Insurance carriers, except direct life | \$24,630,493.22 |
| Ready-mix concrete manufacturing | \$22,302,657.40 |

Figure 4: Top 10 industries by impact output.



2. Operation phase

We estimate the annual economic impact of the operation phase using Intel's estimated 3,000 jobs in the semiconductor manufacturing industry. Table 6 shows the annual direct, indirect, and induced impacts of the operation phase on Ohio's economy. The operation phase is expected to bring over 3,000 direct jobs in the semiconductor manufacturing industry, support another 3,790.92 jobs through indirect effects, and 4,500.84 jobs through induced effects. In total, the operation phase of the Intel semiconductor factories supports 11,291.76 Ohioan jobs annually, with total annual earnings of \$1,12 billion (Table 6). The operation phase of the Intel semiconductor factories is expected to contribute \$1.55 billion annually to Ohio's gross state product (GSP) (Table 6).

Table 7 and Figure 5 show the top 10 industries by employment impact during the operation phase. Besides 3,000 direct jobs created in the semiconductor manufacturing industry, the operation phase of the Intel factories is also expected to support 686 jobs in custom computer programming services, 479 jobs in management of companies and enterprises, 331 jobs in employment services, 328 jobs in hospitals, 509 jobs in restaurant services, 239 jobs in wholesale, 208 jobs in real estate, 202 jobs in truck transportation, and thousands of jobs in other industries (Table 7).

Table 8 and Figure 6 show the top 10 industries by estimated growth in the operation phase of the Intel chip factories. These industries include semiconductor machinery manufacturing industries, custom computer programming services industries, wholesale industries, services industries, and other manufacturing industries. For example, the semiconductor machinery manufacturing industry is expected to grow by 7191.12%, and the custom computer programming services industry is expected to grow by 1.02% (Table 8).

Table 9 and Figure 7 show the top 10 industries by impact output in the operation phase of the intel chip factories. These industries include the semiconductor machinery manufacturing industry, management industries, custom computer programming industries, wholesale industries, hospitals, and truck transportation industries. For example, the semiconductor machinery manufacturing industry is expected to grow \$1.78 billion in output, the management of companies and enterprises industry is expected to increase \$125.9 million in output, and the custom computer programming services industry is expected to increase \$85.1 million in output (Table 9).

Table 6: The annual economic impact of the operation phase

| Impact | Employment | Labor Income | Value Added | Output |
|--------------|------------|--------------------|--------------------|--------------------|
| 1 - Direct | 3,000.00 | \$548,092,253.22 | \$656,188,900.01 | \$1,781,694,777.81 |
| 2 - Indirect | 3,790.92 | \$320,560,951.45 | \$444,637,038.30 | \$793,051,593.48 |
| 3 - Induced | 4,500.84 | \$249,705,536.76 | \$453,121,516.32 | \$790,157,862.59 |
| Total | 11,291.76 | \$1,118,358,741.44 | \$1,553,947,454.63 | \$3,364,904,233.89 |

Table 7: Top 10 industries by employment impact.

| Industry | Employment |
|------------------------------------------------|------------|
| Semiconductor machinery manufacturing | 3,000 |
| Custom computer programming services | 686 |
| Management of companies and enterprises | 479 |
| Employment services | 331 |
| Hospitals | 328 |
| Full-service restaurants | 257 |
| Limited-service restaurants | 252 |
| Wholesale - Machinery, equipment, and supplies | 239 |
| Other real estate | 208 |
| Truck transportation | 202 |

Figure 5: Top 10 industries by employment impact

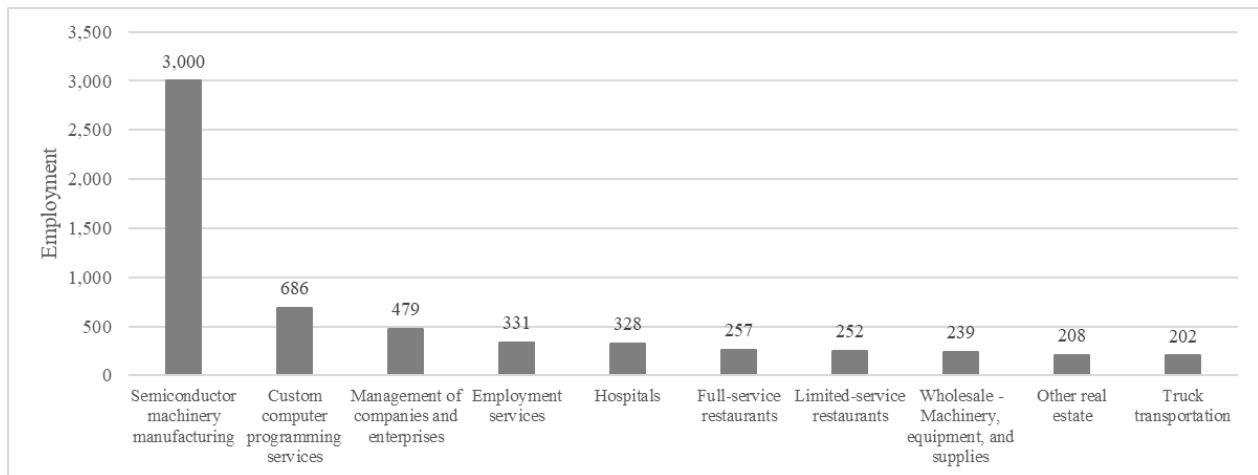


Table 8: Top 10 industries by estimated growth.

| Industry | Estimated Growth Percentage |
|----------------------------------------------------------------------|-----------------------------|
| Semiconductor machinery manufacturing | 7191.12% |
| Custom computer programming services | 1.02% |
| Wholesale - Machinery, equipment, and supplies | 0.72% |
| Turned product and screw, nut, and bolt manufacturing | 0.65% |
| Wholesale - Household appliances and electrical and electronic goods | 0.60% |
| Abrasive product manufacturing | 0.50% |
| Valve and fittings, other than plumbing, manufacturing | 0.47% |
| Wholesale - Other durable goods merchant wholesalers | 0.37% |
| Environmental and other technical consulting services | 0.34% |
| Management of companies and enterprises | 0.33% |

Figure 6: Top 10 industries by estimated growth.

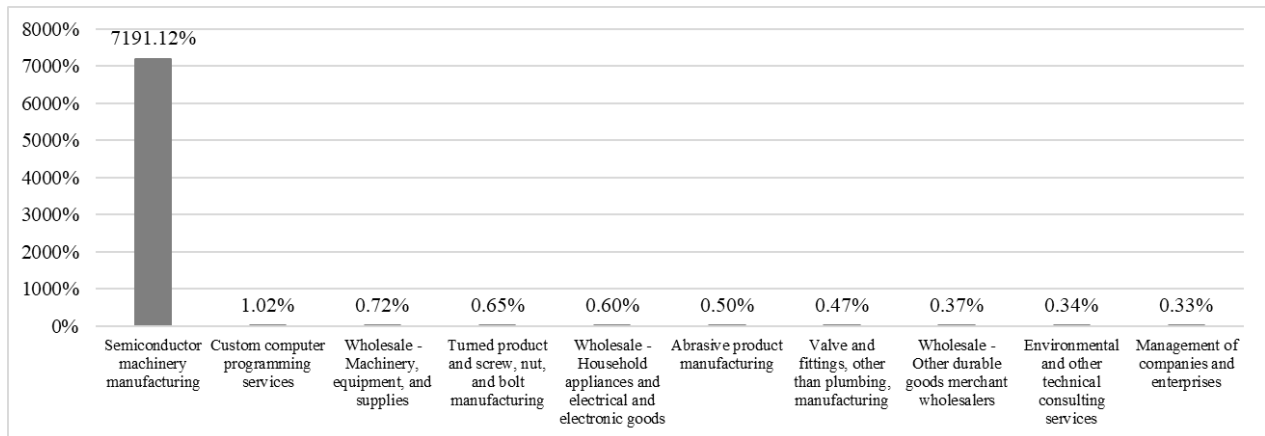


Table 9: Top 10 industries by estimated impact output.

| Industry | Impact Output |
|----------------------------------------------------------------------|--------------------|
| Semiconductor machinery manufacturing | \$1,781,705,639.29 |
| Management of companies and enterprises | \$125,945,858.60 |
| Custom computer programming services | \$85,120,022.73 |
| Owner-occupied dwellings | \$74,412,892.26 |
| Wholesale - Machinery, equipment, and supplies | \$74,211,952.51 |
| Hospitals | \$61,440,707.30 |
| Wholesale - Other durable goods merchant wholesalers | \$57,970,439.40 |
| Other real estate | \$42,762,457.56 |
| Wholesale - Household appliances and electrical and electronic goods | \$41,605,440.10 |
| Truck transportation | \$40,292,049.63 |

Figure 7: Top 10 industries by impact output.

