



Management**Resources**

SUPPLY CHAIN OPTIMIZATION AND INTELLIGENCE NETWORK (SCOIN) OHIO REPORT

ENHANCING RESILIENCE IN EMERGING
MANUFACTURING SECTORS

Prepared for

The Manufacturing Extension Partnership at Columbus State Community College

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Table of Contents

Executive Summary	2
Key Findings	2
Recommendation Highlights	2
Foreword.....	3
Introduction	3
Methodology	4
Data Collection Methods	4
Description of the Target Audience for This Report	5
Analytical Approach and Tools Used for Data Analysis.....	5
Implementation.....	5
Current Situation and Challenges.....	6
Key Challenges Identified.....	9
Market Segment Study and Supply Chain Mapping.....	20
Aerospace Market Segment Analysis:	21
Market Segment Analysis: Aerospace and Fabricated Materials Industry Overview	22
Aerospace Supply Chain.....	25
Automotive/EV Market Segment Analysis:.....	31
Market Segment Analysis: Automotive and Electric Vehicles (EV) in Ohio	32
Automotive/EV Supply Chain	38
Semiconductor Market Segment Analysis:	47
Market Segment Analysis: Semiconductors	48
Semiconductor Supply Chain	53
Recommendations	55
Workforce Development.....	55
Geographic Diversification and Supply Chain Resilience	57
Enhancing Supply Chain Visibility.....	58
Ensuring Raw Materials Supply	60
Conduct More Discovery Activities	61
Conclusion	62
Appendix	63



Executive Summary

The Supply Chain Optimization and Intelligence Network (SCOIN) is a strategic initiative led by the National Institute of Standards and Technology (NIST) under the Manufacturing Extension Partnership (MEP) National Network. Officially launched on June 1, 2023, SCOIN expands the MEP Network's scope from working primarily with individual companies to taking a more comprehensive approach to manufacturing supply chains. SCOIN aims to enhance the resilience of Ohio's manufacturing sector by mapping supply chain capabilities, scaling up supplier scouting services, and strengthening regional manufacturing ecosystems.

The 2024 SCOIN Ohio report provides an in-depth analysis of the current state, challenges, and future opportunities for Ohio's small and medium-sized manufacturers (SMMs). This report aims to offer strategic insights into supply chain dynamics, workforce development, and economic growth, ensuring that Ohio remains a leader in manufacturing resilience and innovation.

Key Findings

Supply Chain Concerns: Ohio's manufacturers face significant challenges related to rising shipping costs (53.4%), supplier performance issues (54.5%), geopolitical tensions (23.8%), and raw material shortages (36.1%). These issues are critical as they directly impact production efficiency and cost management. Global issues, particularly those involving key supply chain regions like Taiwan, underscore the need for strategies such as reshoring and nearshoring to stabilize supply chains and mitigate risks.

Economic Growth Challenges: Rising prices (58%) and workforce availability (78%) are major concerns. The manufacturing sector's growth is heavily dependent on having a skilled and available workforce, alongside managing economic pressures from inflation and other cost increases.

Confidence in Meeting Demand: Despite the challenges, a substantial majority, 95% of manufacturers are either somewhat confident (44.8%) or very confident (50.2%) in their ability to meet customer demand. This optimism is a strong indicator of the sector's resilience and adaptability.

Recommendation Highlights

1. Workforce Development: To address skill shortages and workforce challenges, it is crucial to expand structured training programs, promote competency-based hiring practices, and provide comprehensive support services such as childcare and transportation. Initiatives should also focus on engaging K-12 students and overcoming the stigma associated with vocational education.

2. Geographic Diversification and Supply Chain Resilience: Implementing regional sourcing and multisourcing strategies, encouraging reshoring and nearshoring, developing local supply chains, and investing in platforms like the Sustainment platform are essential steps to enhance supply chain resilience and reduce dependency on single sources or regions.

3. Enhancing Supply Chain Visibility: Investing in AI-driven supply chain monitoring tools, utilizing blockchain for enhanced transparency, fostering collaboration and data sharing, and integrating IoT technologies can significantly improve supply chain visibility and decision-making capabilities.

4. Ensuring Raw Materials Supply: Diversifying raw material sources, increasing investment in local supply chains, implementing advanced forecasting and inventory management, and promoting sustainable practices are critical to securing a steady flow of essential materials and reducing reliance on volatile markets.

5. Conduct More Discovery Activities: Conduct immediate and periodic discovery activities to further define and understand current supply chain resiliency needs and challenges. Utilize the initial survey of 277 manufacturers as a baseline to identify immediate needs and gaps within the supply chain. Implement biannual surveys and interviews with industry stakeholders to track changes in supply chain resiliency needs and trends, ensuring continuous adaptation and improvement.

Ohio's manufacturing sector is at a pivotal point, facing significant challenges but also possessing substantial opportunities for growth and innovation. By focusing on workforce development, geographic diversification, supply chain visibility, and raw materials supply, Ohio can build a resilient and competitive manufacturing ecosystem. The Ohio MEP, supported by NIST's SCOIN initiative, plays a crucial role in facilitating these strategies through partnerships, expertise, and resources.

Through continued investment in these key areas, Ohio can maintain its leadership in manufacturing resilience and innovation, ensuring a prosperous future for its industries and communities. This comprehensive approach will position Ohio as a model for manufacturing excellence and economic stability.

Foreword

The Ohio Department of Development, in collaboration with the Ohio MEP, presents this detailed report on the health and future of the state's manufacturing sector. In an era marked by rapid technological advancements and unprecedented global challenges, it is imperative to understand and address the vulnerabilities within our supply chains. This report reflects our commitment to fostering a robust and resilient manufacturing ecosystem in Ohio.

This initiative is part of the broader CHIPS and Science Act, a bipartisan effort to bolster domestic semiconductor manufacturing and strengthen critical supply chains. Funded through a grant from the National Institute of Standards and Technology (NIST) and the MEP, this effort focuses on identifying and addressing the needs of small and medium-sized manufacturers (SMMs) to ensure their resilience and competitiveness.

Introduction

The manufacturing sector in Ohio is a critical component of the state's economy, contributing significantly to employment, innovation, and economic growth. Small and medium-sized manufacturers (SMMs) are the backbone of this sector, driving productivity and competitiveness. However, recent global events, including the COVID-19 pandemic, have exposed vulnerabilities in supply chains, workforce availability, and raw material sourcing. Addressing these challenges is essential to ensure the resilience and continued growth of Ohio's manufacturing industry.

The Supply Chain Optimization and Intelligence Network (SCOIN) is a strategic initiative launched by the National Institute of Standards and Technology (NIST) under the Manufacturing Extension Partnership (MEP) National Network. SCOIN aims to enhance the resilience of the manufacturing sector by providing comprehensive data, insights, and actionable recommendations. By mapping supply chain capabilities, scaling up supplier scouting



services, and strengthening regional manufacturing ecosystems, SCOIN seeks to support SMMs in navigating the complexities of the modern manufacturing landscape.

This report offers an in-depth analysis of the current state of Ohio's manufacturing sector, highlighting key challenges and opportunities. It provides strategic insights into workforce development, supply chain dynamics, and economic growth, with a focus on ensuring that Ohio remains a leader in manufacturing resilience and innovation. Through a combination of survey data, industry interviews, data gathering and research, this report outlines the current situation and recommendations for enhancing the competitiveness of Ohio's SMMs and fostering a robust, resilient manufacturing ecosystem.

As part of this effort, we conducted a detailed market segment and supply chain analysis on three emerging manufacturing industries: Aerospace, Automotive/EV, and Chemicals/Plastics. This analysis aims to provide a comprehensive overview of the current landscape, highlight critical issues, and offer strategic recommendations to enhance resilience and competitiveness. Each segment analysis includes a detailed examination of supply chain dynamics, key players, gaps, and opportunities for improvement, supported by data and insights from industry experts and stakeholders.

Key areas of focus in this report include:

- **Workforce Development:** Addressing skill shortages and workforce challenges through structured training programs, competency-based hiring practices, and comprehensive support services.
- **Geographic Diversification and Supply Chain Resilience:** Implementing strategies to reduce dependency on single sources or regions, such as regional sourcing, reshoring, and developing local supply chains.
- **Enhancing Supply Chain Visibility:** Leveraging advanced technologies like AI, blockchain, and IoT to improve supply chain transparency and decision-making capabilities.
- **Ensuring Raw Materials Supply:** Diversifying raw material sources, investing in local supply chains, and promoting sustainable practices to secure a steady flow of essential materials.

By focusing on these strategic areas, Ohio can build a resilient and competitive manufacturing sector that is well-prepared to face future challenges and capitalize on new opportunities. The Ohio MEP, supported by NIST's SCOIN initiative, plays a crucial role in facilitating these efforts through partnerships, expertise, and resources. This report aims to provide a comprehensive guide for policymakers, industry leaders, and stakeholders to drive the future success of Ohio's manufacturing industry.

Methodology

Data Collection Methods

To provide a comprehensive assessment of Ohio's small and medium-sized manufacturers (SMMs), we employed a multifaceted data collection approach that included surveys, interviews, and focus groups.

- **Surveys:** A detailed survey was distributed to manufacturers across Ohio, with 277 respondents completing the survey. This survey aimed to gather quantitative data on supply chain concerns, confidence levels, and economic challenges.

- **Interviews:** In-depth interviews were conducted with key industry stakeholders to gain qualitative insights and contextual understanding of the survey results. These interviews allowed us to delve deeper into specific issues faced by manufacturers.
- **Focus Groups:** Several focus groups were conducted during industry events, such as the Council of Supply Chain Management Professionals (CSCMP) Spring Seminar. These sessions provided a platform for manufacturers to discuss their experiences and challenges in a collaborative environment.
- **Research:** The research conducted by ClearView Management Resources was led by a team of experts in the manufacturing and supply chain industry. The study involved collecting information and data from a variety of reputable sources, including industry-leading experts, government agencies, and diverse media outlets. All sources have been meticulously cited throughout this report to ensure transparency and credibility.

Description of the Target Audience for This Report

The target audience for this study includes:

- **Manufacturers:** Small and medium-sized manufacturers across various sectors, with a focus on the automotive/EV, aerospace/fabricated metals, and chemicals/plastics industries.
- **Industry Stakeholders:** Key players in the manufacturing supply chain, including suppliers, logistics providers, and OEMs.
- **Communities of Interest:** Economic development organizations, policy makers, and workforce development agencies interested in enhancing the competitiveness and resilience of Ohio's manufacturing sector.

Analytical Approach and Tools Used for Data Analysis

The analytical approach for this study involved both quantitative and qualitative methods:

- **Quantitative Analysis:** Survey data were analyzed using statistical tools to identify key trends, concerns, and confidence levels among manufacturers. Descriptive statistics, such as means and percentages, were used to summarize the data.
- **Qualitative Analysis:** Interview and focus group data were analyzed using thematic analysis to identify recurring themes and insights. This qualitative approach helped contextualize the quantitative findings and provided a deeper understanding of the issues faced by manufacturers.
- **Supply Chain Mapping:** We utilized surveys, interviews and research to map supply chain capabilities and identify key players, gaps, and opportunities for improvement. This mapping included a detailed analysis of the interconnections within the supply chain and the identification of critical nodes and potential vulnerabilities.

Implementation

This systematic approach allowed us to gather comprehensive data and insights, providing a solid foundation for the recommendations presented in this report. By combining quantitative and qualitative methods, we ensured a complete understanding of the supply chain dynamics affecting Ohio's SMMs.

Current Situation and Challenges

Overview of the Manufacturing Landscape in Ohio

Ohio's manufacturing sector is a crucial pillar of the state's economy, benefiting from its strategic location, robust infrastructure, and skilled workforce. The official slogan "Ohio, the heart of it all" is within 600 miles of 60 percent of the U.S. and Canadian population and is within a one-day drive of 70 percent of North America's manufacturing capacity. The state has seen substantial growth in Gross Domestic Product (GDP) of \$642 billion at a growth rate of 23% putting Ohio's state growth rank at 7th over the last 5 years, outpacing many of its neighbors, boasting a diversified economy that ranks as the 7th largest in the U.S. and the 21st largest globally according to the U.S. Bureau of Economic Analysis. From 2020 to 2022, Ohio saw 1,380 project announcements, with companies planning to invest over \$57.8 billion and create about 92,000 new jobs. The largest share of investments was directed towards manufacturing and durable goods, highlighting the state's strong industrial base. However, recent economic growth challenges and minimal population gains of 0.2%, which put the state's rank at 42nd, have tested the resilience of Ohio's supply chains, particularly in emerging industries such as automotive/EV, aerospace/fabricated metals, and chemicals/plastics.

Awards & Accolades

HERE'S A SNAPSHOT OF OHIO'S 2022 ECONOMIC AWARDS AND ACCOLADES AS PROVIDED BY THE 2022 JOBSOHIO ANNUAL REPORT:

#2

Automotive Manufacturing in the U.S.
– Business Facilities Magazine

#4

Top State to Do Business: Cost of Doing Business
– CNBC

#2

Top State to Do Business: Infrastructure
– CNBC

#6

Business Climate
– Site Selection

#3

Top State to Do Business: Access to Capital
– CNBC

#8

Most Diversified Economy in the U.S.
– Moody's Analytics

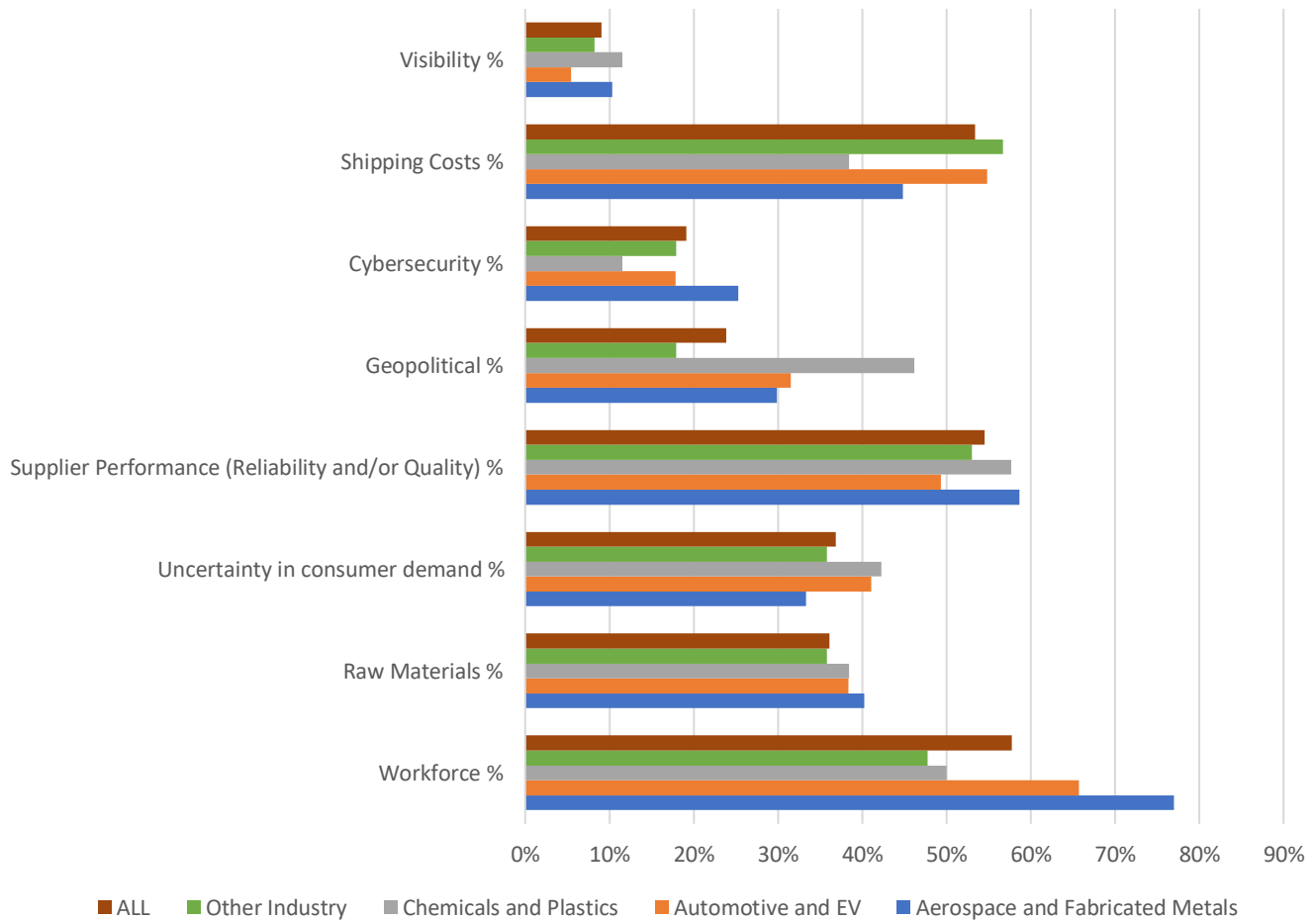
AT A GLANCE: According to [IBIS World Economic Profiles](#), Manufacturing in Ohio is:

The leading GDP producer in Ohio at \$106 billion (6%) with a growth rate of 0.7% from 2018-23

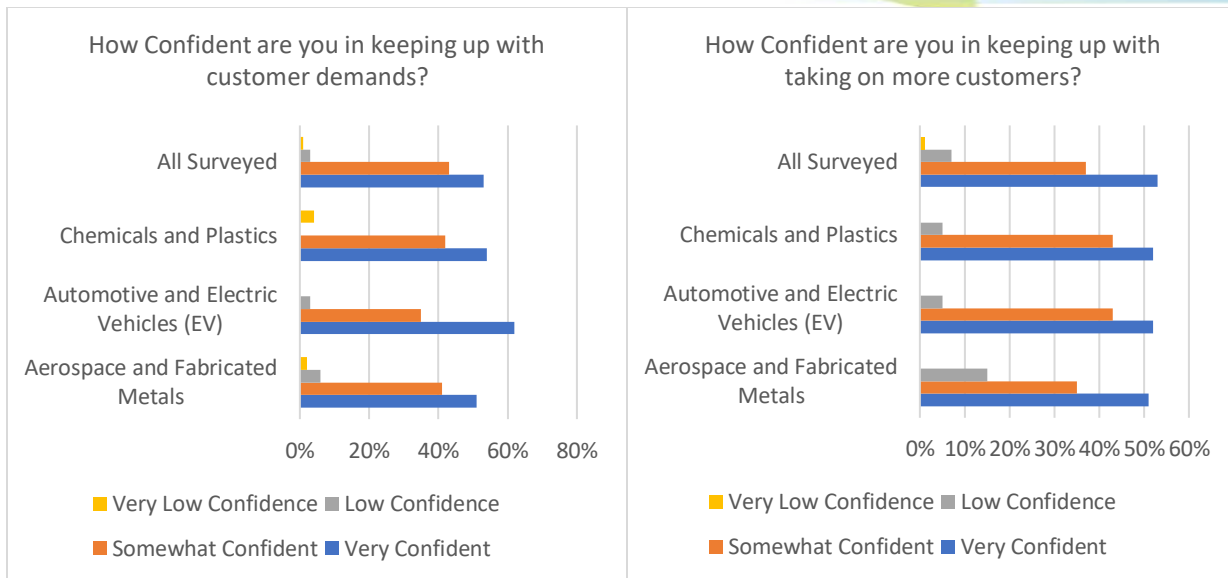
The second leading sector of employment at 716,393 jobs with a growth rate of 1.1% from 2018-23

A comprehensive survey of 277 manufacturers across 62 counties in Ohio reveals key supply chain concerns. The survey data, depicted in the accompanying chart, highlights critical issues such as workforce availability, raw material shortages, uncertainty in consumer demand, and supplier performance. Specifically, 77% of aerospace and fabricated metals companies report workforce challenges, with 40% facing raw material shortages. In the automotive and EV sector, 66% of companies cite workforce issues, and 55% are impacted by rising shipping costs. For chemicals and plastics, 50% of companies struggle with workforce availability, and 58% report issues with supplier performance. These insights underscore the pressing need for targeted interventions to bolster supply chain resilience and sustain growth in Ohio's manufacturing sector. See results from the table below:

SCOIN Survey Data: Supply Chain Concerns



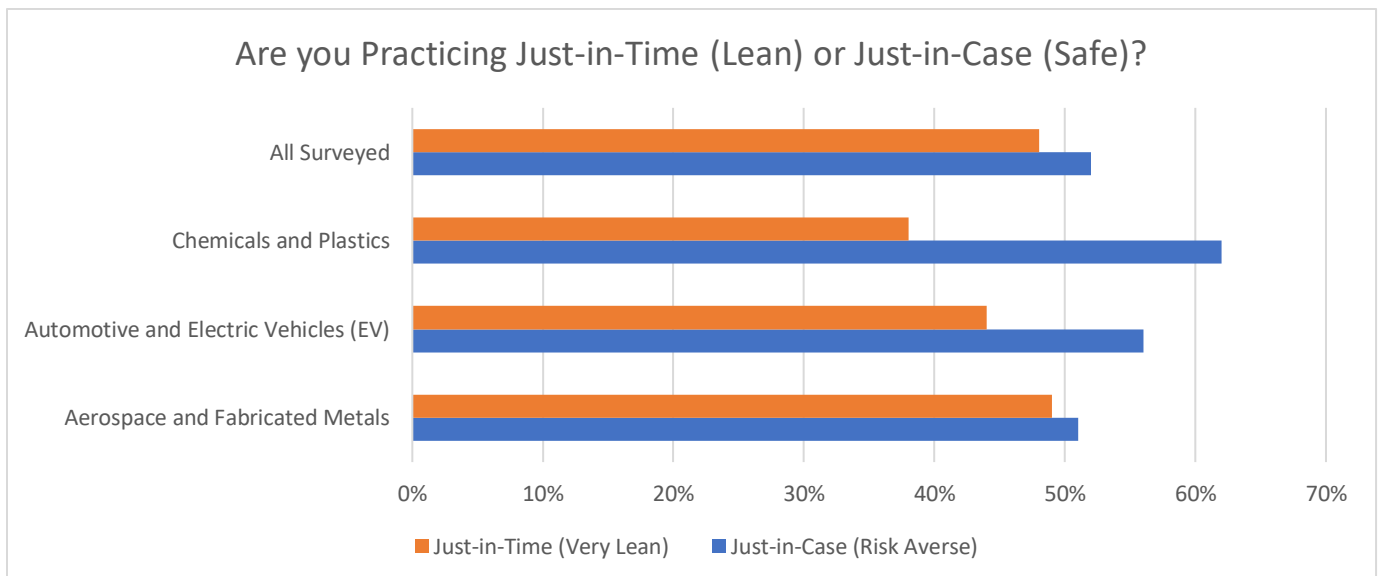
Based on the survey data, there is a significant level of confidence among manufacturers in their ability to meet customer demands. In the aerospace and fabricated metals sector, 92% of respondents are confident (51% very confident, 41% somewhat confident) in their ability to keep up with customer demands. Similarly, the automotive and EV sectors show a 97% confidence rate (62% very confident, 35% somewhat confident), while chemicals and plastics report a 96% confidence rate (54% very confident, 42% somewhat confident). Overall, 96% of all respondents are confident in keeping up with customer demands. Moreover, manufacturers also display high confidence in their ability to take on more customers, with 86% of aerospace and fabricated metals, 95% of automotive and EV, and 95% of chemicals and plastics respondents expressing confidence. Overall, 90% of all respondents are confident in taking on more customers.



Inventory Practices: Just-in-Time vs. Just-in-Case

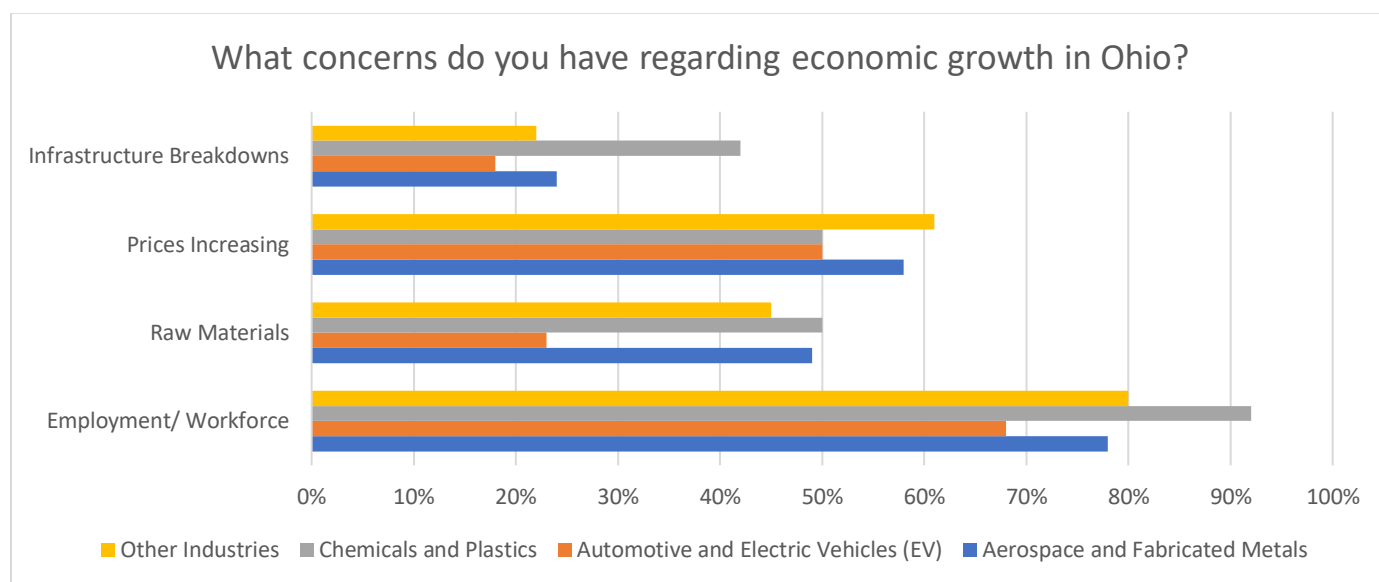
The survey also sheds light on inventory management practices among Ohio manufacturers. In the Aerospace and Fabricated Metals sector, there is an almost even split between Just-in-Time (49%) and Just-in-Case (51%) practices. The Automotive and EV sector leans slightly towards Just-in-Case (56%), while Chemicals and Plastics have a stronger preference for risk-averse Just-in-Case practices (62%). Across all industries, the overall trend shows a balanced approach with 52% adopting Just-in-Case and 48% adopting Just-in-Time, highlighting diverse strategies in inventory management.

As we continue to see more near-shoring and on-shoring efforts, we will see efficiency gains through more lean practices.



And finally, we asked “What concerns do you have regarding economic growth in Ohio?”. Workforce and employment concerns are prevalent across all sectors, with the Aerospace and Fabricated Metals, and Other Industries sectors reporting particularly high concerns. Raw material shortages and increasing prices are significant

issues, impacting nearly half of the companies surveyed. Infrastructure breakdowns and the capacity of current carriers are also notable concerns, though to a lesser extent. Other concerns vary across sectors but remain a critical area of focus for industry leaders. This data underscores the multifaceted challenges that the manufacturing sector in Ohio must navigate to maintain and enhance its competitive edge.



In the following section we will dive deeper into the challenges most threatening to the resiliency of Ohio's Manufacturing supply chain.

Key Challenges Identified

Workforce Availability

Ohio's manufacturing sector is heavily reliant on a skilled workforce. Despite the state's high ranking in workforce training programs and competitive labor market, workforce availability remains a critical concern, particularly in key manufacturing sectors. According to the Ohio Department of Job and Family Services, Bureau of Labor Market Information (December 2022), the overall Ohio economy is expected to add 257,000 additional jobs between 2020 and 2030, with an expected 641,000 job openings annually. The health care and social assistance services industry is expected to add the most jobs, with significant growth also anticipated in health care occupations. However, the overall workforce is projected to grow by only 0.3% over the same period, translating to an estimated addition of only 47,000 people, which leaves a major gap (210,000 jobs) needing to be filled in order to keep up with economic growth.

Figure 2. U.S. and Ohio Population Projections (in thousands)

	2020	2025	2030	% Change 2020-2030
U.S.				
Total Population	334,503	347,335	359,402	7.4%
Working-Age Population	268,750	280,749	291,500	8.5%
Age 25 to 64	173,379	175,664	178,228	2.8%
Age 65 and over	56,441	65,920	74,107	31.3%
Ohio				
Total Population	11,575	11,599	11,615	0.3%
Working-Age Population	9,271	9,316	9,318	0.5%
Age 25 to 64	5,874	5,678	5,551	-5.5%
Age 65 and over	2,011	2,244	2,382	18.4%

Source: Ohio Department of Development and U.S. Census Bureau

From the 2024 Ohio SCOIN Manufacturing Survey conducted, Workforce availability is the largest concern, with 77% of aerospace and fabricated metals companies, 66% of automotive and EV companies, and 50% of chemicals and plastics companies identifying workforce issues as a major challenge. Despite the overall projected decline in manufacturing jobs by just over 2,500 from 2020 to 2030 according to the [Ohio Job Outlook Report](#), key emerging industries show promising growth:

- **Semiconductor and Other Electronic Component Manufacturing:** Expected job growth of 1,141 jobs, or 15.0%.
- **Motor Vehicle Manufacturing:** Projected job growth of 3,235 jobs, or 15.6%.
- **Fabricated Metal Product Manufacturing:** Anticipated job growth of 941 jobs, or 1.0%.

Growth of Key Roles in the Ohio Emerging Industries:

Description	2019 Jobs	2030 Jobs	2019 - 2030 Change	2019 - 2030 % Change
Industrial Engineers	15,993	20,615	4,622	29%
Welders, Cutters, Solderers, and Brazers	18,010	20,488	2,478	14%
Industrial Production Managers	11,485	13,929	2,444	21%
Production Workers, All Other	8,353	9,586	1,233	15%
Electrical Engineers	6,363	7,037	674	11%
Sheet Metal Workers	4,119	4,731	612	15%
Mechanical Engineers	15,911	16,234	323	2%
Aerospace Engineers	3,609	3,812	203	6%
Electrical and Electronics Repairers, Commercial and Industrial Equipment	1,435	1,638	203	14%
Chemists	3,459	3,623	164	5%
Chemical Plant and System Operators	870	952	82	9%

- Data provided via Lightcast

The above table highlights key roles in the three emerging industries growing, some significantly through 2030, with the top four positions growing by more than thousands of jobs expected.

During the interviews of industry stakeholders revealed that workforce challenges are a significant concern across various sectors. A representative from a large company in the aerospace industry noted, "The scarcity of skilled labor is one of the primary hurdles we face, impacting our ability to meet production targets." Similarly, a supply chain manager from a prominent chemical company emphasized the strain caused by workforce shortages, stating, "We have had to delay shipments due to the unavailability of essential raw materials, which has strained our relationships with clients." Another stakeholder from a leading aluminum manufacturer mentioned, "Finding qualified labor is becoming increasingly difficult," highlighting the need for certified production technicians and mechanical engineers. Additionally, a logistics manager from a major transportation company pointed out the high turnover rates and labor shortages, which are challenging the industry's ability to maintain efficiency and reliability.

According to the Governor's Office Workforce Transformation Office report on [Auto & Advanced Mobility Workforce Strategy](#), there is a critical need for skilled labor to support the burgeoning EV industry. The report highlights that "the shortage of skilled workers is a bottleneck for growth." It is expected that by 2030 there will be an estimated creation of 25,000 new EV-related jobs, requiring knowledge similar to roles in internal combustion engine manufacturing, but still requiring a major reskilling effort.

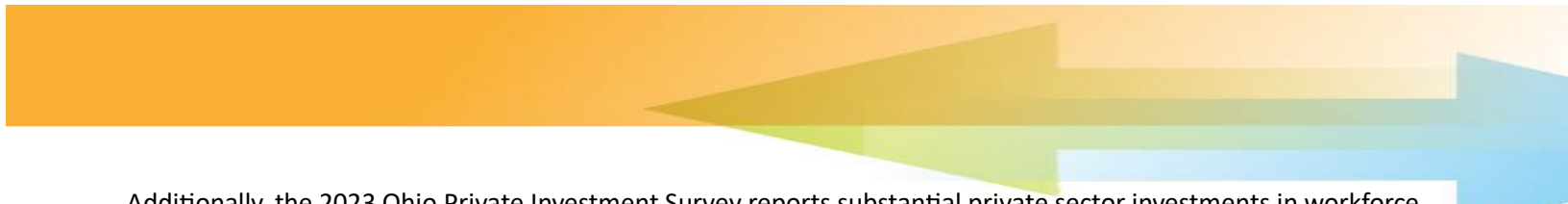
Current Initiatives

Governor DeWine's administration, through the Governor's Office of Workforce Transformation, has implemented several programs to address workforce shortages. Initiatives such as TechCred and IMAP have enabled thousands of Ohioans to earn tech-focused credentials. Ohio also boasts the #3 highest concentration of active apprentices in the United States, with 19,848 active apprentices, and ranks #10 in the nation for workforce training programs. These programs are crucial for upskilling the workforce and meeting the future demands of the manufacturing sector.

Investments in Workforce Development

The Ohio Governor Mike DeWine and Lieutenant Governor John Husted have given significant focus to this issue through various workforce investments in training and development. Below are examples of a few of these:

- **Super RAPIDS Application:** Governor DeWine and Lt. Governor Husted have announced a \$100 million budget through the Super RAPIDS program to address urgent workforce development needs. This includes \$40 million available through a competitive RFP process for significant workforce development projects.
- **TechCred Program:** TechCred helps Ohioans earn technology-focused credentials. JobsOhio has invested significantly in this program, which reimburses employers for training their employees in new technologies and skills.
- **Individual Microcredential Assistance Program (IMAP):** This program provides funding to individuals for earning micro-credentials in high-demand fields, supporting workers in gaining new skills and advancing their careers. The program covers all tuition, fees, and additional costs for participants.
- **Industry Sector Partnership Grant:** This grant supports existing and emerging partnerships to meet common workforce-related goals. It includes funding for sectors to collaborate on addressing shared workforce challenges.
- **High School Tech Internship Program:** This initiative connects high school students with businesses for internship experiences, aiming to build early tech skills and pathways into the workforce.
- **JobsOhio Workforce Grant:** This grant focuses on improving worker skills and abilities across Ohio, with decisions based on factors like job creation and additional payroll.
- **Future Forward Ohio:** Utilizing federal COVID-19 relief funds, this program supports a variety of educational and workforce-related initiatives across the state, aiming to bolster the future workforce through programs such as High-Quality Tutoring and Zearn Math Ohio.



Additionally, the 2023 Ohio Private Investment Survey reports substantial private sector investments in workforce development. Companies are investing heavily in upskilling their employees to keep pace with technological advancements and industry demands. Public-private partnerships have also played a crucial role in workforce training and development, with several successful collaborations highlighted in the report.

Workforce Attraction Initiatives

In addition to workforce development and training programs, Ohio has implemented several initiatives aimed at attracting labor to the state to meet the growing demand in the manufacturing sector and other industries. These initiatives focus on enhancing the state's appeal to workers through various incentives, quality of life improvements, and strategic marketing campaigns.

Marketing and Recruitment Campaigns

Ohio has launched targeted marketing and recruitment campaigns to attract workers from other states and countries. These campaigns highlight the benefits of living and working in Ohio, including its vibrant economy, diverse job opportunities, and high quality of life, such as:

- **Affordable Housing:** Ohio's median home price is \$232,090, ranking it as the 7th lowest among all 50 states. This affordability makes Ohio an attractive place to live and work.
- **Commute Times:** Ohio boasts an average commute time of 23.7 minutes, shorter than the national average of 26.8 minutes. This ease of commuting is appealing to workers seeking a better work-life balance.
- To attract talent, Ohio offers various incentives for relocation, including:
 - **Tax Incentives:** The state provides tax incentives for individuals and businesses relocating to Ohio, making it financially advantageous to move to the state.
 - **Job Placement Assistance:** Programs like JobsOhio's Talent Acquisition Services provide job placement assistance to new residents, helping them find employment opportunities that match their skills and qualifications.

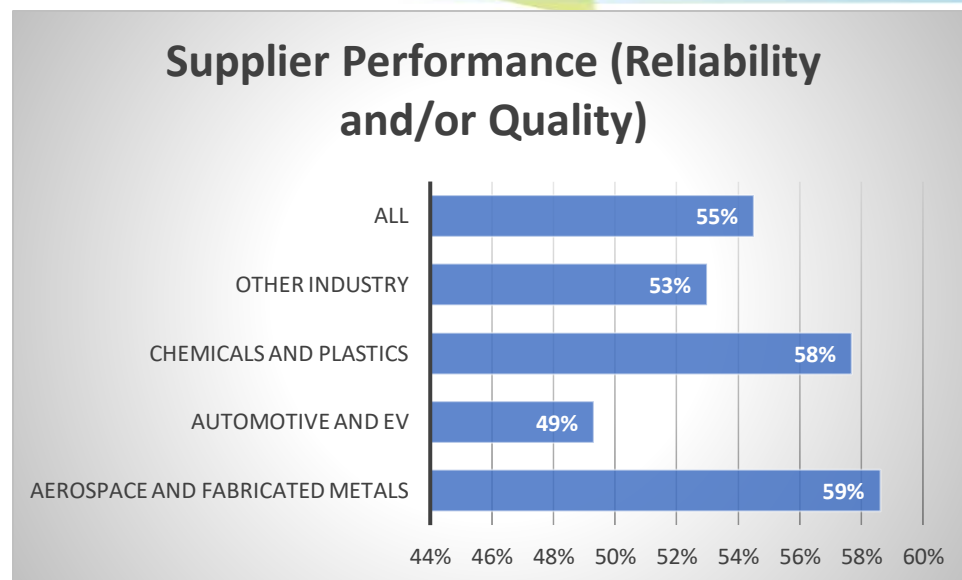
Ohio's commitment to education and training also plays a significant role in attracting labor with its robust higher education system. Ohio has 74 higher education institutions offering programs that lead to aerospace occupations and other high-demand fields. This strong educational infrastructure attracts students and workers looking to advance their careers.

By combining these initiatives, Ohio aims to create an environment that not only develops a skilled workforce but also attracts and retains talent from across the country and around the world. These efforts are essential to supporting the state's economic growth and maintaining its competitive edge in the manufacturing sector and beyond.

Supplier Performance/Reliability

Supplier performance reliability is a significant concern for Ohio's manufacturing sector, impacting production schedules and overall efficiency. Manufacturers face challenges with delays, inconsistent quality, and unreliable supplier performance, which can lead to operational disruptions and increased costs.

According to the 2024 Ohio SCOIN Manufacturing Survey, 54.5% of manufacturers reported issues with supplier performance. The Aerospace and Fabricated Metals sector reported the highest concern, with 59% of companies citing supplier performance issues as a critical challenge, with the Chemicals/Plastics and Automotive/EV sectors following closely behind, at 58% and 55% respectively.



Interviews with industry stakeholders further highlight the impact of unreliable supplier performance. An executive from the automotive sector shared, "Shipping costs have skyrocketed, and we are forced to pass these costs onto our customers, which is not sustainable in the long run. The president of an aluminum manufacturing company explained, "Poor planning and execution on suppliers' part causes us to have to carry excess inventory as a buffer. Multiple times we had to dip into our cash reserves or line of credit to buy excess inventory so that we could ensure we would fulfill our customers' contracts."

Current Initiatives

While addressing supplier performance reliability is primarily the responsibility of individual businesses, Ohio is implementing several initiatives to support these efforts:

- **Ohio Manufacturing Extension Partnership (MEP) and Sustainment Platform:** The Ohio MEP is leveraging the Sustainment platform to help local manufacturers compete more effectively with the global supply chain on a domestic level. The Sustainment platform provides visibility and a marketplace for small and medium-sized manufacturers (SMMs), enhancing communication, supplier management, and performance monitoring. By using AI to optimize interactions, the platform ensures more efficient supplier performance, reducing delays and quality issues. Additionally, the MEP aids in sourcing manufacturers, validating their capacity, and ensuring they have the necessary equipment and expertise to meet production requirements. This comprehensive approach helps Ohio manufacturers streamline their supply chains and improve reliability.

These initiatives, along with proactive measures taken by businesses to manage supplier performance, are crucial for mitigating the challenges associated with unreliable suppliers. By leveraging advanced technologies and fostering local supplier relationships, Ohio's manufacturing sector can improve supply chain resilience and maintain its competitive edge.



Raw Material Shortages

The manufacturing sector in Ohio faces significant challenges with raw material shortages, impacting the ability of manufacturers to maintain steady production lines. This is a national problem and spans the globe. Ohio ranks #3 in Site-Readiness Programs and is highly competitive in logistics, ranked #4 for Logistics & Infrastructure, which should help mitigate some of these challenges.

Ohio Manufacturers participating in the SCOIN survey reported raw material shortages are a significant issue, particularly for the Aerospace and Fabricated Metals sector (49%) and the Chemicals and Plastics sector (50%).

During the interviews we uncovered a supply chain manager from a large chemical company who noted, "We have had to delay shipments due to the unavailability of essential raw materials, which has strained our relationships with clients."

The [2023 Ohio Private Investment Survey](#) emphasizes the impact of global supply chain disruptions on raw material availability, stating, "The disruptions have led to increased lead times and higher costs for raw materials."

The combination of rising input costs and labor shortages is creating a challenging environment for manufacturers. The "Leading Indicators Report" from Ohio highlights that "manufacturers are experiencing unprecedented cost pressures from all sides, including materials, transportation, and labor."

Federal and Statewide Initiatives:

Efforts are underway to mitigate raw material shortages through partnerships with local suppliers and by promoting the reshoring of manufacturing capabilities. The CHIPS and Science Act supports domestic semiconductor manufacturing, reducing dependency on foreign raw materials.

Specific raw materials like lithium for batteries and semiconductors for electronic components have seen significant shortages. According to [McKinsey](#), Battery Insights team projects that the entire lithium-ion (Li-ion) battery chain, from mining through recycling, could grow by over 30 percent annually from 2022 to 2030. Prices for lithium have soared due to rising global demand. Semiconductor constraints have also caused delays across multiple industries, although supply is expected to stabilize in 2023. These specific shortages underline the broader challenges faced by Ohio manufacturers in securing essential raw materials.

The recent discovery of a massive lithium deposit in the McDermitt Caldera, located on the Nevada-Oregon border, has significant implications for the global lithium supply chain and the electric vehicle (EV) industry. This deposit, estimated to contain 20 to 40 million metric tons of lithium, could reduce U.S. dependence on foreign lithium sources and potentially lower costs for lithium-ion batteries. The deposit's geological characteristics suggest a less invasive extraction process, which could mitigate some environmental concerns associated with lithium mining ([InsideHook](#)).

Many companies in Ohio are practicing risk averse methods of delivery, holding on to inventories and insuring they are on hand when needed. One company in the Aluminum industry said, "If we practiced Just in Time, we would have paid tens of thousands of dollars in liquidated damages for not delivering products per project contracts, mostly due to performance of raw material suppliers, especially during COVID."

The persistent raw material shortages continue to challenge Ohio's manufacturing sector, impacting a wide range of industries from automotive and aerospace to chemicals and plastics. These shortages have led to delayed shipments, increased costs, and strained client relationships, forcing companies to adopt risk-averse strategies such

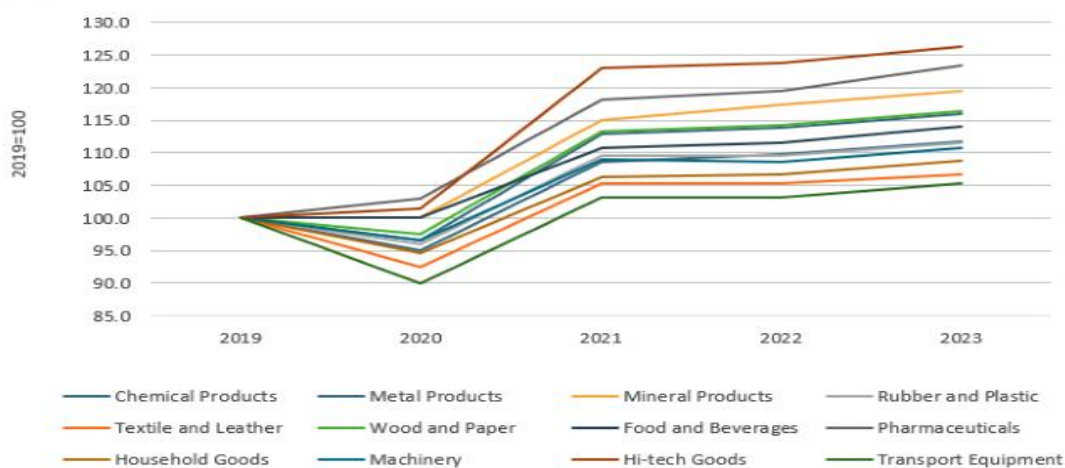
as holding excess inventory. The testimonies from industry professionals underscore the multifaceted impact of these shortages, highlighting the need for more resilient supply chains and better supplier performance. Addressing these challenges will be crucial for Ohio manufacturers to maintain their competitiveness and ensure operational stability in the face of ongoing global supply chain disruptions.

Increasing Costs

Ohio's manufacturing sector is grappling with significant cost pressures, exacerbated by global economic conditions and specific challenges in the supply chain. Key factors contributing to rising costs include raw material price hikes, increased shipping costs, and general inflationary pressures. The global manufacturing sector is experiencing heightened costs, driven by several factors:

- **Energy Prices:** The recent economic outlook highlights energy price shocks as a significant concern, particularly for industries with high energy intensity ([Euromonitor](#)). This is exacerbated by geopolitical events, such as the Russian invasion of Ukraine, which have disrupted energy supplies and driven prices higher.
- **Raw Material Costs:** The cost of essential raw materials like lithium and semiconductors has surged. For instance, lithium prices have increased by 33% due to rising global demand ([Euromonitor](#)). Similarly, semiconductor shortages have impacted various industries, though supply is expected to stabilize.
- **Logistical Challenges:** Transportation and logistics have also seen cost increases, partly due to shipping bottlenecks, inflation and rising fuel prices ([Euromonitor](#)).

Production Value Index in Manufacturing Industries 2019-2023
Index



The table

above highlights the various raw materials production value increasing significantly from 2019 to 2023.

Recent data underscores the dramatic rise in costs for essential materials and services:

- **Lithium Prices:** Prices for lithium, critical for battery production, have surged due to increasing global demand. According to the U.S. Geological Survey, global consumption of lithium rose by 33% in 2021 compared to 2020. S&P Global Commodity Insights reported a 156% year-over-year increase in lithium hydroxide prices as of December 2021. The consultancy BCG noted that lithium prices have increased tenfold over the past two years.

- **Semiconductor Shortages:** The semiconductor supply chain has been under significant strain, causing delays and increasing costs across multiple industries. While some improvement is expected in 2023, chokepoints remain. As stated by TSMC CEO C.C. Wei, actions are being taken to rebalance the semiconductor supply chain by mid-2023. However, challenges persist, as highlighted by Toyota Motor Corp's purchasing group, noting persistent shortages in specific semiconductor components.

A notable portion of Ohio's manufacturers from the Ohio SCOIN survey report rising costs as a major concern. In the Aerospace and Fabricated Metals sector, 58% of companies cited increasing prices as a significant issue. Similarly, 50% of companies in the Chemicals and Plastics sector and 50% in the Automotive and EV sector highlighted this challenge. This indicates a widespread impact across various industries within the state.

The interviews captured an executive from a major automotive supplier who remarked, "Shipping costs have skyrocketed, and we are forced to pass these costs onto our customers, which is not sustainable in the long run." This begs us to look deeper into the current state of global logistics and its impact domestically on costs.

State of Global Logistics and Impact on the USA

In 2024, the logistics landscape faces various challenges and opportunities across different modes of transport.

Air Freight: Driven by an eCommerce boom, particularly from the Asia-Pacific region, air freight demand has surged. In early 2024, international cargo ton-kilometers increased by 19.8% in January and 12.4% in February ([UPS](#)). Despite geopolitical tensions potentially affecting oil prices, air freight rates are expected to remain relatively stable, with slight increases possible towards the year's end as demand grows and capacity tightens.

Ocean Freight: The ocean freight market is dealing with an oversupply of capacity, leading to low freight rates. The market will see 3 million TEUs (Twenty-Foot Equivalent Unit) of new capacity in 2024, creating significant overcapacity ([UPS](#)). Consequently, ocean freight rates have dropped by about 35% from their peaks earlier in the year. Although temporary stabilization has occurred due to geopolitical disruptions, further rate declines are anticipated as the market adjusts.

Truck Freight: The truck freight market is recovering from previous lows, with full-truckload (FTL) rates expected to rise due to increased demand and higher costs, while less-than-truckload (LTL) rates remain stable. In 2023, FTL rates hit 7-year lows but showed improvement in the second half. For 2024, rising demand, fuel prices, and operational costs are likely to drive FTL rates up, whereas LTL rates are projected to stay stable with minor regional variations ([FreightWaves](#)).

Impact on the USA

Domestic Logistics: Rising logistics costs are contributing to inflation, affecting consumer purchasing power. The Consumer Price Index (CPI) in the US increased by 3.5% over the past year, impacting consumer spending and raising the cost of goods ([UPS](#)). Increased capital expenditures in the manufacturing sector signal demand for goods and higher production orders, improving freight demand fundamentals despite ongoing cost pressures. Additionally, the growth of eCommerce and nearshoring trends, especially in Mexico, are driving logistics demand and potentially reducing supply chain disruptions for US companies.

In summary, while the global logistics market navigates through an array of challenges, including geopolitical tensions and market imbalances, the US logistics sector is adapting through increased demand, technological advancements, and strategic shifts like nearshoring. These changes continue to influence consumer prices and the broader economy in 2024.

Ohio's Initiatives to Decrease Costs of Raw Materials, Logistics, and Inflation

Ohio is actively addressing the costs of raw materials, logistics, and inflation, focusing on three key emerging industries: Automotive and Electric Vehicles (EV), Aerospace and Fabricated Metals, and Chemicals and Plastics. Through targeted investments and strategic partnerships, Ohio aims to enhance supply chain efficiency, support local manufacturing, and foster economic growth. Here are some examples of specific initiatives taking place in Ohio:

Ohio Manufacturing Extension Partnership (MEP): The Ohio MEP is actively working to support local manufacturers in reducing costs and improving supply chain efficiency. One key initiative involves promoting the use of the Sustainment platform, which connects manufacturers with local suppliers, streamlining sourcing and logistics to reduce costs and enhance reliability. This platform leverages AI and other advanced technologies to optimize supplier interactions, ensuring a more efficient supply chain.

Silicon Heartland Supplier Consortium: Partnering with Intel, JobsOhio, and the Ohio Grants Alliance to enhance the semiconductor supply chain, supporting the EV industry by ensuring a stable supply of essential components ([Highland County Press](#)) ([The Northeast Ohio Region](#)).

SEMCORP Investment: A \$916 million investment in Sidney, Ohio, to produce lithium-ion battery separator films, creating nearly 1,200 jobs and supporting the local EV supply chain ([Batteries News](#)).

GM/LG Investment: Ohio is a premier location for a cathode active materials (CAM) investment given the state's already significant EV investments, which include the \$2.3B investment in the GM/LG Chem (Ultium Cells) Lordstown plant, that will lead to further industry growth and job creation ([JobsOhio](#))

Infrastructure

Ohio's robust infrastructure is crucial to its manufacturing success, yet challenges related to infrastructure breakdowns and carrier capacity persist. As stated previously, Ohio ranks #4 for Logistics & Infrastructure and #3 for Site-Readiness Programs, showcasing a strong foundation that needs further enhancement. Ohio's manufacturing sector faces infrastructure challenges that impact the efficiency and reliability of supply chains. Key concerns include aging transportation infrastructure, and the need for technological advancements to support modern manufacturing demands.



The [Ohio Freight Electrification](#) report underscores the need for infrastructure improvements to support manufacturing growth, noting that "enhancements in freight infrastructure are crucial to alleviate current bottlenecks and support future demand." Also, from the [Ohio State Freight Plan Working Paper 2ab](#), the below chart identifies increased freight flow in Ohio of 33% over the next two decades.

Figure 54: Incremental Ohio Tonnage and Value of Total Freight Flows by Direction (2018-2045)

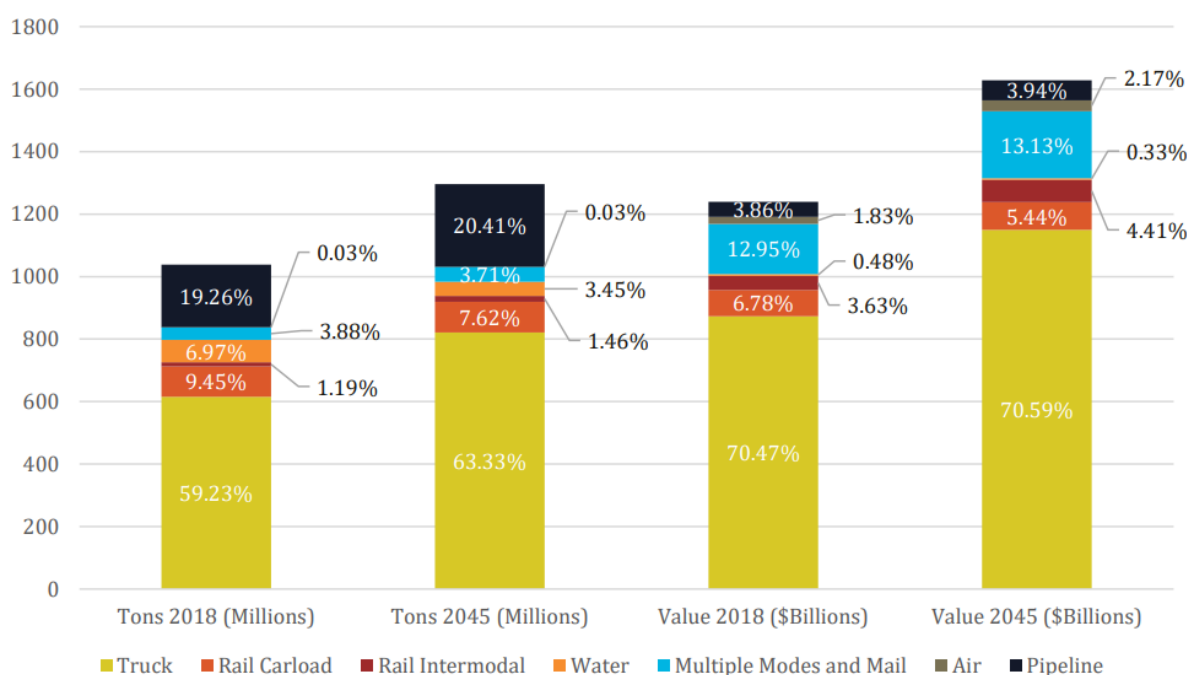
Direction	Tons (Millions)					Value (\$Billions)				
	2018	2045	% Growth	% Annual Rate of Growth	% Share of Increment	2018	2045	% Growth	% Annual Rate of Growth	% Share of Increment
Outbound	278.03	338.53	21.76%	0.73%	17.66%	465.91	610.12	30.95%	1.00%	28.69%
Inbound	318.93	461.56	44.72%	1.38%	41.63%	478.02	761.09	59.22%	1.74%	56.31%
Within	441.27	580.76	31.61%	1.02%	40.71%	295.66	371.08	25.51%	0.85%	15.00%
Total	1038.22	1380.84	33.00%	1.06%	100.00%	1,239.58	1,742.29	40.55%	1.27%	100.00%

Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021;

Note: Includes pipeline tons and volumes

Transport Ohio | Existing & Future Commodity Flow Profile

Figure 55: Tonnage and Value by Mode (2018 and 2045)



Source: FHWA FAF 5 and 2045 Forecast, Analysis of WSP, 2021

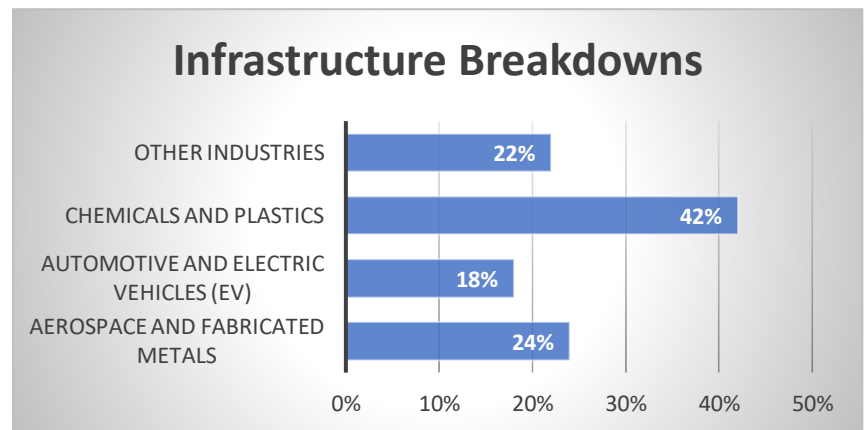
The accelerating growth in e-commerce registered during 2020-2021 is a change in the method of consumer retail distribution and not a change in retail demand. Nevertheless, e-commerce activity will be prominent in three major industry groups, all of them with projected increases in freight traffic. The small package component of Multiple Modes will carry much of this traffic in the final mile, but other modes will be engaged in the earlier stages of shipping:

- Advanced Manufacturing (such as consumer electronics and software, media, home appliances, toys and sporting goods);

- Chemicals, Pharmaceuticals, and Plastics (such as cosmetics, medicines, cleaning supplies, and varieties of plastic materials); and
- Food and Agriculture (encompassing a wide range of fresh, frozen, packaged, and prepared foods).

From a highway network perspective, I-71, I-80/90, and I-70 are the backbones of the system today and tomorrow, along with I-75 in the west, I-77 in the east, and U.S. Highway 33 crossing northwest to southeast (as I-71 crosses northeast to southwest). Even so, and as the depictions in this paper demonstrate, the U.S. and state roadways that blanket the state and connect to its smaller counties and towns are active and growing facilities. These roads are essential to the life and citizens of the state, whether receiving household goods via e-commerce and conventional retail, or building new businesses for domestic and global markets – [Ohio Working Paper #2](#)

Survey Data: Infrastructure issues are a prevalent economic growth concern among Ohio manufacturers. In the Aerospace and Fabricated Metals sector, 24% of companies reported infrastructure breakdowns as a significant challenge. Similarly, 42% of companies in the Chemicals and Plastics sector and 18% in the Automotive and EV sector highlighted infrastructure issues.



Interviews: Industry leaders have stressed the importance of infrastructure improvements. A representative from a major aerospace company stated, "Modernizing our transportation infrastructure is critical to ensure timely delivery of raw materials and finished products, which directly impacts our competitiveness."

- **Aging Infrastructure:** Ohio's transportation infrastructure, including roads, bridges, and railways, is aging and requires significant investment to maintain and upgrade. [The American Society of Civil Engineers \(ASCE\)](#) has given Ohio's infrastructure a grade of C-, indicating substantial room for improvement.
- **Freight Capacity:** Limited freight capacity is another critical issue. Although Ohio is very strong in their position as a national logistic hub; Ohio Department of Transportation (ODOT) are expecting freight volumes to increase by 33%, will further strain existing infrastructure.
- **Technological Advancements:** The need for technological advancements is paramount to support modern manufacturing. Investments in smart infrastructure, including IoT-enabled systems and advanced logistics technologies, are essential for enhancing supply chain efficiency and resilience.

Current Initiatives

Ohio is undertaking several initiatives to address these infrastructure challenges and support future economic growth:

According to the Transport Ohio Statewide Freight Plan, between 2017 and 2021 over \$300 million was spent on projects using freight-related funding. These freight projects leveraged additional funds to total an over \$1.6 billion benefit to the freight system. More than 61% of freight-related funding went to projects on highways. Another 30% went to rail, and over 8% went to maritime.

FIGURE 59: TOTAL FREIGHT SPENDING BY MODE AND PERIOD (\$MILLIONS)

Mode	2017-2021	
	Funding	Percent of Total
Highway	\$176.1	61.3%
Rail	\$87.1	30.3%
Maritime	\$24.2	8.4%
Freight Total	\$287.5	100.0%
Amount Leveraged	\$1,157.2	24.8% from program

Source: CPCS analysis of Ohio ELLIS Project Data

Looking ahead, Ohio's infrastructure modernization plan includes several key initiatives:

- **I-70/71 Corridor Enhancements:** Continued investment in this critical corridor to alleviate congestion and improve freight mobility.
- **Rail Crossing Safety Improvements:** Ongoing projects to install flashing lights and roadway gates at various grade crossings across the state, enhancing safety and reducing delays.
- **Maritime Investments:** Continued funding for port improvements, such as the Cleveland Cuyahoga County Port Authority's dock enhancements, to support increased freight traffic and economic growth.

DriveOhio NEVI Plan: The DriveOhio NEVI Plan is a critical initiative aimed at expanding Ohio's electric vehicle charging infrastructure. Funded through the National Electric Vehicle Infrastructure (NEVI) Formula Program, this plan allocates \$140 million to establish a robust network of EV charging stations across the state. The initiative aims to install fast chargers along major highways and in urban centers, addressing one of the primary barriers to EV adoption—range anxiety. By ensuring convenient and widespread access to charging facilities, the DriveOhio NEVI Plan supports the state's transition to electric mobility and contributes to environmental sustainability.

In conclusion, Ohio is making substantial investments across multiple transportation modes to modernize its infrastructure and address current capacity constraints. With key projects spanning highways, rail, maritime, and intermodal connectivity, the state is poised to support increased freight volumes and ensure efficient logistics operations. These initiatives, backed by significant funding and strategic planning, underscore Ohio's commitment to maintaining its competitive edge in the transportation sector and fostering long-term economic growth.

For more information on this topic as well as Ohio's many initiatives to improve its infrastructure, please visit [The Transport Ohio State Freight Plan](#)

Market Segment Study and Supply Chain Mapping

Understanding the intricacies of different market segments and their supply chains is crucial for identifying strengths, vulnerabilities, and opportunities within Ohio's manufacturing sector. This section focuses on three key market segments: Aerospace, Automotive/EV, and Chemicals/Plastics. By mapping the supply chains of these segments, we aim to provide a comprehensive overview of the current landscape, highlight critical issues, and offer strategic recommendations to enhance resilience and competitiveness. Each segment analysis includes a detailed

examination of supply chain dynamics, key players, gaps, and opportunities for improvement, supported by data and insights from industry experts and stakeholders.

THIS IMAGE SHOWS A GRAPHICAL REPRESENTATION OF OHIO'S LOGISTICS EMPLOYMENT AND DISTRIBUTION AND WAREHOUSING LOCATIONS.

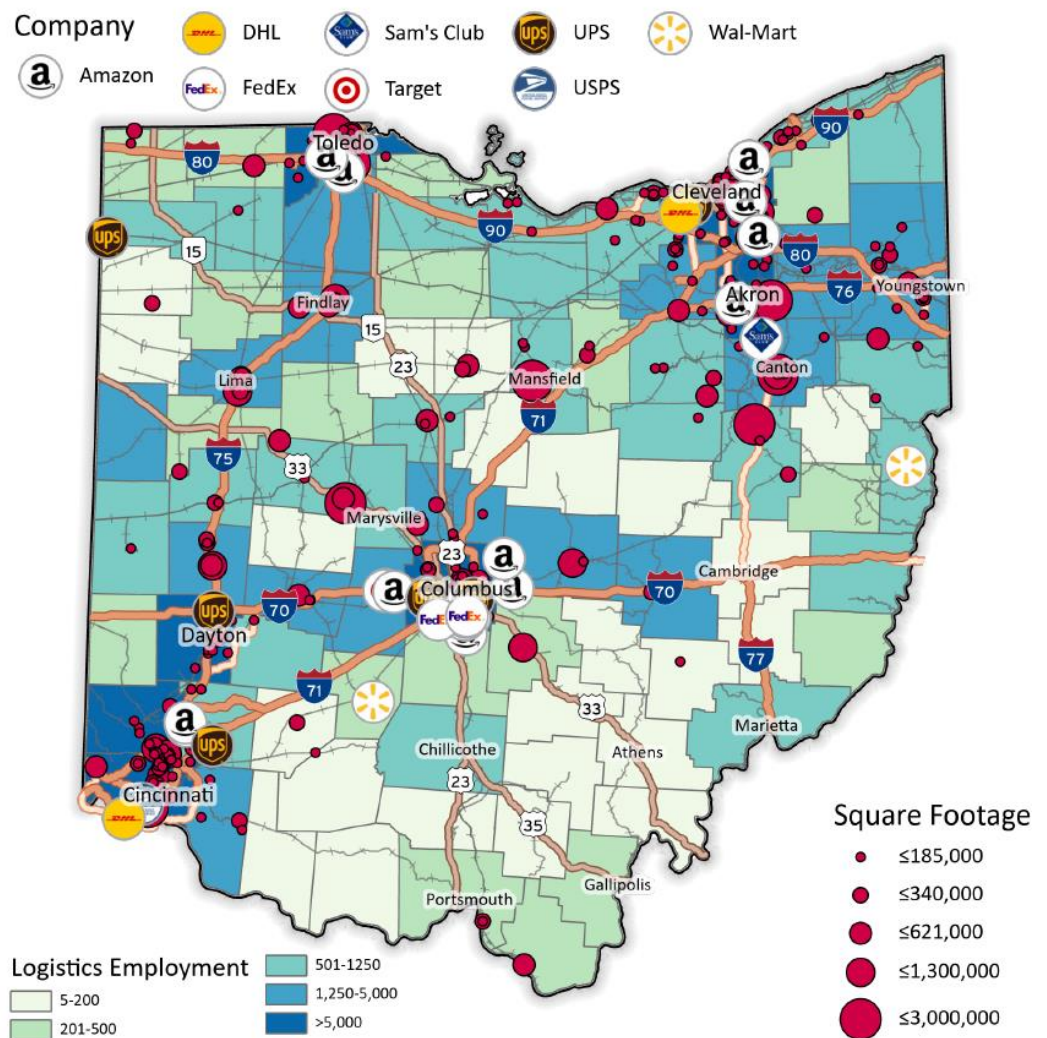


Figure 8: Logistics Employment and Warehouses in Ohio

Aerospace Market Segment Analysis:

Ohio's aerospace and fabricated materials sector stands as a pivotal component of the state's economic framework, distinguished by its strong contributions to both regional and national markets. As the leading supplier to aviation giants like Boeing and Airbus, as well as is home to over 550 aerospace and aviation firms, Ohio encapsulates a dynamic ecosystem of innovation, advanced manufacturing capabilities, and extensive industry networks.

The state's aerospace sector is fueled by a synergy of corporate, governmental, and military investments, which collectively foster an environment ripe for technological advancement and business growth. Ohio's strategic initiatives and investments have cultivated a landscape where aerospace companies can thrive due to competitive operational costs, including favorable tax rates and utility expenses, well below national averages.

Recent trends and challenges, such as global supply chain disruptions, have underscored the sector's resilience and adaptability. For instance, leaders from major aerospace firms in Ohio have remarked on the ongoing pressures and the anticipated recovery of the supply chain, aligning production efforts with global demands and future growth projections.

Ohio is not only excelling in traditional aerospace domains but is also steering advancements in the Advanced Air Mobility (AAM) market, which promises revolutionary changes in urban air transportation through electric vertical takeoff and landing (eVTOL) aircraft. The state's commitment to becoming a nexus for this emerging industry is evident from the substantial public and private investments driving towards a future where air mobility solutions mitigate urban congestion and enhance transportation efficiency.

In preparation for this impending industrial evolution, Ohio is actively expanding its workforce capabilities. Strategic partnerships and educational programs are being tailored to meet the increasing demand for skilled labor that these new technologies entail. The state's proactive approach in developing a competent workforce ensures that it remains at the forefront of the aerospace and advanced manufacturing sectors.

Ohio is the birthplace of aviation and continues to be at the forefront of leading-edge aerospace research. This foundation positions Ohio not only as a critical player in the aerospace and fabricated materials industry but also as a leader in shaping the future of air mobility and manufacturing innovation on a global scale.

****NOTE: For the purposes of this section, NAICS used were*

- 3364 (Aerospace Product and Parts Manufacturing),
- 3329 (Other Fabricated Metal Product Manufacturing) and
- 3345 (Navigational, Measuring, Electromedical, and Control Instruments Manufacturing)

Market Segment Analysis: Aerospace and Fabricated Materials Industry Overview

The aerospace industry is continuously evolving, driven by technological advancements, shifts in geopolitical factors, and changing market dynamics. Here are some key trends and developments currently shaping the global aerospace sector:

Current Trends and Developments

Increased Focus on Sustainability

- **Eco-friendly Technologies:** There is a growing emphasis on reducing environmental impact through sustainable aviation fuels (SAF), electric propulsion systems, and more efficient aircraft designs. Companies are investing in research and development to create greener and more fuel-efficient aircraft to meet regulatory standards and consumer expectations.
- **Carbon Neutrality Goals:** Major aerospace companies are committing to carbon neutrality by 2050, with initiatives aimed at reducing greenhouse gas emissions across manufacturing processes and during flight operations.

Advancements in Aerospace Materials

- **Composite Materials:** The use of composite materials like carbon fiber-reinforced polymers continues to rise. These materials offer significant weight reductions, leading to lower fuel consumption and increased efficiency.

- **Additive Manufacturing:** 3D printing is revolutionizing aerospace manufacturing, allowing for the production of lighter and more complex components that reduce the number of parts in assemblies, thereby optimizing the manufacturing process and reducing waste.

Digital Transformation

- **AI and Machine Learning:** These technologies are increasingly being integrated into aerospace for various applications, including predictive maintenance, flight operations, and personalized passenger experiences.
- **Connectivity and IoT:** Enhanced connectivity solutions are being developed to improve in-flight experiences, optimize operations, and maintain aircraft more effectively. IoT devices are used to monitor critical systems in real time to predict and prevent potential failures.

Autonomous and Unmanned Systems

- **Drones and UAS:** The use of unmanned aerial systems (UAS) is expanding beyond military applications to commercial and civil uses, including delivery services, surveillance, and infrastructure inspection.
- **Autonomous Flight:** Research and development into fully autonomous commercial aircraft are underway, promising to revolutionize air travel by improving safety and efficiency while reducing pilot workload.

Shift in Global Supply Chains

- **Reshoring and Nearshoring:** To mitigate the risks of global supply disruptions as seen during the COVID-19 pandemic, aerospace companies are reconsidering their supply chain strategies. There is a trend towards reshoring or nearshoring of production and sourcing to ensure more resilient supply networks.
- **Supplier Diversification:** Companies are diversifying their supplier base to protect against geopolitical risks and trade disputes, ensuring a more stable supply of critical materials and components.

Growth in Space Exploration

- **Commercial Spaceflight:** The commercial space sector is experiencing rapid growth, with private companies like SpaceX, Blue Origin, and others leading the charge in launching satellites, providing commercial spaceflight services, and exploring deep space missions.
- **Government Partnerships:** Governments are increasingly partnering with private entities to support space missions, reflecting a blend of public and private investment in space exploration and satellite technologies.

Major Players in the Aerospace Sector in Ohio:

- **General Electric (GE) Aerospace:** A key player in engine production for commercial aircraft, partnering with Boeing and Airbus through the CFM joint venture with France's Safran, which holds 55% market share in the narrow-body aircraft engine segment.
- **Wright-Patterson Airforce Base:** Approximately 27,400 employees, making it the largest single-site employer in Ohio. It plays a critical role in research, development, and logistics for the U.S. Air Force.
- **Honeywell:** is a leading supplier to engine and auxiliary power unit (APU) manufacturers for fuel, air, and lubrication systems.

- **NASA Glenn Research Center:** world-class facilities including wind tunnels, drop towers, vacuum chambers, and a research aircraft hangar and is a leading research center for Uncrewed Aircraft Systems (UAS)

OHIO'S LARGEST AEROSPACE EMPLOYERS:

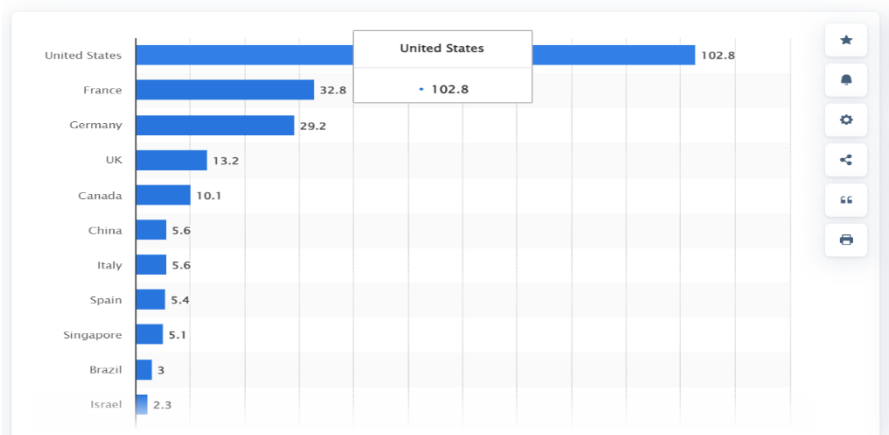


Honeywell

Market Size and Growth Trends:

- **Overall Aerospace and Defense Industry:** The U.S. aerospace and defense (A&D) industry contributed \$418 billion to the national GDP in 2022, representing 1.65% of total nominal GDP ([Aerospace Industries Association](#)) and is by far the leading county in aerospace export.

Leading countries with the highest aerospace exports in 2022 (in billion U.S. dollars)



- **Ohio's aerospace sector** contributes significantly to the state's economic trade, exporting \$9 billion in 2023, up 5% over last year, while importing 5.8 billion, up 3% over 2022 according to [Trade.gov](#). This is a substantial portion purchased in-state, which has an inherent supply chain advantage on other states because there is less potential disruption the closer and more compact the supply chain is. The Aerospace and Aviation gross domestic product (GDP) is projected to grow 24.5% from 2022-2030. This is twice as fast as projected overall GDP in the region ([TeamNEO](#)).

Key Products and Services Offered:

- **Aircraft Engines and Components:** Produced primarily by GE Aerospace and its partners.
- **Motion and Control Systems:** Provided by Parker Hannifin, essential for aircraft performance.
- **Power Management Systems:** Developed by Eaton Corporation.
- **Advanced Defense Systems:** Offered by L3Harris Technologies.

Employment Statistics and Wage Data:

- **Employment:** The aerospace industry in Ohio employs around 124,000 workers. This includes roles in manufacturing, engineering, research and development, and administrative functions. Looking specifically at roles within the manufacturing NAICS codes selected, Lightcast data shows 44.5k jobs currently with a growth rate of 4% or 1,771 jobs through 2030.

- **Wage Data:** The average wage is \$108,900, about 55 percent above the national average. In 2022, the industry paid out \$240 billion in compensation [Aerospace Industries Association](#).
- **Strategic Efforts and Workforce Development:** JobsOhio highlights the state's readiness for advanced mobility and integrated autonomous systems in both air and road transportation. Ohio's colleges and universities are instrumental in educating and upskilling workers in engineering, UAS, aerospace manufacturing, and technology, supporting a workforce prepared for in-demand careers. Over 15,000 permanent, high-paying jobs are forecasted in the AAM sector, with Ohio capitalizing on its strong capabilities in aerospace, advanced manufacturing, materials technologies, and university and R&D capacity.
- For more information on Ohio's Workforce Strategy, visit the [Auto & Advanced Mobility Workforce Strategy](#) report

Significant Projects Happening in Ohio:

Additive Manufacturing

GE Aerospace: GE is investing \$127.3 million across multiple sites in Ohio, including \$64.2 million in Evandale for upgraded machines, new hoists, and specialized tooling for increased production and assembly of GE engines. Additionally, \$25 million is being invested in the Peebles facility for equipment upgrades, smart test cell enhancements, and specialized tooling ([dayton-daily-news](#)).

eVTOL Aircraft Production

Joby Aviation: Joby Aviation is building a significant production facility in Dayton, Ohio, with an investment of up to \$500 million. This facility is expected to deliver up to 500 electric vertical take-off and landing (eVTOL) aircraft per year and support up to 2,000 jobs, highlighting Ohio's leadership in advanced air mobility ([JobsOhio](#)).

AAM Multistate Collaborative: Headed by JobsOhio and Virginia aviation leaders, the collaborative has grown to 27 states, focusing on Advanced Air Mobility (AAM) operations. It aims to deliver consistent guidance to federal policymakers and streamline state policies for efficient unmanned operations. The National Advanced Air Mobility Center of Excellence (NAAMCE) in Springfield, Ohio, serves as a testing hub for drone manufacturers and Air Force pilots, supported by the Department of Defense and NASA Glenn Research Center. For more information regarding this initiative, visit <https://www.compositesworld.com/articles/composites-end-markets-aerospace-2023>

Aerospace Supply Chain

Overview: Ohio's aerospace supply chain is a cornerstone of its industrial landscape, comprising a diverse network of manufacturers, suppliers, and service providers. The state is home to leading aerospace companies, research institutions, and a highly skilled workforce, making it a vital hub for aerospace innovation and production. Ohio's strategic location, robust infrastructure, and commitment to advanced manufacturing technologies position it as a key player in the national and global aerospace supply chain. The strength of Ohio's supply chain is underscored by a higher rate of in-state purchasing compared to out-of-state sourcing, indicating a well-integrated and resilient local ecosystem. The industry in Ohio encompasses the production of aircraft components, avionics, propulsion systems, and advanced materials, driving economic growth and technological advancements in aerospace.



Key Issues and Responses

1. Raw Material Sourcing and Availability:

- **Issue:** The aerospace industry relies on specialized raw materials such as titanium, aluminum alloys, and composite materials. The supply of these materials can be affected by geopolitical tensions, trade policies, and market fluctuations.
- **Response:** Ohio is enhancing its supply chain resilience by fostering partnerships with reliable domestic and international suppliers. The state is also investing in research and development to explore alternative materials and recycling technologies, reducing dependency on volatile markets. Initiatives to develop local supply chains for critical materials are being supported to ensure consistent availability.

2. Manufacturing and Production Capacity:

- **Issue:** The aerospace sector requires highly specialized manufacturing processes and capabilities, which demand continuous investment in technology and infrastructure. Scaling up production to meet increasing demand poses a significant challenge.
- **Response:** Ohio is investing in upgrading existing aerospace manufacturing facilities and constructing new state-of-the-art plants. Public-private partnerships are facilitating these upgrades, ensuring that facilities are equipped with cutting-edge technology. Workforce development programs are also being implemented to train workers in advanced aerospace manufacturing techniques, ensuring a skilled labor pool.

3. Supply Chain Resilience and Diversification:

- **Issue:** The aerospace supply chain is vulnerable to disruptions from geopolitical events, economic shifts, and natural disasters. A lack of diversification can lead to bottlenecks and delays in production.
- **Response:** Efforts are being made to diversify the aerospace supply chain by encouraging the development of local suppliers and reducing reliance on single sources. Ohio is promoting the use of advanced manufacturing technologies such as 3D printing and digital twins to enhance supply chain flexibility and resilience. These technologies enable rapid prototyping and production adjustments, mitigating the impact of disruptions.

4. Technological Advancements and Integration:

- **Issue:** Rapid advancements in aerospace technologies, such as unmanned aerial systems (UAS), advanced propulsion systems, and avionics, require seamless integration into the existing supply chain. This complexity can pose significant challenges.
- **Response:** Ohio is fostering innovation through initiatives like the Aerospace Hub of Innovation and the expansion of research institutions such as the Air Force Research Laboratory. These projects provide a platform for testing and integrating new technologies, facilitating collaboration between OEMs, suppliers, and research entities. Grants and incentives are available to support R&D activities in aerospace technologies.

5. Regulatory and Environmental Compliance:

- **Issue:** The aerospace industry faces stringent regulatory requirements related to safety, emissions, and environmental impact. Compliance with these regulations can be complex and costly.

- **Response:** Ohio is working closely with industry stakeholders to streamline regulatory processes and provide clear guidelines for compliance. Environmental sustainability initiatives, such as promoting the use of renewable energy in manufacturing and supporting green aviation technologies, are being prioritized to meet regulatory standards and reduce the environmental footprint of the aerospace industry.

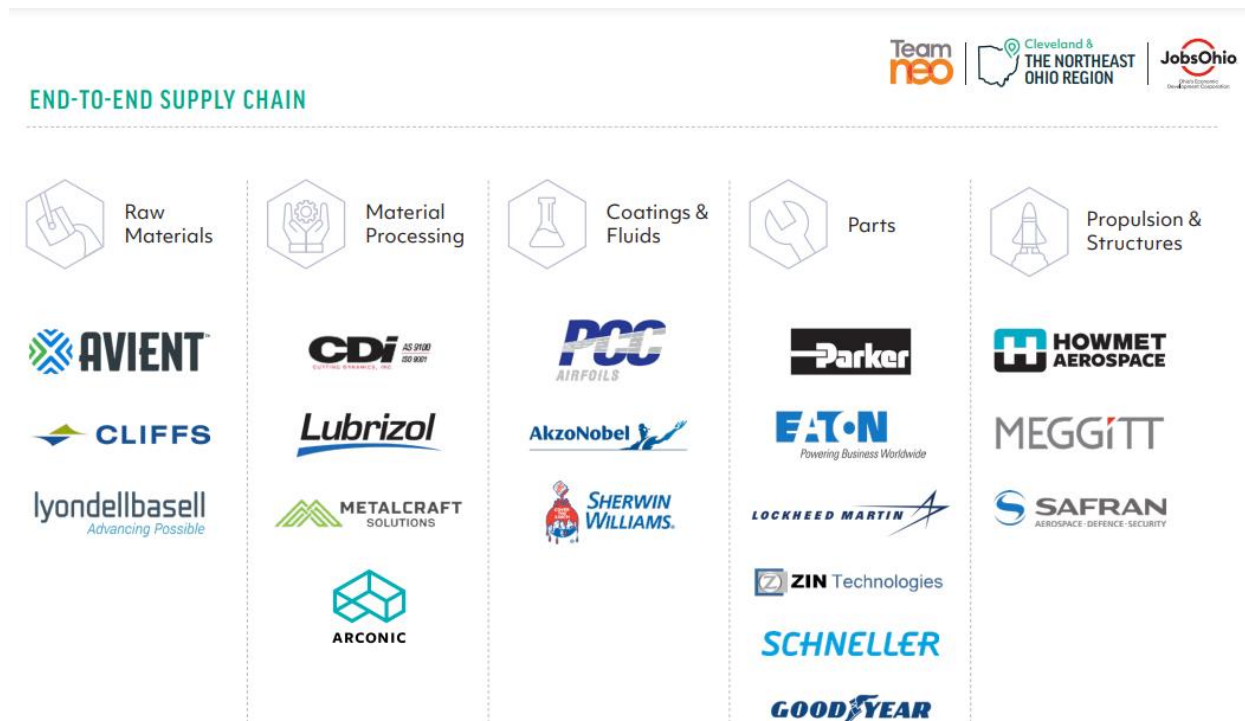
Key Suppliers, Consumers and Raw Material Requirements

Ohio's aerospace supply chain is supported by a robust network of key suppliers, major consumers, and essential raw material providers. The state's strategic location, advanced infrastructure, and strong industrial base position it well to reduce supply chain disruptions. Notably, many key purchases are made within the state, which enhances the resilience of the supply chain. According to data from Lightcast, Ohio purchases 71% or \$5.5 billion of its aerospace-related needs in-state out of a total of \$7.7 billion. This section highlights the critical components and stakeholders that contribute to Ohio's thriving aerospace industry, ensuring a seamless flow of materials and products throughout the supply chain.

Here's a snapshot of some of the largest purchases in the Ohio Aerospace Supply Chain:

NAICS	Purchases from	In-region Purchases	% In-region Purchases	Imported Purchases	% Imported Purchases	Total Purchases
336412	Aircraft Engine and Engine Parts Manufacturing	\$1,977,499,963	99.7%	\$5,812,416	0.3%	\$1,983,312,379
336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing	\$282,874,427	64.1%	\$158,584,966	35.9%	\$441,459,393
551114	Corporate, Subsidiary, and Regional Managing Offices	\$272,238,322	91.7%	\$24,708,568	8.3%	\$296,946,889
331110	Iron and Steel Mills and Ferroalloy Manufacturing	\$145,213,125	54.1%	\$123,089,666	45.9%	\$268,302,791
331420	Copper Rolling, Drawing, Extruding, and Alloying	\$71,898,606	46.5%	\$82,887,493	53.5%	\$154,786,100
331511	Iron Foundries	\$50,082,063	33.3%	\$100,509,733	66.7%	\$150,591,797

Below is a brief high-level view of the Aerospace supply chain and the major players in Ohio:



For a more complete supply chain mapping visit The [Dayton Economic Development](https://www.daytoneconomicdevelopment.com/) website.

Tier 1 Suppliers:

- **Role:** Tier 1 suppliers provide major components directly to OEMs (Original Equipment Manufacturers) in the aerospace industry. They are crucial in delivering high-quality, critical parts such as engines, avionics, and structural components.
- **Notable Companies:**
 - **GE Aviation:** Headquartered in Cincinnati, Ohio, GE Aviation employs over 9,000 people in the state and is a global leader in jet engine production, generating billions in revenue annually.
 - **Parker Hannifin:** With a strong presence in Ohio, Parker Hannifin's Aerospace Group generates over \$2 billion in annual revenue, providing motion and control technologies essential for aerospace applications, including hydraulic systems and fuel management.
 - **Eaton Corporation:** Eaton's aerospace segment, with significant operations in Ohio, contributes approximately \$3 billion to the company's overall revenue, focusing on fuel systems, hydraulics, and electrical components.

Tier 2 and Tier 3 Suppliers:

- **Role:** These suppliers provide sub-components and raw materials to Tier 1 suppliers, ensuring they have the necessary parts and materials to meet OEM demands.
- **Notable Companies:**
 - **Timken Company:** Supplies high-performance bearings and power transmission components, with aerospace sales contributing to Timken's \$3.8 billion in annual revenue.
 - **Alcoa:** A leading supplier of aluminum and advanced alloys, Alcoa's Ohio operations are integral to its \$10 billion global revenue, providing materials critical for aerospace manufacturing.
 - **Ohio Aerospace Institute (OAI):** Facilitates collaboration between companies, universities, and government agencies, supporting aerospace technology development with a focus on innovation and research.

Key Consumers: Original Equipment Manufacturers (OEMs):

- **Role:** OEMs are the end-users of the supply chain, responsible for assembling aircraft and aerospace systems. They rely on a steady flow of parts and components from suppliers to maintain production schedules.
- **Notable Companies:**
 - **Boeing:** Utilizes Ohio's aerospace supply chain for various aircraft components, contributing to its \$76 billion in annual revenue.
 - **Lockheed Martin:** Engages with Ohio suppliers for defense and space systems, with the company's aeronautics segment generating \$26 billion annually.
 - **Northrop Grumman:** Sources components and technologies from Ohio for aerospace and defense projects, contributing to its \$30 billion annual revenue.



Raw Material Requirements

1. Titanium:

- **Importance:** Essential for aircraft structures and engine components due to its high strength-to-weight ratio and corrosion resistance.
- **Sources:** Sourced from both domestic and international suppliers, with significant processing capabilities within Ohio.
- **Concerns:** Minimal concerns due to established supply chains and significant local processing capabilities.

2. Aluminum and Advanced Alloys:

- **Importance:** Widely used in airframe structures and components for their lightweight and strong properties.
- **Sources:** Ohio benefits from a well-developed network of aluminum suppliers, both in-state and nationally, including companies like Alcoa.
- **Concerns:** Minimal concerns due to strong local and national supply networks.

3. Composite Materials:

- **Importance:** Provide lightweight, high-strength alternatives to traditional materials, crucial for modern aircraft design.
- **Sources:** Sourced from specialized manufacturers, with increasing local production capabilities to meet demand.
- **Concerns:** Minimal concerns due to growing local production capabilities and reliable supply chains.

4. Rare Earth Elements:

- **Importance:** Used in various aerospace applications, including avionics, sensors, and advanced propulsion systems.
- **Sources:** Mostly imported, but Ohio is investing in research to develop domestic sources and recycling methods to reduce dependency on foreign suppliers.
- **Concerns:** Some concerns due to high import dependency, primarily from countries like China, which could pose risks due to geopolitical tensions.

5. Steel Alloys:

- **Importance:** Utilized in landing gear, fasteners, and other critical components where high strength is required.
- **Sources:** Ohio's strong steel industry provides a reliable supply of high-quality steel alloys for aerospace applications.
- **Concerns:** Minimal concerns due to a strong local steel industry and reliable supply chains.

Analysis of Demand Trends and Future Projections:

- **Demand Trends:** The demand for aerospace products is driven by the need for more fuel-efficient and technologically advanced aircraft. The defense sector's ongoing modernization efforts also contribute to steady demand.

- **Future Projections:** The global aerospace market is expected to grow, with projections indicating a demand for over 39,000 new aircraft by 2040. This will significantly impact Ohio's aerospace sector, driving increased production and innovation. **By 2025**, Airbus intends to increase production to close to **1,000 aircraft per year**, which means a monthly production rate of about 80 aircraft per month. Such a pace puts pressure not only on Airbus, but the company's supply chain as well — including the composites aerospace supply chain.

For more information regarding the trends and future projections, visit [Investing.com](https://www.investing.com) to read about “GE Aerospace sees supply constraints persisting next year”

Recommendations for Enhancements: Resiliency Strategies in the Aerospace Sector

Enhancing the resilience of the aerospace supply chain is crucial for maintaining stability and ensuring continuous growth. Here are some key strategies based on current industry practices and research:

1. Diversification of Supply Chains

- **Strategy:** Continue to diversify the supplier base to reduce dependency on a single source or region, thus mitigating risks associated with geopolitical tensions and regional disruptions.
- **Implementation:** Establish relationships with multiple suppliers across different geographical regions. This approach ensures that if one supplier faces a disruption, others can fill the gap. Continue to invest in efforts that the Ohio MEP is leading with the platform Sustainment to find, validate and engage manufacturers across the state.
- **Example:** Boeing and Airbus have increased their supplier networks globally, sourcing materials from multiple countries to ensure a steady supply chain ([Air Power Inc.](#)).

2. Increased Inventory and Strategic Stockpiling

- **Strategy:** Maintain higher levels of critical inventory and create strategic stockpiles of essential materials.
- **Implementation:** Use predictive analytics to determine optimal inventory levels and identify critical materials that require stockpiling.
- **Example:** GE Aerospace has increased its inventory levels for key materials like titanium and nickel to buffer against supply chain disruptions ([Air Power Inc.](#)).

3. Digital Supply Chain Management

- **Strategy:** Invest in digital tools and technologies to enhance supply chain visibility, efficiency, and responsiveness.
- **Implementation:** Utilize technologies such as blockchain, AI, and IoT to monitor and manage the supply chain in real-time.
- **Example:** Companies like Honeywell and Rolls-Royce are leveraging digital twins and blockchain technology to track and optimize their supply chains ([Air Power Inc.](#)).

4. Collaborative Efforts and Partnerships

- **Strategy:** Form collaborative partnerships within the industry to share resources, information, and best practices.
- **Implementation:** Participate in industry consortia and public-private partnerships to address common challenges and develop joint solutions.

- **Example:** The National Advanced Air Mobility Center of Excellence (NAAMCE) in Ohio is a collaborative initiative involving government, industry, and academia to enhance supply chain resilience and innovation.

5. Advanced Manufacturing Techniques

- **Strategy:** Adopt advanced manufacturing techniques such as additive manufacturing (3D printing) to reduce dependency on traditional supply chains.
- **Implementation:** Invest in state-of-the-art manufacturing facilities and train the workforce in advanced manufacturing technologies.
- **Example:** Ohio's investment in additive manufacturing through initiatives like GE Aerospace's \$127.3 million investment in advanced manufacturing technologies ([Air Power Inc.](#))

6. Workforce Development and Training

- **Strategy - Upskilling:** Invest in training programs to upskill the existing workforce in advanced manufacturing, digital technologies, and supply chain management.
- **Implementation:** Continue Ohio's efforts to support Industry Recognized Partnerships that unite regional activities and Communities of Interest, such as industry, education, government agencies, economic development and other services that promote and attract good jobs in Aerospace.
- **Example:** Ohio Manufacturing Association's Industry Sector Partnerships won the Good Jobs Challenge grant of over \$23 million for the purpose of workforce development.

Automotive/EV Market Segment Analysis:

Ohio's automotive and electric vehicle (EV) sector is at a pivotal juncture, driven by innovation and a dynamic shift towards electrification. This sector features a robust ecosystem encompassing manufacturing, technology, and infrastructure development, playing a critical role in the state's economic fabric. The rise of electric vehicles, backed by substantial investments and technological advancements, signifies a major evolution in Ohio's automotive landscape.

The United States ranks third in global electric vehicle manufacturing, behind China and Europe. From 2017 to 2020, the U.S. share of cumulative global electric vehicle production decreased from 20% to 18%, while manufacturing in the other regions increased. The automotive production share in the U.S. is heavily concentrated in the Midwest, with Ohio accounting for 10% of the total. In 2023, Ohio ranked #7 in the U.S. for EV industry investment, reflecting its commitment to becoming a leader in this rapidly growing field. The state boasts the nation's second-largest workforce in motor vehicle manufacturing, supporting nearly 90,000 jobs.



Ohio's prominence in producing engines and transmissions, where it ranks as the #1 and #2 producer in the United States respectively, further strengthens its position in the automotive industry. Jobs related to EV production are

expected to fall under the North American Industry Classification System (NAICS) categories 3361 and 3363, with standalone battery plants under NAICS 33591 poised for rapid expansion as new battery plants come online.

Educational programs aligned with industry needs bolster Ohio's capacity. In 2022, there were 16,131 program completions in top auto occupations, including 69 higher education programs in welding, contributing to a workforce well-equipped for modern manufacturing demands.

Greater than 90% of the state's exports currently support the internal combustion engine (ICE) supply chain. Ohio faces a significant risk to its economic future unless investments shift towards the EV supply chain. While ICE and EVs share many parts, they fundamentally differ in their powertrain systems. EVs and their electric drive trains are powered by lithium-ion batteries (LiB), which account for 25-40% of the bill of materials (BOM) of an EV. LiB's importance to the EV revolution cannot be understated.

Ohio's strategic initiatives and partnerships foster an environment conducive to growth and innovation in the automotive/EV industry. These efforts enhance Ohio's manufacturing capabilities and position the state at the forefront of future mobility. This includes developing state-of-the-art facilities and creating high-value jobs, contributing to a sustainable economic future.

By leveraging its historical strengths in automotive manufacturing and integrating cutting-edge EV technologies, Ohio is crafting a new narrative for the automotive industry—one that embraces efficiency, sustainability, and technological sophistication. This transformative journey is reshaping the state's automotive landscape and setting a benchmark for the national and global automotive sectors.

****NOTE: For the purposes of data gathering for manufacturing in the Automotive/EV industry, we are using the following NAICS codes:*

- 3361 - Motor Vehicle Manufacturing
- 3363 - Motor Vehicle Parts Manufacturing
- 3359 - Other Electrical Equipment and Component Manufacturing

Market Segment Analysis: Automotive and Electric Vehicles (EV) in Ohio

Ohio's automotive sector, historically centered on internal combustion engines (ICE), is undergoing a transformative shift towards electric vehicles (EVs), positioning the state at the forefront of automotive innovation and environmental sustainability. This transition is propelled by both increasing consumer demand for EVs and significant investments in electric mobility, reflecting a broader commitment to reducing greenhouse gas emissions and enhancing energy efficiency.

Current Trends and Developments:

- **Shift to EVs:** Major automotive manufacturers are reallocating investments from ICE vehicles to EVs, driven by environmental policies and a surge in consumer interest. This shift is supported by substantial financial commitments, with automakers pledging over \$600 billion towards new EV models and related technologies.

U.S. EV Growth Trajectory Projections (2016-2030)

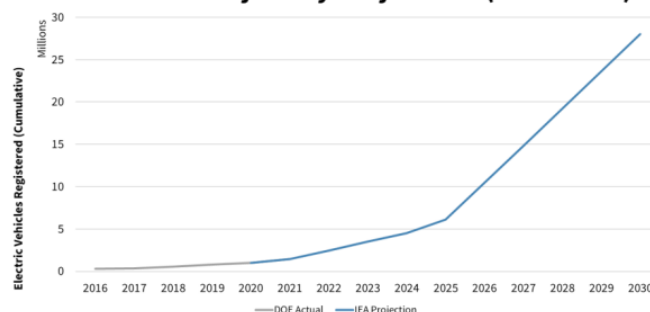
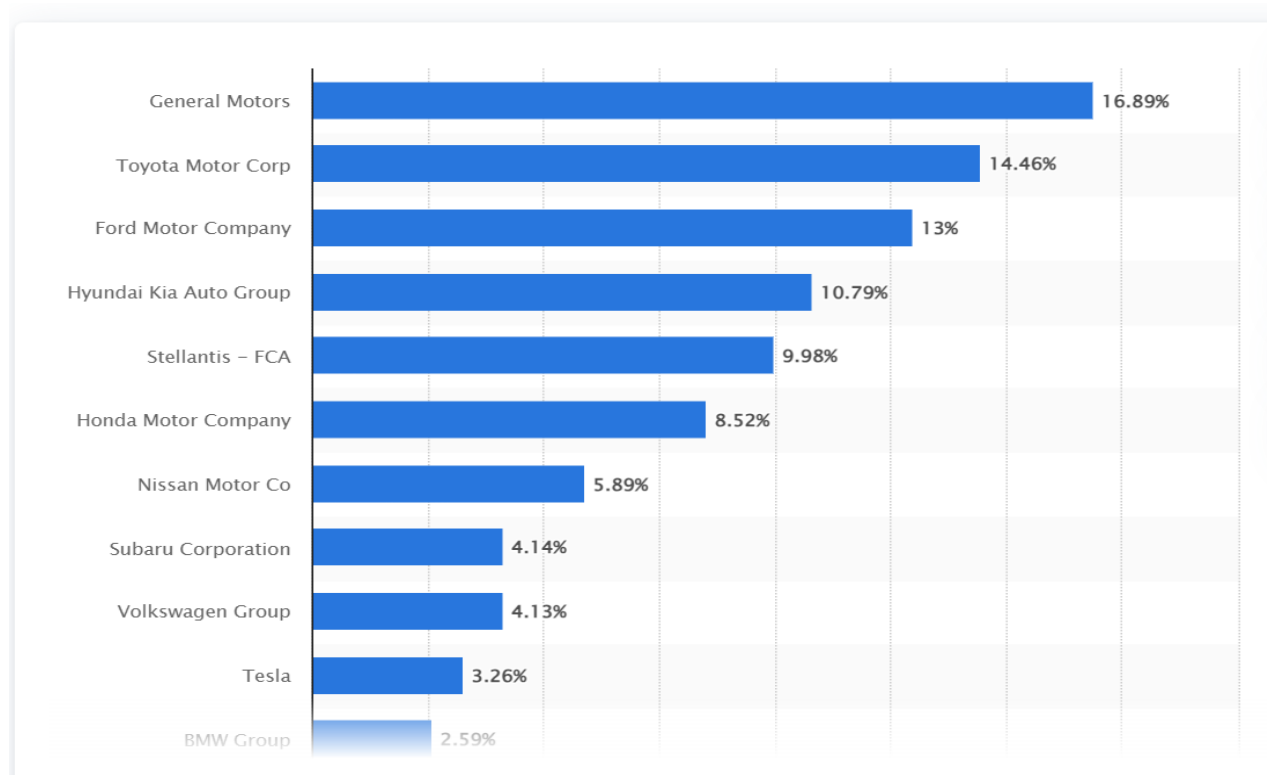


Figure 1: Electric Vehicle Growth

Source: DOE [Advanced Fuels Data Center](#) and IEA APS 2020-2030 EV Stock [Estimates](#) from [2023 Outlook](#)

- **Battery Production and Supply Chain:** Ohio has become a pivotal player in the battery manufacturing arena, particularly with the establishment of the GM-LG Chem joint venture (Ultium Cells) in Lordstown. This facility is set to produce 30 GWh of EV-grade lithium-ion batteries, marking a significant step in developing a localized battery supply chain. With costs declining nearly 90% over the past decade, it is expected to make EVs cost-competitive with ICE vehicles by 2023 for some passenger vehicle segments.
- **Supply Chain Challenges and Opportunities:** While the battery segment attracts heavy investments, Ohio faces the challenge of building a comprehensive supply chain for battery components, such as cathode active materials (CAM), which are crucial for battery production but currently lack significant manufacturing capacity in the U.S. Key vulnerabilities include dependencies on global supply chains, workforce reskilling and potential bottlenecks in lithium-ion battery production.

Major Players in the Industry with Market Share



Honda

- **Market Position:** Honda holds an 8.52% market share in the US automotive market. Honda has a substantial presence in Ohio, with major manufacturing plants producing a wide range of vehicles, including both traditional internal combustion engine (ICE) vehicles and electric vehicles (EVs).
- **Key Facilities:**
 - **Marysville Auto Plant:** Central to Honda's operations in Ohio, producing various models including those transitioning to electric powertrains.
 - **East Liberty Auto Plant:** Another major facility contributing to Honda's manufacturing prowess in the state.
 - **New EV Manufacturing Facility:** Honda's latest investment includes plans for a new facility dedicated to electric vehicle production, leveraging Ohio's skilled workforce and strategic location.

General Motors (GM)

- **Market Position:** General Motors holds a significant market share in the US automotive industry, accounting for 17% of the market. GM is a key player in Ohio's automotive sector, operating significant manufacturing facilities in the state with a strong focus on electric vehicle production.
- **Key Facilities:** The GM-LG Chem joint venture in Lordstown, Ohio, is a notable facility dedicated to EV battery production, which is crucial for GM's electric vehicle lineup.

Ford

- **Market Position:** Ford holds a 13% market share in the US automotive industry. Ford maintains a significant manufacturing footprint in Ohio, focusing on producing engines, transmissions, and vehicles. The company is heavily investing in EV technology and infrastructure.
- **Key Facilities:** Ford's Ohio Assembly Plant in Avon Lake is a major production site, particularly known for manufacturing trucks and utility vehicles, including components for electric vehicles.

Market Size and Growth Trends

National Contribution: The U.S. automotive industry contributed approximately \$1.3 trillion to the national GDP in 2022, representing about 6.7% of total GDP (Bureau of Economic Analysis). The automotive sector remains a cornerstone of the U.S. economy, driven by robust domestic demand and significant advancements in electric vehicle (EV) technology. The United States is the third largest electric vehicle manufacturer, behind China and Europe. From 2017 to 2020, the U.S. share of cumulative global electric vehicle production since 2010 decreased from 20% to 18%, while manufacturing increased in the other two regions. According to the [Ohio Freight Electrification](#) report, over the next decade, 29 major global automakers are investing at least \$300 billion into EVs

Ohio's automotive/EV sector contributes significantly to the state's economic trade, and creating a very even in and out trade balance by exporting \$11 billion in 2023, up 14% over last year, while importing 11 billion, down 2% over 2022 according to [Trade.gov](#). The automotive industry in Ohio produced \$17 billion in Gross State Product (GSP) in 2022, underscoring its significant contribution to the state's economy. Ohio ranks fifth among 15 states in auto production, with 880,543 units produced in 2022 ([Wards](#)).

Honda and LG Energy Solution leaders held an official groundbreaking ceremony on February 28, 2023, for a new joint venture electric vehicle battery plant spanning over 2 million square feet or 78 football fields.

The two companies have committed to investing \$3.5 billion in the new joint venture (JV) facility, with their overall investment projected to reach \$4.4 billion. The facility will create 2,200 jobs and draw workers from Fayette County and Columbus, Cincinnati, Dayton, and Ohio's Appalachian counties.

Key Products and Services Offered in Ohio

- **Electric Vehicles (EVs):** Produced by General Motors, Honda, and Lordstown Motors.
- **Battery Systems:** Advanced battery systems are produced by the GM-LG Chem joint venture in Lordstown.
- **Drivetrain and Powertrain Components:** Produced by Dana Incorporated.
- **Electronic Systems:** Developed and manufactured by Aptiv.
- **Charging Infrastructure:** Led by DriveOhio.
- **R&D and Innovation Centers:** Conducted at the Transportation Research Center (TRC) in East Liberty.

Employment Statistics and Wage Data

- **Employment:** Ohio's automotive industry, including the EV sector, employs approximately 98,408 workers as of 2022. This includes roles in manufacturing, engineering, research and development, and administrative functions. Looking specifically at roles within the manufacturing NAICS codes selected, Lightcast data shows 96k jobs currently declining over the next declining by 8% or 7,471 jobs through 2030. This is despite having a 32% growth rate or 2.6k increased jobs in the Other Electrical Equipment and Component Manufacturing function. The state is projected to create over 25,000 new jobs in the EV sector by 2030, spanning roles in EV manufacturing, battery development, and charging station installation and operations. Current employment in NAICS 3361/3362 (over 835,000) far outweighs battery manufacturing (around 46,000), but NAICS 33591 is poised for rapid expansion as the announced battery plants come online. Over time, jobs related to EV production in NAICS 3361/3362 will come at the expense of jobs producing traditional combustion vehicles. With less labor required per EV vehicle, this transition can be at odds with overall employment levels in the industry. From a regional perspective, however, shifting production trends related to where companies open new facilities can be a net positive for jobs in certain areas within the United States. [SPGlobal](#)
- **Wage Data:** The average wage in Ohio's automotive sector is significantly competitive, reflecting the high value and skill level required for these roles. For example, mechanical engineers in Ohio have an average salary of approximately \$77,000 per year, while electrical engineers earn around \$81,000 annually. According to the Auto and Advanced Mobility Workforce Strategy, Ohio alone is projected to create 2,000 jobs, putting \$135 million more dollars (in annual wages) into the Ohio economy – which suggests new jobs related to EV growth are expected to average annual wage salaries of \$67,500 (\$135MM/2k jobs).
- **Strategic Efforts and Workforce Development:** Ohio is investing significantly in workforce development to support its growing automotive and EV sectors. Key initiatives include:
 - Educational Programs: Ohio's educational institutions are expanding their curricula to include EV-specific training programs. In 2022, Ohio had 16,131 program completions in top auto occupations. There are 69 higher education programs in welding alone, with 1,247 program completions in 2022.
 - Apprenticeships and Training: Apprenticeship programs, particularly for electricians and automotive technicians, are being scaled to meet the increasing demand. Ohio had 772 graduates from apprenticeship programs that mapped to auto and advanced mobility occupations in 2022.

Significant Projects Happening in Ohio

1. Honda and LG Energy Solutions Joint Venture:

- **Overview and Details:** Honda and LG Energy Solutions have teamed up to establish a new EV battery production facility in Ohio, with an investment of \$4.4 billion. This partnership underscores the state's strategic importance in the electric vehicle supply chain and aims to produce batteries to support Honda's expanding EV lineup.
- **Economic Impact:** The venture is expected to generate 2,200 direct jobs, along with significant indirect employment, strengthening Ohio's position as a key player in the national and global EV markets.
- **Supply Chain Impact:** The joint venture will drive demand for local suppliers of battery materials and components, fostering the development of a comprehensive EV battery supply chain within Ohio. This will enhance the state's ability to attract further investments in battery technology and related sectors.
- **Source:** [2023 Ohio Private Investment Survey](#)

2. GM-LG Chem Ultium Cells Plant:

- **Overview and Details:** The GM-LG Chem Ultium Cells joint venture in Lordstown represents a major leap forward in Ohio's automotive industry. This \$2.3 billion facility is dedicated to producing advanced lithium-ion batteries for electric vehicles, with an annual capacity of 30 GWh, aligning with General Motors' strategy to transition to an all-electric vehicle portfolio.
- **Economic Impact:** The project is set to create 1,100 direct jobs and numerous indirect jobs through the supply chain and local businesses, significantly boosting the regional economy.
- **Supply Chain Impact:** The plant will require a robust supply chain for raw materials like lithium, cobalt, and nickel, as well as components such as battery cells and modules. This will create opportunities for local suppliers and stimulate growth in related industries. Additionally, the production output will support various OEMs in the region, enhancing the overall supply chain resilience.
- **Source:** [Business Insider](#)

3. Smart Mobility Corridor:

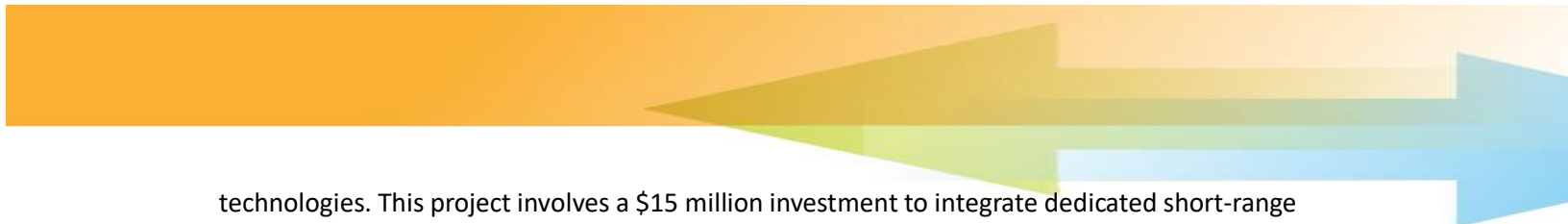
- **Overview and Details:** Ohio's Smart Mobility Corridor is a 33-mile stretch of highway equipped with advanced infrastructure to support the testing and deployment of autonomous and connected vehicle



Retrofitting OHIO

Major EV-Related Investments in Ohio





technologies. This project involves a \$15 million investment to integrate dedicated short-range communication (DSRC) units, high-definition mapping, and roadside sensors.

- **Economic Impact:** The Smart Mobility Corridor attracts technology companies and research institutions, fostering innovation and investment in the region. It also creates high-tech jobs and positions Ohio as a leader in smart transportation infrastructure.
- **Supply Chain Impact:** The development of the Smart Mobility Corridor will stimulate demand for advanced communication systems, sensors, and data analytics services. This will create opportunities for local tech companies and enhance the overall supply chain for smart mobility solutions.
- **Source:** [Transport Ohio Statewide Freight Plan](#)

4. Transportation Research Center (TRC) Expansion:

- **Overview and Details:** The Transportation Research Center (TRC), located in East Liberty, Ohio, is expanding its facilities to enhance its testing capabilities for autonomous and electric vehicles. This expansion involves a \$100 million investment to add new test tracks, simulation labs, and research facilities.
- **Economic Impact:** The TRC expansion supports the local economy by creating specialized jobs in automotive research and development. It also attracts investment from automotive and technology companies looking to leverage the center's state-of-the-art facilities.
- **Supply Chain Impact:** The TRC expansion will increase demand for specialized testing equipment, advanced simulation software, and engineering services. This will strengthen the local supply chain for automotive R&D and support the development of new technologies.
- **Source:** [Transport Ohio Statewide Freight Plan](#)

5. Ford Investment in Lorain County:

- **Overview and Details:** Ford has announced a significant investment of \$1.5 billion to transform its Avon Lake plant in Lorain County into a center for electric vehicle production. This investment is part of Ford's broader strategy to expand its EV manufacturing capabilities in the United States.
- **Economic Impact:** The project is expected to create 1,800 new jobs, enhancing economic growth and stability in the region. It also underscores Ford's commitment to investing in the future of electric mobility.
- **Supply Chain Impact:** The Avon Lake plant will necessitate a robust supply chain for EV components, including batteries, electric drivetrains, and electronic systems. This will create opportunities for local suppliers and stimulate growth in Ohio's manufacturing sector.
- **Source:** [2023 Ohio Private Investment Survey](#)

6. SEMCORP Manufacturing Facility:

- **Overview and Details:** SEMCORP, a leading supplier of separator films for lithium-ion batteries, is building a new manufacturing facility in Sidney, Ohio, with an investment of \$916 million. This facility will be the company's first in the United States and will produce separator films critical for EV batteries.

- **Economic Impact:** The facility is expected to create 1,200 jobs, contributing to local economic development and positioning Ohio as a crucial player in the EV supply chain.
- **Supply Chain Impact:** The SEMCORP facility will support the growing demand for lithium-ion battery components in the U.S. market, creating a reliable local supply chain for separator films and enhancing the overall resilience and efficiency of the EV battery supply chain.
- **Source:** [PRNewsWire](#)

Automotive/EV Supply Chain

The automotive and electric vehicle (EV) supply chain in Ohio is a complex and dynamic ecosystem that spans the entire manufacturing process, from raw material extraction to vehicle assembly. Ohio's strategic location, skilled workforce, and robust infrastructure make it a critical hub for automotive and EV manufacturing. The state hosts numerous OEMs, Tier 1 suppliers, and an extensive network of smaller suppliers, all contributing to the production of both traditional and electric vehicles. With significant investments in EV technology and infrastructure as well as purchasing patterns are fairly balanced between in state and out-of-state sources, Ohio is poised to lead the transition to a more sustainable and innovative automotive industry.

Key Suppliers, Consumers and Raw Material Requirements

Key Suppliers

Tier 1 Suppliers:

- **Role:** Tier 1 suppliers provide major components directly to OEMs (Original Equipment Manufacturers). They play a crucial role in the automotive and EV supply chain by delivering high-quality, critical parts such as engines, transmissions, and electronic systems.
- **Notable Companies:**
 - **Dana Incorporated:** Headquartered in Maumee, Ohio, Dana employs over 36,000 people globally, with significant operations in Ohio, specializing in drivetrain and e-propulsion systems.
 - **Aptiv:** With major operations in Ohio, Aptiv focuses on advanced safety, electrification, and connectivity solutions for the automotive industry, generating over \$14 billion in annual revenue.
 - **BorgWarner:** BorgWarner's Ohio operations contribute to its \$10 billion global revenue, providing clean and efficient technology solutions, including electric drive motors and battery management systems.

Tier 2 and Tier 3 Suppliers:

- **Role:** These suppliers provide sub-components and raw materials to Tier 1 suppliers. They are integral in ensuring that Tier 1 suppliers have the necessary parts and materials to meet OEM demands.
- **Notable Companies:**
 - **Goodyear Tire & Rubber Company:** Based in Akron, Ohio, Goodyear is a global leader in tire manufacturing, generating over \$12 billion in annual revenue.
 - **Parker Hannifin:** Specializes in motion and control technologies, including hydraulic and pneumatic components, contributing to its \$14 billion in annual revenue.



Key Consumers

Original Equipment Manufacturers (OEMs):

- **Role:** OEMs are the end-users of the supply chain, responsible for assembling vehicles and bringing them to market. They rely on a steady flow of parts and components from suppliers to maintain production schedules.
- **Notable Companies:**
 - **General Motors (GM):** With significant operations in Ohio, GM produces a wide range of vehicles, including electric models, contributing to its \$122 billion annual revenue.
 - **Honda:** Operates major manufacturing facilities in Ohio, producing cars, engines, and transmissions, with the company's annual revenue exceeding \$137 billion.
 - **Ford:** Recently invested in EV manufacturing capabilities in Lorain County, expanding their production of electric vehicles, contributing to their \$160 billion annual revenue.

Raw Material Requirements

1. Lithium:

- **Importance:** Essential for the production of lithium-ion batteries, which are critical for EVs.
- **Sources:** Ohio secures lithium through international suppliers and is exploring recycling programs to supplement supply.
- **Concerns:** Minimal concerns due to established international supply chains and the recent discovery of a massive lithium deposit in the McDermitt Caldera, located on the Nevada-Oregon border.

2. Cobalt:

- **Importance:** Used in battery cathodes to improve energy density and longevity.
- **Sources:** Primarily imported from countries like the Democratic Republic of Congo, with efforts to diversify sourcing and reduce dependency.
- **Concerns:** Some concerns due to the geopolitical stability of major sourcing regions, but diversification efforts are underway.

3. Nickel:

- **Importance:** Enhances battery capacity and energy density, crucial for high-performance EV batteries.
- **Sources:** Obtained through a mix of domestic and international suppliers, with ongoing research into alternative materials to reduce reliance.
- **Concerns:** Minimal concerns due to strong global supply chains and ongoing research into alternative materials.

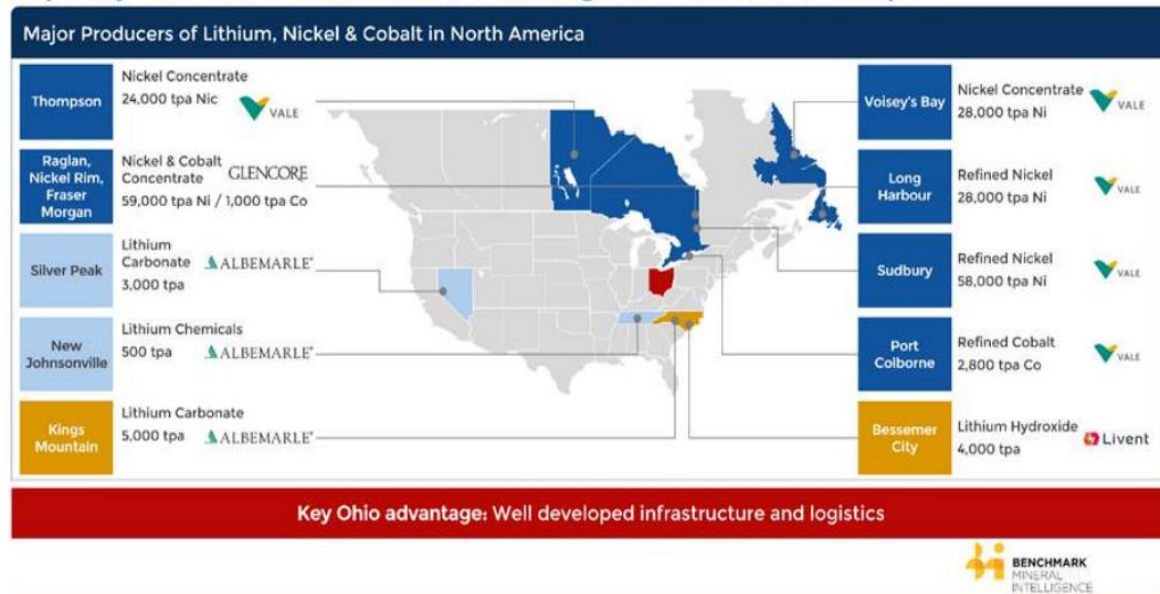
4. Aluminum and Advanced Alloys:

- **Importance:** Used extensively in vehicle structures to reduce weight and improve fuel efficiency.
- **Sources:** Ohio benefits from a well-developed network of aluminum suppliers, both in-state and nationally.
- **Concerns:** Minimal concerns due to a strong local and national supply network.

5. Composite Materials:

- **Importance:** Provide lightweight, high-strength alternatives to traditional materials, used in both automotive and aerospace applications.
- **Sources:** Sourced from specialized manufacturers, with increasing local production capabilities to meet demand.
- **Concerns:** Minimal concerns due to growing local production capabilities and reliable supply chains.

While raw material availability is not an Ohio specific strength, the region's capacity and Ohio's infrastructure and logistics are well developed



- [Courtesy of the Final BMI Report](#)

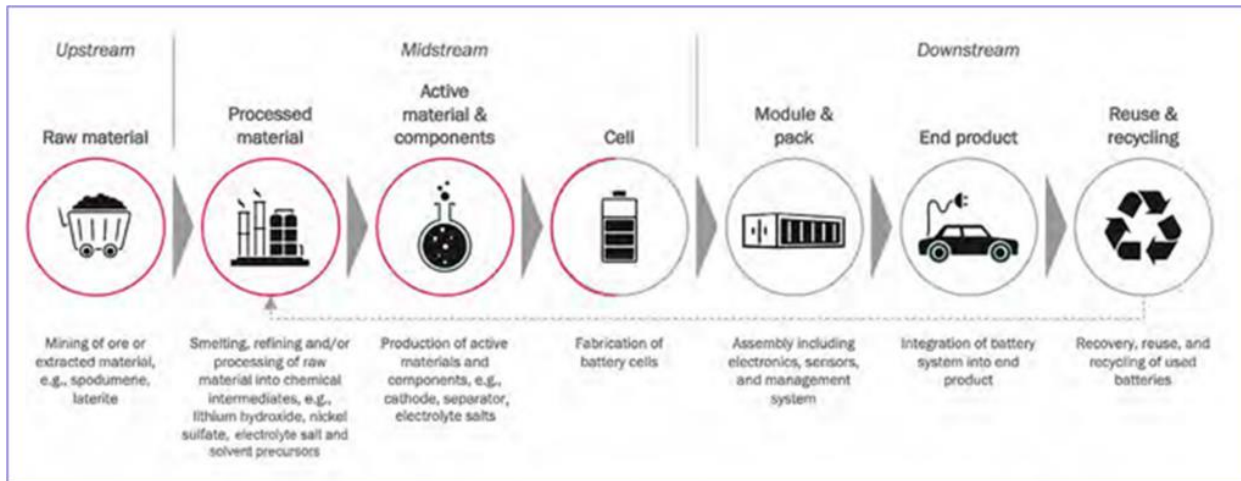
FIGURE 8: OHIO AUTOMOTIVE COMPONENTS AND MATERIALS PRODUCTION (NORTH AMERICA)



The strength and resilience of Ohio's automotive and EV supply chain is bolstered by its key suppliers, major consumers, and essential raw material providers. The balanced purchasing patterns between in state and out-of-state sources reflect the diverse and interconnected nature of the supply chain. This interconnected network ensures the efficient production and delivery of vehicles, supporting the state's leadership in the automotive and EV industries. By maintaining robust relationships with these critical stakeholders, Ohio continues to drive innovation and economic growth within the sector.

Emerging EV Supply Chain

Steps Involved in Producing and Using an EV Battery:



Source: Argonne National Laboratory's Li-Bridge 2023 Report

Upstream:

- **Process:** Mines extract raw materials necessary for battery production, including lithium, cobalt, manganese, nickel, and graphite.
- **Key Points:**
 - **Lithium:** The U.S. has less than 2% of the world's lithium reserves, with the only active lithium mine located in Nevada. Processing is predominantly done in China.
 - **Cobalt and Nickel:** Mostly sourced from international suppliers, with ongoing efforts to diversify sourcing and reduce dependency on specific regions.

Midstream:

- **Process:** Processors and refiners purify raw materials to create cathode and anode active battery materials. Commodities traders facilitate the buying and selling of these materials to battery cell producers.
- **Key Points:**
 - **Cathode and Anode Materials:** The processing and refining stages are crucial for ensuring the quality and performance of battery materials.
 - **Trade and Commerce:** The movement of these materials is managed by commodities traders, who ensure the materials reach battery cell manufacturers.

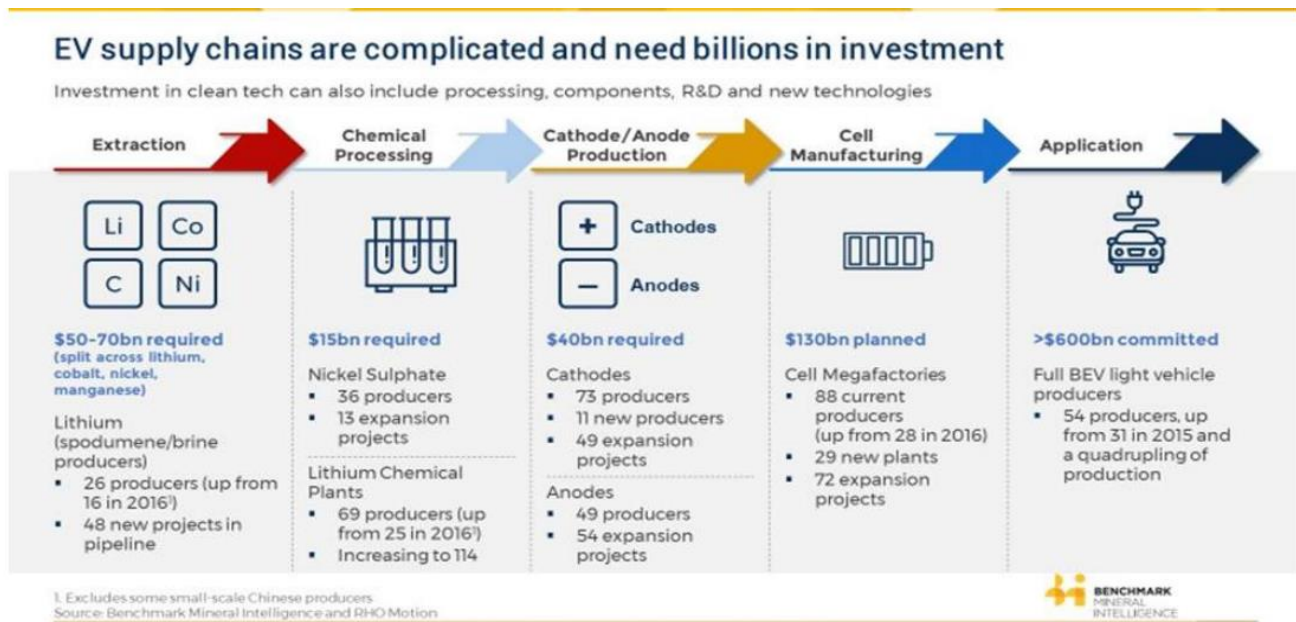
Downstream:

- **Process:** Battery manufacturers assemble battery cells into modules and pack them for automakers, who then integrate the batteries into EVs.
- **Key Points:**
 - **Battery Assembly:** Major automakers like Ford and Stellantis have formed partnerships with battery manufacturers to produce their own batteries, ensuring control over the quality and supply of critical components.
 - **Automaker Integration:** Automakers place finished batteries in EVs, completing the production process.

End of Life:

- **Process:** When batteries no longer serve their original purpose, they can be reused or recycled.
- **Key Points:**
 - **Recycling and Reuse:** Developing efficient recycling methods can mitigate the environmental impact of battery disposal and provide a secondary source of critical materials.

The global EV battery supply chain is highly dispersed, with battery minerals traveling an average of 50,000 miles from extraction to production. Concentration of mineral supplies in a few countries and the long distances traveled make the supply chain vulnerable to disruptions. These disruptions include extreme weather, geopolitical conflicts, changing trade alliances, and corporate consolidation. New technologies that alter battery chemistries also affect the supply chain, necessitating adaptive strategies to manage these risks.



According to the [International Council on Clean Transportation](#), The electric vehicle production dynamics reflect where there has been the most electric vehicle market growth and where policies are encouraging the transition to electric vehicles. About 15% of the approximately \$340 billion in global automaker electric vehicle investments appear to be destined for the United States. Based on company announcements through 2020, about 5% of this global total is actively being invested in specific U.S. assembly plants to increase electric vehicle production. Similarly, of the automakers' announcements that sum to 22 million annual electric vehicle sales by 2025, about 2.3 million (or about 10%) are slated to be manufactured in the United States.

According to [RMI](#), Several legislative acts and initiatives are designed to strengthen the EV supply chain and promote domestic manufacturing:

The Infrastructure Investment and Jobs Act:

- Provides funding for various programs, including:
 - Battery and Critical Minerals Mining and Recycling Grant Program (\$125 million)
 - Earth Mapping Resources Initiative (\$320 million)
 - US Geological Survey's Energy and Minerals Research Facility (\$167 million)

- Rare Earth Elements Demonstration Facility Program (\$140 million)
- Battery Materials Processing and Battery Manufacturing Recycling (\$2.8 billion)
- Electric Drive Vehicle Battery Recycling and 2nd Life Apps Program (\$200 million)
- Advanced Energy Manufacturing and Recycling Grant Program (\$750 million)
- Future of Industry Program and Industrial Research and Assessment Centers (\$550 million)

The CHIPS and Science Act:

- Funds American semiconductor research, development, and production with \$2 billion allocated for advanced manufacturing and materials research, reducing reliance on foreign semiconductors.

The Inflation Reduction Act:

- Focuses on improving clean energy manufacturing and recycling, critical materials processing, and incentivizing domestic production. Key provisions include:
 - Qualifying Advanced Energy Project Credit (\$10 billion)
 - Advanced Manufacturing Production Tax Credit (\$30.62 billion)
 - Defense Production Act of 1950 enhancements (\$500 million)
 - Advanced Technology Vehicles Manufacturing Direct Loan Program expansion (\$3 billion)
 - Domestic Manufacturing Conversion Grants (\$2 billion) and Clean Heavy-Duty Vehicle Program (\$1 billion)
 - Clean Vehicle Tax Credit, providing up to \$7,500 for new qualified plug-in EVs or fuel cell electric vehicles

Challenges and Opportunities

The battery value chain continues to face numerous environmental, social, and governance challenges.



McKinsey & Company

According to [McKinsey](#), The global battery value chain, like others within industrial manufacturing, faces significant environmental, social, and governance (ESG) challenges (see above). Together with GBA members representing the entire battery value chain, McKinsey has identified 21 risks along ESG dimensions:

- **Environmental:** The extraction and refining of raw materials, as well as cell production, can have severe environmental effects, such as land degradation, biodiversity loss, creation of hazardous waste, or contamination of water, soil, and air. Unprofessional or even illegal battery disposal can cause severe toxic pollution. This is a problem within today's lead-acid battery value chain.
- **Social:** Unless strictly managed, operations across the battery value chain could have unfavorable effects on regional communities through violations of labor laws, child and forced labor, and indigenous rights, especially in emerging markets.
- **Governance:** Businesses in the battery value chain may encounter conflicts of interest or other companies with subpar management practices. To meet longstanding expectations for ethical businesses, companies must avoid financial situations involving corruption, bribery, funding armed conflicts, and tax evasion.

Enhancing the resilience of the automotive and electric vehicle (EV) supply chain is crucial for maintaining stability and ensuring continuous growth. Here are some key strategies based on current industry practices and specific needs identified in the automotive/EV sector.

Diversification of Semiconductor Sources

- **Strategy:** Mitigate risks associated with semiconductor shortages by diversifying sources and investing in alternative suppliers.
- **Implementation:** Establish relationships with multiple semiconductor manufacturers globally and encourage local production through incentives and partnerships.
- **Example:** Ford has diversified its semiconductor suppliers to avoid disruptions caused by geopolitical tensions and supply chain bottlenecks.
 - Source: [Ford to Partner with GlobalFoundries to Boost Chip Supply - Reuters](#)

Battery Supply Chain Security

- **Strategy:** Secure a stable and ethical supply of critical battery materials like lithium, cobalt, and nickel.
- **Implementation:** Invest in local battery production facilities and form partnerships with ethical mining operations. Implement recycling programs for battery materials to ensure a sustainable supply chain.
- **Example:** General Motors has partnered with mining companies to secure ethically sourced cobalt and has invested in battery recycling technologies.
 - Source: [GM to Source Sustainable Cobalt from Glencore - GM Newsroom](#)

Adoption of Advanced Manufacturing Technologies

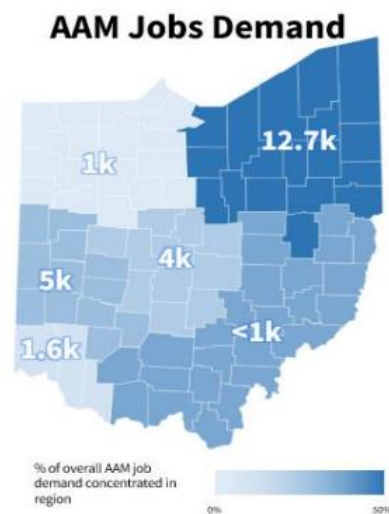
- **Strategy:** Increase the adoption of advanced manufacturing technologies such as automation, AI, and additive manufacturing to improve production efficiency and flexibility.
- **Implementation:** Provide incentives for automotive manufacturers to upgrade their production facilities and train their workforce in advanced manufacturing techniques.
- **Example:** Tesla's Gigafactories employ advanced automation and AI to streamline the production of electric vehicles.
 - Source: [Inside Tesla's Gigafactory: A Peek at How Elon Musk Keeps His Production Lines Moving - CNBC](#)

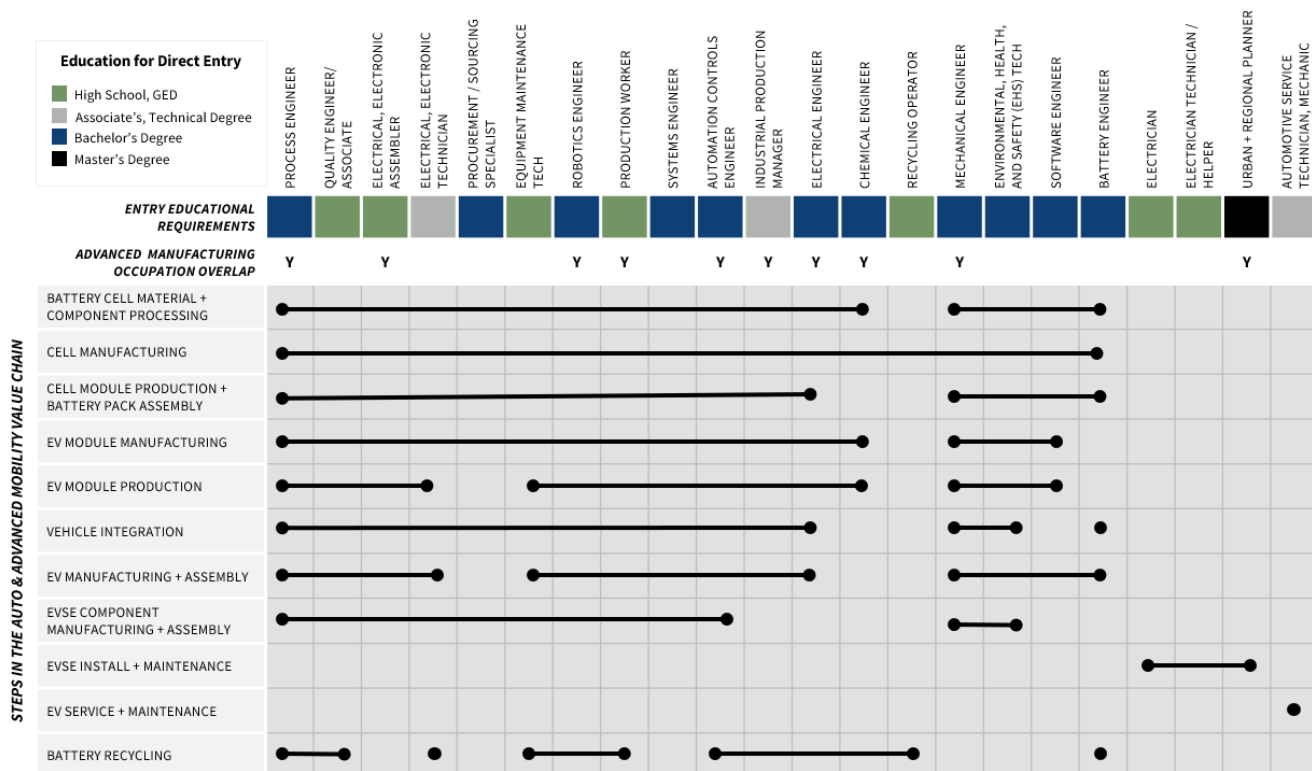
Strengthening Local Supplier Networks

- **Strategy:** Develop and strengthen local supplier networks to reduce dependency on international suppliers and enhance supply chain resilience.
- **Implementation:** Encourage local manufacturing through tax incentives and grants. Support local suppliers in meeting industry standards and certifications.
- **Example:** Ohio's initiatives to support local automotive part manufacturers through the Ohio Manufacturing Extension Partnership (MEP) and its platform Sustainment.
 - Source: [Ohio MEP: Connecting Manufacturers with Resources - Ohio MEP](#)

Enhancing Workforce Skills for EV Transition

- **Challenge:** Need for training and reskilling the workforce to support EV production and maintenance.
- **Opportunity:** Ohio is expanding existing vocational programs and leveraging industry partnerships to provide comprehensive EV training. Programs at institutions such as Ohio State University's Center for Automotive Research and collaboration with organizations like Smart Columbus ensure that the workforce is well-prepared for the demands of the EV industry. Grants are being used to procure equipment and expand training facilities, providing hands-on experience with EV technologies.
- **Key insights:** The Ohio Auto & Advanced Mobility Workforce Strategy Report's says *In total, we identified 22 auto and advanced mobility-related occupations that are key in the electrification value chain. These 22 occupations have varying entry-level requirements, career pathways, and career trajectories, indicating that the industry includes all skill levels (advanced, skilled assembly, hourly) and across each portion of the auto and advanced mobility value chain.*





The below outlines Ohio's AAM stakeholder engagement strategies:

Ohio Auto & Advanced Mobility Workforce Stakeholders Engaged



Promoting Sustainability in Manufacturing

- Strategy:** Encourage sustainable manufacturing practices to comply with environmental regulations and reduce carbon footprint.

- **Implementation:** Invest in green technologies, such as renewable energy sources and eco-friendly materials. Provide incentives for manufacturers to adopt sustainable practices.
- **Example:** Honda's investment in green manufacturing technologies and its commitment to achieving carbon neutrality by 2050.
 - Source: [Honda's Commitment to Sustainability - Honda Sustainability Report](#)

Ohio has several key advantages to spur upstream EV supply chain investment



In conclusion, Ohio is uniquely positioned to capitalize on the growth of the EV industry due to its strong automotive manufacturing base and supportive legislative environment. By addressing supply chain vulnerabilities and investing in workforce development and infrastructure, Ohio can lead the transition to a sustainable and innovative automotive future. The continued focus on building a resilient and efficient EV supply chain will ensure the state's economic growth and leadership in the automotive industry.

Semiconductor Market Segment Analysis:

Ohio's economic landscape is poised for significant transformation with the burgeoning semiconductor manufacturing sector, which is becoming a pivotal component of the state's industrial future. Despite facing recent setbacks, such as the delay of Intel's \$20 billion project in New Albany due to market slowdowns and funding challenges, Ohio's commitment to advancing this sector demonstrates its strategic intent to cultivate a high-tech industry hub.

The delay, attributed to slower than expected market conditions and delayed disbursement of funds from the U.S. government's CHIPS Act, has adjusted the project's completion timeline to late 2026. However, this has not deterred the state's resolve. Ohio's proactive initiatives, supported by state and federal policies including the CHIPS and Science Act, aim to fortify the U.S. semiconductor supply by reducing dependency on overseas production, thus enhancing national security and economic stability.



In response to these challenges, Ohio is not only focusing on attracting large-scale investments but is also enhancing its educational and infrastructural capabilities to support this high-tech sector. Strategic investments are being channeled into workforce development and research partnerships with universities, which are crucial for sustaining growth and innovation in semiconductor technologies.

This burgeoning sector promises to bolster Ohio's manufacturing capabilities and drive future economic growth by creating high-paying tech jobs and fostering a robust ecosystem for semiconductor production. With state and federal support, Ohio is set to navigate the complexities of global semiconductor demands, making it a critical player in reshaping the national and global tech landscapes.

****NOTE: For the purposes of data gathering for manufacturing in the chemical and plastics industry, we are using the following NAICS code: Semiconductors and Other Electronic Components (NAICS 3344)*

Market Segment Analysis: Semiconductors

Ohio is emerging as a key player in the semiconductor manufacturing industry, driven by substantial investments and strategic support from state and federal initiatives. Major projects like Intel's \$20 billion investment in New Albany, highlight the state's commitment to becoming a leader in this high-tech sector. Government policies, workforce development programs, and infrastructure advancements are all aligning to bolster Ohio's position in the global semiconductor supply chain, addressing both current challenges and future opportunities.

Current Trends and Developments

- **Investment Dynamics and Project Delays:** Ohio is becoming a major hub for semiconductor manufacturing, highlighted by Intel's \$20 billion investment in a state-of-the-art facility in New Albany. Despite this significant commitment, the project has faced delays due to a slow chip market and delayed federal funding under the CHIPS Act, with the new completion date set for late 2026. This delay reflects the broader market challenges but also underscores the potential for growth in Ohio's semiconductor sector.
- **Government Support and Policy Initiatives:** The federal government's CHIPS and Science Act, alongside the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, are key to supporting semiconductor manufacturing in Ohio. These policies aim to reduce reliance on foreign supply chains and boost domestic production capabilities. Key funding allocations include grants for battery materials processing, critical minerals mining, and advanced energy manufacturing.
- **Supply Chain Challenges and Opportunities:** Ohio faces several challenges in building a comprehensive semiconductor supply chain. These include dependencies on global supply chains for critical materials, the need for workforce reskilling, and potential bottlenecks in production. However, the state is addressing these issues through strategic investments in local production capabilities and partnerships with educational institutions to develop a skilled workforce.
- **Workforce Development and Education:** A significant focus is on workforce development, with Ohio investing in specialized training programs through partnerships with major universities and technical schools. Initiatives such as those at Ohio State University's Center for Automotive Research are aligning skills with industry demands, ensuring a steady pipeline of skilled workers for the semiconductor industry.

Major Players in the Industry with Market Share

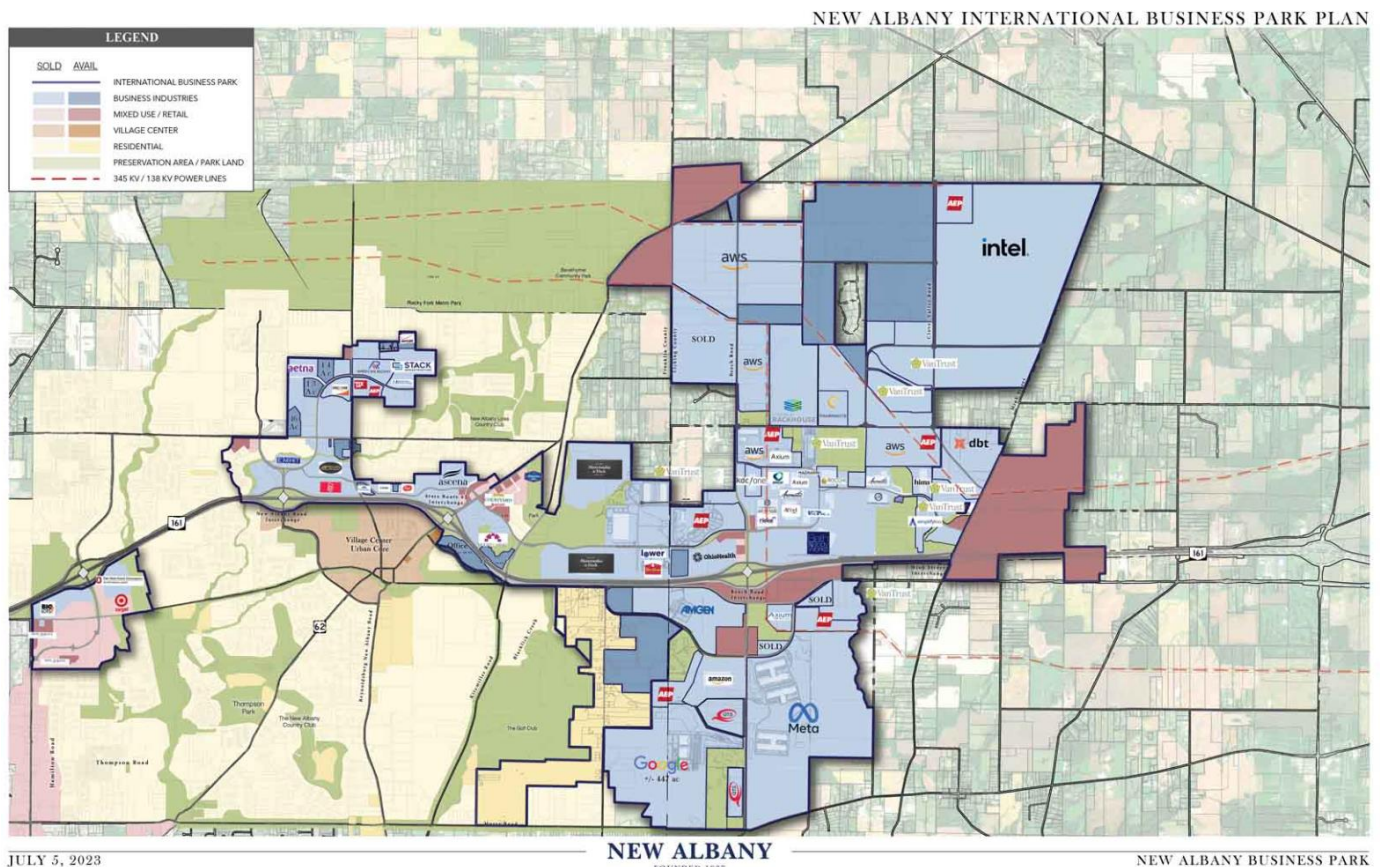
For Ohio, it's **Intel Corporation**:

Market Position: Intel holds a 9.4% share of the global semiconductor market, generating \$51 billion in revenue in 2023. It remains a key player in the industry. All is not well at Intel, however, with the company's stock price down over 20% year-to-date after it revealed [billion-dollar losses](#) in its foundry business.

Rank	Company	2023 Revenue	% of Industry Revenue
1	Intel	\$51B	9.4%
2	NVIDIA	\$49B	9.0%
3	Samsung Electronics	\$44B	8.1%
4	Qualcomm	\$31B	5.7%
5	Broadcom	\$28B	5.2%

- **Key Facilities in Ohio:**
 - **New Albany Facility:** Intel's \$20 billion investment in this state-of-the-art manufacturing plant underscores its commitment to expanding semiconductor production in Ohio. The facility, though delayed, is expected to create 3,000 direct jobs and significantly bolster the local supply chain ([Visual Capitalist](#))

BELOW IS A MAP DEVELOPED BY THE [The New Albany Co](#) THAT IDENTIFIES INTEL SUPPLIERS AND SUPPORTING COMPANIES THAT HAVE STARTED ANNOUNCING PLANS TO JOIN INTEL IN NEW ALBANY AND IN THE WIDER REGION. APPLIED MATERIALS, LAM RESEARCH, ULTRA CLEAN TECHNOLOGY, AIR PRODUCTS, DSV, QTS, LINCOLN RACKHOUSE, AND DBT LABS ARE SOME OF THE COMPANIES THAT HAVE ANNOUNCED PLANS, WITH MORE IN THE PIPELINE.



According to the [Ohio Department of Development](#), Intel's Ohio supplier footprint has grown from approximately 150 Ohio suppliers when the project investment was announced to more than 350 current Ohio suppliers across 47 Ohio counties. Among the top suppliers are Bechtel Construction, Gilbane Building Company, and Linde.

- **Linde Gas & Equipment Inc.:** Supplies essential industrial gases for semiconductor fabrication.
- **Bechtel Construction:** Leading global engineering, construction, and project management company, managing and constructing critical infrastructure for semiconductor manufacturing facilities.
- **Gilbane Building Company:** Provides construction and facilities management services, constructing and managing semiconductor manufacturing facilities.



Market Size and Growth Trends

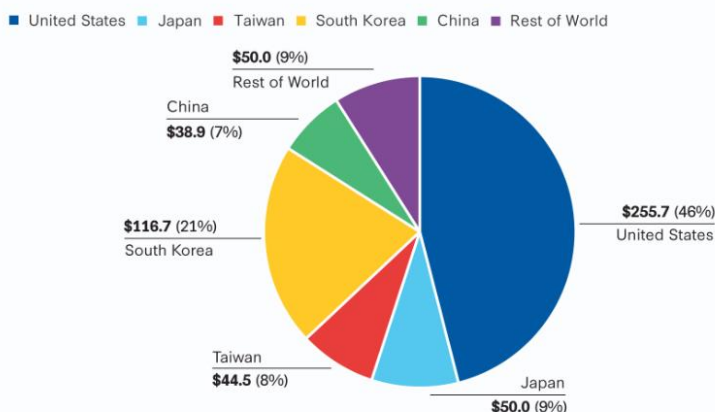
National Contribution: The U.S. semiconductor industry contributed approximately \$277 billion (Up from 255.7 billion as shown in the figure here) to the national GDP in 2023, representing about 1.2% of total GDP (Semiconductor Industry Association). The industry remains a cornerstone of the U.S. economy, driven by robust domestic demand and significant advancements in technology. The United States is a leading semiconductor manufacturer, with key players like Intel, NVIDIA, and Texas Instruments spearheading innovation. According to the Semiconductor Industry Association, federal investments in semiconductor

R&D have propelled significant growth, with each dollar invested by the federal government increasing overall U.S. GDP by \$16.50 ([Semiconductor Industry Association](#)). The CHIPS Act has catalyzed a surge in semiconductor investments across the United States, with Ohio receiving a substantial share. The state is part of the Midwest Microelectronics Consortium (MMEC), which has been awarded \$24.3 million to develop infrastructure and support

FIGURE 1

Semiconductor Sales by Country (2021, in billions)

Total semiconductor sales in 2021: \$555.9 million



Source: "SIA Factbook 2022," Semiconductor Industry Association, May 2022, https://www.semiconductors.org/wp-content/uploads/2022/05/SIA-2022-Factbook_May-2022.pdf.

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microelectronics R&D. These investments are part of a broader \$52.7 billion federal funding initiative aimed at enhancing semiconductor research, development, and manufacturing across the country.

Ohio's Contribution: Ohio's semiconductor sector contributes has minimal contributions to the states exports in 2023 at \$243 million, down 33% to last year and importing \$1.5 billion up 7% from 2022 ([Trade.gov](https://www.trade.gov)). While not finding specific projected export data on future growth expectations, we can infer that similar states with semiconductor manufacturing, such as Arizona, where exports trade at \$3 to \$4 billion per year.

Key Products and Services

- **Semiconductor Chips:** Produced by Intel at their New Albany facility.
- **Industrial Gases:** Supplied by Linde Gas & Equipment Inc.
- **Construction and Project Management:** Managed by Bechtel Construction for Intel's facilities.
- **Facility Management Services:** Provided by Gilbane Building Company.
- **Manufacturing Equipment and Software:** Developed by Applied Materials.
- **Packaging and Test Services:** Offered by Amkor Technology.
- **Wafer Fabrication Equipment:** Produced by Lam Research.
- **Research and Development Centers:** Conducted at various universities and institutions in Ohio, including partnerships with Intel.

Employment Statistics and Wage Data

- **Employment:** Ohio's semiconductor industry employs approximately 11,425 workers as of 2023 according to Lightcast data, which is an increase of 2,514 jobs or 28% from the previous year. This includes roles in manufacturing, engineering, research and development, and administrative functions. With Intel's new facility in New Albany, the state expects to increase semiconductor-related jobs by 3k more and another 7k by 2030.
- **Wage Data:** New positions that are being created at the New Albany site are expected to have an average salary of [\\$130,000](#). According to Lightcast data, current jobs in this industry average \$83,025.
- **Strategic Efforts and Workforce Development:** Intel is investing significantly in workforce development to support its growing semiconductor operations in Ohio. Key initiatives include:
 - **Educational Programs:** Intel has committed \$50 million over the next 10 years to support Ohio's higher education institutions. This investment will fund collaborative programs designed to improve semiconductor innovation and provide real-world experience to students. This includes partnerships with Ohio's two- and four-year institutions to expand STEM education and research capabilities ([Intel Newsroom](#))
 - **Training:** Intel has launched the Quick



Start program, an accelerated two-week training program that prepares students for careers as semiconductor technicians. This program emphasizes hands-on learning from experienced Intel employees and aims to quickly upskill the local workforce to meet the industry's growing demands ([Intel Community](#)).

- **National Partnerships:** Intel, in collaboration with the National Science Foundation (NSF), has committed \$100 million to expand semiconductor-related research and educational programs across the United States. This partnership aims to enhance STEM education and research to advance semiconductor design and manufacturing ([Intel Community](#)) ([Intel Newsroom](#)).

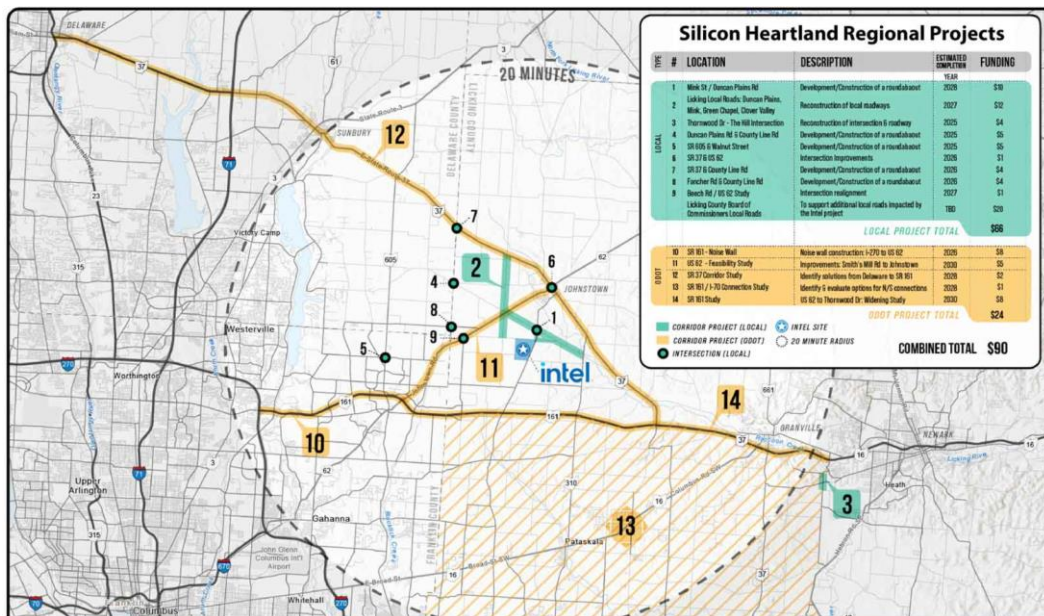
Significant Projects Happening in Ohio

The Intel project in Ohio is expected to generate substantial economic benefits. Intel has invested approximately \$1.5 billion to date, with an additional \$3 billion contractually committed. Intel's supplier footprint in Ohio has grown significantly, expanding from approximately 150 suppliers when the investment was first announced to over 350 suppliers today. These suppliers are spread across 47 counties in Ohio, supporting both Intel's operations at other facilities and the construction of the new semiconductor manufacturing plant in Licking County. This growth highlights the robust network and collaborative ecosystem being built around Intel's presence in Ohio.

Economic and Employment Impact: Intel's project is projected to bring 3,000 direct Intel jobs to Licking County with an annual payroll of \$405 million. The broader economic impact includes the creation of an additional 20,000 jobs across Ohio, contributing \$2.8 billion to the state's annual gross state product. The construction phase alone has engaged workers from 75 of Ohio's 88 counties, underscoring the project's statewide reach ([Richland Source](#)) ([10TV](#))

Infrastructure and Community Development: Licking County is undergoing significant infrastructure improvements to support the influx of new workers and their families. These include enhancements to transportation networks and utilities, as well as the development of new housing projects to accommodate the growing population. Regional planners are actively working on increasing and diversifying the housing stock, simplifying zoning regulations, and investing in long-term planning to support the projected population growth ([10TV](#)).

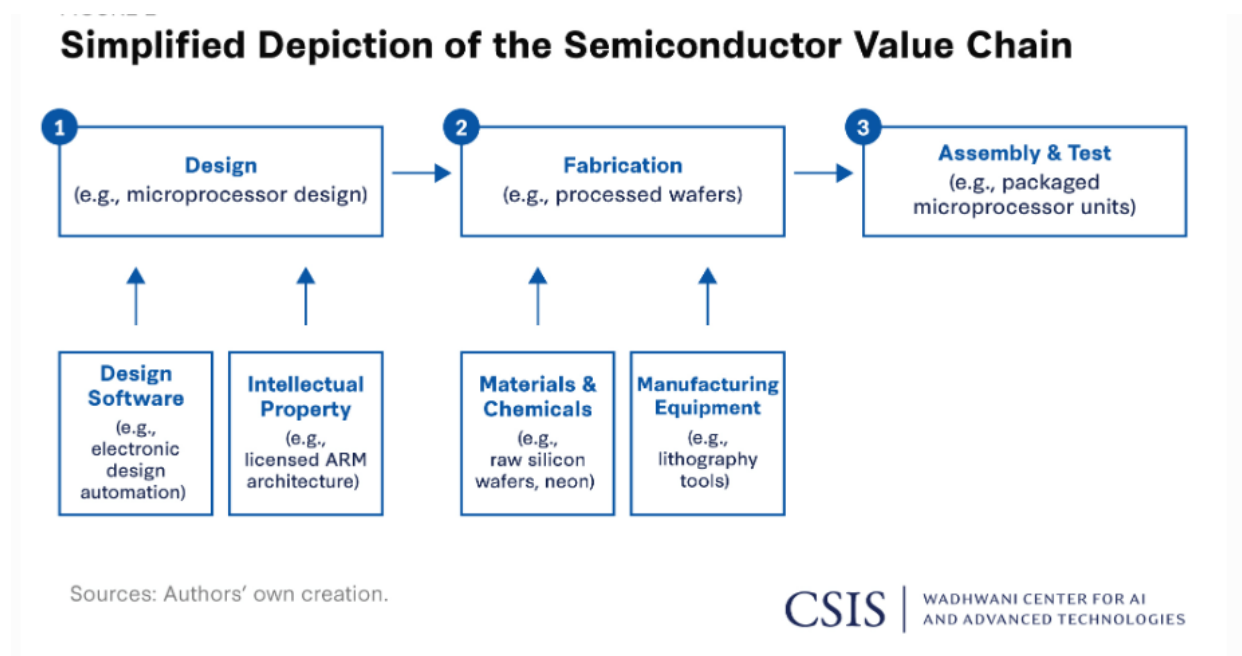
The image below shows the number of projects in this region alone:



Environmental and Technological Advancements: Intel is also advancing its environmental and technological initiatives in Licking County. The development includes plans for a water treatment and reclamation facility and an air separation unit to support sustainable manufacturing processes. These facilities are part of Intel's commitment to environmental stewardship and technological innovation ([Richland Source](#)).

Community Response and Regional Collaboration: A podcast hosted by Nate Johnson from the Brookings Institution highlights the local community's response to Intel's megasite. Guests such as Jennifer Keller, Licking County Commissioner, discuss local government strategies, while John Hinderer, a business owner, talks about economic opportunities and challenges. Dr. Mark Carr, Superintendent of Schools, emphasizes the impact on local education, noting plans to expand facilities and programs to accommodate the growing student population ([Brookings](#)).

Semiconductor Supply Chain



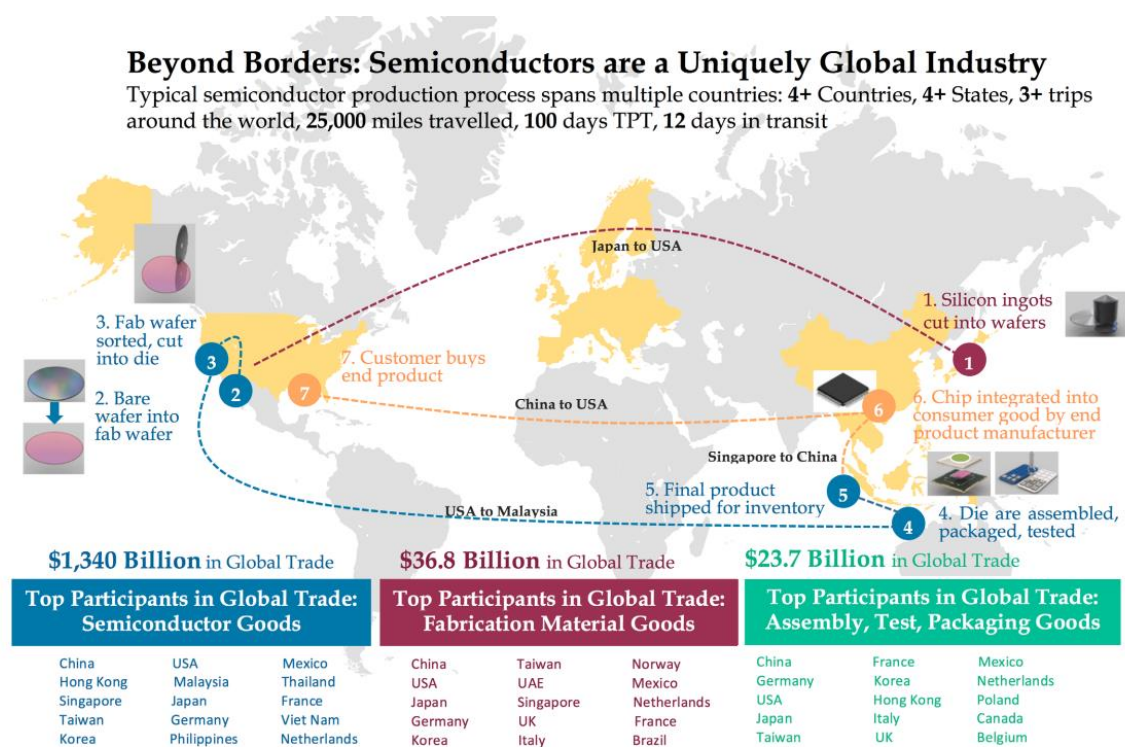
The semiconductor industry is integral to modern technology, powering everything from smartphones to automobiles. However, the supply chain for semiconductors is extremely complex, involving numerous stages from design and raw material procurement to manufacturing and final assembly. This report provides a comprehensive overview of the semiconductor supply chain, identifying key players, bottlenecks, and strategies for enhancing resilience, particularly in the context of the Indo-Pacific region.

The global semiconductor market is anticipated to grow significantly due to advancements in AI, IoT, and 5G technologies. Despite this growth, the industry faces substantial challenges. The average annual growth rate for semiconductor capacity is expected to slow down from 7.6% (2015-2022) to 4.9% (2022-2026). Additionally, industry revenues are projected to decline by 3-4% in 2023 due to macroeconomic headwinds ([McKinsey & Company](#)) ([S&P Global](#)).

The semiconductor supply chain involves several critical stages. The design phase is dominated by companies such as ARM, Synopsys, and Cadence, which provide essential design software and IP cores. Essential raw materials, including silicon wafers, gases, and chemicals, are supplied by major companies like Shin-Etsu Chemical and Sumco

(CSIS). The United States and Japan dominate the wafer fab equipment market, supplying over 70% of the world's needs. Companies like Applied Materials, Lam Research, and ASML are key players, with ASML being the exclusive provider of EUV lithography machines (CSIS). Major fabs are located in Taiwan (TSMC), South Korea (Samsung), and the United States (Intel). These facilities transform raw silicon into semiconductor chips. The back-end process of assembly, testing, and packaging is less capital-intensive but equally crucial. Japan leads in assembly and test equipment (CSIS).

The production process for individual integrated circuit (IC) chips is highly intricate, taking four to six months and involving more than 500 discrete stages. Inputs to a typical IC chip cross more than 70 international borders before the final product is delivered to consumers.



Source: UN Comtrade and Taiwan Customs Administration, Ministry of Finance; Year of 2014

Key Issues and Bottlenecks

The semiconductor supply chain faces several significant issues and bottlenecks. Taiwan's significant role in semiconductor manufacturing creates a vulnerability due to potential geopolitical conflicts. The concentration of manufacturing in this region exposes the global supply chain to substantial risk (The White House) (U.S. Department of Commerce). Critical stages of semiconductor production rely on highly specialized equipment, such as ASML's EUV lithography machines. The limited number of suppliers for such advanced technology represents a significant bottleneck (CSIS) (The White House). The heavy reliance on a few countries for semiconductor production and specific stages, like wafer fabrication, creates potential points of failure. Disruptions in these regions can have global repercussions (CSIS). Many fabs operate at or near full capacity, leaving little room for scaling production in response to sudden increases in demand or supply disruptions. This limitation hinders the industry's ability to adapt quickly to market changes (McKinsey & Company) (S&P Global). There are critical shortages of essential materials



like silicon wafers and specialized chemicals. The supply constraints in these areas can halt production across the entire supply chain ([CSIS](#)) ([U.S. Department of Commerce](#)).

Materials such as silicon wafers are crucial, and the market for these materials exceeded \$40 billion in 2021. The supply of these wafers is dominated by a few companies, including Shin-Etsu, Sumco, GlobalWafers, Siltronic, SK Siltron, and Soitec, which collectively control 95% of the market ([The White House](#)) ([U.S. Department of Commerce](#)) ([The White House](#)) ([S&P Global](#)).

Strategic Projects Enhancing Resilience

Several key projects and initiatives are already in place to address these challenges and enhance supply chain resilience. The US government, through the CHIPS and Science Act, is investing \$52 billion to boost domestic semiconductor manufacturing and reduce dependency on foreign suppliers ([The White House](#)). Similarly, the European Union has launched the European Chips Act to strengthen its own semiconductor ecosystem. Companies are implementing AI-driven supply chain monitoring tools to improve transparency and preempt disruptions. Major semiconductor firms are leveraging machine learning algorithms to forecast supply chain risks and optimize inventory management ([McKinsey & Company](#)). The Semiconductor Industry Association (SIA) and the Semiconductor Research Corporation (SRC) are collaborating on initiatives to enhance R&D and address supply chain vulnerabilities. This includes partnerships between industry leaders and academic institutions to drive innovation and ensure a steady pipeline of advanced semiconductor technologies ([BCG Global](#)). Industry players are focusing on meeting stringent environmental regulations and sustainability goals. This includes initiatives to reduce carbon footprints and comply with international standards, thereby enhancing both corporate reputation and regulatory adherence ([McKinsey & Company](#)) ([U.S. Department of Commerce](#)).

The semiconductor supply chain is a cornerstone of modern technology, yet it faces numerous challenges that necessitate strategic, proactive measures. By diversifying geographically, enhancing supply chain transparency, fostering collaboration, and ensuring regulatory compliance, the semiconductor industry can build a more resilient and robust supply chain, capable of supporting future technological advancements and economic growth.

Recommendations

Workforce Development

Investing in a diverse talent pool, including veterans, underserved populations, second chance citizens, and K-12 students, is critical for Ohio's long-term economic health. Addressing barriers such as childcare and other wraparound services is also crucial. A diverse workforce brings varied skills and perspectives, driving innovation, and addressing barriers such as childcare helps increase workforce participation.

Ohio has several initiatives already in place to support workforce development. Programs such as the TechCred and IMAP Programs enable Ohioans to earn technology-focused credentials, addressing workforce shortages and enhancing skill sets. The High School Tech Internship Pilot Program provides high school students with hands-on experience in technology fields, encouraging them to pursue careers in manufacturing and advanced mobility sectors. DriveOhio's workforce strategy focuses on training programs and partnerships to develop skills in advanced manufacturing and automated vehicle technologies.

The importance of workforce development is underscored by survey data indicating that 78% of respondents face workforce challenges, with the highest concern in the chemicals and plastics sector (92%).



A representative from a large aerospace company noted, “Investing in a diverse talent pool, including veterans and second chance citizens, is crucial. Our programs targeting these groups have been successful and should be expanded.”

Recommendations

1. Expand Structured Training Programs

Expanding structured training programs to include more underserved populations and veterans can significantly enhance workforce diversity and address skill shortages. We recommend increasing funding for these programs and creating partnerships with local educational institutions to provide specialized training that aligns with industry needs. Tools and methodologies that can help structure these programs include:

- **Competency-based Training:** Focuses on specific skills and outcomes, ensuring that trainees achieve the necessary competencies.
- **Apprenticeship Programs:** Provide hands-on experience under the guidance of skilled professionals.
- **Modular Training:** Breaks down training into smaller, manageable modules that can be completed independently.

2. Support Services

Providing support services such as childcare and transportation can help individuals enter and stay in the workforce. We suggest implementing initiatives to subsidize childcare for working parents and developing transportation solutions to ensure that all workers can access job opportunities. In the K-12 sector, addressing transportation issues is crucial. Virtual learning platforms can also be leveraged to provide flexible learning options, reducing the need for physical transportation.

3. Competency-based Hiring Practices

Encouraging competency-based hiring practices across the manufacturing sector is essential. We recommend offering incentives for companies that actively recruit from diverse talent pools, including veterans, second chance citizens, and underserved populations. These incentives could include tax breaks or grants for companies that demonstrate a commitment to competency-based hiring.

4. Strengthen K-12 Engagement

Engaging with K-12 students to promote careers in manufacturing and advanced technologies can help build a future talent pipeline. We suggest expanding programs that provide students with hands-on experience and exposure to the manufacturing industry. Partnerships with schools to integrate STEM (Science, Technology, Engineering, and Mathematics) education and career exploration activities can inspire students to pursue careers in these fields. Additionally, addressing the stigma associated with vocational schools through marketing efforts can highlight the value and opportunities these schools provide. Virtual learning platforms can also help overcome transportation barriers for students.

5. Collaborate with Industry Partners

Collaboration with industry partners is crucial to ensure that training programs align with the current needs of the manufacturing sector. We recommend forming and/or improving upon advisory councils comprising industry leaders, educators, and workforce development professionals to guide curriculum development and training initiatives. This collaboration can help ensure that the skills being taught are relevant and in demand.

6. Leverage Technology for Training

Utilizing technology to enhance training programs can provide more flexible and accessible learning opportunities. We suggest incorporating online learning platforms and virtual reality (VR) simulations to offer practical training experiences. These technologies can help bridge the gap between theoretical knowledge and real-world application, making training more effective and engaging.

7. Attracting Workforce to Ohio

To support geographic diversification, attracting a skilled workforce to Ohio is crucial. The MEP can collaborate with state and local agencies to enhance workforce attraction strategies by promoting Ohio's quality of life and low cost of living through marketing campaigns. Expanding innovative earn-and-learn programs, such as those led by the Ohio Manufacturing Workforce Partnership (OMWP), can help build the talent pipeline by combining education with hands-on work experience. Additionally, targeted recruitment campaigns and flexible work arrangements can attract diverse talent pools, including veterans, second-chance citizens, and young professionals, making Ohio an appealing destination for a skilled workforce.

Workforce development is a cornerstone of Ohio's manufacturing sector's future success. By investing in a diverse talent pool and addressing barriers to workforce participation, Ohio can build a robust and skilled workforce that meets the evolving needs of the industry. Implementing these recommendations will help ensure that Ohio remains competitive and can sustain its economic growth in the manufacturing sector.

Geographic Diversification and Supply Chain Resilience

Expanding manufacturing capacity beyond traditional hubs reduces dependency on specific regions and mitigates risks associated with geopolitical tensions. Initiatives like the CHIPS and Science Act, which promote domestic manufacturing, and incentives to attract investments in diverse locations are pivotal in achieving this goal.

Several initiatives support geographic diversification in Ohio. The CHIPS and Science Act promotes domestic semiconductor manufacturing, reducing dependency on foreign suppliers. Additionally, JobsOhio has established Innovation Districts in Cleveland, Columbus, and Cincinnati, fostering collaboration between academic institutions, healthcare, and technology sectors.

Ohio also offers a variety of incentives to attract manufacturing investments in diverse locations, such as the JobsOhio Economic Development Grant, the Ohio Opportunity Zones Tax Credit, the Ohio Enterprise Zone Program, and the Ohio Community Reinvestment Area (CRA).

The importance of geographic diversification is highlighted by survey data indicating that 24% of respondents identified geopolitical issues as a risk, with the chemicals and plastics industry being the most affected (46%).

A representative from a large aerospace company highlighted, "We are currently relying heavily on our primary manufacturing sites, which poses a risk. Expanding into other regions would mitigate this risk and enhance our resilience."

Recommendations

1. Implement Regional Sourcing and Multisourcing

To mitigate risks associated with regional dependencies, we recommend continuing to support and expand regional sourcing and multisourcing strategies. This approach involves diversifying suppliers across multiple regions to

reduce the impact of any single point of failure. By spreading out manufacturing and sourcing activities, companies can ensure a more resilient supply chain that is less vulnerable to regional disruptions. The MEP can assist manufacturers in identifying and establishing relationships with regional suppliers through their extensive network and supplier scouting services ([National Governors Association](#)) ([NIST](#)).

2. Encourage Reshoring and Nearshoring

Encouraging reshoring and nearshoring efforts can bring manufacturing closer to home, reducing reliance on distant suppliers and improving supply chain stability. The COVID-19 pandemic demonstrated the vulnerabilities of relying heavily on offshore production. Continuing to provide incentives for reshoring and nearshoring, such as tax breaks and grants, can help companies better control their supply chains and reduce transportation costs. The MEP Centers can provide tailored support to manufacturers in transitioning their supply chains back to domestic sources, offering expertise in risk assessment and supply chain optimization.

3. Develop Local Supply Chains

Fostering the development of local supply chains can reduce dependency on international suppliers and enhance resilience. Continuing to support local suppliers and manufacturers through initiatives like the Ohio MEP Supplier Scouting service can create a more self-sufficient manufacturing ecosystem. This includes encouraging partnerships between local companies and investing in the capabilities of regional suppliers to meet the needs of large manufacturers. The MEP can facilitate these partnerships and provide training and resources to help local suppliers meet the required standards and certifications.

4. Invest in the Sustainment Platform

The Sustainment platform plays a crucial role in making domestic manufacturers more competitive. Increasing investment in this initiative can promote and encourage businesses to become aware of and utilize its benefits. The platform enhances visibility and communication across the state, allowing small and medium-sized manufacturers to effectively compete on a global scale. We recommend further investment in the Sustainment platform to expand its reach and capabilities, providing more resources and support to local manufacturers. The MEP can help integrate the Sustainment platform with existing tools and provide training to manufacturers on how to maximize its use.

Geographic diversification and supply chain resilience are essential for building a robust manufacturing sector in Ohio. By implementing strategies such as regional sourcing, reshoring, developing local supply chains, and investing in the Sustainment platform, Ohio can mitigate the risks associated with regional dependencies and enhance its manufacturing capabilities. These efforts will contribute to the state's economic growth and position Ohio as a leader in manufacturing resilience and innovation.

By addressing these key areas, Ohio can continue to develop a resilient and diversified manufacturing sector that is well-prepared to face future challenges and capitalize on new opportunities. The MEP's role in facilitating these strategies through partnerships, expertise, and resources is critical to their successful implementation.

Enhancing Supply Chain Visibility

Improving supply chain visibility is essential for building a resilient and efficient manufacturing sector in Ohio. Enhanced visibility allows for proactive management of potential disruptions and real-time tracking of inventory, leading to better decision-making and optimized operations. Many of the small manufacturers in Ohio are utilizing simple, outdated tools, like MS Excel to manage their data, which leads to oversight and accuracy issues.



Several initiatives and technologies are already in place to support supply chain visibility. The Ohio Manufacturing Extension Partnership leverages platforms like the Sustainment platform to enhance visibility and communication across the state. Additionally, digital finance technologies, such as AI and IoT, are being used to integrate management reporting platforms for timely and accurate financial decision-making.

Survey Data

Survey data indicates that 9% of manufacturers need better visibility in their supply chains, highlighting the importance of implementing effective visibility solutions.

Interview Insights

A representative from a large aluminum manufacturing company remarked, “There is a need for better supply chain visibility. Implementing AI-driven tools can help us track our inventory in real-time and respond more efficiently to changes.”

Recommendations

1. Implement AI-Driven Supply Chain Monitoring Tools

We recommend continuing to invest in AI-driven supply chain monitoring tools to preempt disruptions and optimize inventory management. These technologies provide real-time tracking and predictive analytics, enabling manufacturers to respond swiftly to potential issues. The MEP can assist manufacturers in integrating these tools into their operations, offering training and support to maximize their effectiveness.

2. Utilize Blockchain for Enhanced Transparency

Blockchain technology can be used to create a transparent and secure record of all transactions within the supply chain. This can help reduce fraud, improve traceability, and enhance trust between supply chain partners. The MEP can facilitate the adoption of blockchain technology by providing resources and guidance on its implementation.

3. Foster Collaboration and Data Sharing

Encouraging collaboration and data sharing among supply chain partners is crucial for enhancing visibility. The MEP can play a pivotal role in establishing data-sharing agreements and promoting a culture of collaboration. This can include organizing industry forums, workshops, and training sessions to educate manufacturers on the benefits of data sharing and collaboration.

4. Invest in IoT and Sensor Technologies

Investing in IoT and sensor technologies can significantly improve supply chain visibility by providing real-time data on the location and condition of goods. These technologies can help monitor inventory levels, track shipments, and ensure the quality of products throughout the supply chain. The MEP can support manufacturers in adopting IoT and sensor technologies by offering technical assistance and access to funding opportunities.

Enhancing supply chain visibility is critical for building a resilient and efficient manufacturing sector in Ohio. By implementing AI-driven monitoring tools, utilizing blockchain technology, fostering collaboration and data sharing, and investing in IoT and sensor technologies, Ohio can improve its supply chain operations and enhance its competitive advantage. The MEP’s role in facilitating these strategies through partnerships, expertise, and resources is essential to their successful implementation.



Ensuring Raw Materials Supply

The availability of raw materials is critical for the manufacturing sector in Ohio, especially given the complexities and uncertainties of global supply chains. Challenges such as material scarcity, geopolitical risks, and logistical disruptions can significantly impact production processes and costs.

Several efforts are already in place to address raw material supply challenges. These include initiatives by the Ohio Manufacturing Extension Partnership (MEP) to support local sourcing and supplier diversification. Additionally, technologies like AI and machine learning are being utilized to forecast demand and manage inventory more effectively ([McKinsey & Company](#)) ([NetSuite](#)).

Survey data highlights that 45% of manufacturers reported issues with raw materials, with significant concerns in the chemicals and plastics industries (50%).

A representative from a large industrial company emphasized, “Adopting environmentally sustainable practices is not just a regulatory requirement but also a strategic advantage. We need more initiatives promoting renewable energy use and sustainable manufacturing.”

Recommendations

1. Diversify Raw Material Sources

We recommend continuing to support and expand efforts to diversify raw material sources. This involves establishing relationships with multiple suppliers and exploring alternative materials to reduce dependency on single sources. The MEP can assist manufacturers in identifying and qualifying new suppliers, both domestically and internationally.

2. Increase Investment in Local Supply Chains

Enhancing local supply chains can mitigate risks associated with global disruptions. By investing in local mining and processing capabilities, Ohio can reduce its reliance on imported raw materials. The MEP can facilitate partnerships between local suppliers and manufacturers to strengthen these supply chains and ensure a steady flow of essential materials.

3. Implement Advanced Forecasting and Inventory Management

Utilizing AI and machine learning for advanced forecasting and inventory management can help predict demand and optimize stock levels. These technologies can provide real-time insights into supply chain operations, enabling manufacturers to respond swiftly to potential disruptions. The MEP can offer training and resources to help manufacturers implement these technologies effectively.

4. Promote Sustainable Practices

Encouraging the adoption of sustainable practices in raw material sourcing and usage can enhance supply chain resilience. This includes promoting the use of recycled materials and supporting initiatives that reduce environmental impact. The MEP can provide guidance on best practices for sustainability and help manufacturers achieve relevant certifications and standards.

Ensuring a reliable supply of raw materials is vital for the resilience and competitiveness of Ohio’s manufacturing sector. By diversifying sources, investing in local supply chains, implementing advanced forecasting and inventory



management, and promoting sustainable practices, Ohio can better manage raw material supply challenges. The MEP's role in supporting these efforts through partnerships, expertise, and resources is crucial to their success.

Conduct More Discovery Activities

To ensure that Ohio's manufacturing sector remains resilient and competitive, it is essential to continuously gather and analyze data on supply chain resiliency needs. This involves two key components: immediate additional defining and periodic re-discovery activities.

Immediate Additional Defining: Conducting immediate discovery activities helps to further define and deepen the understanding of the current supply chain resiliency needs and challenges across all market segments. This process involves:

- Engaging with key stakeholders, including manufacturers, suppliers, and industry experts, to gather detailed information on supply chain vulnerabilities and strengths.
- Utilizing advanced data analytics and supply chain mapping tools to identify critical gaps and areas for improvement.
- Assessing the impact of recent global events, such as the COVID-19 pandemic and geopolitical tensions, on the supply chain dynamics.
- Leveraging the initial survey of 277 manufacturers as a baseline to identify immediate needs and gaps within the supply chain, and to prioritize areas for in-depth exploration.

Periodic Re-Discovery: Implementing periodic re-discovery activities ensures that the strategies and solutions remain relevant and effective over time. This ongoing process includes:

- Conducting biannual surveys and interviews with industry stakeholders to track changes in supply chain resiliency needs and trends.
- Monitoring technological advancements and their implications for supply chain management.
- Evaluating the effectiveness of implemented strategies and making necessary adjustments based on the latest insights and data.
- Using the initial survey and subsequent surveys to keep a pulse on the evolving needs and conditions within the manufacturing sector, allowing for continuous adaptation and improvement.

By incorporating both immediate and periodic discovery activities, Ohio can proactively address evolving supply chain challenges and capitalize on new opportunities. This approach will enable the state to maintain a robust and adaptive manufacturing ecosystem, ensuring long-term resilience and competitiveness.

These discovery activities will also facilitate continuous improvement and innovation within the manufacturing sector, aligning with the goals of initiatives like SCOIN and the Ohio MEP. This comprehensive and dynamic approach to supply chain management will position Ohio as a leader in manufacturing excellence and economic stability.



Conclusion

The 2024 SCOIN Ohio report highlights the critical challenges and opportunities within Ohio's manufacturing sector, specifically focusing on supply chain resilience, workforce development, visibility, and raw material availability. The comprehensive analysis, supported by survey data and industry interviews, provides a clear roadmap for strengthening Ohio's manufacturing capabilities and maintaining its competitive edge.

Ohio's manufacturing landscape is robust, yet faces significant challenges. Workforce availability remains a paramount concern, with critical shortages impacting various industries, including aerospace, automotive/EV, and chemicals/plastics. The state has implemented several initiatives, such as the Ohio Manufacturing Workforce Partnership and TechCred program, to address these gaps, but ongoing efforts are needed to ensure a steady pipeline of skilled labor.

Supply chain visibility and raw material availability are equally pressing issues. Enhancing visibility through advanced technologies like AI, IoT, and blockchain can help manufacturers manage risks and optimize operations. Meanwhile, diversifying raw material sources and investing in local supply chains are essential strategies to mitigate the impact of global disruptions and geopolitical tensions.

Key recommendations outlined in this report include:

1. **Workforce Development:** Expanding structured training programs, promoting competency-based hiring practices, and providing comprehensive support services such as transportation and childcare. These initiatives will help attract and retain talent across all demographics, including veterans, underserved populations, and second-chance citizens.
2. **Geographic Diversification and Supply Chain Resilience:** Continuing to support regional sourcing, reshoring, and local supply chain development. Investing in platforms like the Sustainment platform can enhance the competitiveness of domestic manufacturers and ensure a more resilient supply chain network.
3. **Enhancing Supply Chain Visibility:** Implementing AI-driven supply chain monitoring tools, utilizing blockchain for transparency, fostering collaboration, and investing in IoT technologies. These measures will improve real-time tracking and decision-making capabilities.
4. **Ensuring Raw Materials Supply:** Diversifying sources, increasing investment in local supply chains, implementing advanced forecasting and inventory management, and promoting sustainable practices. These strategies will help secure a steady flow of essential materials and reduce dependency on volatile markets.

Ohio's initiatives, such as the CHIPS and Science Act, Innovation Districts, and various workforce development programs, are crucial steps towards achieving these goals. The recommendations provided in this report aim to build on these efforts, ensuring that Ohio remains a leader in manufacturing innovation and resilience.

By addressing these key areas, Ohio can continue to foster a resilient and diversified manufacturing sector, well-prepared to face future challenges and capitalize on new opportunities. The Ohio MEP's role in facilitating these strategies through partnerships, expertise, and resources is vital to their successful implementation, driving sustainable economic growth and maintaining Ohio's competitive edge on a global scale.

Appendix

Appendix A: Ohio Supply Chain Survey for Manufacturers

The Ohio Supply Chain Survey for Manufacturers provides critical insights into the current state of supply chains within Ohio's manufacturing sector. The survey results highlight key challenges, concerns, and areas for improvement as identified by 277 manufacturers across various industries.

- **Document Title:** Ohio Supply Chain Survey for Manufacturers
- **Content:** Survey questions, responses, and summary of findings

Appendix B: 2024 SCOIN Survey Analysis (Confidential)

The 2024 SCOIN Survey Analysis contains detailed analysis and interpretation of the survey data. This analysis provides a comprehensive understanding of supply chain dynamics, challenges, and opportunities within Ohio's manufacturing sector.

- **Document Title:** 2024 SCOIN Survey Analysis
- **Content:** Detailed analysis of survey data, including charts, graphs, and statistical summaries

Appendix C: SCOIN Ohio Supporting Data

The SCOIN Ohio Supporting Data spreadsheet includes additional data sets and supplementary information that support the findings and recommendations presented in the report.

- **Document Title:** SCOIN Ohio Supporting Data
- **Content:** Additional data sets, supporting information, and supplementary analysis

Appendix D: Interview Forms (Confidential)

The interview forms document the qualitative insights gathered from key industry stakeholders. These interviews provide a deeper understanding of specific challenges and opportunities within Ohio's manufacturing sector.

- **Document Titles:**
 - SCOIN Interview - Nifco
 - SCOIN Interview - GE Aviation
 - SCOIN Interview - Superior Aluminum
 - SCOIN Interview - Scenic
 - SCOIN Interview - Staub
 - SCOIN Interview - Transcon
 - SCOIN Interview – P&S Bakery
 - SCOIN Interview - WIKA
 - SCOIN Interview - Schafer
- **Content:** Transcripts and summaries of interviews with industry stakeholders