Indiana: The Center of Innovation, Collaboration and Progress

November 2020

Created with
Bloomberg Media

Table of Contents

Introduction

Within six months of the pandemic, nearly 100,000 business across the country were permanently shut down. With a growing list of corporate casualties, the importance of having strategic partners at the state-government level is now clearer than ever before.

Granted, it's not possible for a state's administrators or business development advocators to completely inoculate a company from an unpredictable contagion. However, they can clear paths to facilitate deal flow and leverage resources as a liaison between hope and opportunity. They can match a company's steely resolve and gritty self-reliance with favorable tax policies, a talent pool from top-tier universities and a renowned incubator system on the radar of global companies.

Indiana is central to how the world eats, defends, travels and manages inventory.

Indiana is central to how the world eats, defends, travels and manages inventory. And leadership in these four areas isn't some recent phenomenon: Indiana has a decorated history of partnering with businesses to cultivate innovation in biosciences, national defense, automotive technology and logistics.

Indiana's farmers, for example, have created and maintained their legacies with a legendary work ethic and a willingness to tweak their strategies with innovation, such as identifying areas of their fields with the highest yield or using drones to monitor irrigation strategies.

To stay atop of the automotive industry, Indiana's nationally ranked universities steadily produce engineers with advanced degrees to work alongside an already established automotive workforce. All told, Indiana has more than 100,000 people working in automotive manufacturing.

When the U.S. military needed a secure location to test and expand the limits of hypersonic technology, it chose Indiana. At the Naval Surface Warfare Center in Indiana, the nation's leading researchers test the ability for aircraft and weapons to travel at least five times faster than the speed of sound, or 60 miles per minute. Advanced missile and hypersonic vehicle technologies could enhance end-to-end strike force systems, which could deter future threats.

In addition to the military, the nation's prime defense contractors continue to keep multi-million-dollar deals flowing in Indiana. Lockheed Martin Corp., for instance, depends on its Indiana-based supply chain to fulfill global orders for fighter jets. More Rolls-Royce products are built in Indianapolis than anywhere else in the world, supporting key customers such as the U.S. Department of Defense, Boeing, Lockheed Martin and Northrop Grumman. Approximately 4,000 employees work in Indianapolis in manufacturing, assembly, test, engineering and a variety of staff support roles. Rolls-Royce recently completed a $600 million investment to modernize equipment and technology at its Indianapolis facilities. This marks Rolls-Royce's single largest investment in the U.S. in 25 years.

But growth in agriculture, automotive and defense-related businesses creates a greater need for logistical support. As a result, Indiana's economy is closely tied to freight movement, mainly because of its strategic location serving regional, national and international markets. Each year, 724 million tons of freight travel through Indiana, making it the fifth busiest state for commercial freight traffic. By 2040, freight flow is expected to increase by 60%.

Today, the top emerging technologies in logistics revolve around the Internet of Things (IoT), artificial intelligence (AI), robotics, last-mile delivery and warehouse automation.

Indiana as a state that cultivates and innovates, a state that secures and procures — A State That Works.

The New Tech Belt:
Indiana provides fertile ground for innovative ag+bio+science industry.

November 2020

Created with
Bloomberg Media

A legacy of innovation continues

Indiana's rich agricultural history serves as the launching pad for its bioscience ingenuity and leadership. That same steely resolve of 19th-century settlers who migrated in search of land and opportunity still exists in the high-tech roles of researchers, biologists and software developers who call Indiana home.

Perhaps no other state in the nation has been as successful as Indiana in connecting legacy industries with cutting-edge technology sectors. This combination has kept Indiana an American breadwinner, even during the COVID-19 pandemic. The state's digital agriculture platforms and innovations — underwritten by its renowned universities — play to its strengths and the country's needs. Resilient technology helps farmers and grows jobs, which stabilizes the economy while continuing to support innovation, and creativity.

Throughout the nation's history, whenever there's a financial crisis or an economic downturn, America is reminded that the Heartland is its breadwinner.

Yet there's still room for more investment, innovations and settlers in search of opportunity. Indiana's farmers will likely need to economize in the coming months and even years. This focus on efficiency means they will need platforms and services to improve operations via digitalization. In response, the state stands ready as a strategic connector with a track record of creative, tailored partnership opportunities for companies looking to relocate and do business within its borders.

The possibilities for agricultural innovation today are as numerous as the uses of the simple corn kernel in the 19th century, which early settlers manipulated in every way possible, from pounding it into powder to make bread to distilling it for sweet whiskey.

Much has changed since then. Labeling the industry simply as "agriculture" no longer is an accurate depiction. Today's farmers are mastering cloud biology, plant genetics, crop protection systems and Big Data to better control profits and outputs. The advancements are resulting in the use of fewer chemicals and less water, providing consumers with healthy, clean and nutritional options.

"Agbioscience" now best describes the industry because Indiana's agriculture sector is at the nexus of scientific innovation. The increased growth forecast through 2021 promises to bring more companies and high-wage jobs to this accelerating subsector. Put another way, the harvest is plentiful in Indiana.

Forward-thinking agriculture technology sets the standard

Indiana's farmers and related businesses have created and maintained their legacies with a legendary work ethic and a willingness to tweak their strategies with innovation. That combination of sweat and savvy planted in Indiana's soil has yielded success in bull and bear markets.

There are numerous examples of Indiana corn and soybean producers and legacy businesses demonstrating agricultural agility and growth strategies:

- In Marshall County, Ind., farmers are growing water-conserving wheat, known as edible Kerzna, all year long. It's being used successfully to make crackers, tortillas, cookies, pasta and beer.

  MPS Egg Farms, a sixth-generation family farm in North Manchester, has 630 employees who daily care for some 11 million hens that produce more than 9 million eggs daily at six farms in Indiana, Illinois and Texas. Each farm features state-of-the-art equipment certified by the strictest animal health and safety standards. MPS is a national poultry industry leader in the conversion to cage-free egg production, which an increasing number of consumers demand. The owners — Bob, Dan and Sam Krouse — each serve on the boards of several industry groups, such as United Egg Producers and the American Egg Board. An example of agricultural agility, MPS Egg Farms also has more than 3,000 solar panels at their North Manchester egg production facility, a testament to their environmental commitment.

Farmers, as enterprising as they may be, can't convert at Silicon Valley speeds on their own.

- Agdia Inc., which specializes in agricultural diagnostics, produces a test strip that detects a protein in transgenic soybeans to promote food safety. The Elkhart, Ind. company also has commercialized a molecular diagnostic test to find grapevine leafroll disease, considered one of the most destructive diseases contaminating wine, juice and table grapes.
- Corteva Agriscience, is based in Indianapolis, makes a high-oleic acid soybean oil with longer shelf life and no trans fats.
- Culture Systems Inc., based in Mishawaka, Ind., develops cultures that can be used in yogurt, cheeses and a variety of other fermented foods.
- Precision Farming Solutions LLC, of Birdseye, Ind., can help farmers identify areas of their fields with the highest yield. Precision Farming uses Big Data to farm each area for profit, not just for bushels. They also use data for independent planting, fertilizing and optimal drainage recommendations. In addition, the company generates tile plans optimized for specific farms, using customized elevation maps. With data, they can tile more acres using fewer resources, and can calculate the cost of tile in advance.

Other examples of breakthrough technologies in Indiana:

- Unmanned aerial vehicles, commonly known as drones, can increasingly be seen hovering over Indiana farms. Companies and independent field agronomists gather aerial imagery and data so they can make in-season decisions to improve crop yield outcomes. The drones also are used to check irrigation systems, review storm damage and even monitor livestock giving birth.
- Indiana-based software developers announced in October 2020 that they have created a multi-sensor technology platform to collect research data for plant breeders; the technology enables seed companies to create precise, repeatable analytic solutions. GRYFN, the Purdue University-affiliated startup, secured funding from a division of the U.S. Department of Energy to develop its software.

Indiana's recent deal flow underscores the state's commitment to being a global leader in agricultural technology. Among the highlights:

- Taranis, an Israeli precision scouting and agricultural intelligence company, announced in December 2020 that it would relocate its global headquarters in Westfield, Ind., and create up to 60 jobs by the end of 2023. "Locating our global headquarters in the heart of America's largest commodity crop production region enables us to interact more directly with our customers to better address the agronomic challenges of their growers," says Mike DiPaola, general manager of North America and vice president of global sales at Taranis.
- In August 2020, Greenfield-based Elanco Animal Health Inc. closed a $6.9 billion deal to purchase animal health assets from Germany-based Bayer AG. With the purchase, Elanco is the nation's second-largest animal-health company in terms of global revenue. The goal, according to Elanco President and CEO Jeff Simmons, is to be the best resource for farmers, veterinarians and pet owners.
- Solinftec, a digital precision agriculture company, moved its global headquarters from South America to West Lafayette because Indiana offered the best opportunity to expand its offerings and meet its increased North American demand, says Daniel Padrão, Solinftec's chief operating officer.
- As for sustainability, AquaBounty Technologies based in Albany, Indiana, creates bio-engineered salmon that grow at twice the rate of wild salmon. These are the first genetically engineered animals deemed safe to eat by the U.S. Food and Drug Administration. It also means Indiana is the first state where a genetically modified food animal is raised and sold in the United States. AquaBounty says it will reach 100 metric tons of salmon per month by early 2021. The annual capacity of the 40-acre farm is approximately 1,200 metric tons.

Even with all this innovation, merging legacy industries with new technology takes time and partnerships. Farmers, as enterprising as they may be, can't convert at Silicon Valley speeds on their own. To facilitate the transition, the Indiana Farm Bureau and other government agencies have 2021 policy priorities geared toward transforming agriculture to meet tomorrow's demands. For instance, the Farm Bureau is expanding broadband to the unserved and underserved to support education, telehealth, remote work and agriculture technology.

A triangle of science and education supports innovation in Indiana

Though fierce competitors in sports, behind the scenes there is strong collaboration between Indiana University, Notre Dame and Purdue University. For decades, the schools have strategically built a triangular support system, designed to give Indiana companies significant industry leverage in their pursuit to stay competitive and disruptive:

Indiana University leads in bioscience

NĒRx Biosciences got its start in the lab of Dr. John Turchi at the Indiana University School of Medicine. The company regularly produces lifesaving work in their study of DNA damage to better understand genome instability in cancer treatment. Specifically, the company is focusing on a new generation of cancer drugs targeting cellular processes to treat lung and ovarian cancer.

Underscoring the Triangle's bioscience strength, Indiana University and Purdue University entrepreneurs also collaborated to create prototypes of handheld force-sensing instruments to improve the outcomes of manual therapy when treating soft-tissue injuries. A metal tip on each device transmits the applied forces to a 3D load cell, which sends the measured force signals to a microprocessor. That calculates the pressure, angle, duration and stroke frequency of the tool during treatment.

It promises to be a game changer for physical and occupational therapists, athletic trainers, chiropractors and other medical professionals. The discovery led to a startup company, Health Smart Technologies Inc. -- just one example of how academia and industry are making good ideas into reality in the Midwest.

University of Notre Dame fills talent needs

A common concern for any company considering relocation is whether they can find enough talent to stay competitive. The University of Notre Dame has invested millions of dollars to take that concern off the table for bioscience and tech companies looking to move to Indiana.

Notre Dame's IDEA (Innovation, De-risking and Enterprise Acceleration) Center, located in Innovation Park, just south of campus, offers an 11-month Engineering, Science and Technology Entrepreneurship Excellence Master's (ESTEEM) program. The curriculum is designed to equip students with the skills and experience necessary to start their own businesses or become collaborative innovators within existing corporations.

That talent-producing effort extends beyond Notre Dame to the other points in the Triangle. In partnership with BioCrossroads and the Indiana Biosciences Research Institute — two initiatives promoting the advancement of and investment in public-private bioscience collaborations — Notre Dame, Indiana University and Purdue University launched a mentoring program focused on developing the state's entrepreneurial talent. The effort —Accelerating Innovation IN Science, or AXIS — matches experienced mentors with rising stars to support the state's life sciences ecosystem with serial entrepreneurs and innovators.

Purdue University leads in agricultural innovation

Congress passed the Morrill Act in 1862 to establish a nationwide chain of land-grant schools to teach agricultural and mechanical arts. That decision paved the way for Purdue University, which was founded with an emphasis on scientific farming. Since its inception in 1869, the school has helped business owners learn new farming methods, adopt new technologies and increase production.

Purdue University biological engineer Mohit Verma is developing a test that takes less than an hour to help producers track sources of contamination.

Today, Purdue's influence is felt in every part of the food continuum, from farm to table. Purdue is home to the only plant phenotyping facility at a U.S. university. Phenomics, the science of measuring and analyzing the genetic background of a plant in a lab to see how it interacts with its environment, is cutting-edge technology, and Purdue's phenotyping facility gives it an environmentally controlled space for quickly exploring plant traits.

The school also has a world-renowned meat science program that attracts students globally. Many of the advancements in meat quality for fresh and processed meats can be attributed to the studies of Purdue researchers. In October 2020, Purdue announced that it won a grant from the Center for Produce Safety to develop a test that can shorten the time it takes to detect foodborne illnesses such as Salmonella, Listeria and E. coli. Though it normally takes several days to send samples off to labs and analyze results, Purdue University biological engineer Mohit Verma is developing a test that takes less than an hour to help producers track sources of contamination.

Such accomplishments have kept Purdue in the top 10 among the world's top 300 schools for agriculture and forestry, according to a study by the British educational research organization QS Intelligence Unit. The school also boasts the No. 1-ranked agricultural and biological engineering program in the U.S. — for the 10th straight year — according to a 2020 report from the College of Agriculture Academic Programs.

Indiana is a systems integrator. Take the Wabash Heartland Innovation Network, for example. This consortium of 10 counties in north central Indiana leverages the advancements in Internet of Things from Purdue University and Ivy Tech Community College to bring cutting-edge technology to the region's agriculture and manufacturing industries.

Agricultural agility has pushed Indiana forward during the pandemic

Throughout the nation's history, whenever there's a financial crisis or an economic downturn, America is reminded to lean on "A State That Works." Indiana consistently has shown leadership in agricultural agility to keep the nation fed.

Headlines throughout the recent COVID-19 pandemic have closely monitored the state's agriculture industry. The legendary work ethic of Indiana farmers has dovetailed with the latest advancements in agriculture to stabilize food prices and steer the economy through troubled waters.

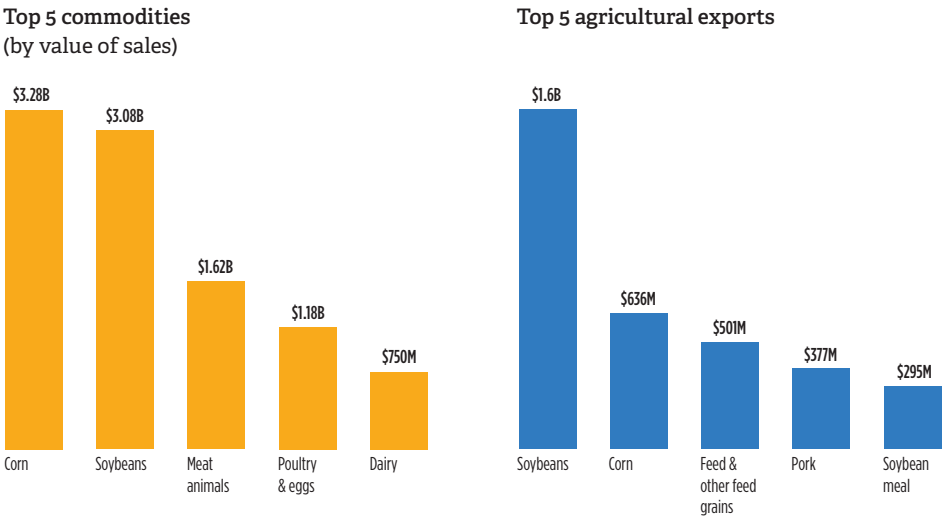
After a dramatic downturn in the immediate aftermath of the first COVID-19 outbreaks, Indiana's agriculture industry has largely recovered to pre-pandemic levels. In fact, demand is expected to be stronger than ever, according to analysts with Rabo AgriFinance.

The bedrock of Indiana's agriculture industry is global exports of soybeans and corn. Analysts say exports for these two crops are on pace to reach record-high levels, with China a key buyer of both corn and soybeans. China used to buy its soybeans from South America but recently switched to purchasing U.S. soybeans, which bodes well for Indiana.

These five commodity groups accounted for almost 93% of the 2017 cash receipts.

Source: USDA NASS

Indiana State Department of Agriculture:
Top 5 commodities by value of sales and Top 5 agriculture exports



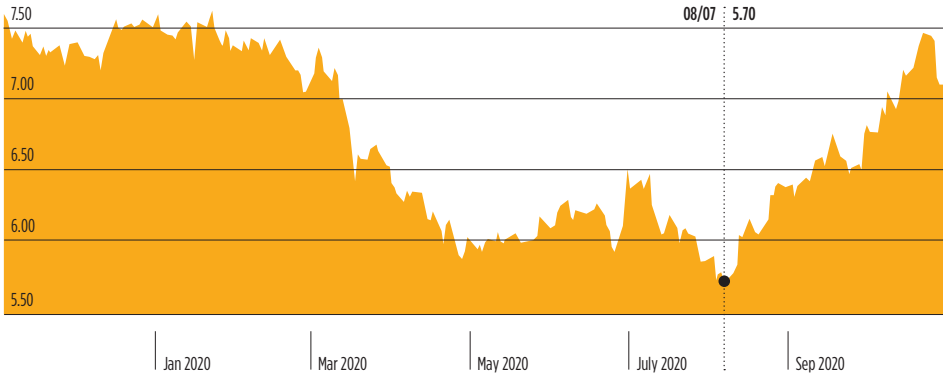
Source: USDA Economic Research Service

China's purchasing decision underscores its longstanding relationship with Indiana. Governor Holcomb is a familiar face in China, having met with Chinese government officials multiple times to promote mutual business interests. In fact, Indiana has shared a sister-state relationship with China's Zhejiang Province since 1987.

Corn also is making a comeback, with China a major purchaser. Analysts in Shanghai say that China soon will face a deficit in corn, and predict that over 9 million metric tons will be exported to China in 2021, which would be the most ever, shattering the 5.5 million metric tons exported in 1995 - 1996.

The price of corn often is a pacesetter for the agriculture industry because it drives profit for U.S. farmers. After several weeks at multi-year lows, corn prices have proven to be resilient, returning to typical pre-pandemic levels. The Bloomberg Corn Subindex, composed of futures contracts on corn, traded at a low of $5.70 in early August 2020, but jumped 30% to $7.46 in late October.

BCOMCN:IND
Bloomberg Corn Subindex



There's also a steady march toward more ethanol use, which heavily depends on Indiana corn crops. Currently, the USDA ethanol use mark is set at 5 billion bushels.

The price of corn is often a pacesetter for the industry because it drives profit for U.S. farmers. After some weeks at multi-year lows, corn prices have shown resilience in their quick return to around $3.75 levels that were typical pre-pandemic. While 2019 saw some elevated prices that dwarf what we see today, the "new normal" of this sector seems to have settled in around $4 per bushel.

The COVID-19 recession also is expected to increase demand for low-cost digital agriculture technology. Specifically, the adoption of remote field mapping technology is expected to increase because it allows farmers to monitor their fields without leaving their houses unnecessarily and risking exposure.

Success is defined by numbers — and values — in Indiana

The numbers speak for themselves. Indiana agriculture contributes about $31.2 billion to the state's annual GDP, with about 107,500 jobs supported by agriculture production, processing and related activities. With more than 15 million acres of farmland, Indiana is a leading producer of corn, soybeans, hogs, poultry and tomato products.

The state boasts more than 10,000 agribusiness companies responsible for $4.6 billion in agricultural exports.

Indiana also is home to 1,689 life sciences companies employing 55,000 people and is second in the nation for worldwide life sciences exports, totaling $8.2 billion. All told, that's a $78 billion impact.

Indiana ranks as one of the top five states for the number of life sciences companies, concentration of companies and total number of life sciences industry jobs. In addition, Indiana has the second-highest concentration of biopharmaceutical jobs.

The state boasts more than 10,000 agribusiness companies responsible for $4.6 billion in agricultural exports.

Indiana also is one of only two states with a specialized employment concentration in four of the five major agriculture subsectors: agricultural feedstock and chemicals; drugs and pharmaceuticals; medical devices and equipment; and bioscience-related distribution.

Behind those impressive national rankings are vignettes of agricultural innovation that make Indiana's story all the more compelling. Take Fair Oaks Farms, for example. A group of farmers led by Sue and Mike McCloskey had successfully experimented with innovative farming for decades. In a joint effort, they decided in 2004 to open their farms to showcase their cutting-edge farming techniques. Today visitors can visit Fair Oaks Farms to learn about strategies for pollinators, egg production, vertical farming and aquaculture, to name a few. In addition, Fair Oaks Farms allows visitors to see firsthand how the farms' waste is transformed into energy through anaerobic digesters. Their goal is to achieve a zero-carbon footprint.

Beck's Hybrids, the nation's largest family owned retail seed company, is another institution of Indiana's innovative agricultural story. The Hamilton County company started in the early 1900s when the Beck family started planting a hybrid parent seed corn on a three-acre allotment with a two-row, horse-drawn planter and harvested it by hand. Today, Beck's has access to the latest genetics and trait technologies from suppliers across the world. Farmers across the nation depend on Beck's seed to secure their livelihoods.

A Legacy of Excellence:

Indiana builds on a 100-year foundation of automotive manufacturing and performance expertise.

November 2020

Created with
Bloomberg Media

Lessons from the rearview mirror

When consumer demand shifted toward a new, gasoline-powered form of transportation, the Studebaker brothers from South Bend, Ind., adjusted. By the early 1900s, the Studebakers had fully transitioned from horse-drawn wagons to automobiles.

Their story — emblematic of the state's proud manufacturing history — doubles as a business parable for companies facing today's seismic generational changes. The Studebakers weathered the Civil War, World War I, the Great Depression, World War II and the Korean War — while still managing to produce gems like the 1947 Starlight Coupe and the 1950 "Bullet Nose."

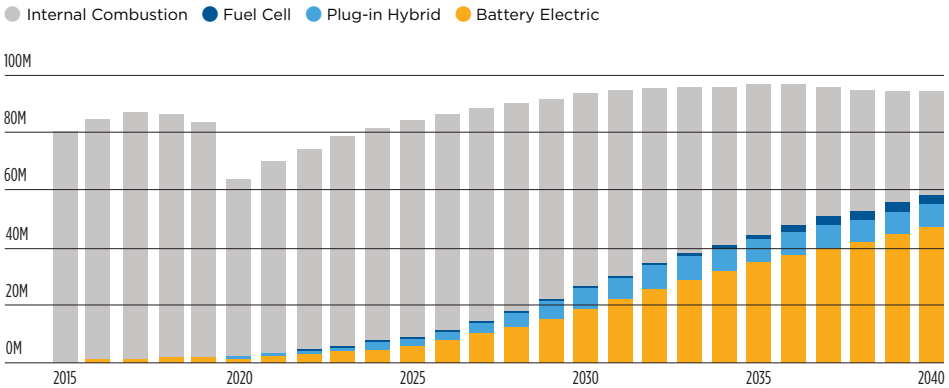
Consumer demand once again has shifted toward new technology, even as COVID-19 emerges as this era's landmark manufacturing obstacle.

Today, Indiana boasts a global garage of automotive companies. Subaru, for example, has been manufacturing vehicles for 30 years in Lafayette, Ind., which also is its North American headquarters. From 2012 to 2016, the company invested $1.3 billion in its automotive plant. In addition, Indiana is home to other global brands, such as Honda — which makes the Civic, CRV and Insight Hybrid in Greensburg, Ind. — and Toyota, which makes the Highlander and Sequoia SUVs in Princeton, Ind.

Consumer demand once again has shifted toward new technology, even as COVID-19 emerges as this era's landmark manufacturing obstacle. How automotive companies respond to challenges today will determine their financial health for years to come.

Specifically, for automotive companies to power through current setbacks and be successful, they must embrace the electronic revolution underway. It won't be easy and it will take collaboration and support from the surrounding community. Indiana provides a hub for this type of forward-thinking innovation.

Global passenger vehicles sales by drivetrain



ICE: internal combustion engine vehicle PHEV: plug-in hybrid electric vehicle BEV: battery electric vehicle
Source: BloombergNEF

Eyes are on the post-pandemic road ahead

The auto industry employs 59 million people globally, either directly or indirectly, and contributes an estimated $5.5 trillion to the global economy. Since its inception, the industry has grown in importance to the global economy, so much so that it now causes ripple effects through other industries when it slows. Put another way, the world has a vested interest in keeping the industry rolling.

But to avoid falling behind industry innovations, automotive-related businesses should pay close attention to key trends and make the necessary adjustments now.

Auto manufacturers

Low-margin electric vehicles are struggling to grow beyond 2% of the U.S. market. In response, Bloomberg Intelligence expects automakers to, at least temporarily, de-emphasize electric vehicles and promote dependable high-margin trucks. This bodes well for Indiana, which builds the Chevrolet Silverado and GMC Sierra at the Fort Wayne Assembly plant in Roanoke, Ind.

Given the time it takes to bring new technology to market, auto suppliers must work to stay years ahead of the current consumer demand.

Taking the long view, the COVID-19 pandemic is a mere pothole in the automotive industry's road toward electronic innovations. Auto manufacturers and their suppliers would be smart to continue shifting their focus toward hybrid-vehicle technology, which is expected to account for 18.9%of North American production volume by 2025. That's up a percentage point from pre-COVID-19 forecasts, according to London-based auto industry analytics firm IHS Markit.

Auto suppliers

That push toward electronification is encompassing not only how the car is powered, but also the driver experience, with a focus on luxury and digital upgrades. As the virus pushes people toward a more digital lifestyle, buyers will place a greater emphasis on digital safety, tracking and efficiency. And with the rapid adoption of 5G technology, expect consumers to demand more screens in their cars to further propel the digitalization trend.

Given the time it takes to bring new technology to market, auto suppliers must work to stay years ahead of current consumer demand. This means keeping the focus on a digital and autonomous future. The sensor and service elements are popular now, but they will only grow in importance and become essential in electronic and autonomous vehicles.

In the next five years, the compound annual growth rate in the global automotive sensor market is expected to jump 10.5%, from $24.5 billion in 2020 to $40.3 billion in 2025.

COVID-19 impact on specific features and services of automotive digitalization

● Low ● Medium ● High

In-Vehicle Features	
Feature	**COVID-19 Impact**
Digital keys	●
Navigation	●
Wi-Fi hotspot	●
Vitual assistant	●
Video/music streaming	●
Gesture control	●
Personalization	●

Safety Features	
Feature	**COVID-19 Impact**
TPMS	●
ACC	●
AEB	●
LDW	●
V2X	●

Services	
Feature	**COVID-19 Impact**
Pay as you go	●
OTA updates	●
Health apps	●
Predictive maintenance	●

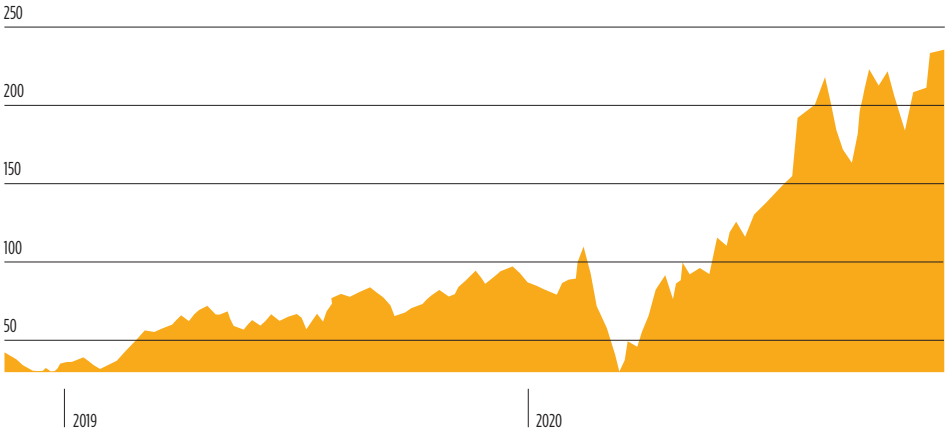
TPMS – Tire Pressure Monitor System
ACC – Adaptive Cruise Control
AEB – Automatic Energy Braking
LDW – Lane Departure Warning
V2X – Vehicle to Everything

Source: Counterpoint Research

Auto dealers

Online automobile retailers are best positioned, at least immediately, for the new post-COVID-19 shopping experience. Consumers have already come to expect a touchless, socially distant experience in all facets of their daily lives, and they'll expect the same considerations during their next vehicle purchase. Online retailers like Vroom and Carvana have perfected their selling format and may have a head start over traditional auto dealers who are now trying to shift gears; Bloomberg Intelligence expects 23%year-over-year growth for Carvana.

CVNA

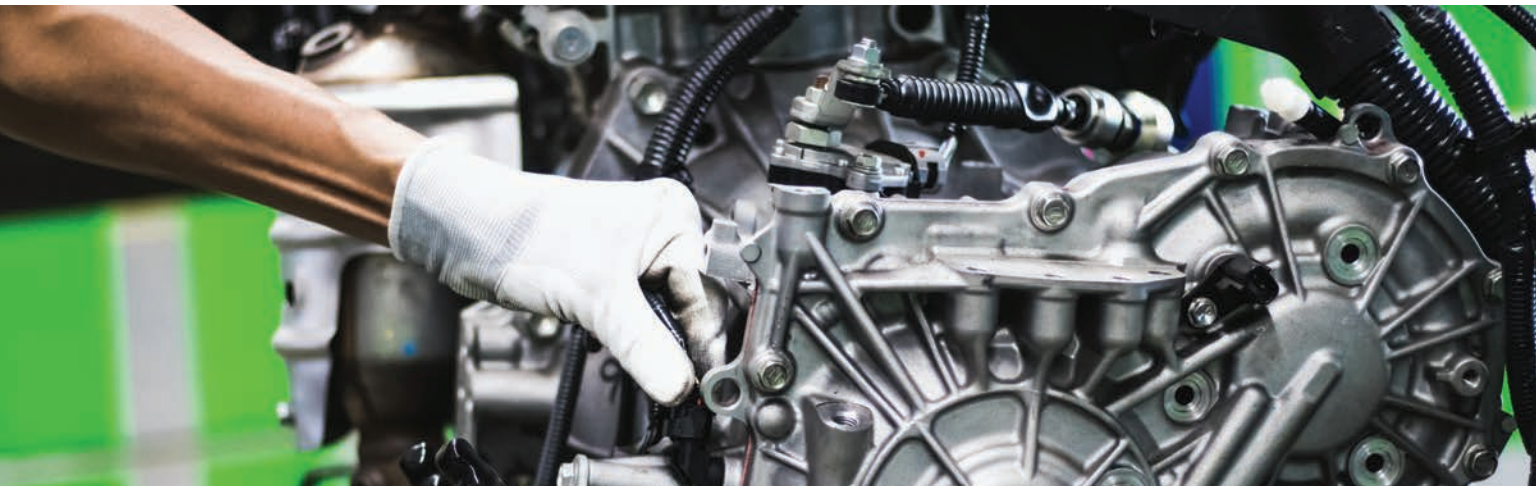


Source: 12Stocks.com

Need for a 21st century workforce

Global automotive sales took a hit because of COVID-19, but consumers are returning to the market even as the automotive industry tries to supply pent-up demand.

Almost every major automaker has multi-year expansion plans, creating a positive domino effect for Tier 1, 2 and 3 auto suppliers. That's good news for workers, but it creates a complicated labor puzzle for those companies in growth mode.



If automakers and their suppliers are to be successful, they must carefully monitor local labor markets before deciding where to expand. Every MBA professor will confirm that a company should optimize its location to ensure the lowest manufacturing and transportation costs, so it can deliver the best quality and price.

To be sure, workforce is just part of the calculus in deciding where to expand. Automakers tend to work with a select pool of suppliers located near their plants, and successful suppliers also must consider availability of raw materials, energy sources and expansion space.

But the workforce gets the most attention because it's the one puzzle piece that really doesn't have a viable substitute. A business can find alternative energy sources and get creative with expansion space, but without a skilled workforce, a company's engine can't start, and even if it does, it won't get very far.

When looking at potential locations, automotive-related companies must have a long-term vision of their workforce needs, and be positioned to support the entire life cycle of a particular vehicle model or technology feature. Second, as seen with the disruptions of the global COVID-19 pandemic, a strong labor market gives a company manufacturing agility. Those suppliers in workforce-rich areas are better positioned to ramp up production as consumers return to the market.

For its part, Indiana has been strengthening its skilled automotive workforce for decades, and the automotive manufacturers and suppliers that call the state home are capitalizing on the advantage. Jim Riggs, President of NTN Driveshaft Inc., based in Columbus, Ind., knows the benefits. The company first opened its bearing manufacturing plant 25 years ago in Indiana. When time came for a major expansion, he had options to consider.

"After conducting an exhaustive multi-state search, we selected Indiana for our new facility because of its business-friendly climate and policies, the availability of skilled labor and the strong Hoosier work ethic," Riggs says.

Indiana has more than 100,000 people working in automotive manufacturing. Indiana also is home to more than 34,000 engineers, and the majority — more than 21,000 — work as industrial, mechanical or electrical engineers.

Nurturing a talent pipeline doesn't happen automatically. Behind the scenes of Indiana's skilled workforce are public and private partnerships to address potential regional talent gaps across the state. Conexus Indiana, for example is a nonprofit organization focused on promoting and accelerating Indiana's advanced manufacturing economy through collaborations with academic, industry and public sector partners. It works with automotive companies such as Cummins, Caterpillar, Honda, Toyota, Subaru, GM and FCA Chrysler.

Brad Rhorer, Chief Talent Programs Officer for Conexus Indiana, has said it's focused on manufacturing industries because they account for 520,000 — 16% — out of 3.3 million jobs in Indiana. "Manufacturing is becoming more advanced, with increased automation, higher productivity and expanded support for workers to deliver at a higher quality," Rhorer said. "Manufacturing accounts for about $104 billion in our overall economy, and the average annual salary of $77,000 is a great salary to raise a family in Indiana."

"Manufacturing is becoming more advanced, with increased automation, higher productivity and expanded support for workers to deliver at a higher quality."

Brad Rhorer
Chief Talent Programs Officer for Conexus Indiana

Workforce agility will be important because today's innovations will create new labor demands tomorrow. "A lot of jobs that we will see in the next 10 years have not even been thought of yet because technology is advancing so quickly," Rhorer said. "The jobs that we're creating now are more technical in nature. We must take our current workforce and continue to develop their skill sets to evolve with technology to make their jobs better and more meaningful for them."

Consider the different skilled workforce conditions between the cities of Columbus, Ohio and Indianapolis. In Columbus, there's a talent shortfall in cloud computing. Many of the roles associated with these skills are hybrid and require both financial services and machine learning, and the talent in Columbus is not keeping up with the demand. By contrast, Indianapolis has an abundance of IT network skills, and the region appears to be showing a surplus of data warehousing skills among cybersecurity professionals, according to a skills gap analysis by consulting firm Strada.

Need for talent tomorrow

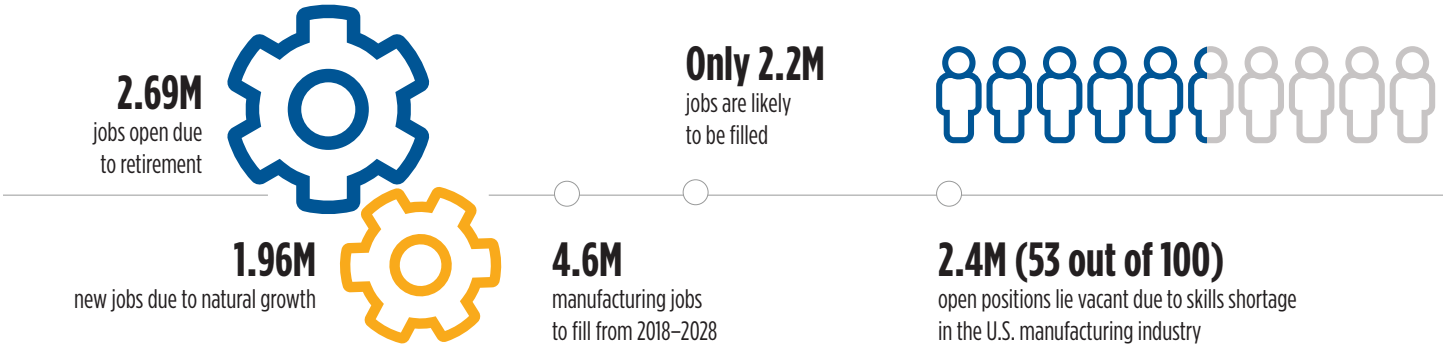
Globally, training for the next generation of automotive workforce talent lags far behind the advanced technical capabilities of tomorrow's vehicles. To meet consumer demand for cutting-edge automobile technology, more attention must be placed on developing tomorrow's talent and updating their skillset.

Education precision will be required, as opposed to the current cookie-cutter, one-size-fits-all educational approaches that tend to dominate communities near automotive plants. The existing workforce may not necessarily need the comprehensive bundled training programs many institutions offer; many times, rather than upskilling, such programs duplicate what these experienced workers already know.

More than 1,000 public institutions across the country annually teach 1 million working-class adults. The challenge, however, is that many of these students are not positioned to finish a two-year degree program to update their skills, either because of cost or time.

Adding to the problem, many of the country's automotive workers are nearing retirement. More than 2.6 million baby boomers are expected to retire from manufacturing jobs in the next decade. And potentially more than half of the 2.4 million vacant manufacturing jobs between now and 2028 could remain unfilled because of baby boomer retirements and shifting skill sets due to advanced technologies, according to a survey of employers from Deloitte Insights.

The Skills Gap May Leave an Estimated 2.4 Million Positions Unfilled Between 2018 and 2028



*Calculated on the basis of 52% of the skilled manufacturing positions that are unfilled (per 2018 survey). **Retirement age of 66.
Source: BLS Data, OEM (Oxford Economics Model), Deloitte and Manufacturing Insitute skills research initiative.

Manufacturing workforce analysts are sounding the alarm that if the skills shortage is not addressed, it could pose a major economic threat. The danger ranges from automakers not being positioned to respond to new market opportunities, all the way to losing out on an estimated $454 billion of potential additional manufacturing value.

Indiana is addressing the automotive skills shortage in two primary ways. First, the state is home to nationally ranked engineering schools such as Purdue University, University of Notre Dame and Rose-Hulman Institute of Technology. All three schools offer professional development programs in engineering geared for students working in the automotive sector.

Indiana also is proactively engaging students from kindergarten through 12th grade in specific programs to create an interest in manufacturing jobs. Programs like "Dream It. Do It.", "Hire Tech" and "Project Lead The Way" establish networks of high school "champions" that share industry information with Indiana youth in a variety of seminars and hands-on training sessions.

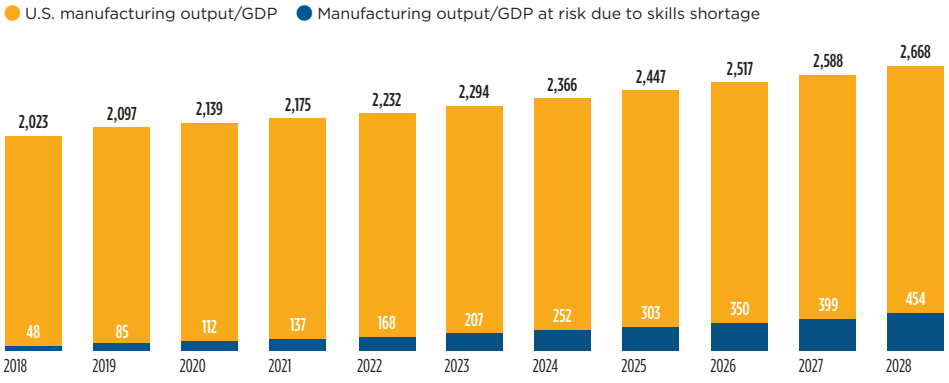
There is a proactive effort to attract, develop and connect talent with employers. Take the 21st Century Talent Regions program, for example. Communities across the state are increasing average wages to grow household income and reducing high school dropouts to raise overall education attainment. The program encourages an ecosystem of educators helping students identify career paths, adult workers who can more easily transition to new careers, and community leaders with stronger incentives to invest. Ultimately, businesses benefit from a globally competitive talent pipeline.

Since 2012, Indiana's automotive companies have offered more than 1,000 high school and college internships and co-ops each year. Toyota, for example, has partnered with Vincennes University to create the Toyota Advanced Manufacturing Technician Program, which offers a two-year degree in Computer Integrated Manufacturing. The program enables students to earn money and gain hands-on experience even while attending college.

"Indiana understands that the future workforce is critical to our long-term success," says Leah Curry, President of Toyota Motor Manufacturing, Indiana Inc. "Promoting STEM and advanced manufacturing programs in Indiana high schools is just one example of how Indiana collaborates with us to ensure our future success."

A persistent skills shortage could risk $1.5 trillion economic output over the decade.

Skills Shortage Could Put $454 Billion of Manufacturing GDP at Risk in 2028 Alone

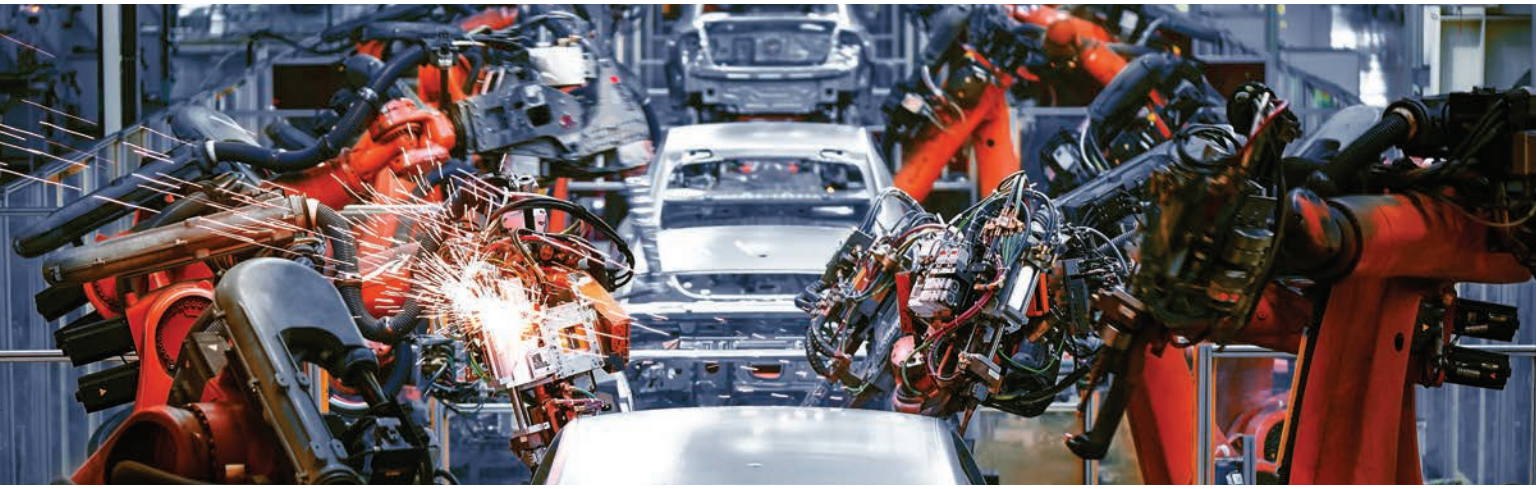


Note: 2017 base year.
Source: Data from BLS and Oxford Economics Model, Deloitte and Manufacturing Institute skills

Need for collaborative support

For an automotive manufacturer or supplier to be successful, it must have strong public and private support throughout the state. Regardless of a company's forward-thinking and aggressive plans for expansion, if it doesn't have backing from representatives throughout the state — from the nonprofit community through the governor's office — it will be fighting an uphill battle in completing major projects.

The core problem is that profit margins are tighter than ever in the auto industry. As a result, it has been forced to adjust with leaner manufacturing practices, supplier consolidations and other painful structural changes.



The need for collaboration is further underscored when considering the consumer demand for greater fuel efficiency at lower costs; globalization; and a technology revolution toward more interconnectivity.

Positioning an automotive company for growth and potential collaborations starts with selecting the right location.

The Indiana Economic Development Corporation offers performance-based tax credits, workforce training grants and other resources to help automotive companies, but other Indiana programs also are positioned to help. For example, during the past decade Indianapolis-based Energy Systems Network has worked with automotive companies and government partners to bring sustainable energy and mobility solutions, including electric car sharing, to Indiana.

In October 2020, Energy Systems Network and the IEDC collaborated with the Toyota Mobility Foundation, a Japan-based nonprofit, to establish Indiana as Toyota's first "Future Mobility District" in the United States. Through the partnership, Toyota will be working with Indiana to create a campus where auto suppliers, technologists and community stakeholders can collaborate to test mobility innovations for interoperability. Possible advancements may include a low- to zero-carbon city transit system or a short-distance mobility program that uses autonomous vehicles.

Such partnerships have come a long way from the state's auto manufacturing roots in the early 1900s. Back then, growth from the state's 170 companies manufacturing cars and car parts forced Hoosiers to adapt to a new way of life. By 1925, the Indiana Highway Commission reported, "Horse-drawn traffic has almost disappeared from our main highways."

History should serve as a reminder. For Indiana, the ride may be different, but sitting in the driver's seat of change feels familiar.

November 2020

Created with
Bloomberg Media

Department of Defense contractors, by the numbers

The thousands of defense contractors across the country are far too critical to national security to fail, according to the former U.S. Under Secretary of Defense for Acquisition and Sustainment, Ellen Lord. In response to the looming facilities shutdown necessitated by COVID-19, Lord issued a memo in March 2020 explaining that suppliers to the Department of Defense have a special responsibility to maintain their normal work schedule.

"We need your support and dedication in these trying times to ensure the security of this nation," Lord wrote.

That's welcome language for suppliers facing the impact of an unprecedented pandemic, and the DOD's words have buoyed the hopes of companies trying to establish new roots or expand operations.

The real threat, however, that generated this message may not necessarily be COVID-19, but rather China's pursuit of American supplier ingenuity. Flashes of that coveted innovative spirit are revealed daily across the Hoosier state, from legacy tool and die shops to the hypersonic research labs at Indiana University. The Department of Defense is in a race to shore up support for these contractors.

The DOD has relied on innovative contractors throughout its history, and it's a strategic advantage for the U.S. to lean on the talents of private industry to protect the nation's military interests.

The growing importance of contractors over the past 30 years can clearly be seen in the sheer number of contracts awarded and the type of work being performed. In fiscal year 2018, for instance, the Defense Department awarded more money to fulfill federal contracts — $360 billion — than all other government agencies combined.

"We need your support and dedication in these trying times to ensure the security of this nation."

Ellen Lord
U.S. Under Secretary of Defense for Acquisition and Sustainment

The contracts were dominated by five companies: Lockheed Martin Corp., The Boeing Co., Raytheon Co., General Dynamics Corp. and Northrop Grumman Corp. Those companies rely on thousands of subcontractors globally to help make products and provide services.

Indiana is a key player. From 2000 through 2019, Indiana-based companies were awarded 135,686 contracts connected to the U.S. Department of Defense, valued at $69.4 billion. And given the state's rich history of military support, contracts are likely to be rewarded for years to come.

Indiana is a key player. From 2000 through 2019, Indiana-based companies were awarded 135,686 contracts connected to the U.S. Department of Defense.

Five Largest DOD Contractors by Obligations, FY2018

in billions of current dollars

Company	Contracted Dollars
Lockheed Martin Corporation	$39.0
The Boeing Corporation	$27.4
Raytheon Company	$18.1
General Dynamics Corporation	$14.3
Northrop Grumman Corporation	$10.8

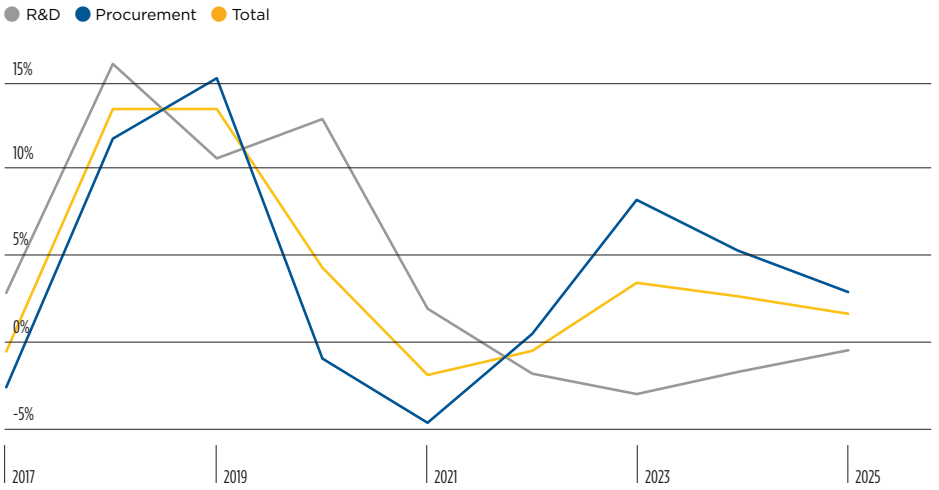
Source: FPDS Top 100 Contractors Report, FY2018
Note: Fifty percent of the Bell-Boeing Joint Project Office is attributed to the Boeing Company

Resilient defense budgets support continued demand

Defense budgets are typically more stable and resilient to economic recessions. The revenue of most defense companies is supported by strong backlogs and demand. Companies can bank on the Pentagon's steady spending.

Even though growth is expected to stall in 2021, it's not expected to dip much below 0%. Analysts expect defense spending to pick back up toward the end of 2021 through 2025, with procurement spending leading the way.

U.S. defense spending YOY change in key items



Economic downturns have little to no bearing on defense spending.

Recession-proof

Economic downturns have little to no bearing on defense spending. In a review of recessions from 1948 through the present day, some came before declines in defense spending and some came after declines in spending; there was no correlation.

Although defense budgets are recession-proof, they are susceptible to deficits and political gridlock, which can lead to across-the-board reductions. The 2008 economic crisis along with the ensuing Budget Control Act is proof of how defense spending can be cut. Defense spending cuts between 2010 and 2015 — a drop from $839 billion to $635 billion— are an example of what could happen if the country's debt continues to increase.

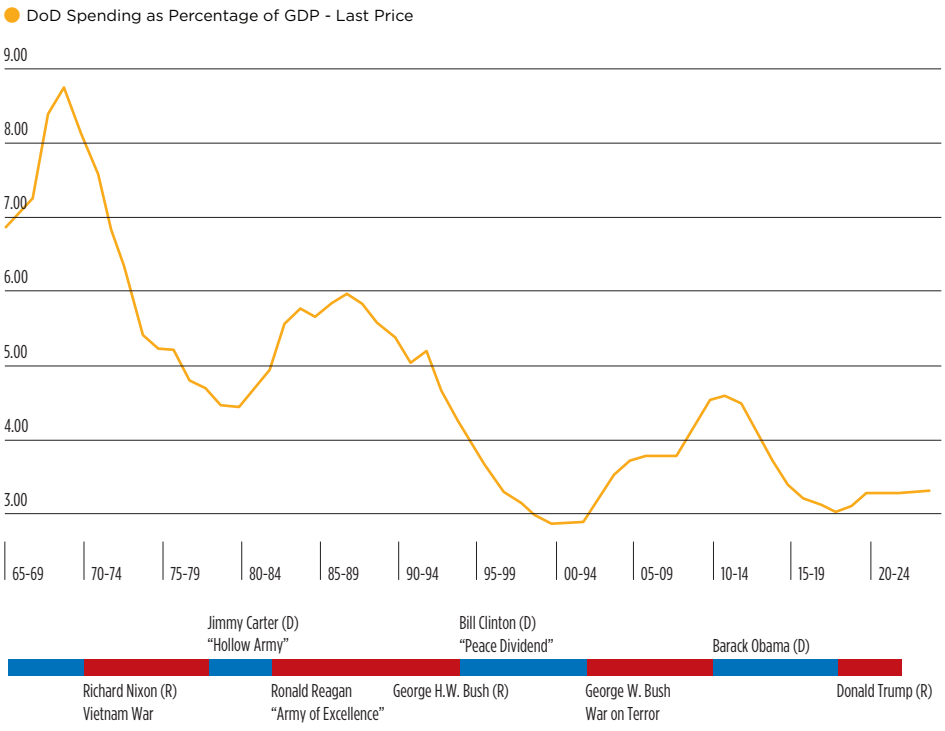
Expect a surge in spending

History offers us some clues to what we might expect from defense spending. In the early 1980s, the U.S. economy endured three years of recession. Still, President Jimmy Carter increased defense spending in his last year in office in response to an aggressive Soviet Union foreign policy, according to an analysis from Matt Vallone, Director of Research and Analysis at Avascent. The Reagan administration took the spending to another level through the mid-1980s as the Cold War with Russia grew tenser.

Generally, defense spending is nonpartisan, though it is often used as a political football depending on what's happening at the moment, the indicators to look for are interest rates and U.S. foreign relations. Defense spending could increase after the COVID-19 pandemic subsides if legislators grow concerned about foreign threats, namely from China, Russia, Iran and North Korea.

As interest rates rise, the amount of money that the government needs to service the national debt increases, which means less money for spending on national defense. Interest rates on the federal debt were key factors behind the Clinton administration's spending cuts in the early 1990s.

Defense spending as percentage of GDP, highlighted by party in the White House



Source: Green Book 2019, Office of the Under Secretary of Defense (Comptroller)

Backlog drives demand

Lockheed Martin is getting a new surge in orders for its F-16 Fighting Falcon aircraft. It now has a backlog of 130 jets, with more countries on tap to place orders.

"We're seeing a … resurgence of the F-16 business," said Michele A. Evans, Lockheed's Executive Vice President of Aeronautic, in a September 2020 interview with *Air Force Magazine*. "We're up to about 4,600 aircraft delivered, and can see possibly getting up to 5,000."

The backlog doesn't include orders from India, from which Lockheed expects a contract for an advanced version of the F-16, to be called the F-21. In addition, current F-16 sales could translate into future F-35 customers, Evans said.

The current backlog will keep the F-16 in production through 2025, though Lockheed has indicated it will increase the production rate if demand increases. The strong backlog is welcome news for F-16 suppliers nationwide, including Indiana suppliers like St. John-based Midwest Aerospace LTD, which supplies a range of parts including airframe components, navigational equipment and landing gear.

"We're seeing a … resurgence of the F-16 business."

Michele A. Evans
Executive Vice President of Aeronautic
Lockheed Martin

Contractors and the Pentagon are speeding up cash to suppliers

In March 2020, the Department of Defense announced it was increasing the cash flow for its legions of defense contractors. It is doing this by increasing the percentages paid to contractors, known as periodic progress payments. For large contractors, defense items under contract will increase from 80% of cost to 90%; for smaller contractors, percentages will go from 90% of cost to 95% of cost. Essentially, it allows contractors to get more of their cash up front, positioning them better to weather pandemic-induced financial storms.

To be sure, the move doesn't solve all problems for smaller defense contractors. The impacts of COVID-19 can seep deep into the balance sheet, and have affected the production and delivery abilities of smaller suppliers. For instance, production of the F-35 was temporarily halted in Italy and Japan because of the coronavirus. The same could happen in the U.S. if state governments issue mandates to stay home. It's far more difficult for a small business to get restarted

after a shutdown; for some, bailouts and an economic stimulus would be too little and too late. A 2018 Pentagon report on the defense-industrial base warned of "domestic extinction" among sole suppliers of critical industrial parts if they faced poor economic conditions for an extended period.

States like Indiana know the value of defense suppliers to their economy and will do everything possible to keep companies healthy. For its part, the U.S. Small Business Administration likely will use emergency loan programs to shore up financial support for vulnerable key defense suppliers.

In addition to improving percentages paid to contractors, Lt. Col. Mike Andrews said in March 2020 that the Department of Defense is accelerating payments through several means to prime contracts, and directing prime contractors — Lockheed Martin Corp., The Boeing Co., Raytheon Co., General Dynamics Corp. and Northrop Grumman Corp. — to expedite payments to subcontractors.

The March announcement also was issued with a warning that "it is especially important to understand that during this crisis the [defense-industrial base] is vulnerable to adversarial capital and we need to ensure companies stay in business without losing their technology." That language was a semi-veiled security threat warning about the impact of potential Chinese investments into American defense suppliers that possess competitive technology.

For local suppliers, the announcement should offer some assurance that the Department of Defense is standing by, ready to ensure continuity in the supply chain.

Hypersonics are increasingly important as geopolitics remain tense

The Defense Department is partly driven to help suppliers stay financially solvent because of pressure to go full throttle on advancements like hypersonics. The U.S. government is refusing to allow the threat of COVID-19 to relinquish its leadership position with this technology. The study of hypersonics has generated such strong global interest because of its powerful potential, and mastering it could mean military leverage for generations to come.

Hypersonic refers to the ability of aircraft and weapons to travel at least five times faster than the speed of sound, or 60 miles per minute. Hypersonic systems can provide advantages in speed, maneuverability, survivability and ability to reach well-defended targets. Advanced missile and hypersonic vehicle technologies will enhance end-to-end strike force systems, increasing the potential to deter future threats.

The study of hypersonics has generated such strong global interest because of its powerful potential.

As one might imagine, traveling that fast creates a physics and engineering puzzle that the world's brightest minds are racing to figure out. According to Lockheed Martin, moving that fast comes with specific challenges, including:

Heat — At hypersonic speeds, friction and air resistance create an enormous amount of heat that must be properly managed. Suppliers will need to develop sensors and electronics hardened enough to withstand extreme conditions.

Maneuverability — Hypersonic systems are designed to operate in contested environments and must be able to overcome a wide range of defenses.

Accuracy — Since the aircraft or missiles are moving a mile per second, they need to operate with an incredible degree of control and precision.

Communication — A hypersonic system must maintain connectivity to operators and decision makers through global communications and sensor systems.

Given the challenges, it's no small matter for Indiana to be chosen for key hypersonics research. In October 2020, the Department of Defense announced it will use the Naval Surface Warfare Center in Crane, Ind. as a hypersonics facility. Some 30 engineers and program managers will work to improve the technology and capabilities of hypersonics by leveraging NSWC Crane's network of government, industry and academic partners.

"This exciting announcement is the culmination of the hard work and dedication of many people," said Rick Davidoff, an acting director of the Joint Hypersonics Transition Office located at Crane. The new facility will help the government "improve their hypersonic weapons with more rapid, adaptable and modular upgrades. Indiana and the larger Midwest will have a long-term, critical role in this important national security mission."

Scott Greene, Executive Vice President of Lockheed Martin Missiles and Fire Control, said the demand to build hypersonic strike and defense systems is growing so fast that it requires his industry "to think 10 steps ahead and put our best and brightest in front to solve our numerous engineering challenges."

"We are partnering with a consortium of universities to leverage new talent, utilize state-of-the-art testing facilities and build collaborative relationships."

Scott Greene
Executive Vice President
Lockheed Martin Missiles and Fire Control

Greene said it is imperative to form partnerships with universities to not only address the research aspect of hypersonics, but also talent acquisition.

"We are partnering with a consortium of universities to leverage new talent, utilize state-of-the-art testing facilities and build collaborative relationships," Greene said.

Indiana academia is stepping up to the plate. Purdue University and the University of Notre Dame are working with the Air Force to build a series of new wind tunnels for hypersonic technology testing. The Air Force wants to use wind tunnels to both minimize freestream disturbances and yield more accurate aerothermodynamics predictions.

Indiana University also is cultivating hypersonic talent through its School of Informatics, Computing and Engineering and its IU Pervasive Technology Institute, which will partner directly with the new hypersonic facility in Crane, Ind. Students are learning parallel programming, supercomputing systems and software that facilitates the use of advanced supercomputers.

Partnering to grow defense investments

With ambitious goals for hypersonics and a push to stay globally competitive, defense industry demand for domestic suppliers is strong. Despite COVID-19, defense deals have continued to flow in Indiana. Some 2020 defense contracts awarded to Indiana suppliers include:

$1.3 Billion – Rolls-Royce Corp. was awarded a new $1.2 billion contract from the U.S. Navy to continue its work on engines for the V-22 Osprey. The aircraft has tiltrotor systems, meaning it can take off like a helicopter but cruise like a turboprop aircraft.

The company also was awarded a $9 million contract extension from the U.S. Navy for three spare AE1107C engines for the Japanese government's V-22 Osprey program.

Additionally, Rolls-Royce was awarded a $67 million contract from Defense Logistics Agency Aviation for supplies to upgrade T-56 turboprop engines, used by the U.S. Air Force and Navy.

$54M – AAR Aircraft Services Inc. was awarded a $45 million contract modification for work on the Boeing P-8 Poseidon, an aircraft used for anti-submarine warfare. The aircraft is armed with torpedoes and sonar-equipped buoys. Some of the work will support the government of Australia.

The company also will provide maintenance and repair for four P-8A Poseidon aircraft in a $9 million contract for the U.S. Navy.

$20M – Harris Corp. was awarded a contract from the U.S. Missile Defense Agency to build the "Hypersonic and Ballistic Tracking Space Sensor (HBTSS) program," which includes new capabilities for the U.S. missile shield.

$9.5M – GTA Containers Inc. has been awarded a contract to build collapsible fuel tanks for the U.S. Air Force. This is an extension of a previous $24 million order.

$8M – George Koch Sons LLC was awarded a contract from the U.S. Army Contracting Command to design, fabricate, supply and install metal finishing processes.

That said, without the right connections, it's difficult for a company to break into the defense industry or expand operations.

The Department of Defense sends the lion's share of its dollars to the aforementioned five largest contractors known in the industry as the primes. State leaders and defense supplier associations have a history of helping the primes find suitable subcontractors.

Indiana, already among the nation's leading states for defense industry dollars, recently set an ambitious goal to do better. In March 2020, Governor Eric J. Holcomb said the state will triple federal defense investment by 2025, supported by a new office of defense development housed within the IEDC.

Landing the federal hypersonics research program for Crane, Ind. was a major step toward the governor's goal. During the announcement of that research program, Dr. Mark Lewis, Acting Under Secretary of Defense for Research and Engineering, paid Indiana a generous compliment.

"Leveraging the capabilities at NSWC Crane, we can not only develop effective hypersonic technologies, but we can also develop them affordably at the speed of relevance to our warfighters," Dr. Lewis said.

In Indiana, perhaps the only thing faster than hypersonic is the "speed of relevance."

The Future of Logistics:
Indiana is innovating the way goods move globally.

November 2020

Created with
Bloomberg Media

The pandemic highlights logistical leadership

Over the years, Indiana has established itself as an integral piece of the logistical puzzle for companies needing an edge in the planning, execution and control of procurement. Since logistics is the lifeblood of every business, it should be a priority for every city and state focused on business growth. For Indiana — with dozens of airports, major water ports, 14 interstates and more than 4,000 miles of rail — logistics is top of mind and a key sector for growth.

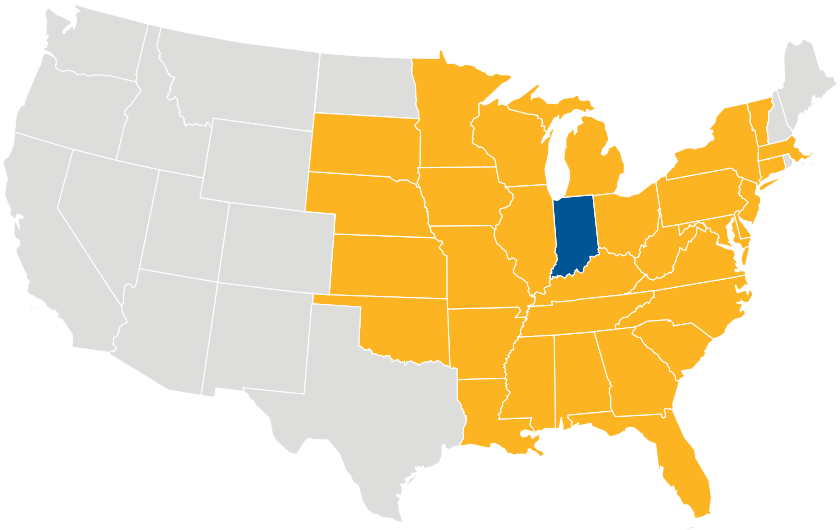
COVID-19 put Indiana's strong logistical position to the test like nothing else.

But COVID-19 has put Indiana's strong logistical position to the test like nothing else. The pandemic has created stronger demand for e-commerce, higher shipping rates and an opportunity for high-tech startups. In many respects, COVID-19 has only amplified how essential Indiana's logistical attributes are to national and international markets, and how much business potential is yet to be realized.

Pent-up consumer demand after months of being sheltered in place has been complicated by fewer trucks on the interstate, rerouted ships and grounded planes. Today's new realities are forcing industry leaders to search for innovative solutions that enable new possibilities with technology, and investment dollars are being poured into digital logistics platforms.

Years from now, Indiana likely will be judged by how well it integrates new technology solutions with the old-school attributes it previously mastered. The Hoosier state, centrally positioned, is no more than a day's drive away from 80% of the population of both the U.S. and Canada.

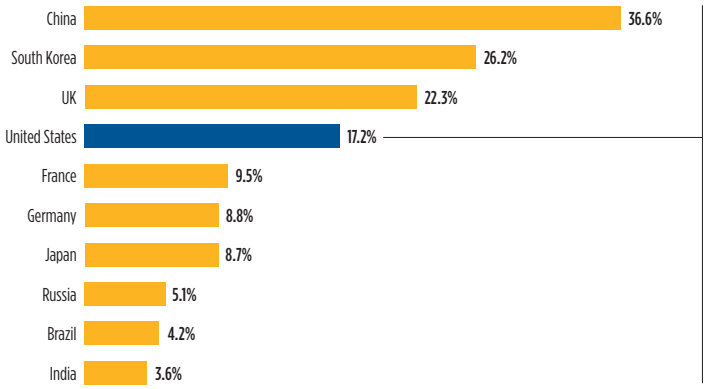
1 Day's Drive



Indiana is a national leader in pass-through interstates and truck tonnage, experiencing more interstate commerce than any other state. Indiana is home to the second-largest FedEx air hub worldwide and is third in total freight railroads. With three maritime ports that together rank sixth in domestic waterborne shipping, Indiana provides the only statewide port system with direct waterway access to two U.S. coasts.

E-Commerce Penetration Varies Considerably from Market to Market and from Category to Category

Global e-commerce share of total retail sales, 2019



US e-commerce share of total market, 2019[1]

Music[2]	87%
Computers	78%
Books	58%
Household Goods[3]	48%
Office Products	41%
Toys	38%
Clothing	27%
Pets	23%
Personal Care	17%
Drugs & Medical Supplies	9%
Food & Drink	4%

Sources: EMarketer, Forrester Analytics, BCG analysis.
1. Comprises all internet-driven purchases, including in-store pickup and digitsal goods.
2. Includes streaming services and digital downloads.
3. Includes dinnerware, cookware, cutlery, linens, and draperies.

Stronger e-commerce demand

Being sheltered in place has forced shoppers to buy online. Even grandparents who may be tech averse have now succumbed to getting an Amazon account for contact-free online shopping.

According to a March 2020 consumer survey from Statista, 5%of consumers aged 65 years and above in the U.S. have bought a product online for the first time due to physical distancing and self-quarantining practices. A third of the survey respondents over age 65 planned on increasing their spending on goods from other marketplaces because of COVID-19.

E-commerce as a percentage of retail sales is now up to 16%, and this even excludes brick-and-mortar retailers' online sales. Bloomberg Intelligence expects e-commerce to retain this market share when life returns to normal due to habits formed during the pandemic. This permanent shift is likely to have real consequences not just for online companies but also for the companies that deliver those packages. Questions abound regarding whether those logistics providers are positioned to handle the sudden volume increase. The companies that can adapt will thrive in this new world order of online shopping and speedy doorstep deliveries.

Even before the pandemic, e-commerce as a percentage of retail sales was steadily growing. From 2017 to 2019, global growth in e-commerce sales outperformed brick-and-mortar sales by a factor greater than 10, and retail sales online are expected to rise from 12% in 2017 to $6.5 trillion, or 22% of total retail sales, by 2023, according to research from Boston Consulting Group.

Before the pandemic, several of the world's largest economies, including the U.S., had not reached their potential for e-commerce sales.

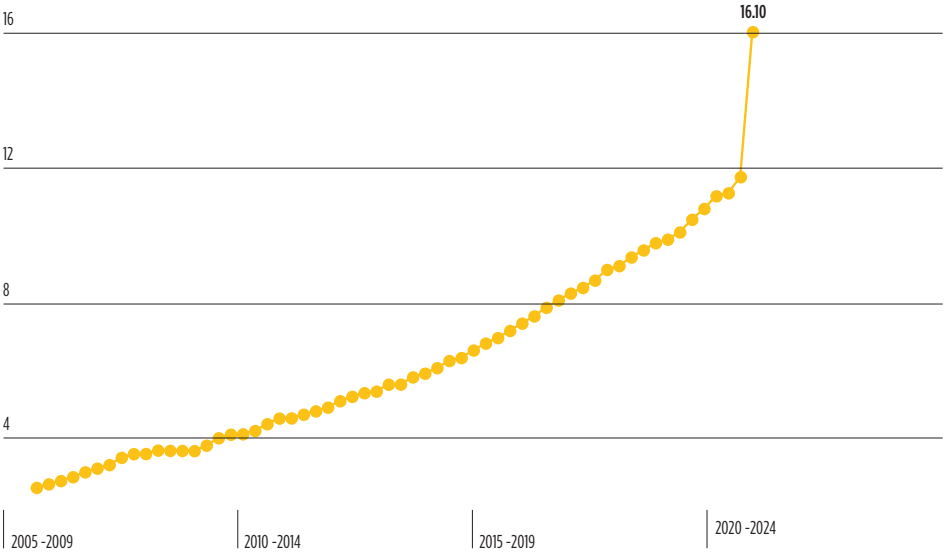
Before the pandemic, several of the world's largest economies, including the U.S., had not reached their potential for e-commerce sales; the U.S. had only 17.2% e-commerce sales as a percentage of total sales in 2019.

The pandemic has created new consumer buying habits and spawned new business models to address the habits. The frequency of online purchases is increasing: By mid-March, half of Chinese consumers had already bought more goods online than they had in all of February, and half of U.S. consumers said they bought groceries online in March because of COVID-19, with one-fifth of them doing so for the first time. It's a sign that the concerns consumers had about online purchases — quality, ordering complexity and security — are quickly dissipating.

The number of retail stores closing permanently because of the pandemic also is forcing retailers to reinvent themselves online. In addition, improvements in same-day delivery from retailers like JD.com, China's largest online retailer, and food services, like Uber Eats, also are increasing online click traffic.

These trends have encouraged FedEx to project that the U.S. market will hit 100 million e-commerce packages per day by 2023; FedEx bumped up its projection by three years because of the pandemic.

E-Commerce as a percentage of total U.S. retail sales



Source: U.S. Census Bureau, Bloomberg Intelligence

More volume, limited capacity means higher rates

Indiana's economy is tied to freight movement, mainly because of its strategic location serving regional, national and international markets. Each year, 724 million tons of freight travel through Indiana, making it the fifth-busiest state for commercial freight traffic. By 2040, freight flow is expected to increase by 60%.

The Indiana Department of Transportation (INDOT) is responsible for maintaining a seamless integration of transportation infrastructure. One-third of the freight on Indiana's transportation network passes through the state without stopping; this means the carriers are stakeholders in the state's freight system. INDOT's goal is to partner with others to provide an integrated freight transportation and logistics system that ensures the efficient movement of goods, materials and services. Recent INDOT innovations have realized tens of millions of dollars in cost savings.

Among the highlights, INDOT now has Virtual Weigh Stations using in-ground sensors to weigh trucks as they travel along interstate and intrastate roads. As trucks cross the sensors, their weight, speed and axle spacings are recorded, even as a camera snaps a photo of the vehicle.

Less capacity, higher rates

Trucks traveling along INDOT roads increasingly command higher freight rates. The trucking industry closely follows the spot market rates -- the hauling prices that exist currently if a freight service provider were to get hired "on the spot." If there are fewer trucks on the road during a given week, but there is a surplus of freight, spot rates will increase. It's a key indicator, because many truck drivers and fleet owners have relationships with shippers and brokers so they can negotiate contracts quickly and get on the road.

Each year, 724 million tons of freight travel through Indiana, making it the fifth busiest state for commercial freight traffic.

The nationwide shortage of trucks combined with the growth in e-commerce is pushing the spot market higher. Because of COVID-19, many truck fleets haven't had the capacity to take advantage of stronger retail freight volumes. That overflow freight has moved to the spot market. A late-summer surge continued in spot market rates across all equipment types, according to DAT Freight & Analytics.

In general, delivery companies are struggling to keep up with the demand. Market capitalization of the largest companies such as DHL, FedEx and UPS declined 15% to 30%from January 2020 to mid-May 2020. One reason for the declines is that the pandemic forced ocean cargo to be rerouted around Asia and shipping capacity on routes between Asia, and North America has been down significantly compared with pre-pandemic capacity. Those lost trips and weak capacity have led to lost revenue and poor financial results for delivery companies.

Airlines also have shut down routes. With many global air cargo fleets grounded, there's been a shortage of airfreight capacity and a quadrupling of costs for one-way charters of full freighters.

Combined, the ocean and air freight turbulence has increased shipping rates, leaving customers with no choice but to pay up.

Investing in digital logistics platforms

The pandemic exposed supply chain problems that prevented many companies from delivering on promises to their customers, who increasingly expect more product variety and personalized services. In response, companies now are looking for the next generation in logistics management to improve efficiency, transparency, flexibility and traceability. There's mounting pressure, however, to figure out which technologies are worthy of their investments.

Indiana has a roster full of seasoned logistics companies that have dealt with that pressure over the years. These companies are constantly in transition mode; they're continuously setting industry benchmarks, while keeping an eye out for what's next.

Take Integrated Distribution Services, for example. The Indianapolis-based third-party logistics provider is celebrating a its 50-year anniversary in the transportation and warehousing business has adapted to meet the changing needs of the market. In its infancy during the 1960s, the company served the public storage needs of local businesses. During the 1980s, it expanded to include transportation services for the bulk plastics industry. In the mid-1990s, under new ownership, it transitioned again to become a modern logistics provider with

an enterprise-wide warehouse management system. Integrated Distribution became the gold standard for implementing electronic data interchange, a feature now required by most large retailers and manufacturers, and one of the first companies to implement bar code scanning and radio frequency technology in their facilities.

As many of its retailers transitioned to become Ecommerce companies, Integrated Distribution has stayed a step ahead and leveraged its logistics expertise and advanced technology to meet their needs for direct-to-consumer order fulfillment.

Today, the top emerging technologies in logistics revolve around the Internet of Things, artificial intelligence, robotics, last-minute delivery and warehouse automation.

Today, the top emerging technologies in logistics revolve around the Internet of Things, artificial intelligence, robotics, last-mile delivery and warehouse automation, according to data analytics firm StartUs, which analyzed more than 900 startups and emerging companies. Other technologies being explored include the use of blockchain, cloud computing and autonomous vehicles.

The Internet of Things (IoT) creates automated warehouses and tracking of couriers and packages. With IoT, logistics managers have visibility at every step in the supply chain, which can improve inventory management. For example, startup logistics companies using IoT can get detailed diagnostic vehicle reports for fleet managers, including fuel level management and upcoming vehicle maintenance requirements. The IoT also is helping them with route optimization and advanced delivery solutions.

Indiana IOT Lab, located in Fishers, Ind., has become the state's incubator for entrepreneurs, startups and established companies developing IoT solutions to bring to market. The three-year initiative is part of Governor Eric J. Holcomb's goal to invest $1 billion through the end of the decade in innovation and entrepreneurship.

Logistics platforms integrating artificial intelligence can be programmed to automate manual tasks. For instance, AI-based cognitive automation technology can combine and speed up back-office roles and administrative tasks, which can significantly save money over time. Companies using artificial intelligence today can enable logistics managers with actionable insights on demand forecasting, product replenishment and even weather patterns that might impact deliveries.

Robotics will be used to reduce human error. Logistics companies have plans to use physical collaborative robots and autonomous mobile robots to pick, palletize, package and transport goods in warehouses and facilities. Startups in this space also are using robotic process automation software for invoice processing, storing data for audit trails and completing purchase orders.

Last-mile delivery is the last step in the supply chain, where products move from the warehouse to the customer. This step is typically where many of the cost overruns and delays occur. To combat this problem, logistics companies are testing drones to solve traffic congestion issues in the last mile. They also are utilizing smart locker configurations to enhance security and protection from adverse weather conditions.

AI-based cognitive automation technology can combine and speed up back office roles and administrative tasks, which can significantly save money over time.

Warehouse automation involves a range of technologies including automated guided vehicles, robotic picking and automated storage and retrieval systems. Startups focused on warehouse automation also are using vertical storage methods to increase height where space is limited.

Indiana has added more than 12.5 million square feet of new warehousing in the past few years. The state has a growing third-party logistics presence and one of the largest warehousing workforces in the country.

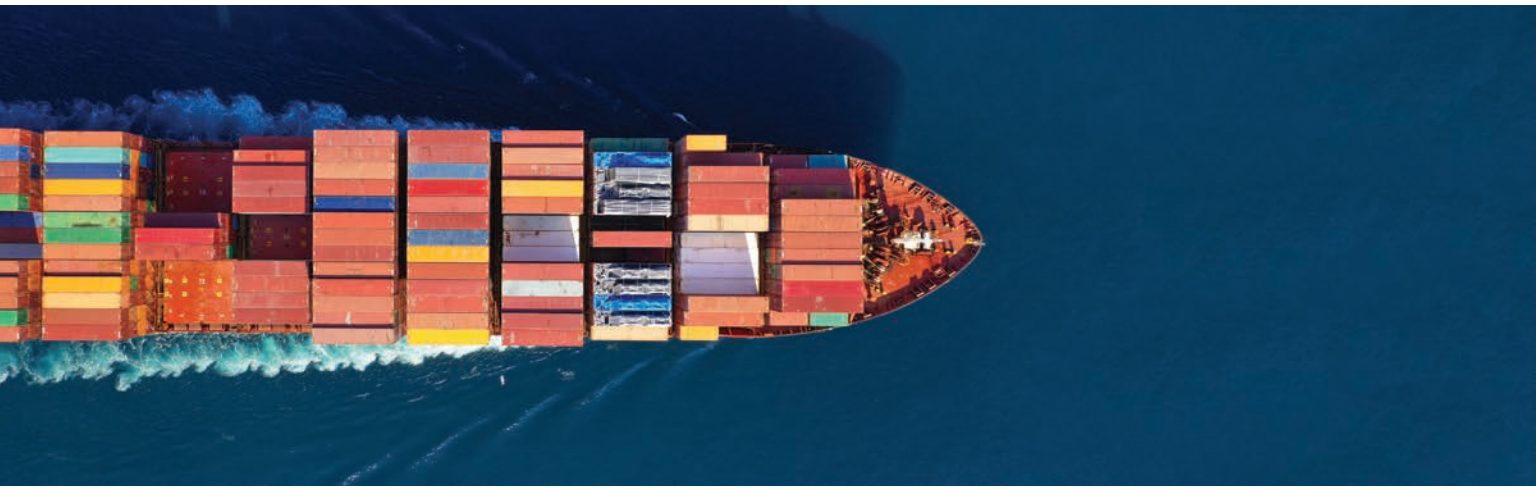
To meet tomorrow's logistical demands, state business leaders are banking on that vast industry knowledge perfected over the years dovetailed with emerging technologies.

Clearing a growth path with workforce and incentives

As companies look to start or expand their logistics operations, they will need to find locations with a ready workforce and a supportive business environment to help remove obstacles that could impede growth.

Indiana's 127,000 jobs in transportation and logistics account for more than 4%of the jobs in the state, which is 44% greater than the national average. Most of those jobs are in the truck transportation subsector, and employment in this area is expected to grow by 10.3% through 2026. The warehousing and storage subsector is expected to see the largest increase in employment, adding more than 5,000 jobs by 2026, according to data from Emsi, an affiliate of Strada Education Network.

To train the next group of logistics leaders and technology innovators, schools in the innovation triangle of Indiana University, Purdue University and the University of Notre Dame offer advanced degrees in global supply chain management. Indiana's workforce pipeline for logistics is strong due to key investments in academic programming and on-the-job training.



As an example, Indiana University's 16-week "Supply Chain Management with Digital Technologies" course teaches students an integrated approach to planning, implementing and controlling the flow of information, materials and services. They learn management along the entire product continuum, from raw materials and component suppliers through the manufacturing of the finished product for distribution to customers.

During the course, students also learn how that process is improved with digital technologies, such as blockchain, artificial intelligence and virtual reality, and practice how to leverage those digital capabilities for more granular decision-making in supply chain management.

Even if a logistics company has the workforce problem resolved, it may face hurdles when crunching the numbers to account for inventory. For many small businesses, inventory is a difficult financial consideration because it is so closely tied to the bottom line; You can't deduct inventory expenses from your taxes.

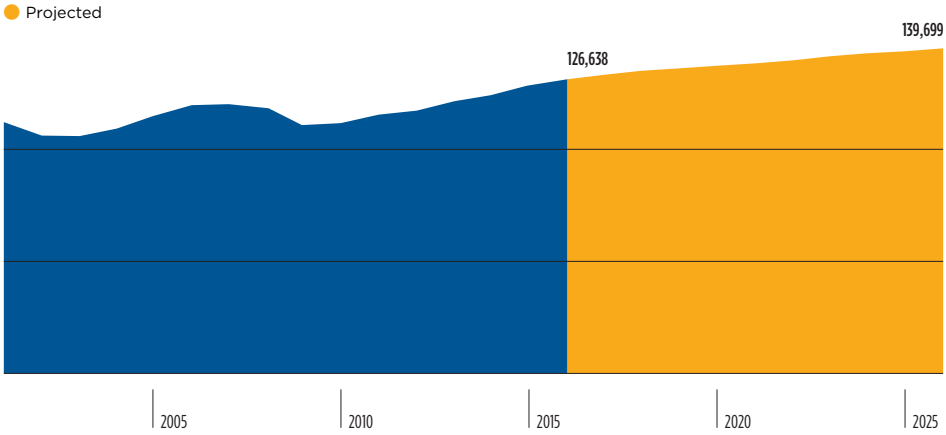
In addition, many states have an inventory tax, an additional property tax against the value of a business's inventory. Given that inventory varies by location, it's difficult to offset the inventory when taxes are due.

When choosing where to set up a logistics company or deciding where to expand, companies would be wise to learn the state's inventory tax rules, which aren't consistent among the states that have them. It's difficult for states to remove inventory taxes because the money goes directly to needy local governments. Alaska, Arkansas, Kentucky, Louisiana, Maryland, Mississippi, Oklahoma, Texas, West Virginia, Vermont and Virginia all impose some form of an inventory tax.

"Logistics companies need a place of financial affordability, stability and a reduced regulatory burden."

Eric J. Holcomb
Governor of Indiana

Transportation and Logistics Jobs Over Time, All Countries



Indiana has a different take: The state not only eliminated its inventory tax, but since 2013 Indiana has provided a logistics tax credit up to 25% of a company's new logistics investment.

"Logistics companies need a place of financial affordability, stability and a reduced regulatory burden," said Indiana Governor Eric J. Holcomb in a recent report on the state of the logistics industry.

Indiana's logistical challenge is to procure companies, which involves planning, execution and eliminating obstacles in that procurement process. With creative policy-making solutions and a commitment to industry partners, Indiana is committed to being a prime location for logistics innovation.

The Indiana Economic Development Corporation provides businesses with the information and assistance they need to succeed.

To learn more about A State That Works, visit IEDC's website at www.iedc.in.gov or email iedc@iedc.in.gov.

Indiana
A State that Works

INDIANA ECONOMIC DEVELOPMENT CORPORATION

Created with
Bloomberg Media