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NORTHEAST INDIANA FOOD & AGRICULTURE CLUSTER STRATEGY: Catalyzing the Growth of a Robust Industry Cluster



Prepared by: TEconomy Partners, LLC
Performed For: Northeast Indiana Regional Partnership





TEconomy Partners, LLC is a global leader in research, analysis, and strategy for innovation-driven economic development. Today, we're helping nations, states, regions, universities, and industries blueprint their future and translate knowledge into prosperity.

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Executive Summary

Agricultural production anchors Northeast Indiana’s food and agriculture industry cluster. With 78 percent of the total land area utilized for agricultural production, it is a substantial component of the region’s economy. However, a heavy dependence on just two row crops ensures that the region’s economy is heavily influenced by national and global trade and pricing. Furthermore, while the broader food and agriculture industry cluster is a significant driver of Northeast Indiana’s economy, it has been losing ground. Reversing this decline in the coming decade will be critical to maintaining Northeast Indiana’s economic vitality and quality of place.

As Northeast Indiana considers how to ensure that its prominence in agricultural production continues to be a major driver of its economy, it is important to understand that the overall food and agriculture industry sector is diverse and complex. Production agriculture represents one important component in a vertically integrated agbioscience value chain. Across Northeast Indiana, farmers and related industry are engaged in economic activity across this value chain, centered around crop and livestock production, but also including the development of inputs for production (agriculture equipment, seeds, agricultural chemicals, etc.) and the downstream conversion of agricultural products into a wide variety of value-added food and beverage products. This diverse and complex value-chain is illustrated in Figure ES-1.

Figure ES-1: The Northeast Indiana Food and Agriculture Industry Cluster



Source: TEconomy Partners, LLC.

The food and agriculture value-chain is complex not just in its vertically integrated structure, but also in terms of its uniquely variable operating environment conditions. Consider, for example, that unlike almost any other industry, agriculture must contend with significant annual challenges:

- Highly variable weather patterns, rainfall volumes, soil conditions and other environmental factors
- Waxing and waning diseases, pests, weeds, and natural threats to production

- Primary production spread across a very large volume of independent production entities each having to make their own individual decisions
- Sales into global commodity markets over which producers have little influence
- Increasing pressures to meet global challenges in food security while sustaining environmentally sustainable production practices, and
- Variable governmental policies, regulations and other factors that influence market structure and the production environment.

To proactively take advantage of the unique opportunities that the food and agriculture industrial sector presents the region, the Northeast Indiana Regional Partnership engaged TEconomy Partners, LLC (TEconomy) to develop a food and agriculture strategy. The Northeast Indiana Food and Agriculture Strategy seeks to capitalize upon the region’s agricultural assets and guide efforts to foster the further development of the industry cluster throughout the region. Ultimately, the strategy informs how the region can focus its economic development efforts to ensure that its existing food and agriculture industry drivers can raise their level of competitiveness, as well as identify new drivers of growth to diversify and improve the industry cluster’s economic prospects in the region.

By focusing on supporting the development, retention, and expansion of the entire food and agriculture industry cluster, the Northeast Indiana Region has the opportunity to continue to catalyze a robust ecosystem that supports the ongoing competitiveness of existing firms and advance entrepreneurship and new business development in emerging areas of opportunity.

However, for Northeast Indiana to be able to further catalyze a continued robust and thriving food and agriculture industry cluster, it must be able to overcome the following four identified challenges:

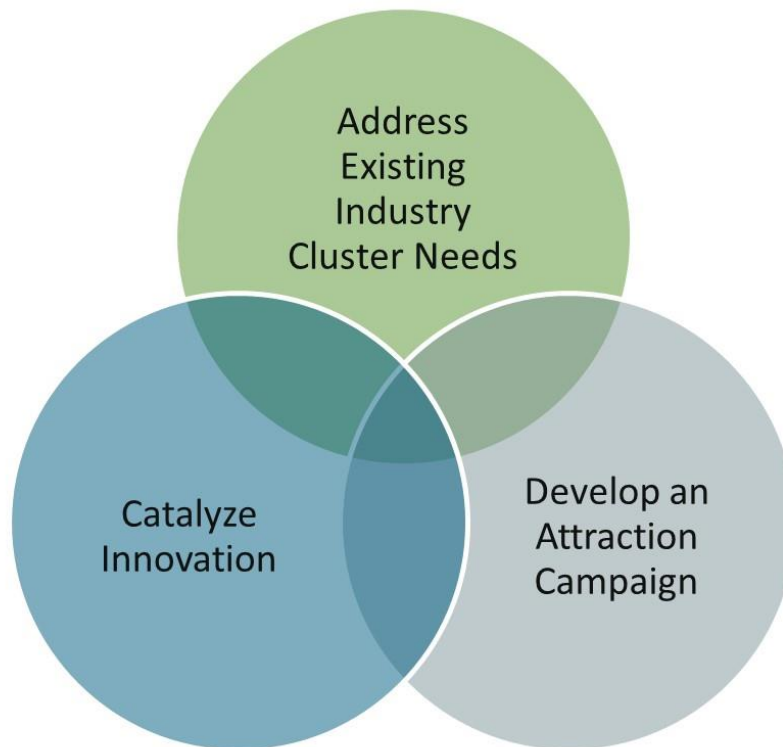
1. The lack of recent food and agriculture industrial growth, is in part, driven by the lack of agbioscience-related innovation in the region.
2. The lack of entrepreneurial endeavors in the region related to food and agriculture limits emerging opportunities.
3. Access to skilled talent is the greatest concern expressed by the food and agriculture industry in their ability to grow and remain competitive.
4. While there are successful industry cluster/networking initiatives focused on other industry sectors in the region, the food and agriculture sector lacks connectivity.

Economic gains realized by robust industry clusters:

- Rising productivity of companies in the cluster, creating a competitive edge for the region.
- Accelerating pace of innovation resulting in new products and services.
- More frequent startup of new, high-growth-potential businesses.
- Stronger supplier networks, increasing the economic multiplier impact of the cluster for the region.
- Larger pools of specialized workers and education and training programs geared to the particular cluster needs, introducing significant cost savings for firms, and increasing the breadth and depth of employment opportunities for workers in the cluster.
- Growing demand for high-wage professional services such as legal, accounting, marketing, management consulting, and finance, as well as for many other support services such as conferences, restaurants, and entertainment.

These challenges, however, are not insurmountable; and, with a renewed and re-oriented focus toward addressing these barriers, the region’s food and agriculture industry cluster can thrive. The Northeast Indiana Regional Partnership and its stakeholders have a critical role to play in ensuring that its food and agriculture cluster-based ecosystem is structured to foster the retention and growth of this important industry cluster. To help ensure a robust regional economy in the coming decades, it is proposed that the region focus its food and agriculture investments on three strategic priorities (Figure ES-2).

Figure ES-2. Northeast Indiana’s Food and Agriculture Cluster Strategic Framework



Source: TEconomy Partners, LLC.

Specifically, the three strategies focus on the following priorities:

- Retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues by **addressing existing industry cluster needs**.
- Encourage new food and agriculture enterprise development by infusing cutting-edge technology into the region’s food and agriculture industrial economic drivers by **catalyzing innovation**.
- Catalyze new food and agriculture business attraction by **developing an attraction campaign**.

Table ES-1 provides a summary of the recommended action plan to catalyze the growth of Northeast Indiana’s food and agriculture industry cluster.

Table ES-1. Northeast Indiana’s Food and Agriculture Industry Cluster Strategy

Strategy	Baseline Actions for Northeast Indiana
Strategy One Retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues.	Action 1: Create a Food and Agriculture Industry Council to address common needs/issues.
	Action 2: Develop an agbioscience talent pipeline to support the region’s food and agriculture industry.
Strategy Two Foster new food and agriculture enterprise development by catalyzing innovation.	Action 3: Create a pilot/testbed/demonstration effort to foster greater innovation and connectivity.
	Action 4: Catalyze food and agriculture startups.
Strategy Three Develop a campaign to attract new food and agriculture businesses to the region.	Action 5: Initiate an attraction campaign that leverages synergies with the region’s advanced manufacturing strengths.
	Action 6: Tell the Region’s Story—Promote Northeast Indiana as a food and agriculture economic hub.

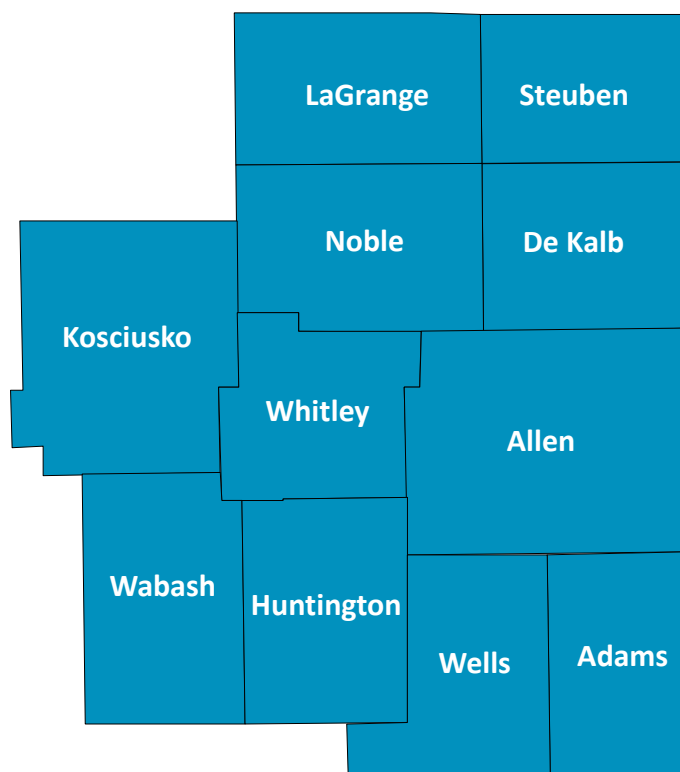
By implementing the strategies and actions outlined in this cluster roadmap, Northeast Indiana will help ensure that it is positioning its economy for economic growth. Now is the time for Northeast Indiana to double down and leverage its existing strengths to develop a vibrant and high-functioning food and agricultural industry cluster ecosystem.

Chapter 1. Introduction

Food and Agriculture—an Ongoing Development Opportunity

The Northeast Indiana Region, comprised of 11 counties as illustrated in Figure 1, has historically been and continues to be a heavily concentrated agrarian region. The 11 counties have a total land area of 2.9 million acres of which 78 percent is being utilized for primary agricultural production across more than 11,000 individual farms. The vast majority of farm acreage in the region is operated as cropland (nearly 2 million acres), while the rest is operated as pastureland. However, in terms of cash receipts from sales of primary production, crop receipts and livestock receipts are evenly matched, with crop receipts in the region totaling \$905,956,000 and livestock receipts totaling \$996,602,000. From a crop production standpoint, soybeans and corn dominate regional production while livestock and poultry production in the region are more diverse.

Figure 1: The 11 Counties that Comprise the Northeast Indiana Region



Source: TEconomy Partners, LLC.

As Northeast Indiana considers how to ensure that its prominence in agricultural production continues to be a major driver of its economy, it is important to understand that the overall food and agriculture industry sector is a diverse and complex industry cluster. Production agriculture represents one important component in a vertically integrated agbioscience value chain. Across Northeast Indiana, farmers and related industry are engaged in economic activity across this value chain, centered around crop and livestock production, but also including the development of inputs for production (agriculture equipment, seeds, agricultural chemicals, etc.) and the downstream conversion of agricultural products

into a wide variety of value-added food and beverage products. This diverse and complex value-chain, rooted in Northeast Indiana’s agriculture production system, is illustrated in Figure 2.

Figure 2: The Northeast Indiana Food and Agriculture Industry Cluster



Source: TEconomy Partners, LLC.

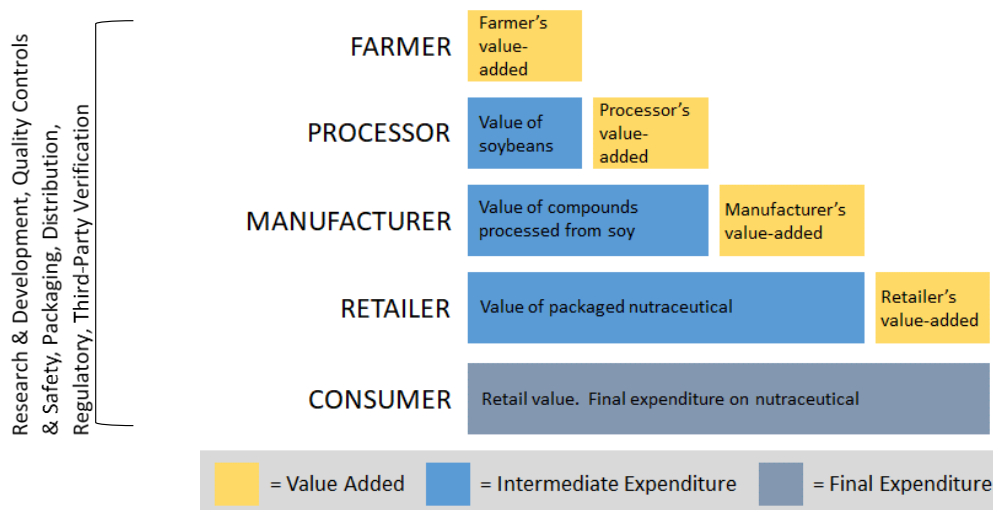
The agbioscience value-chain is complex, not just in its vertically integrated structure, but also in terms of its uniquely variable operating environment conditions. Consider, for example, that unlike almost any other industry, agriculture must contend with significant annual challenges:

- Highly variable weather patterns, rainfall volumes, soil conditions and other environmental factors
- Waxing and waning diseases, pests, weeds, and natural threats to production
- Primary production spread across a very large volume of independent production entities each having to make their own individual decisions
- Sales into global commodity markets over which producers have little influence
- Increasing pressures to meet global challenges in food security while sustaining environmentally sustainable production practices, and
- Variable governmental policies, regulations and other factors that influence market structure and the production environment.

While commodity production will no doubt remain a major component of Northeast Indiana’s agricultural output for the foreseeable future, benefits could be achieved through building enhanced value-chains that increase in-region inputs to production as well as additional value-added processing to downstream activities. Companies engaged in the production of finished food products, for example, may seek to secure their ingredient supply through contracting with local agricultural processing firms, individual farmers, or farm cooperatives. Working contractually together, producers, processors, and manufacturers can partially decouple themselves from more volatile commodity markets and benefit from a more stable and predictable operating environment. Similarly, farmers can individually or collaboratively engage in value-added business activities themselves to raise their incomes—ranging from the production of specialty processed food products on the farm (for example, artisan cheese) to co-investing in corporative business ventures (for example, the development of biorefineries).

An example value-added concept is shown in Figure 3 and illustrates the difference in potential income between simply growing and selling soybeans (the farmer row) and the total income that may be realized in a region that provides a vertically integrated value-added chain—in this example, by growing soybeans, performing the raw agricultural processing step (soybean crushing), further processing the soy product to obtain components and compounds of nutraceutical value, and then retailing them. For a commodity product like soybeans, which is Northeast Indiana’s top agricultural commodity, an integrated value-chain would capture a far higher percentage of the final dollar figure spent on the product for the region.

Figure 3: Example Value-Added Concept—Soybeans to Nutraceuticals Illustrative Example¹



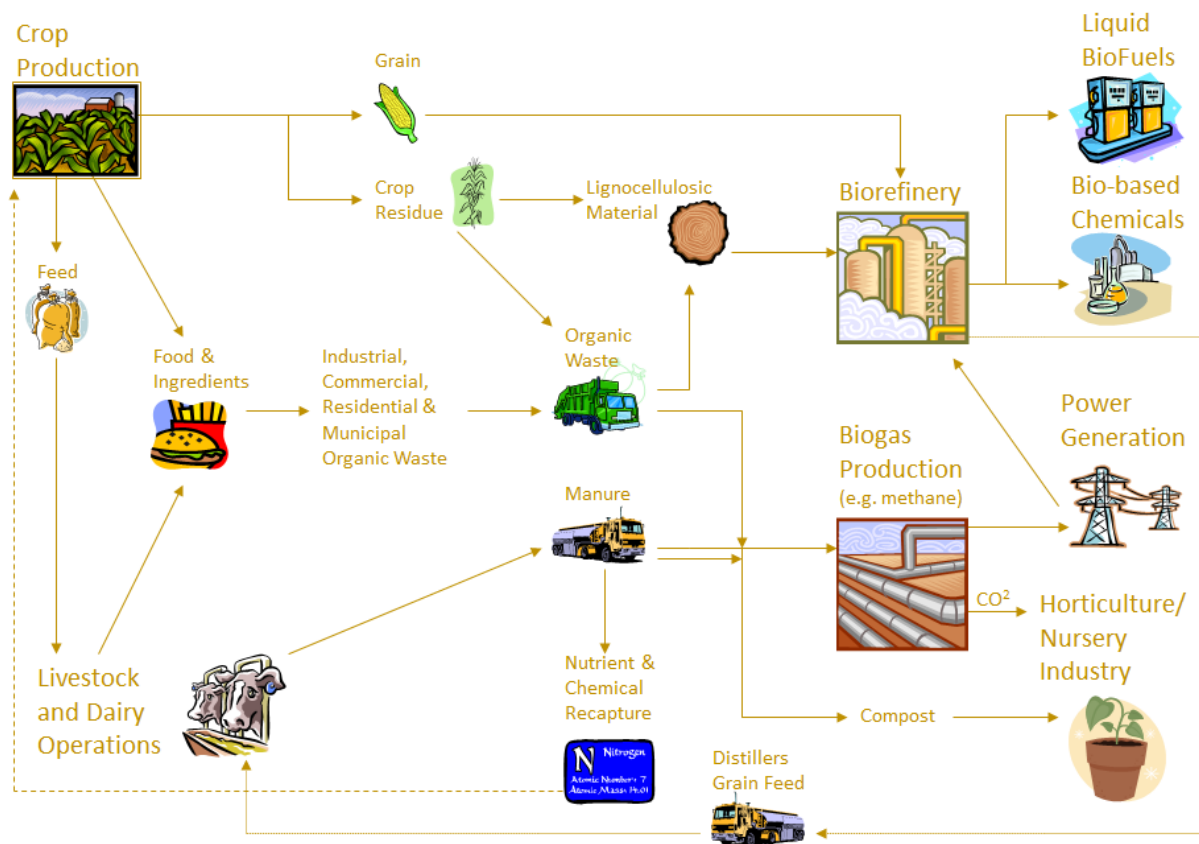
Source: TEconomy Partners, LLC.

As noted above, multiple paths can be pursued to capture increased added value, including production of value-added products on the farm; production of value-added products by farmer co-ops; development of individual companies specializing in different steps along the value-chain; and contractual relationships, partnerships, or other business structures engaged between entities.

Figure 3 helps to illustrate “value-added” conceptually; but, in the marketplace, the value-added activity takes place within more complex transactional ecosystems. By example, Figure 4 illustrates this by showing the multiple potential pathways and interrelationships in the uses of an individual crop—with the specific example shown of corn. Corn could be grown in the region and simply exported as a commodity with no value added to it, or as shown in Figure 4, can be the key input to a complex in-state chain of interrelated economic activity—adding value, economic output, and jobs.

¹ Note: Size of individual bars are illustrative only and not to a specific scale.

Figure 4: Agricultural Products as Inputs to a Complex Value-Added Production Ecosystem: Corn Example



Source: TEconomy Partners, LLC

By focusing on supporting the development, retention, and expansion of the entire food and agriculture industry cluster, the Northeast Indiana Region has the opportunity to continue to catalyze a robust ecosystem that supports the ongoing competitiveness of existing industries and advance entrepreneurship and new business development in emerging areas of opportunity.

Value of Catalyzing Advanced Industry Clusters

Industry clusters drive regional economic development. Industry clusters are geographical concentrations of firms in related industry sectors that conduct business with each other and have common needs for trained workers, infrastructure, and technology. The economic concept dates back in the economic literature to the writings of Alfred Marshall in the late 19th and early 20th centuries.²

But the application of industry clusters for economic development is a relatively recent phenomenon triggered by the work of Michael Porter, one of the nation’s leading experts in business and regional competitiveness, in the 1990s. Porter helped establish industry clusters as an economic development

² For a discussion of industry cluster theory, see National Research Council’s report on Best Practices in State and Regional Innovation Initiatives, pages 31–34.

strategy that offers regions a way to gain competitive advantage by specializing in inter-related industries and evolving those specializations over time.³

In just the past two decades, industry clusters have become the centerpiece for regional economic development strategies. As the Brookings Institution explains in a 2018 report:

Today, a basic tenet of good economic development practice is that interventions should be organized around addressing the shared needs of groups of firms. This mindset enables regions to approach economic development not as a succession of reactive and opportunistic business attraction efforts, but rather as a series of strategic investments designed to spur self-reinforcing cycles of growth and development. Most regional economic development entities rely on industry clusters as the organizing principles for their work to the point that clusters are practically synonymous with economic development strategy.⁴

Industry clusters have become a powerful means for organizing a region's economic development efforts. Pursuing industry cluster development provides more than just a focus for economic development efforts, they provide an organizing framework. This framework includes the following:

- Rather than assisting one firm at a time, cluster development efforts require solving related problems and addressing common needs of groups of firms, which is most effectively done by having individuals leading the effort who have direct industry experience, subject-matter expertise, and economic development knowledge.
- Cluster development makes it essential that a region define its identity, which can be a powerful tool for outreach marketing and attraction efforts.
- Cluster development, because of its broad reach within a region, calls for the importance of public-private partnerships that, in turn, can leverage resources and bring the region together for a common purpose.

Economic gains realized by robust industry clusters:

- Rising productivity of companies in the cluster, creating a competitive edge for the region.
- Accelerating pace of innovation resulting in new products and services.
- More frequent startup of new, high-growth-potential businesses.
- Stronger supplier networks, increasing the economic multiplier impact of the cluster for the region.
- Larger pools of specialized workers and education and training programs geared to the particular cluster needs, introducing significant cost savings for firms, and increasing the breadth and depth of employment opportunities for workers in the cluster.
- Growing demand for high-wage professional services such as legal, accounting, marketing, management consulting, and finance, as well as for many other support services such as conferences, restaurants, and entertainment.

³ For a discussion of industry clusters for economic development strategy, see Michael Porter, Harvard Business School Professor, "Clusters and the New Economics of Competition," Harvard Business Review, November–December 1998.

⁴ Donahue, Parilla and McDearman, Rethinking Cluster Initiatives, Metropolitan Policy Program, Brookings Institution, July 2018, page 7.

- Most important, cluster development brings a new level of accountability to economic development that requires having an impact at a broad scale that can advance the economic well-being and quality of life in a region.

Often overlooked, a focus on industry cluster development also offers regions a strategy for evolving into new growth industries of the future. Regions across the nation have been able to identify specific areas in which they possess the basic ingredients to be successful, making key investments and seeing economic returns. This has happened with biotechnology in San Diego, biofuels in Des Moines, electronics in Austin, robotics/computers in Pittsburgh, and semiconductors in Portland. Clusters are a powerful means for organizing a region's economic development effort.

Purpose of the Study

To proactively take advantage of the unique opportunities that the food and agriculture industrial sector presents the region, the Northeast Indiana Regional Partnership engaged TEconomy Partners, LLC (TEconomy) to develop a food and agriculture strategy for the region. TEconomy is a global leader in research, analysis, and strategy for innovation-based economic development, and brings to this project a position as the national leader in cluster-driven economic development practice with an established track record in developing and advising many of the most successful modern agbioscience development programs in the U.S.

The effort was overseen by a Project Steering Committee, a public-private thought leadership group comprised of eleven members representing industry, academia, and economic development organizations. TEconomy's work included a detailed quantitative analysis of economic conditions, as well as qualitative interviews and focus groups with business, academic, and civic leaders throughout the region to gain an understanding of the Northeast Indiana Region's existing food and agriculture strengths and capabilities and to gather input on the types of activities needed to catalyze further growth.

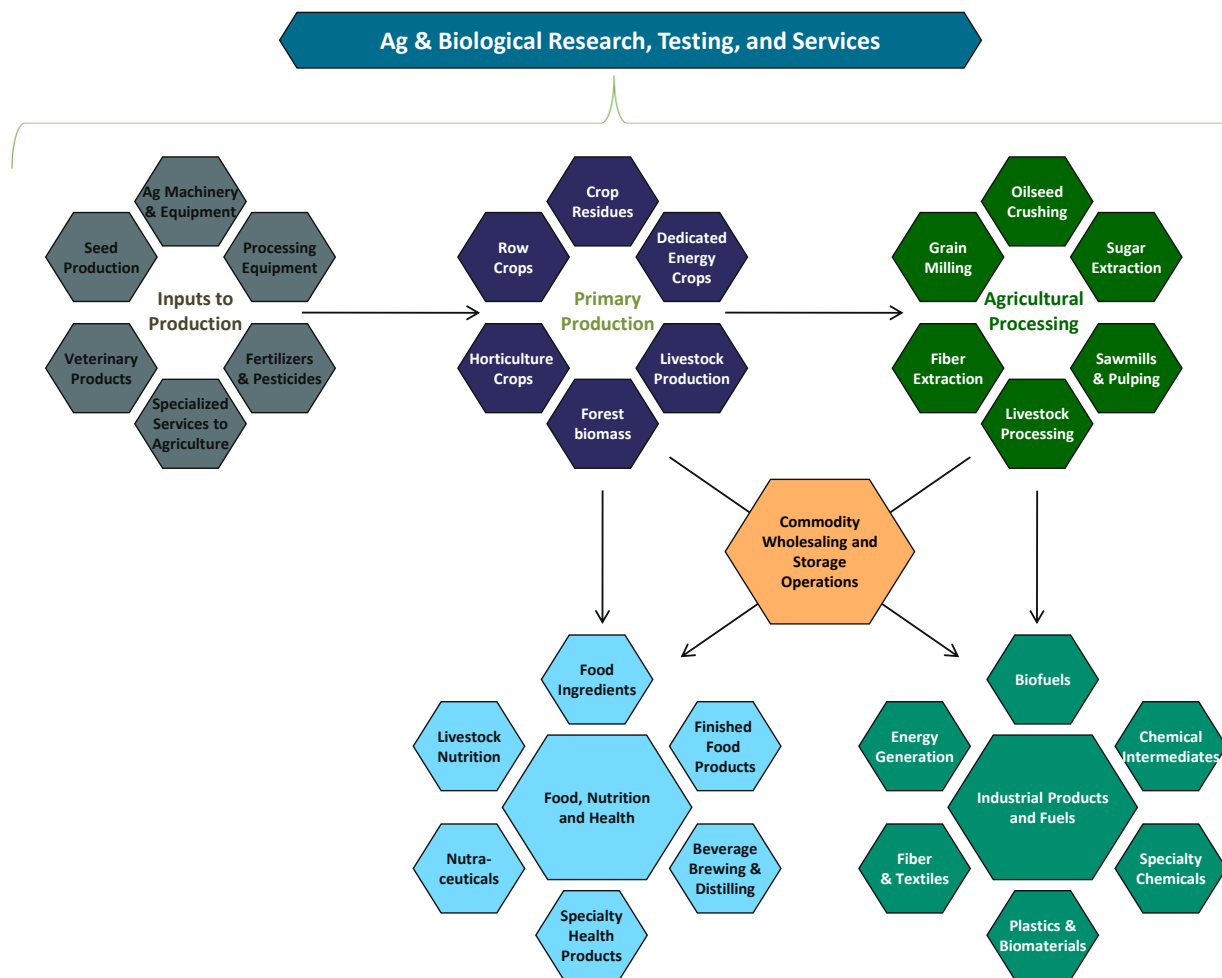
The Northeast Indiana Food and Agriculture strategy seeks to capitalize upon the region's agricultural assets and guide efforts to foster the further development of the industry sector throughout the region. Ultimately, the strategy informs how the region can focus its economic development efforts to ensure that its existing food and agriculture industry drivers can raise their level of competitiveness, as well as identify new drivers of growth to diversify and improve the industry cluster's economic prospects in the region.

Chapter 2. Northeast Indiana’s Food & Agriculture Profile

Critical in assessing the ability of Northeast Indiana to further develop its food and agriculture industry is to first understand the position of the industry within the region today. How is the sector currently positioned and what are the implications of this going forward? What have been the recent trends relative to the national industry? Is the region well concentrated in the sector and does it have distinct niche strengths from which to build? Are there gaps in the continuum of sectors and infrastructure necessary to thrive as an industry “cluster”?

The answers to these key questions are addressed in this section of the report through an analysis of Northeast Indiana’s industry employment, establishment, and wage data and recent trends in food and agriculture and related industries. As Figure 5 illustrates, production agriculture anchors a complex, vertically integrated agbioscience value chain. Across Northeast Indiana, farmers and related industry are engaged in economic activity across this value chain, centered around crop and livestock production, but also including the development of inputs for production (agriculture equipment, seeds, agricultural chemicals, etc.) and the downstream conversion of agricultural products into a wide variety of value-added food, feed, fiber, fuel, and industrial bio-based products.

Figure 5: The Northeast Indiana Agbioscience Economy



Source: TEconomy Partners, LLC.

Data and Methodology

The following economic analysis examines Northeast Indiana’s agriculture and agbioscience composition from 2015 through 2018 (with 2018 being the most recent full year for available data). The analysis highlights key growth sectors and employment trends (both positive and negative) across a range of major agriculture and agbioscience subsectors, as well as detailed component industries based on the North American Industrial Classification System (NAICS).⁵

For the employment analysis, TEconomy uses BLS QCEW program data. The QCEW data are the most current, detailed state- and county-level industry establishment, employment, and wage figures available.⁶ The QCEW program, a cooperative program involving BLS and the State Employment Security Agencies, produces a comprehensive tabulation of employment and wage information for workers covered by state unemployment insurance (UI) laws and federal workers covered by the Unemployment Compensation for Federal Employees (UCFE) program.⁷ TEconomy utilizes an “enhanced” version of these state and county data purchased from IMPLAN, a private vendor.

It is important to note that QCEW data do not include many workers on small farms. The program data are collected from unemployment insurance records and do not cover self-employed farmers and some wage and salary farm workers. Because small farms and their workforce contribute significantly to Northeast Indiana’s farm economy TEconomy sources other data to account for this farm-related activity. Economic data on family farms and their employment are tracked by the USDA’s Economic Research Service (ERS) and the U.S. Department of Commerce’s Bureau of Economic Analysis (BEA). The USDA’s National Agricultural Statistics Service (NASS) also publishes useful information on the number and size of farms, as well as crop, livestock, and other agricultural production metrics. Data from these sources are used to supplement the BLS data for the economic analysis. Employment estimates from BLS may differ significantly from other sources due to differences in concepts, definitions, and estimation methodologies.

⁵ The NAICS is the official federal government system for classifying establishments and their activities into the appropriate sectors. The NAICS is based on the production processes of firms and categorizing them in groups with other establishments engaged in the same or similar activities. NAICS industries at the most detailed (six-digit) level were selected for this analysis and together make up the major sectors and subsectors. Using this system, industries at the six-digit level of detail were chosen. These detailed industries were aggregated up to the six major subsectors of the food and agriculture (agbioscience) industry. A full list of NAICS codes and the corresponding agbioscience subsector appears in Table A-1 of Appendix A.

⁶ In general, QCEW monthly *employment* data represent the number of covered workers who worked during, or received pay for, the pay period that included the 12th day of the month. Virtually all workers are reported in the state in which their jobs are located. Covered private-industry employment includes most corporate officials, executives, supervisory personnel, professionals, clerical workers, wage earners, piece workers, and part-time workers. It excludes proprietors, the unincorporated self-employed, unpaid family members, and certain farm and domestic workers. An *establishment* is an economic unit such as a farm, mine, factory, or store that produces goods or provides services. It is typically at a single physical location and engaged in one, or predominantly one, type of economic activity for which a single industrial classification may be applied. *Total wages*: Covered employers in most states report total compensation paid during the calendar quarter, regardless of when the services were performed. A few state laws, however, specify that wages be reported for or be based on the period during which services are performed, rather than for the period during which compensation is paid. Under most state laws or regulations, wages include bonuses, stock options, severance pay, the cash value of meals and lodging, tips and other gratuities, and—in some states—employer contributions to certain deferred compensation plans such as 401(k) plans.

⁷ Major exclusions from UI coverage, and thus from the QCEW data, include self-employed workers (both farmers and non-agriculture), some wage and salary agricultural workers, unpaid family workers, railroad workers, and some state and local government workers.

BEA estimates for the number of self-employed farm proprietors are used extensively in this report. County, state, and national estimates are available through 2018. Though they are derived from a data source separate from the BLS data, farm proprietors are included in charts and tables in this report and aggregated with totals for the incorporated agricultural production subsector to provide a detailed overview of the entire agricultural production industry in Northeast Indiana.

Size and Performance of Northeast Indiana's Agriculture and Agbioscience Industry

Table 1 provides comparative data for 2015 and 2018, both for the agbioscience sector as defined overall and for its primary segments and subsectors.

Employment within the Northeast Indiana Agbioscience Cluster

For agbiosciences overall, Northeast Indiana agbioscience corporate employment (defined as all employment but not counting farm proprietors) stood at 11,577 jobs in 2018 (21,878 jobs when including farm proprietors). This represents a decline in corporate agbioscience employment in the region of 5.9 percent between 2015 and 2018. While agbiosciences employment overall declined during the 2015-2018 time period, the overall private sector in the region experienced a 3.3 percent growth in employment. Overall, the agbioscience sector is not yet a "regional specialization" for Northeast Indiana as shown by the location quotient being 0.72 (whereas a location quotient of 1.0 would equate to parity with national concentration of employment in the sector, and a location quotient of 1.2 or higher is generally considered indicative of a comparative regional specialization in an industry).

The picture changes when examining individual segments of agbioscience. The region demonstrates a specialized location quotient (LQ) in:

- **Inputs to Production** with an LQ of 2.06
- **Primary Production Agriculture** (including farm proprietors) with an LQ of 1.58

The region is also more concentrated than the nation in **Agricultural and Biomass Processing** with an LQ of 1.16. It is basically at parity with the nation in **Food, Nutrition, & Health** where the LQ is 1.03. The region is less concentrated than the nation in **Ag/Bio Research, Testing, and Services** (0.90) and in **Wholesaling, Distribution, and Storage Operations** (0.87).

Further perspective is provided by examining the individual sub-sectors where specialization is evident:

- **Agricultural Machinery and Equipment**, employing 1,038 (LQ=2.46)
- **Agricultural Inputs Wholesaling**, employing 697 (LQ=2.27)
- **Livestock Production**, employing 1,645 (LQ=2.13)
- **Agricultural Processing**, employing 190 (LQ=1.20)
- **Agricultural Commodity Wholesaling**, employing 609 (LQ=3.27).

The **Food Processing and Manufacturing** subsector is on the cusp of being specialized with an LQ of 1.19 and a significant employment base of 4,798 personnel (41.4 percent of all agbioscience employment, not including farm proprietors). Also close to being specialized is **Biomass Processing**, with an LQ of 1.14 and 294 personnel.

Taken together, the specialized (or very close to being specialized) subsectors account for 9,271 jobs (exclusive of farm proprietors), which is 80 percent of all agbioscience subsector jobs in the region.

While these specialized subsectors show areas where Northeast Indiana demonstrates comparatively high employment concentration, it is notable that performance is mixed in terms of growth rate in employment relative to the nation in these subsectors. Relative to the nation, the region experienced the following performance in employment within its specialized and near-specialized subsectors between 2015 and 2018:

- Agricultural Machinery and Equipment: **-11.7 percent**
- Agricultural Inputs Wholesaling: **-24.1 percent**
- Livestock Production: **+1.2 percent**
- Agricultural Processing: **-14.2 percent**
- Agricultural Commodity Wholesaling: **+20.1 percent**
- Food Processing and Manufacturing: **-13.6 percent**
- Biomass Processing: **+1.7 percent**

Figures 6 and 7 provide further analytical perspective on the numbers shown in Table 1, placing segments and subsectors on quadrants measuring specialization (LQ) and employment growth.

Table 1: Northeast Indiana Agbioscience Industry Segment and Subsector Detail

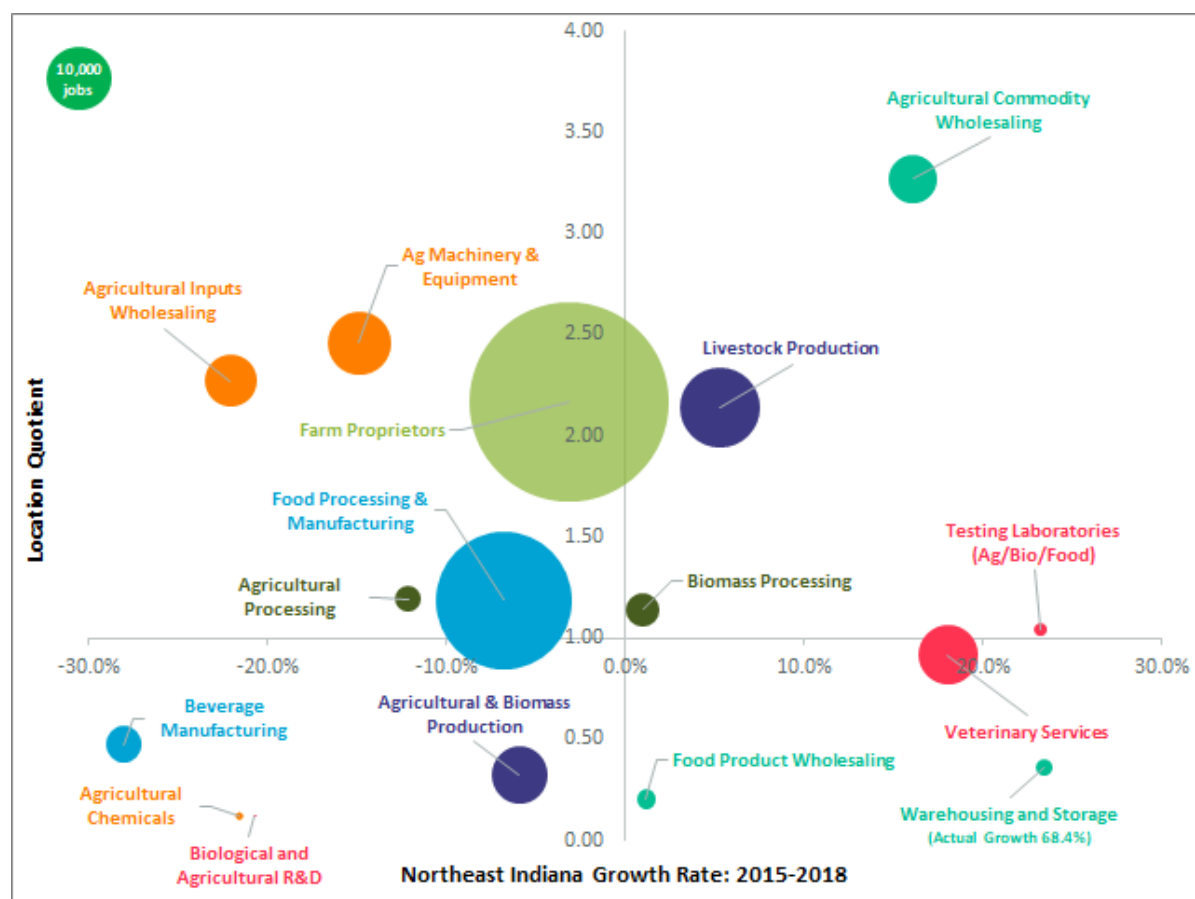
Agbioscience Segment and Subsector	Establishments 2018	Employment 2018	2018 Emp LQ	Regional Emp Growth, 2012-2015	Regional Emp Growth, 2015-2018	Regional Emp Growth, 2012-2018	Relative Regional Emp Growth, 2015-2018	Average Wages 2018
Ag/Bio Research, Testing, & Services	83	972	0.90	15.5%	18.1%	36.3%	5.2%	\$ 37,306
Biological and Agricultural R&D	2	3	0.12	-44.6%	-20.7%	-56.0%	-26.7%	\$ 65,621
Veterinary Services	76	930	0.92	16.3%	18.1%	37.3%	4.6%	\$ 36,579
Testing Laboratories (Ag/Bio/Food)	4	39	1.04	8.3%	23.2%	33.5%	18.7%	\$ 52,724
Inputs to Production	125	1,746	2.06	17.7%	-17.9%	-3.4%	-16.8%	\$ 60,020
Ag Machinery & Equipment	48	1,038	2.46	14.4%	-14.9%	-2.6%	-11.7%	\$ 60,432
Agricultural Chemicals	3	11	0.12	-9.8%	-21.5%	-29.2%	-19.3%	\$ 62,016
Agricultural Inputs Wholesaling	74	697	2.27	23.3%	-22.1%	-3.9%	-24.1%	\$ 59,373
Primary Production (Corporate)	315	2,461	0.75	17.2%	1.3%	18.7%	0.2%	\$ 36,159
Primary Production (Corporate + Farm Proprietors)	N/A	12,762	1.58	2.1%	-2.3%	-0.2%	-1.5%	N/A
Agricultural & Biomass Production	155	816	0.33	23.6%	-5.9%	16.3%	-6.2%	\$ 35,981
Livestock Production	160	1,645	2.13	13.8%	5.3%	19.9%	1.2%	\$ 36,247
Farm Proprietors (BEA)	N/A	10,301	2.17	-0.8%	-3.1%	-3.9%	-1.0%	N/A
Agricultural & Biomass Processing	15	484	1.16	-37.5%	-4.6%	-40.4%	-5.0%	\$ 64,825
Agricultural Processing	4	190	1.20	-49.3%	-12.1%	-55.5%	-14.2%	\$ 68,545
Biomass Processing	11	294	1.14	-24.5%	1.0%	-23.8%	1.7%	\$ 62,423
Food, Nutrition, & Health	112	5,127	1.03	15.6%	-10.7%	3.2%	-20.3%	\$ 42,103
Beverage Manufacturing	22	329	0.48	496.6%	-28.0%	329.6%	-53.6%	\$ 26,575
Food Processing & Manufacturing	90	4,798	1.19	6.9%	-6.8%	-0.3%	-13.6%	\$ 43,167
Wholesaling, Distribution, & Storage Operations	42	786	0.87	-29.5%	17.1%	-17.5%	9.9%	\$ 41,602
Agricultural Commodity Wholesaling	29	609	3.27	-34.8%	16.1%	-24.3%	20.1%	\$ 38,931
Food Product Wholesaling	7	106	0.20	53.5%	1.2%	55.4%	-8.1%	\$ 55,952
Warehousing and Storage	6	71	0.36	-47.3%	68.4%	-11.3%	54.5%	\$ 43,123
NE Indiana Agbioscience Industry Corporate Total	691	11,577	0.72	8.6%	-5.9%	2.2%	-9.4%	\$ 44,055
NE Indiana Agbioscience Industry Corporate & Proprietor Tot	N/A	21,878						
Total Private Sector	17,516	325,314	1.00	6.0%	3.3%	9.5%	-2.0%	\$ 45,114

Source: TEconomy analysis of Bureau of Labor Statistics, CEW enhanced data from IMPLAN, farm proprietor employment data from the Bureau of Economic Analysis, and farm proprietor establishment data from USDA National Agricultural Statistics Service 2018 Agricultural Survey.

* Average wage estimate for corporate workers only.

Figure 6 summarizes the 2015-2018 employment data. The Y-axis is location quotient in 2018 while the X-axis is employment growth rate for 2015-2018. The size of each bubble is proportionate to its total 2018 employment.

Figure 6: Northeast Indiana Agbioscience Segment Performance: 2015–2018
(Bubble size is proportionate to employment volume)



Source: TEconomy analysis of Bureau of Labor Statistics, CEW enhanced data from IMPLAN and farm proprietor employment data from the Bureau of Economic Analysis.

Several sub-sectors can be seen to stand out as performing well, being in the upper right quadrant of the graphic indicative or being both specialized and experience absolute growth in employment. These subsectors include:

- Agricultural Commodity Wholesaling (609 jobs)
- Livestock Production (1,645 jobs)
- Testing Laboratories (Ag/Bio/Food) (39 jobs)
- Biomass Processing (294 jobs).

Combined, these high performing subsectors employ 2,587 (22.3 percent of non-proprietor agbioscience employment).

A comparatively large amount of agbioscience employment in the region is in subsectors that are specialized but experienced a decline in absolute job numbers between 2015 and 2018 (the upper left quadrant). These subsectors account for 6,723 jobs (not including farm proprietors) which is 58.1

percent of the corporate total. When including farm proprietors (which is also in this quadrant), the specialized but declining in employment quadrant contains 77.8 percent of total agbioscience employment in the Northeast Indiana Region.

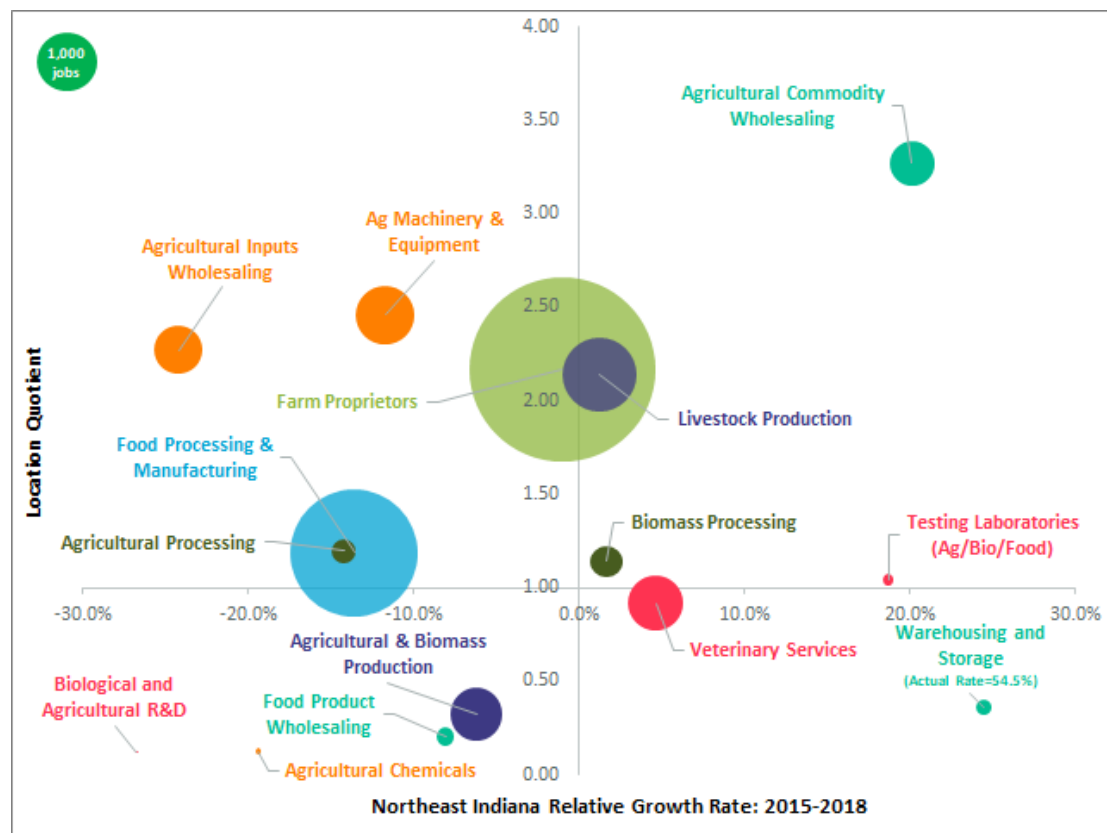
Up-and-coming sectors (those that are not yet specialized but increased employment) are in the lower right quadrant. These have comparatively low levels of employment currently, combining for 1,107 jobs (9.6 percent of non-proprietor regional agbioscience employment).

In the most problematic lower left quadrant (not specialized and experiencing declining employment levels) are four subsectors:

- Agricultural and Biomass Production (LQ=0.33, 816 jobs, -5.9 percent employment change)
- Beverage Manufacturing (LQ=0.48, 329 jobs, -28 percent employment change)
- Agricultural Chemicals (LQ=0.12, 11 jobs, -21.5 percent employment change)
- Biological and Agricultural R&D (LQ=0.12, 3 jobs, -20.7 percent employment change)

The above analysis references change in absolute employment gains or losses across the subsectors. Further perspective can be gained by doing similar analysis but using employment gains or losses relative to the U.S. in each subsector as the “x” axis. This effectively shows where Northeast Indiana is gaining or losing market share in each subsector. Figure 7 shows these data.

Figure 7: Northeast Indiana Agbioscience Subsector Performance: 2015–2018
(Bubble size is proportionate to employment volume)



Source: TEconomy analysis of Bureau of Labor Statistics, CEW enhanced data from IMPLAN and farm proprietor employment data from the Bureau of Economic Analysis.

Wages within the Northeast Indiana Agbioscience Cluster

Overall, the agbioscience cluster in Northeast Indiana paid average wages in 2018 that are close to being at parity with the average private sector wage for the region. Agbioscience jobs paid an average of \$44,055 in 2018 (not including farm proprietors) which is 97.7 percent of the \$45,114 overall average private sector wage in Northeast Indiana. Several of the sub-sectors in Northeast Indiana pay particularly strong average wages, with the highest being in:

- Biological and Agricultural R&D – with 3 jobs and an average wage of \$65,621
- Testing Laboratories (Ag/Bio/Food) – with 39 jobs and an average wage of \$52,724
- Ag Machinery and Equipment – with 1,038 jobs and an average wage of 60,432
- Agricultural Chemicals – with 11 jobs and an average wage of \$62,016
- Agricultural Inputs Wholesaling – with 697 jobs and an average wage of \$59,373
- Agricultural Processing – with 190 jobs and an average wage of \$68,545
- Biomass Processing – with 294 jobs and an average wage of \$62,423
- Food Product Wholesaling – with 106 jobs and an average wage of \$55,952.

Combined, the eight subsectors that pay above the average private sector wage within the region account for 2,378 jobs (20.5 percent of regional agbioscience sector jobs). Overall, therefore, considerably more jobs in the region (79.5 percent) in the agbiosciences cluster are paying wages that fall below the average private sector regional wage. The largest subsector in terms of employment (not including farm proprietors) is “Food Processing and Manufacturing” with 4,798 jobs paying an average wage of \$43,167 (close to the average regional private sector wage). The lowest paying jobs are in the beverage manufacturing subsector and in the primary agricultural production sectors.

Primary Agriculture Production in Northeast Indiana

USDA’s National Agricultural Statistics Service (NASS) reports that the 11-county Northeast Indiana Region has a total land area of 2,872,694 acres of which 78 percent (2,240,670) is land in farms. Table 2 summarizes NASS reported statistics on a per county and 11-county combined basis.

As of 2017 (the most recent data reported by NASS at the county level, the region contained 11,054 farms with an average per farm size of 202.7 acres (less than half of the average US farm size which was 441 acres for 2017). The average size of farms in Northeast Indiana is also below the state average for Indiana, which was 265 acres in 2017. Compared to immediate surrounding states, the size of farms in the NE region is not atypical, with the average size of farms in Michigan being 206 acres, in Ohio 180 acres, Kentucky 171 acres. Average farm size is, however, considerably higher in Illinois, at 371 acres.

Average cash receipts from farming in the region are \$172,115 per farm. However, average realized net income per farm is quite low, averaging just \$16,527 per farm for 2017 in Northeast Indiana (versus \$29,356 for Indiana statewide, and \$36,778 for the US).

The vast majority of farm acreage in the region is operated as cropland (1,973,085 acres), while only 82,996 acres are operated as pastureland. In terms of cash receipts from sales of primary production, crop receipts and livestock receipts are quite evenly matched, with crop receipts in the region totaling \$905,956,000 and livestock receipts totaling \$996,602,000 for 2017.

Table 2: Summary Statistics for Agricultural Production in the Northeast Indiana Region

	Adams	Allen	De Kalb	Huntington	Kosciusko	Lagrange	Noble	Steuben	Wabash	Wells	Whitley	Total
Population 2017	35,491	372,877	42,836	36,337	79,206	39,303	47,452	34,484	31,443	27,984	33,756	781,169
Total Land Area	216,978	420,685	232,213	244,895	340,106	242,963	262,938	197,617	263,959	235,576	214,764	2,872,694
Percent of Land in Farms	98.1%	66.9%	68.4%	80.5%	76.9%	80.4%	76.1%	60.9%	80.0%	95.5%	82.1%	78.0%
Number of Farms 2017	1,450	1,548	771	611	1,042	2,144	1,015	472	724	581	696	11,054
Land in Farms (acres) 2017	212,963	281,635	158,931	197,236	261,674	195,370	199,996	120,324	211,239	225,047	176,255	2,240,670
Average Size of Farm (acres) 2017	147	182	206	323	251	91	197	255	292	387	253	202.7
Cropland (acres) 2017	194,386	249,509	140,136	181,427	229,746	144,137	172,337	101,665	190,261	215,386	154,095	1,973,085
Harvested Cropland (acres) 2017	186,932	238,415	128,731	174,162	216,980	128,860	163,566	91,426	178,664	212,268	148,339	1,868,343
Pastureland (acres) 2017	6,940	6,958	1,896	5,073	10,932	31,737	7,126	2,957	3,819	1,810	3,748	82,996
Woodland (acres) 2017	7,005	17,271	11,222	6,467	15,297	21,244	13,840	9,007	12,711	4,532	10,252	128,848
Cash Receipts Total 2017	\$227,196,000	\$159,273,000	\$102,798,000	\$164,188,000	\$278,615,000	\$279,830,000	\$139,433,000	\$58,251,000	\$214,665,000	\$187,415,000	\$90,898,000	\$1,902,562,000
Average Cash Receipts per Farm	\$156,687	\$102,890	\$133,331	\$268,720	\$267,385	\$130,518	\$137,372	\$123,413	\$296,499	\$322,573	\$130,601	\$172,115
Crop Receipts 2017	\$82,983,000	\$111,083,000	\$58,203,000	\$95,249,000	\$119,762,000	\$58,317,000	\$70,729,000	\$35,608,000	\$96,752,000	\$111,212,000	\$66,058,000	\$905,956,000
Livestock Receipts 2017	\$144,213,000	\$48,190,000	\$44,595,000	\$68,939,000	\$158,853,000	\$221,513,000	\$68,704,000	\$22,643,000	\$117,913,000	\$76,203,000	\$24,836,000	\$996,602,000
Total Income 2017	\$240,980,000	\$178,668,000	\$114,449,000	\$176,123,000	\$299,503,000	\$295,196,000	\$150,533,000	\$67,631,000	\$229,256,000	\$199,769,000	\$103,479,000	\$2,055,587,000
Average Total Income per Farm	\$166,193	\$115,419	\$148,442	\$288,254	\$287,431	\$137,685	\$148,308	\$143,286	\$316,652	\$343,836	\$148,677	\$185,959
Realized Net Income 2017	\$22,607,000	\$740,000	\$2,299,000	\$7,227,000	\$33,604,000	\$51,582,000	\$3,817,000	\$3,022,000	\$30,004,000	\$19,191,000	\$8,593,000	\$182,686,000
Average Realized Net Income per Farm	\$15,591	\$478	\$2,982	\$11,828	\$32,250	\$24,059	\$3,761	\$6,403	\$41,442	\$33,031	\$12,346	\$16,527
Corn - Harvested Acres 2017	56,000	72,000	42,000	53,000	96,000	38,000	59,000	39,000	71,000	74,000	57,000	657,000
Corn Yield 2017	194.6	181.9	159.5	183.0	180.2	142.1	169.5	148.7	201.4	204.1	180.7	180.5
Corn Production (bushels) 2017	10,900,000	13,100,000	6,700,000	9,700,000	17,300,000	5,400,000	10,000,000	5,800,000	14,300,000	15,100,000	10,300,000	118,600,000
Soybeans - Harvested Acres 2017	84,800	106,000	76,000	99,300	88,100	35,500	63,300	37,700	93,700	103,500	65,900	853,800
Soybeans Yield 2017	61.8	59.6	50.5	59.8	61.6	54.2	52.9	48.1	60.2	62.4	56.1	\$58.1
Soybeans Production (bushels) 2017	5,239,000	6,322,000	3,839,000	5,939,000	5,429,000	1,924,000	3,346,000	1,812,000	5,638,000	6,463,000	3,695,000	49,646,000
Wheat - Harvested Acres 2017	6,000	11,300	9,400	4,800	4,500	1,400	3,000	3,700	4,900	3,300	6,700	59,000
Wheat Yield 2017	80.2	81.2	64.7	80.2	74.2	63.6	72.3	71.1	94.3	76.4	76.9	76.7
Wheat Production (bushels) 2017	481,000	918,000	608,000	385,000	334,000	89,000	217,000	263,000	462,000	252,000	515,000	4,524,000
Livestock -- All Cattle (head) 2017	31,500	15,500	14,500	8,600	23,000	62,000	19,300	9,500	17,000	7,900	7,000	215,800
Beef Cows	1,100	1,900	1,000	900	2,400	3,000	1,800	1,500	1,400	300	900	16,200
Dairy Cows	8,600	2,100	1,200	3,200	3,800	12,800	4,300	2,300	2,400	3,200	900	44,800
Livestock -- Hogs	185,713	43,283	1,500	27,501	147,464	30,423	65,880	0	138,901	180,138	92,600	913,403
Livestock -- Sheep	1,753	1,307	472	671	1,037	2,576	1,193	165	1,392	84	342	10,992
Livestock -- Chickens	0	119,720	1,262	657,226		901,594	199,171	442	1,638	0	2,066	1,883,119
Livestock -- Turkeys	88,528	0	0	0	48	192	119	0	24	170	15	89,096
Other Crop: Alfalfa Hay - Harvested Acres	0	8,300	4,500	0	0	16,000	0	6,100	0	0	4,200	39,100
Other Crop: Alfalfa Hay - Yield (Ton)	0.00	3.25	3.50	0	0.00	3.35	0.00	2.80	0.00	0.00	3.15	3.3
Other Crop: Alfalfa Hay - Production (Ton)	0.0	27,100.0	15,700.0	0	0.0	53,900.0	0.0	17,100.0	0.0	0.0	13,300.0	127,100.0
Other Crop: Other Hay - Harvested Acres	0	0	0	1,200	0	0	0	0	1,700	0	1,300	4,200
Other Crop: Other Hay - Yield (Ton)	0.00	0.00	0.00	1.90	0.00	0.00	0.00	0.00	2.30	0.00	2.60	2.3
Other Crop: Other Hay - Production (Ton)	0	0	0	2,300	0	0	0	0	3,900	0	3,400	9,600
Other Crop: Popcorn - Harvested Acres	557	60	0	1,589	0	0	0	0	0	1,580	0	3,786
Other Crop: Popcorn - Production (Lbs)	2,354,431	174,000	0	6,577,607	0	0	0	0	0	7,677,804	0	16,783,842

Source: USDA-NASS. https://www.nass.usda.gov/Statistics_by_State/Indiana/Publications/Annual_Statistical_Bulletin/1819/pg96-126.pdf

Livestock and poultry production in the region are diverse. The region has significant operations in hog production and in poultry (including layers, ducks, and turkeys). There is also a significant dairy herd, and lower levels of beef production.

From a crop production standpoint, soybeans and corn dominate regional production. Soybeans were harvested on 853,800 regional acres in 2017 and corn harvested on 657,000 acres. Together these two crops accounted for 1,510,800 acres of harvested production, amounting to 80.9 percent of total harvested regional cropland (1,868,343 acres). The remaining cropland acres is predominantly planted with wheat (59,000 acres harvested), alfalfa for hay (39,100 acres harvested), and “other hay” (4,200 acres harvested).

Popcorn comprises a specialized crop grown at a significant scale in the region, harvested on 3,786 acres in 2017. Data reported by the Indiana Department of Agriculture at an individual county level, provides further detail on some additional row crops and vegetable production in the region. Table 3 shows regional production acreage for barley, oats, and rye, indicating a combined acreage for these three crops of 1,813 acres in the region – with production concentrated primarily in Lagrange, Adams, and Allen counties.

Table 3: Specialty Small Grains Production in the Northeast Indiana Region

	Adams	Allen	De Kalb	Huntington	Kosciusko	Lagrange	Noble	Steuben	Wabash	Wells	Whitley	Total
Barley	0	0	0	0	0	235	*	0	30	0	0	265
Oats	373	366	0	0	45	372	36	0	*	0	*	1192
Rye	0	0	75	*	26	233	*	0	22	*	0	356
	373	366	75	0	71	840	36	0	52	0	0	1813

Source: USDA-NASS.

Lagrange County also has a significant production acreage dedicated to vegetable production, with 5,246 acres used for vegetables (with the majority, 4805 acres, for vegetables used in processing). Vegetable production in the region is summarized on Table 4, ranked by total regional production acreage. Potatoes and tomatoes (in both cases mainly for processing) are the largest component and are heavily concentrated in Lagrange County.

Table 4: Vegetable Production in the Northeast Indiana Region

	Adams	Allen	De Kalb	Huntington	Kosciusko	Lagrange	Noble	Steuben	Wabash	Wells	Whitley	Total
Vegetables - Total	110	159	24	14	*	5246	40	*	22	148	42	5805
<i>Vegetables - Fresh Market</i>	*	116	14	*	*	441	*	*	22	*	42	635
<i>Vegetables - Processing</i>	*	43	10	*	*	4805	*	0	0	*	0	4858
<i>Vegetables - Other</i>	2	1	3	*	*	*	*	0	2	*	0	8
Potatoes	3	*	*	*	1	4044	*	0	1	1	11	4061
Tomatoes	3	5	3	*	1	598	1	*	1	*	7	619
Pumpkins	57	43	*	*	4	56	16	*	6	4	1	187
Squash	4	46	1	*	1	20	1	0	1	2	*	76
Melons	12	*	*	0	1	17	*	0	0	0	1	31
Peppers	1	4	1	*	1	3	1	*	1	1	4	17
Cabbage	3	*	*	0	3	4	*	0	*	0	2	12
Onions	3	1	*	0	1	6	0	0	1	0	0	12
Cucumber	3	1	*	0	1	*	1	*	*	1	2	9
Asparagus	0	*	*	*	4	1	0	0	1	*	*	6
Beans - Snap	1	*	1	*	*	*	1	0	1	1	1	6
Lettuce - Leaf	0	*	*	0	*	1	*	0	3	*	2	6
Broccoli	1	*	0	0	*	2	*	0	*	1	*	4
Carrots	1	0	0	0	*	1	0	0	1	*	1	4
Hops	0	0	0	0	0	0	0	3	0	0	*	3
Beets	*	1	0	0	1	*	*	0	*	*	*	2
Eggplant	*	*	*	0	1	1	0	0	0	0	*	2
Greens - Kale	0	1	0	0	0	1	*	0	*	0	*	2
Herbs	0	1	*	0	0	1	0	0	0	0	0	2
Cauliflower	1	0	0	0	*	*	*	0	0	0	0	1
Garlic	*	*	0	0	*	*	*	0	1	0	*	1

Source: USDA-NASS.

*suppressed data, likely indicative of one producer

Summary

The analysis makes clear that primary production anchors Northeast Indiana’s food and agriculture industry cluster. With over 11,000 farms in the region covering 78 percent of the total land area, primary agricultural production is a substantial component of the region’s economy. However, a heavy dependence on just two principal crops, soybeans and corn, means that the financial performance of the farm economy in Northeast Indiana is heavily influenced by national and global trade and pricing. This is evidenced by the fact that average realized net income per farm is quite low, averaging just \$16,527 per farm in Northeast Indiana compared to \$29,356 for Indiana and \$36,778 for the U.S. This is in part driven by the smaller farm size found in the region, average of 202.7 acres, which is less than half of the average U.S. farm size of 441 acres and below the state average of 265 acres. This requires that many farmers have off-farm employment to be able to sustain their farming operations.

The broader food and agriculture industry cluster (the agbioscience industry sector) is a significant driver of Northeast Indiana’s economy, but is losing ground. The overall cluster employed 21,878 individuals in 2018 (7 percent of total private sector employment). However, this was a decline of 4.6 percent from 2015 employment levels. Northeast Indiana’s decline in food and agricultural employment is particularly concerning when compared to state and national growth rates, 0.6 percent and 2.0 percent growth comparatively.

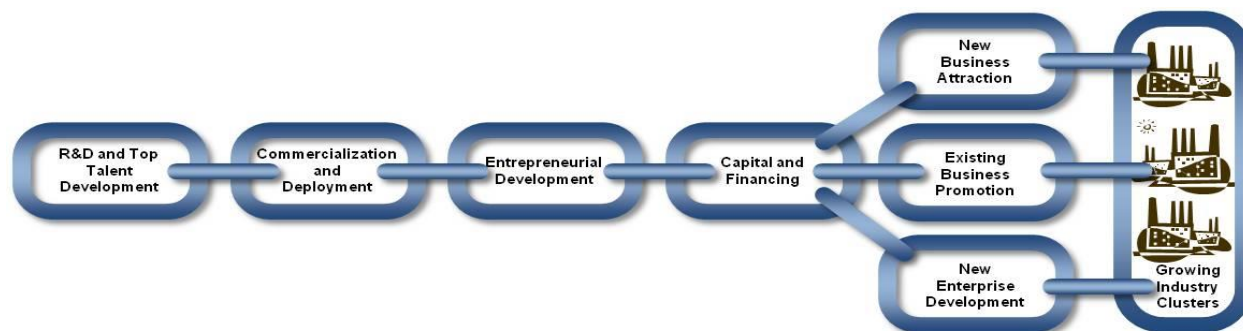
Reversing this decline in the coming decade will be critical to maintaining Northeast Indiana’s economic vitality and quality of place. There is a need to drive further value-added operations, both upstream and downstream from the farm-gate, to take advantage of Northeast Indiana’s agricultural strengths.

Chapter 3. Key Challenges Hindering the Further Development of the Region’s Food and Agriculture Cluster

The United States, its individual states, counties, cities, and communities are engaged in intense global economic competition. There are 195 independent countries in the world that are recognized by the United States. Most of these nations are engaged in global trade and are seeking to advance their economies and living standards via economic development activities. Obviously, competition in the global economy does not occur only between nations. The competition is felt at far smaller spatial scales—individual states, metropolitan areas, counties, and towns. The United States has become a patchwork of economies—some competing well within the new global economy and others failing to adapt and experiencing economic decline. The harsh reality of the modern 21st Century economy is that there are, and will continue to be, winners and losers. The core question, of course, is what does it take to be a winner?

Best practice in economic development recognizes that, for economic prosperity to occur, an entire interconnected sequence of positive factors, or ecosystem, must be in place that connects and strengthens the drivers of industry cluster development. If components in the ecosystem either inadequately address the economic needs of an industry cluster or are missing altogether, a sustainable, value-added economic base able to generate quality jobs is unlikely to develop (Figure 8).

Figure 8. A Robust Cluster-Based Ecosystem



Source: TEconomy Partners, LLC.

The value of developing a robust cluster-based ecosystem is that it will spur growth and competitive advantage within a region. Economic gains that are achieved when a robust, proactive, action plan for fostering economic growth is implemented include the following:

- Rising productivity of companies, creating a competitive advantage for the region.
- Accelerated development of new products and processes, helping to ensure global competitiveness.
- Increased frequency of new startups with high-growth business potential.
- Stronger supplier networks, increasing the economic multiplier impact of the value-chain.
- Larger pools of specialized workers and education and training programs, introducing significant cost savings for firms and increasing the breadth and depth of employment opportunities for workers.
- Increased standards of living and quality of life for the region’s citizens.

Regions that have achieved economic prosperity in recent years have addressed gaps and weaknesses withing their cluster-based ecosystems.

While the Northeast Indiana food and agriculture quantitative profile noted that the industry sector is a significant driver of the region’s economy, the analysis also noted that the cluster has been declining in recent years. Knowing that reversing this decline in the coming decade will be critical to maintaining Northeast Indiana’s economic vitality and quality of place, TEconomy undertook a series of one-on-one interviews and focus groups with industry leaders, academia, service providers, and economic development stakeholders to better understand the underlying root causes to better inform what strategic actions could be taken in the future. This situational analysis identified four key “challenges” Northeast Indiana is facing in further developing a robust ecosystem that can support the growth of the food and agriculture industry sector. These challenges range in their scale and scope, but when combined significantly hold back the ability the sector to expand operations and start new endeavors within the region. The four challenges identified must be addressed through intentional, strategic efforts to realize a more successful and vibrant food and agriculture industry sector. The four primary challenges are:

1. The lack of recent food and agriculture industrial growth, is in part, driven by the lack of agbioscience-related innovation in the region.
2. The lack of entrepreneurial endeavors in the region related to food and agriculture limits emerging opportunities.
3. Access to skilled talent is the greatest concern expressed by the food and agriculture industry in their ability to grow and remain competitive.
4. While there are successful industry cluster/networking initiatives focused on other industry sectors in the region, the food and agriculture sector lacks connectivity.

The following narrative addresses each challenge in turn, describing and providing evidence for its identification.

Challenge One: The lack of recent food and agriculture industrial growth, is in part, driven by the lack of agbioscience-related innovation in the region.

A strong foundation in both industrial and academic research is vital to initiating and propelling innovation within a regional economy. University and industry research brings with it a powerful asset—the scientific, engineering, computer science, and other talent necessary to advance research breakthroughs and spawn commercial outcomes.

In Northeast Indiana, R&D expenditures of regional universities has been in a state of decline in recent years. As Table 5 indicates, Purdue University Ft. Wayne (reported as Indiana U.-Purdue U., Fort Wayne) experienced a 30 decline in R&D expenditures between 2015 and 2018. Furthermore, Agricultural Sciences is not an area of research, which is a critical component of helping ensure a robust agbioscience industry cluster within the region. Related areas of research, including engineering and life sciences, has also been declining, 33 percent and 9 percent, respectively. Manchester University is the only other research institution in the region expending greater than \$500k.

Table 5. R&D Expenditures of Regional Universities by Academic Discipline

Institution	Discipline	2018	2015	Change, 2015-2018
Indiana U.- Purdue U., Fort Wayne	Engineering, Total	\$ 533,000	\$ 796,000	-33%
	<i>Civil engineering</i>	\$ 254,000	\$ -	N/A
	<i>Electrical, electronic, and communications engineering</i>	\$ 17,000	\$ 11,000	55%
	<i>Mechanical engineering</i>	\$ 94,000	\$ 487,000	-81%
	<i>Other engineering</i>	\$ 168,000	\$ 298,000	-44%
	Geosciences, atmospheric sciences, and ocean sciences, Total	\$ 10,000	\$ 44,000	-77%
	Life Sciences, Total	\$ 2,355,000	\$ 2,585,000	-9%
	<i>Biological and biomedical sciences</i>	\$ 861,000	\$ 483,000	78%
	<i>Health sciences</i>	\$ 1,494,000	\$ 1,854,000	-19%
	<i>Other life sciences</i>	\$ -	\$ 248,000	-100%
	Mathematics and statistics, Total	\$ 93,000	\$ 74,000	26%
	Computer and information sciences	\$ 57,000	\$ 11,000	418%
	Physical Sciences, Total	\$ 61,000	\$ 120,000	-49%
	<i>Chemistry</i>	\$ 51,000	\$ 118,000	-57%
	Psychology, Total	\$ 39,000	\$ 244,000	-84%
	Social Sciences, Total	\$ 230,000	\$ 122,000	89%
	<i>Economics</i>	\$ 69,000	\$ -	N/A
	<i>Other social sciences</i>	\$ 161,000	\$ 122,000	32%
	Other sciences, Total	\$ 23,000	\$ 17,000	35%
	Total, S&E R&D	\$ 3,401,000	\$ 4,013,000	-15%
	Non-S&E R&D, Total	\$ 1,544,000	\$ 3,039,000	-49%
	Total, All R&D	\$ 4,945,000	\$ 7,052,000	-30%
	Manchester University	Life Sciences, Total	\$ 477,000	N/A
Total, S&E R&D		\$ 493,000	N/A	N/A
Non-S&E R&D, Total		\$ 58,000	N/A	N/A
Total, All R&D		\$ 551,000	N/A	N/A

Source: TEconomy analysis of National Science Foundation, Higher Education Research & Development (HERD) Survey, Long Form and Short Form data.

The level of publication activity is another way to measure the level of R&D productivity within a region. When the Northeast Indiana Region’s publication activity between 2015 and 2019 is analyzed, three agbioscience fields are identified as having publication activity across fifteen different entities, which represent a mix of industrial and academic organizations (Table 6):

- Plant Science and Crop Protection had the largest number of publications at 26
- Animal Health and Nutrition was the second largest at 15 publications, and
- Value-Added Food and Nutrition had one publication during the time period.

Table 6. Food and Agriculture Publications by Topic Area/Organization Publishing, 2015-2019

Topic Area/Organization Publishing	# of Pubs
Animal Health and Nutrition	15
Agri Stats Inc	1
LaGrange Vet Clin	1
Maple Leaf Farms	8
Northeast Indiana Vet Emergency & Specialty Hosp	3
Owl Manor Vet Inc	1
Purdue University - Fort Wayne	1
Plant Science and Crop Protection	26
A&L Great Lakes Labs Inc	1
Advanced Agrilytics	1
G&K Concepts Inc	1
Manchester University	2
NIMA LLC	1
Purdue University - Fort Wayne	17
PureTek Genetics	1
Trellis Growing System	2
Value-Added Food and Nutrition	1
Indiana Univ Sch Med	1
Other	5
Manchester University	1
Purdue University - Fort Wayne	3
William Sluis	1
Grand Total	47

Source: TEconomy analysis of Clarivate Analytics' Web of Science database.

In and of itself, research spending does not lead to broad-based or significant economic growth and development. Rather, the translation of market-driven research activity into commercially viable products or technological processes is what ultimately leads to economic gains. How well universities and companies can successfully navigate and execute this translation and commercialize is highly pivotal to reaping the economic and societal benefits of innovative research and development. Inventing and successfully commercializing an agbioscience-related product or process is challenging. Patents offer a legal framework for protecting valuable intellectual property (IP), which in the agbioscience sector can represent significant time and resources invested.

When the level of agbioscience patenting occurring in Northeast Indiana is analyzed, it is discovered that three patent classes accounted for 70 percent of the region's 52 agbioscience patents between 2015 and 2019 (Table 7):

- Novel Plant Types (17 patents)
- Animal Husbandry and Management (10 patents), and
- Food Production and Additives (9 patents).

Table 7. Food and Agriculture Patents, 2015-2019

Agbio Patent Group	Total, 2015-2019
Agricultural Machinery and Planting Processes	6
Animal Husbandry and Management	10
Fertilizers and Agricultural Chemicals	3
Food Production and Additives	9
Genetic Engineering, Microorganisms, or Enzymes	1
Novel Plant Types	17
Veterinary Instruments and Tools	1
All Other Agbio	5
Total, Indiana Ag/bio-related Patents	52

Source: TEconomy analysis of Clarivate Analytics’ Derwent Innovation patent analysis database.

During this time period, three companies accounted for nearly 40 percent of the region’s agbioscience patent activity:

- Syngenta AG (10 patents)
- Midwest Apple Improvement Association (7 patents), and
- E-Collar Tech (3 patents).

The bottom line is that the lack of recent food and agriculture industrial growth is, in part, driven by the lack of agbioscience-related innovation in the region. While there are certainly examples of innovative companies in Northeast Indiana, there is not a critical mass of innovation to help drive growth as evidenced by the limited level of agbioscience patenting activity. Furthermore, while several regional universities have developed agbioscience-related degree programs, there is still limited academic R&D and minimal publication activity of relevance to the food and agriculture industry cluster.

While Purdue’s College of Agriculture is thought of highly within the region, there is limited R&D interaction with faculty and staff, and that which does exist, occurs in West Lafayette. Furthermore, the role of Purdue Extension in driving innovation is viewed by those interviewed for this study as quite limited with companies/producers more apt to access/adopt innovation through cooperatives and consultants.

Challenge Two: The lack of entrepreneurial endeavors in the region related to food and agriculture limits emerging opportunities.

A region’s entrepreneurial “culture” is a critical ingredient for a thriving industry cluster. Such a culture does not develop over a few years, but rather stems from multi-generational attitudes toward risk-taking and entrepreneurial endeavors. These factors are then translated into intentional efforts to build entrepreneurial programming and infrastructure such as establishing mentor networks, developing incubators and accelerators, and ensuring entrepreneurs have the tools to succeed.

A critical element of the innovation and entrepreneurial ecosystem is the availability of, and access to, investment capital. To move a technology or company beyond its nascent ideation through to early stages and onwards towards commercial success in the marketplace requires funding to advance proof of concept; initiate prototype development; hire talented individuals; advance marketing; and other key

functions. Funding for innovative, technology-driven companies often takes the form of formal venture capital or other private equity such as angel investors. In addition, small startup companies advancing innovative, market-driven R&D can apply for Federal funding through the Small Business Administration's Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) programs. Both formal venture capital funding and these federal grant programs are included as key metrics regarding ecosystem performance.

In examining Northeast Indiana's level of food and agriculture-related entrepreneurial activity, there appears to be minimal activity which in turn limits the region's ability to take advantage of emerging opportunities. For example, between 2015 and 2019 there was only one agbioscience venture capital investment in the region—Owl Manor Veterinary (provider of regenerative medical techniques related to joint and soft tissue repair for companion animals) which raised \$1.2 million from Elevate Ventures. In addition, there was only one company within the region that was awarded SBIR/STTR grant funding—Trellis Growing Systems received two SBIR Awards totaling \$569k to focus on the development of a low trellis production and harvesting system for hops.

Furthermore, there is limited efforts to support food manufacturing startups. The region has limited availability of co-packing operations for smaller runs, which stymies smaller value-added operations in addition to the lack of a processing authority to assist companies in complying with federal regulations and labeling.

Finally, those interviewed for this effort noted that there is limited assistance available for companies and/or farmers interested in developing value-added products. There is limited knowledge within the region regarding product development, distribution channels, market placement, etc. In addition, it was noted that farmers overall are not incented to diversify, which make it challenging to engage them in new crops or new market opportunities, particularly with the limited sources of information regarding emerging opportunities. While there are entrepreneurial service providers in the region, such as the Northeast Indiana Innovation Center (NIIC), they note that they have experienced extremely limited deal flow/entrepreneurial activity within the food and agriculture cluster. While there are efforts underway to develop an innovation center in Warsaw focused on Ortho and Agriculture, it is still in a very nascent stage.

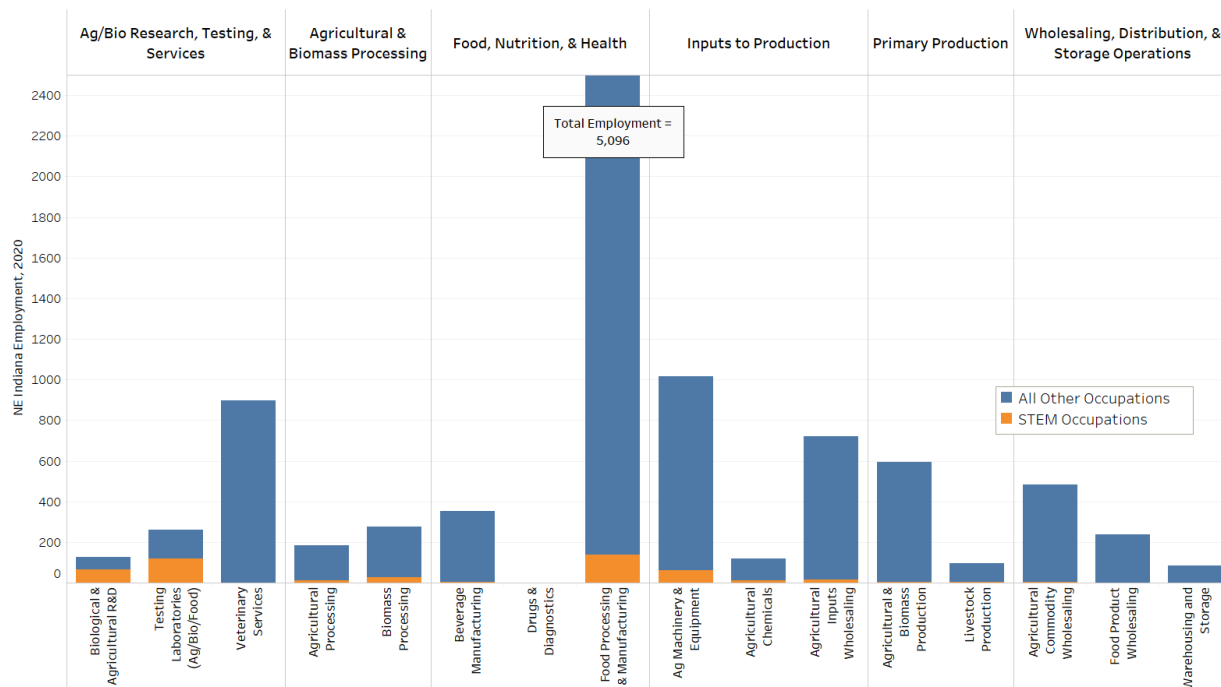
Challenge Three: Access to skilled talent is the greatest concern expressed by the food and agriculture industry in their ability to grow and remain competitive.

The availability of skilled talent is arguably the most critical element of a robust economy. Advancing scientific and other technological innovation in terms of new research, products, and processes requires strong concentrations of highly skilled, STEM (science, technology, engineering, and mathematics)-related talent across the workforce. In addition, ensuring a robust talent pipeline means a dedication by regions to excellence in their K-12 education system, as well as graduating students from colleges and universities with the appropriate education, training, and skills to meet the needs of industry.

While individuals with STEM-related degrees are critical to helping to ensure a robust food and agriculture-based economy, Northeast Indiana's industry cluster relies primarily on a non-STEM workforce. As Figure 9 illustrates, only 4.4 percent of the occupational workforce involved in the

agbioscience industries in Northeast Indiana are focused on occupations that primarily leverage STEM⁸ skills. This compares to an 11.7 percent STEM share nationally, meaning the region employs a significantly lower STEM skill base in its food and agriculture industries compared to the country.

Figure 9. Composition of STEM-Skills within Northeast Food and Agriculture Industry Cluster



Source: EMSI Staffing Patterns Data 2020.1

Further compounding the problem is the fact that while STEM skills make up a small proportion of all food and agriculture industries, Northeast Indiana’s food and agriculture workforce is also at a deficit across key skill segments relative to national workforce composition trends (Table 8).

Table 8. STEM Skill Segments in Northeast Indiana’s Food and Agriculture Industry Cluster Workforce

STEM Occupational Skills Segment	NE Indiana Employment in Food and Agriculture Industries, 2020	NE Indiana Share of All Food and Agriculture Industry Employment	US Share of All Food and Agriculture Industry Employment
Engineering	208	2.0%	3.8%
Scientists	98	0.9%	3.5%
Technicians	92	0.9%	1.9%
Computing & IT	47	0.4%	1.9%
Other	19	0.2%	0.3%
Math & Statistics	0	0.0%	0.2%
Non-STEM Occupations	10,081	95.6%	88.3%

Source: EMSI Staffing Patterns Data 2020.1

⁸ Using U.S. Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES) STEM Definition, May 2018.

It is important to note that to address this growing demand, there have been increasing efforts by regional colleges and universities to develop new agricultural-related degrees and several local K-12 school systems are also attempting to develop agbioscience curriculum. However, even with these efforts, access to talent is the greatest concern expressed by the food and agriculture industry, and industry demand continues to outstrip supply.

Challenge Four: While there are successful industry cluster/networking initiatives focused on other industry sectors in the region, the food and agriculture sector lacks connectivity.

Industry clusters are groups of firms that gain a competitive advantage through local proximity and interdependence. Clusters matter because regional economies grow based on their ability to specialize in high-value industries and then evolve those specializations over time. As the Brookings Institution notes:

Clusters may suffer from information gaps—both internally and externally—that hinder their potential. Internally, cluster initiatives provide information and research to educate firms and other internal stakeholders about opportunities and priorities for shared action. Externally, evidence-based promotion of clusters can address information failures among firms and investors outside the cluster that may benefit from cluster dynamics.⁹

Over time, industry clusters provide regions a competitive edge. “[Regions] can be thought of as developing specialized and distinctive technology capabilities, which give them unique global market opportunities.”¹⁰

Firms within industry clusters have similar information needs. These needs include:

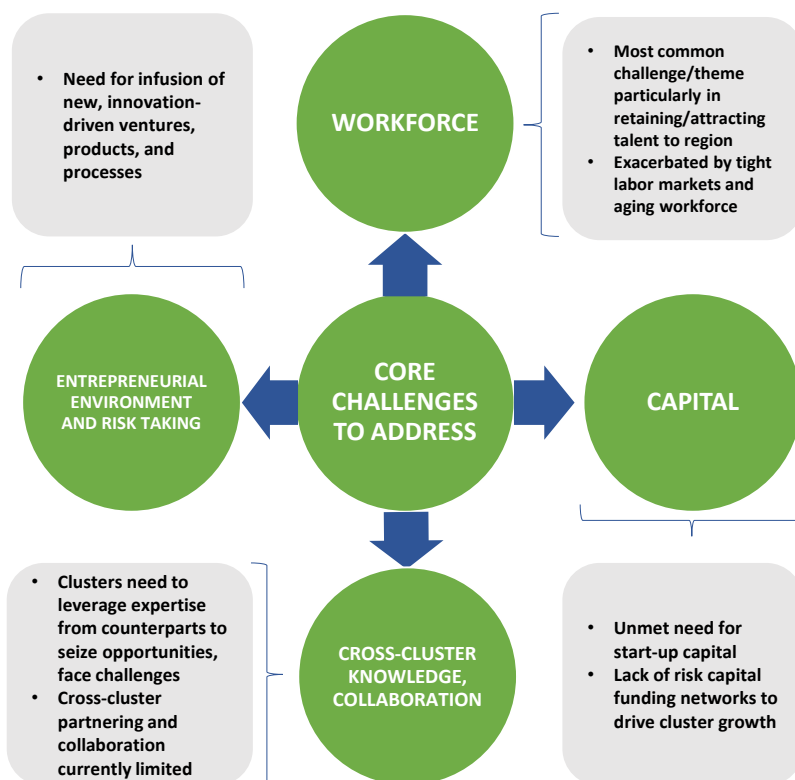
- Knowledge of regional firms
- Knowledge of higher education resources
- Competitive market intelligence and benchmarking
- Vendor sourcing
- Outsourcing strategies/practices
- Technology scanning
- Directory of firms with core competencies
- Spotlighting firms
- Matchmaking.

Research finds that, across regions, there are common challenges for growing and scaling industry clusters. These include workforce/talent development, the entrepreneurial environment, access to capital, and collaboration and knowledge sharing (Figure 10). In working to address challenges in each of these areas, regional industry clusters can help advance business attraction, retention, and expansion in key sectors of the regional economy.

⁹ Donahue, Parilla and McDearman, Rethinking Cluster Initiatives, Metropolitan Policy Program, Brookings Institution, July 2018.

¹⁰ Michael Best, The New Competitive Advantage, Oxford University Press, 2001.

Figure 10. Core Challenges Facing Industry Clusters



Source: TEconomy Partners, LLC.

Northeast Indiana has historically been very successful in driving economic growth by focusing on catalyzing industry clusters in which it has comparative advantage, such as the orthopedic device cluster. The current challenge the region faces with its food and agriculture industry cluster is the need to build stronger connectivity and collaboration across the region’s industry stakeholders to address common business growth needs. Interviews and focus group meetings with food and agriculture industry executives identified the lack of active, programmatic networking and connectivity among cluster stakeholders as a barrier for growth. This lack of connectivity/cluster networking limits the region’s ability to address common challenges/needs faced by the food and agriculture industry sector. It also limits information sharing and coordination around talent efforts. As previously noted, interviews with companies revealed that many are establishing relationships with higher education institutions as well as the local K-12 school systems, but on an individual company basis and not part of a broader effort. This takes time and resources by each individual firm, often without significant human resource capacity to support. This leads to one-off efforts instead of addressing the human capital issue systemically. In addition, there is concern that there is a growing anti-agricultural movement in the state/region that is hampering growth (or has the potential to). Agricultural communication around topics such as GMOs, production practices, conditions for livestock, etc. must be addressed to combat misinformation.

Summary

For Northeast Indiana to be able to further catalyze a continued robust and thriving food and agriculture industry cluster, it must be able to overcome the following four identified challenges:

1. The lack of recent food and agriculture industrial growth, is in part, driven by the lack of agbioscience-related innovation in the region.
2. The lack of entrepreneurial endeavors in the region related to food and agriculture limits emerging opportunities.
3. Access to skilled talent is the greatest concern expressed by the food and agriculture industry in their ability to grow and remain competitive.
4. While there are successful industry cluster/networking initiatives focused on other industry sectors in the region, the food and agriculture sector lacks connectivity.

The four challenges identified must be addressed through intentional, strategic efforts to realize a more successful and vibrant food and agriculture industry sector within the region. The strategies and actions that are outlined in the next section attempt to address the barriers currently facing the food and agriculture industry within the region and lay-out a roadmap for Northeast Indiana that if pursued can create opportunities for this critically important anchor industry.

Chapter 4. A Strategic Roadmap to Catalyze the Growth of the Food and Agriculture Industry Cluster

Regional economies with robust cluster-based ecosystems are able to catalyze a variety of economic activities, including developing innovation-driven products and processes that can meet the marketplace’s price points, developing effective management teams to drive business growth, securing access to financial capital that will fund the development of the firm through its various maturity stages, providing access to human capital that meet the industry cluster’s growth demands, and establishing the region as a competitive site within domestic and global markets.

A robust food and agriculture cluster-based ecosystem is at the core of Northeast Indiana’s ability to achieve long-term economic prosperity and community vitality. Cluster-based ecosystems consist of five interconnected elements, each of which plays a vital role in developing new value-added products and services that create strong economic impacts (Figure 11).

Figure 11: Interrelated Components of a Robust Cluster-Based Ecosystem



Source: TEconomy Partners, LLC.

Taken together, these five components of the cluster-based ecosystem fuel economic development in the 21st century. By serving as the base for the “three-legged stool” of economic development, a highly functioning cluster-based ecosystem can play a pivotal role in fueling new enterprise development, supporting existing businesses, and attracting new firms to an area, thereby strengthening the region’s economy (Figure 12).

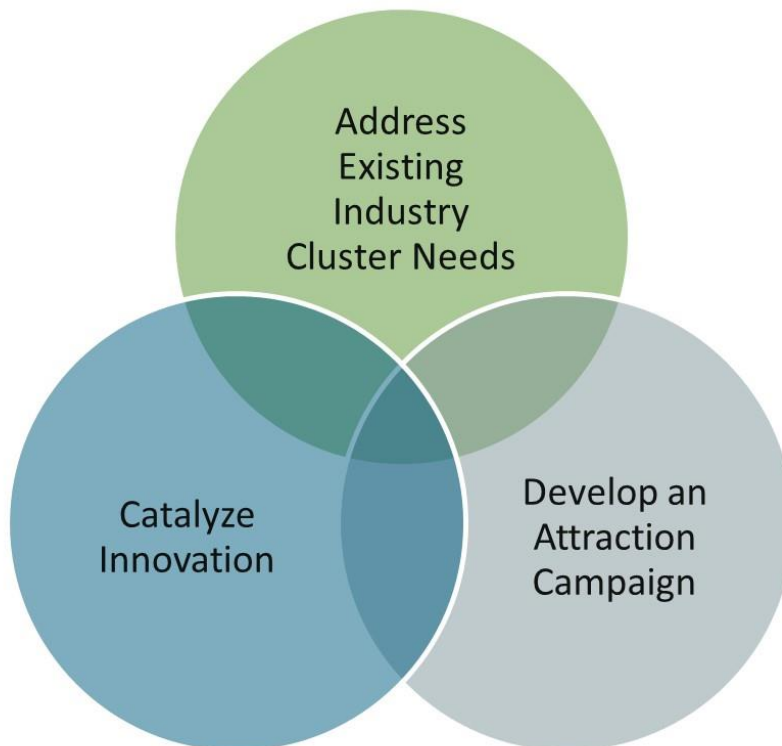
Figure 12: Innovation Ecosystems as a Foundation for Economic Development



Source: TEconomy Partners, LLC.

The Northeast Indiana Regional Partnership and its stakeholders have a critical role to play in ensuring that its food and agriculture cluster-based ecosystem is structured to foster the retention and growth of this important industry cluster. To help ensure a robust regional economy in the coming decades, it is proposed that the region focus its food and agriculture investments on three strategic priorities (Figure 13).

Figure 13. Northeast Indiana’s Food and Agriculture Cluster Strategic Framework



Source: TEconomy Partners, LLC.

Specifically, the three strategies focus on the following:

- Retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues by **addressing existing industry cluster needs**.
- Encourage new food and agriculture enterprise development by infusing cutting-edge technology into the region’s food and agriculture industrial economic drivers by **catalyzing innovation**.
- Catalyze new food and agriculture business attraction by **developing an attraction campaign**.

Table 9 provides a summary of the recommended action plan to catalyze the growth of Northeast Indiana’s food and agriculture industry cluster.

Table 9. Northeast Indiana’s Food and Agriculture Industry Cluster Strategy

Strategy	Baseline Actions for Northeast Indiana
Strategy One Retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues.	Action 1: Create a Food and Agriculture Industry Council to address common needs/issues.
	Action 2: Develop an agbioscience talent pipeline to support the region’s food and agriculture industry.
Strategy Two Foster new food and agriculture enterprise development by catalyzing innovation.	Action 3: Create a pilot/testbed/demonstration effort to foster greater innovation and connectivity.
	Action 4: Catalyze food and agriculture startups.
Strategy Three Develop a campaign to attract new food and agriculture businesses to the region.	Action 5: Initiate an attraction campaign that leverages synergies with the region’s advanced manufacturing strengths.
	Action 6: Tell the Region’s Story—Promote Northeast Indiana as a food and agriculture economic hub.

The details regarding each strategy and subsequent action are outlined in the narrative that follows.

Strategy 1: Retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues.

As detailed in the previous sections, primary agricultural production anchors Northeast Indiana's food and agriculture industry cluster. With 78 percent of the total land area utilized for agricultural production, it is a substantial component of the region's economy. However, a heavy dependence on just two row crops ensures that the region's economy is heavily influenced by national and global trade and pricing. Furthermore, while the broader food and agriculture industry cluster is a significant driver of Northeast Indiana's economy, it has been losing ground. Northeast Indiana's decline in food and agricultural employment is particularly concerning when compared to state and national growth rates.

Reversing this decline in the coming decade will be critical to maintaining Northeast Indiana's economic vitality and quality of place. There is a need to drive further value-added operations, both upstream and downstream from the farm-gate, to take advantage of Northeast Indiana's agricultural strengths. This creates a business development imperative for the Northeast Indiana Regional Partnership—to create a high value business location for food and agriculture companies to maximize the level of cluster activity in the region.

The challenge the Northeast Indiana Region faces is the need to build stronger connectivity and collaboration across the base of food and agriculture companies in the region. Interviews and focus group meetings with food and agriculture industry executives identified the lack of connectivity/cluster networking as limiting the region's ability to address common challenges/needs faced by the food and agriculture industry sector. It also limits information sharing and coordination around talent efforts. As previously noted, interviews with companies revealed that many are establishing relationships with higher education institutions as well as the local K-12 school systems, but on an individual company basis and not as part of a broader effort. This takes time and resources by each individual firm, often without significant human resource capacity to support. This leads to one-off efforts instead of addressing the human capital issue systemically. In addition, there is concern that there is a growing anti-agricultural movement in the state/region that is hampering growth (or has the potential to). Agricultural communication around topics such as GMOs, production practices, conditions for livestock, etc. must be addressed to combat misinformation. This siloed culture limits the region's ability to address common challenges/needs faced by the food and agriculture industry sector.

Actions to retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues.

Action 1: Create a Food and Agriculture Industry Council to address common needs/issues.

To achieve an expanded footprint of the food and agriculture industry cluster, the Northeast Indiana Region must work proactively to develop synergies between the existing companies that comprise the cluster—relationships that, for the most part, do not currently exist. Networking between industry representatives, R&D leaders, educational providers, intermediary organizations, and the public sector has been a proven staple of economic development for many regions. Whether formalized through collaborative institutes, industry cluster councils, or more ad hoc informal efforts, there should be little doubt that regular contact and dialogue between industry, academia, and the public sector can be the spark that leads to broad transformative initiatives.

Raising awareness and building relationships is a foundational building block for establishing stronger collaborations between industry, academia, and the public and nonprofit sectors. However, the Northeast Indiana Region currently lacks the region-wide, systemic, reproducible, and sustainable mechanisms that allow organizations to learn about each other's approaches and capabilities. All too often, organizational silos exist that limit how entities understand the opportunities for engagement and collaboration with one another.

Developing a Food and Agriculture Industry Council requires a tailored approach. Activities should include the following:

- Fostering relationships and synergies among cluster members through networking events.
- Identifying common needs through dialogue with companies, and then focusing on shaping ways to provide more common services to the industry cluster, such as addressing technical assistance for modernization, access to markets, business service gaps, accessing new market opportunities, regulatory issues, etc.
- Serving as the portal/coordinated effort for expansion opportunities to ensure that seamless and unified information and services are provided.
- Aggregating and then addressing the industry cluster's education, training, and workforce needs to impact curriculum, program development, and experiential learning with K–12 and higher-education institutions, helping education institutions by offering pools of skills needed to be addressed (see Action 2).
- Staying abreast of emerging business issues impacting the cluster, including federal and state regulatory changes, legislative issues, foreign trade issues, zoning, and legislative issues, and providing a base for common education and advocacy with elected officials and others.
- Providing “regional supply chain” services to work with purchasing departments within cluster companies to identify manufacturing or service inputs that are currently supplied by providers external to the community that could be fulfilled by local suppliers.
- Addressing misinformation/communication issues faced by the agricultural community.

While a few regions have been able to develop these value-added networks seemingly serendipitously, most regions spend considerable energy and effort in fostering value-added networks and connectivity among members of its academic, private, and public sectors. While there are numerous models that exist, critical elements include the following:

- **Relevant:** Councils should have an individual leading the initiative who has direct industry experience, subject matter expertise, and economic development knowledge.
- **Targeted:** Councils should focus on solving specific problems facing the industry cluster in the Northeast Indiana Region.
- **Exclusive:** Council membership must be limited to decision makers within the respective companies that compose the cluster. To ensure the councils add value, they cannot simply become a service networking function.
- **Direct:** Conduct company visitation program to help in aggregating demand for key services, such as need for expansion space, talent connections, and workforce upskilling.

The Northeast Indiana Regional Partnership, as part of its industry cluster efforts, should be tasked with establishing the Food and Agriculture Industry Council and provide staff support to foster its operations/activities.

Action 2: Develop an agbioscience talent pipeline to support the region's food and agriculture industry.

Talent, representing the skills, knowledge, and experience of a region's workforce, is one of the few market factors that are locally based and have the potential to create a comparative advantage that can differentiate a region from its competition. A region cannot change its physical location, so its locational advantages are fixed. In contrast, talent is a largely locally provided and locally managed resource, thus able to be differentiated from other regions. The quantity, quality, and management of talent are competitive factors very much in local control. This means that talent pipeline development must be an essential part of any regional economic development strategy to create a competitive advantage.

It is important to note that if the firms within a regional industry cluster do not view its workforce as anything more than a low-skill, low-wage, and high-turnover commodity, the industry cluster will not generate or retain any type of enduring market advantage in a marketplace that is increasingly emphasizing the use of high-tech tools that add value for suppliers and end customers. So, how does human capital/talent factor into a region's comparative advantage?

In a framework where strong industry clusters are the engine behind strong regional economies, talent is the fuel that allows this engine to operate. To support regional growth, an industry cluster development roadmap must incorporate the supply of talent that is needed for industry to flourish.

As noted in the previous section, access to skilled talent is the greatest concern expressed by the food and agriculture industry in their ability to grow and remain competitive; yet, Northeast Indiana's food and agriculture industry cluster relies primarily on a non-STEM workforce. Further compounding the problem is the fact that Northeast Indiana's food and agriculture workforce is also at a deficit across key skill segments relative to national workforce composition trends.

It is important to note that to address this growing demand, there have been increasing efforts by regional colleges and universities to develop new agricultural-related degrees and several local K-12 school systems are also attempting to develop agbioscience curricula. However, even with these efforts, industry demand continues to outstrip supply.

As the primary common need discussed by industry, the Food and Agriculture Industry Council (Action 1) should set as one of its priorities the development of regional initiatives that develop an agbioscience talent pipeline that can reach a critical mass of supply. Efforts should be focused on two primary areas of the pipeline:

Within Northeast Indiana's K-12 educational system, the Council should systemically encourage career exploration by:

- **Integrating agbioscience curricula into every K-12 district.** Numerous individuals interviewed for the study expressed concern over the lack of agbioscience awareness both within student bodies as well as with their trusted advisors (parents, teachers, guidance counselors, etc.). As communities are becoming further removed from primary agriculture production, this trend is increasing, causing an even greater gap of knowledge. The Council should work across all school systems within the region to help ensure a consistent agbioscience curriculum is available for

every child regardless of the school district he/she attends. In addition, the Council should consider partnering with the Indiana Farm Bureau to bring Agriculture in the Classroom (AIRC) programming to supplement and enhance teachers' existing curriculum by providing teaching materials, strategies, interactive exercises, and volunteer support to bring agriculture education to every school.

- **Developing robust food and agriculture career awareness programs.** The lack of agbioscience career awareness at the primary and secondary levels is a problem with respect to developing a robust pipeline of students interested in pursuing agbioscience careers. Children will not become interested in pursuing careers for which they have no knowledge, or their perceptions are negative. To help overcome this issue, the Council should promote educational campaigns to inform the public of the tremendous career potential, in terms of advancement and success, that exist within the food and agriculture industry cluster and how these careers will help change the world in the coming decades. First, the Council should work with the local K-12 school systems to promote the utilization of Field Atlas, a career exploration platform for students to discover innovation-driven careers within the agbiosciences.¹¹ Significant resources have already been invested to create this dynamic statewide website, and the Northeast Indiana Region should ensure that it is well promoted through its K-12 systems. In addition, the Council should work with industry partners to create an Agbioscience Career Day modeled after the existing, nationally led Manufacturing DaySM. Agbioscience Career Day would be designed to amplify the voice of individual companies and coordinate a collective voice of food and agriculture companies to share with youth and their parents the exciting nature of the agbioscience industry and the career opportunities it affords.
- **Encouraging student's entrance into agbioscience degree programs** by ensuring that they understand the opportunities that currently exist both within the region as well as around the state. By integrating agbioscience curricula into every K-12 school district, utilizing Field Atlas as a career exploration tool, and creating a regional Agbioscience Career Day, children from the region will be much better-informed regarding career pathways within the food and agriculture industry to pursue. This work will need to be reinforced through high school career guidance counselors to then help direct students to regional colleges and other opportunities to further their education.

Through Northeast Indiana's Regional College and Universities, catalyze food and agbioscience career planning/engagement by:

- **Fostering industry connections through internships and co-ops (including with Purdue students).** Both co-op programs and internships are structured and supervised experiential learning opportunities that provide students with practical experience in their chosen fields. Co-op programs and internships illustrate classroom relevance in the professional world. Beneficial for both students and employers, they offer career exploration and skills application for students and provide employers with workers who are creative, enthusiastic, can assist with

¹¹ <https://myfieldatlas.com/>

projects, and are open for mentorship. Transitioning students into full-time employees is also a proven time- and cost-saving recruiting method. The hardest part of developing co-op programs and internships is gaining the participation of employers. The Council should develop a coordinated outreach effort and consistent platform across higher education institutions granting ag-specific degrees to stimulate and implement employer involvement with co-op programs, internships, job shadowing, and other work experience activities for students.

- **Ensure allied¹² occupational degrees introduce food and agriculture career awareness campaigns.** The food and agriculture industry needs professionals with broader training that integrates agricultural sciences with other STEM disciplines as well as business acumen programs. However, industry is often unable to attract the number and quality of individuals to serve in allied occupations. This requires that programs and initiatives be developed to help ensure that allied occupational groups are aware of and linked to the opportunities that Northeast Indiana's food and agriculture industry affords. However, this will not be easy. Currently, the general perception of the food and agriculture industry is one that often involves difficult working environments, is located in very rural communities, and overall is considered by many as "uncool." This image lacks the following: understanding of the high-tech, cutting-edge nature of the industry; awareness of the global relevance of its markets; and knowledge regarding the influence the industry will have in solving many of the world's greatest challenges in the 21st Century. The overall lack of career awareness for allied occupations requires that programs and initiatives be developed to help ensure that allied occupational groups are aware of and linked to the opportunities that Northeast Indiana's food and agriculture industry offers.

The Northeast Indiana Regional Partnership, as part of its support for the Food and Agriculture Industry Council, should provide staff support to help coordinate activities among key regional academic and industrial stakeholders.

Strategy 2: Foster new food and agriculture enterprise development by catalyzing innovation.

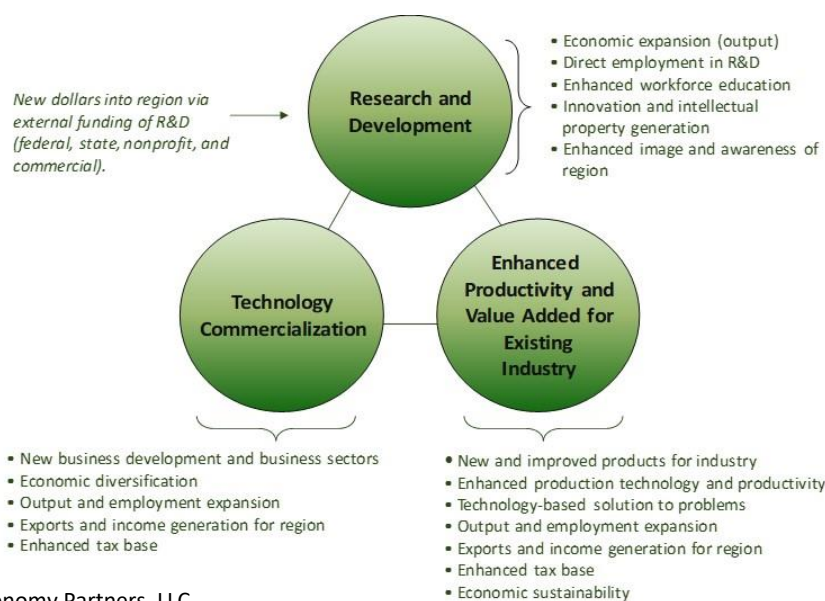
As illustrated in Figure 14, innovation is a key driver of economic growth, the creation of high-quality jobs, and rising standards of living—explaining not only the differences in economic growth among nations, but also at the level of regional economies. The World Economic Forum in its highly touted Global Competitiveness Report explains as follows:

In the long run, standards of living can be expanded only by technological innovation.... This requires an environment that is conducive to innovative activity, supported by both the public and the private sectors.¹³

¹² Allied Occupations—those jobs, such as business, IT, and skilled production, that have key roles and functions yet transcend multiple industry sectors.

¹³ World Economic Forum, The Global Competitiveness Report 2010–2011, p. 8.

Figure 14: Innovation-Led Development is a Key Driver of Economic Growth



Source: TEconomy Partners, LLC.

The U.S. economy has always been carried upon the back of inventiveness and creativity, so the “innovation economy” per se is not a new phenomenon; rather, it is more accurate to say that innovation has increased in importance as the primary impetus of economic growth and competitiveness. Two fundamental forces are driving the preeminent importance of technology and knowledge advancement as the determinant of economic success:

- The first of these is the rapidly accelerating pace of scientific discoveries and the technologies that these discoveries give rise to. The opportunity to speed the discovery and development processes, in concert with the ability to protect and profit from intellectual property (IP), is leading to an innovation race among competing countries, regions, and states.
- The second fundamental force is the globalization of world markets and the increasing pressure to maintain a high-wage/high-skill employment base through consistently staying ahead in technology and productivity.

Within an environment of stiff and increasing competition, it is important for a region to be able to make informed decisions regarding the right strategic investments for its economic future. Research indicates that the key determinant of the long-term economic prosperity of any region lies within its ability to innovate and enhance economic output based upon that innovation. Generating an economic ecosystem conducive to innovation is increasingly central to the future sustainability of a region’s economy.

As the prior analysis indicated, the Northeast Indiana Region’s lack of recent agbioscience industrial growth is, in part, driven by the lack of agbioscience-related innovation in the region. While there are certainly examples of innovative agbioscience companies in Northeast Indiana, there is not a critical mass of innovation to help drive growth as evidenced by the limited level of agbioscience patenting activity. Furthermore, while several regional universities have developed agbioscience-related degree programs, there is still limited academic R&D and minimal publication activity of relevance to the agbioscience industry cluster. In addition, the lack of food and agricultural entrepreneurial endeavors limits the region’s ability to take advantage of emerging opportunities.

Actions to foster new food and agriculture enterprise development by catalyzing innovation.

Action 3: Create a pilot/testbed/demonstration effort to foster greater innovation and connectivity.

Worldwide agricultural commodity markets are highly competitive and price driven. As a result, even though national agricultural productivity continues to increase, the real value of that production at “the farmgate” continues to decline. The future of agricultural and rural sustainability in Northeast Indiana will very much depend on the ability to construct “value-added” chains of production that vertically integrate the food-related business model/value supply chain. The basic value-added concept was illustrated in Figures 3 and 4 in the first chapter and depicts the substantial difference in potential income between simply growing and selling any agricultural commodity and the total income that may be realized in a region that provides a vertically integrated value-added chain.

Producers involved with adding value will become more than commodity producers absorbing all the shocks brought about by global markets. They will think of themselves as producing products for end users, instead of producing only raw commodities. This, however, requires a different way of doing business and will require agricultural diversification as well as coordination throughout the value-added supply chain.

As highlighted in this report, currently the regional agricultural profile is not particularly diverse. Diversification can take the form of both crop variety (i.e., adding horticultural crops to diversify potential food processing/manufacturing opportunities) as well as plant characteristics (i.e., growing organic or non-GMO cultivars to increase potential market opportunities as well as food processing/manufacturing opportunities). Through diversifying the agricultural base of the region, food processing and manufacturing opportunities will increase. In examining opportunities, there are three potential pathways that could be pursued (and they could each be pursued concurrently):

- Diversifying crop production through developing farmer networks to achieve critical mass
- Diversifying the value-chain by facilitating product development, piloting, and testing
- Building platforms to advance the testing and demonstration of next generation agriculture equipment and digital agriculture.

Coordination focuses on arrangements among those that produce and market farm products. Horizontal coordination involves pooling or consolidation among individuals or companies from the same level of the food chain. An example would be independent livestock producers combining their production to enter into processing contracts with a local small-scale meat processor to expand processing operations and become USDA certified, which allows the livestock producers to become direct marketers of value-added meat products across the country. Vertical coordination includes contracting, strategic alliances, licensing agreements, and single ownership of multiple market stages in different levels of the food chain. Vertical coordination, either through ownership integration or contractual arrangements, is necessary to link production processes and product characteristics to the preferences of consumers and processors.

It is recommended that the Northeast Indiana Regional Partnership work in coordination with its regional higher education partners and Purdue’s College of Agriculture to create a Food & Agriculture Innovation Center that would serve as a regional hub for activities around the three diversification pathways identified above. It should be noted that while Purdue should be asked to participate, it is

unreasonable to expect them to duplicate resources they already have in West Lafayette or to invest heavily in standing up new facilities in Northeast Indiana. Funding for such a center should instead be sought through request for a state appropriation with a joint ask from the counties and regional higher education institutions that could participate in, and benefit from, the envisioned center.

It is envisioned that the Food & Agriculture Innovation Center would comprise:

- An initiative focused on identification of alternative value-added crops and processing capacities that could help build improve resiliency into the regional farming system. This should include forming an “AgLaunch”¹⁴ type of program that will bring producers together to provide a critical mass of land to create meaningful production volumes needed to support local processing into value-added processed products. The effort would include food labs, pilot plant facilities, intermediary food processing facilities, testbeds, and demonstration facilities, and would focus its activities on downstream pilot-plant and product production and applications support rather than the more basic research found within a typical academic department. There are both academic and non-academic models to look to for inspiration in developing such a program. In academe, the Center for Crops Utilization Research at Iowa State University is focused on similar efforts. In Northwest Ohio there is the Center for Innovative Food Technology (CIFT) as a free-standing institution. There may be potential, given the proximity of CIFT to Northeast Indiana, to look towards alignment with them under a strategic partnership to provide services and advise.
- It is envisioned that in addition to working with a range of companies and agricultural producers, encompassing every stage in the business life cycle, the Food & Agriculture Innovation Center would also be charged with working with the various state commodity groups to ascertain which commodities would be best served by developing a value-added research and application program. It may be necessary to develop intermediary aggregators and processors in order to develop a critical mass, or economies of scale, to ensure the economic viability of such efforts. It will also be critical to develop public/private/academic partnerships by building enhanced value-chains that increase regional value-added processing by linking food manufacturers with local agricultural processing firms, individual farmers, and/or farm cooperatives. Working contractually together producers, processors and manufacturers can partially de-couple themselves from more volatile commodity markets and benefit from a more stable and predictable operating environment.
- A third programmatic area of opportunity would seek to provide services in the development, piloting, and demonstration of agtech (especially precision farming, sensors, and autonomous systems). This is an extremely fast-growing area of technology business development. In analyzing the various food and agriculture industry subsectors in Northeast Indiana, it is evident that the precision machining sector and advanced manufacturing (much of it built up to serve the medical device and automotive sectors in the region) have capabilities that could be used to advance the agtech industry in the region. Purdue University is a global research leader working intensively on digital agriculture and agtech, so gaining their involvement in this area would be highly beneficial. Purdue has a regional experiment station within the region that could be part

¹⁴ <http://aglaunch.com/>

of this offering, as could networking farmers (under the first bullet above) to facilitate piloting and testing of technology.

As a next step, a business plan for the Food & Agriculture Innovation Center needs to be developed, including the initial design and organizational planning. It is envisioned that the Food & Agriculture Innovation Center would be located within the region serving from a central location the needs of the food and agriculture industry both within the region and across the state.

Action 4: Catalyze food and agriculture startups.

Entrepreneurial activity is critically important to regional economic development because it drives industrial innovation and new business formation. However, with a few notable exceptions such as Boston and Silicon Valley, the entrepreneurial climate necessary to generate high-growth enterprises has not developed fully and sustainably through market forces alone. Building a critical mass of entrepreneurial management talent in a locality depends on providing the resources that must be amassed, and the services needed to successfully build a company. As a result, catalyzing entrepreneurial activity is a challenge for many regions.

Interviews with Northeast Indiana stakeholders noted that there is limited assistance as well as risk capital available for companies and/or farmers interested in developing value-added products. There is limited knowledge within the region regarding product development, distribution channels, market placement, etc. In addition, it was noted that farmers overall are not incented to diversify, which make it challenging to engage them in new crops or new market opportunities, particularly with the limited sources of information regarding emerging opportunities. While there are entrepreneurial service providers in the region, such as the Northeast Indiana Innovation Center (NIIC), they note that they have experienced extremely limited deal flow/entrepreneurial activity within the food and agriculture cluster. While there are efforts underway to develop an innovation center in Warsaw focused on Ortho and Agriculture, it is still in a very nascent stage.

If Northeast Indiana is to have the ability to scale entrepreneurial endeavors to a level in which economic development will be impactful, it will be critical to develop a seamless entrepreneurial services delivery system that provides the services required by an entrepreneur to ideate, develop, create, and scale their food and/or agriculture business. By either leveraging existing entrepreneurial efforts or by creating a specific food and agriculture-focused entrepreneurial support effort, the region must provide the following value-added assistance to emerging opportunities:

- Access to business experts (through mentorship networks, Entrepreneurs-in-Residence, etc.) that can guide startups through market entry to growth/scalability
- Connect/tie efforts to existing/emerging industrial base
- Deliver services throughout the region in coordination with academic assets
- Provide linkages to Purdue for additional domain expertise
- Provide non-dilutive sources of proof-of-concept/prototype development funding
- Incentivize angel funding by providing funding for network administration and due diligence
- Create a Process Authority that would focus on product testing, product classification, nutritional label and process authority letter development, label review, and consultation
- Develop a pilot-size co-packing plant to conduct smaller batch runs.

As a next step, a business plan for the Food and Agriculture Entrepreneurship Network needs to be developed with input from a variety of regional partners, including incorporating the efforts underway

at the NIIC, Ivy Tech Ft. Wayne's Technology Division, Purdue University Ft. Wayne's College of Engineering, the Northeast Indiana Small Business Development Center, and the Purdue Manufacturing Extension Partnership (MEP).

Strategy 3: Develop a campaign to attract new food and agriculture businesses to the region.

Further developing a strong food and agriculture industry cluster requires that Northeast Indiana sees itself and is seen by others as a dynamic hub: a place with exciting food and agriculture opportunities and a supportive business environment. To obtain a vibrant reputation as a cluster leader, more and more regions are undertaking branding/marketing campaigns that communicate to key audiences, both internal and external, the depth and breadth of the region's assets and the unique resources and opportunities that the region provides for advancing the cluster.

In speaking with cluster stakeholders, there was sense that the inability to effectively tell Northeast Indiana's food and agriculture story was a missed opportunity, especially considering the strengths of the region. Successfully telling Northeast Indiana's story as an economy driven by the food and agriculture cluster can help attract new firms. For example, research by faculty at Cleveland State University finds that factors associated with economic and place image play a role in the strategic location of firms. "When the list of place options is between the final two or three choices, emotion becomes the basis for the decision and that is where place image is key to winning the bid," the authors find.¹⁵ The authors also suggest that this is also true at the individual level, and that sense of place (the experience of visiting and interacting with a place) and identity (the character of a place's residents) are important factors that help retain talent in a region.

Understanding key regional assets (for example regional machining and advanced manufacturing capabilities with potential for application to agtech product manufacturing) should be a component of building a compelling case statement or "pitch" to help attract companies into the region. In addition, it is anticipated that the previously recommended program to expand production diversity into selected higher value crops may be leveraged to attract processing enterprises to the region.

Actions to develop a campaign to attract new food and agriculture businesses to the region.

Action 5: Initiate an attraction campaign that leverages synergies with the region's advanced manufacturing strengths.

Northeast Indiana is in the unique position to proactively leverage its advanced manufacturing strengths with its food and agriculture production capabilities, including access to agricultural commodities, water, a trained workforce, and proximity to large population centers, to proactively pursue food and agriculture supply-chain attraction opportunities. As a next step, the Northeast Indiana Regional Partnership, in close partnership with the Indiana Economic Development Corporation (IEDC), should either further develop or recruit staff with food processing/manufacturing and/or related supply chain business expertise and then proactively target industrial candidates for relocation marketing efforts.

¹⁵ Ashutosh Dixit, Candice Clouse, and Nazli Turken; "Strategic Business Location Decisions: Importance of Economic Factors and Place Image"; Rutgers Business Review; 4. No. 1; 2019.

The proactive attraction campaign should target supply chain and strategic partners of existing regional firms who are seeking to expand or make business location decisions and therefore would be targets for business recruitment efforts. Potential opportunities that would leverage existing strengths of the region include the recruitment of international food equipment manufacturers and producers of digital agriculture technologies. A potential market position for Northeast Indiana to pursue would be to position the region as the North American headquarters (or American headquarters) for European and Canadian firms seeking to expand their footprint.

Attraction campaign efforts could entail:

- **Active Media:** Developing a consistent and active media presence in major business and technology publications such as special sections and announcements of company accomplishments and generally raising the awareness of the region's brand.
- **Earned-Media Campaign:** Having articles appear in newspapers and magazines globally describing the region's food and agriculture strategy. The placement of such articles, however, will require an active public relations effort to develop news stories and reach key publications.
- **Trade Missions:** Conducting trade missions in targeted foreign markets, focusing on companies with linkages to the region's industry strengths, and undertaking reverse trade missions inviting foreign businesses to tour the region.
- **Conferences and Events:** Building upon the region's reputation by hosting international and national conferences and events.
- **Website:** A highly informative website will need to be developed, in parallel, providing a first level resource for interested parties to examine regional assets and opportunities.

The Northeast Indiana Regional Partnership, in close collaboration with IEDC, should lead the attraction campaign efforts as part of its industry cluster economic development efforts.

Action 6: Tell the Region's Story—Promote Northeast Indiana as a food and agriculture economic hub.

To project a robust food and agriculture industry cluster to external audiences, Northeast Indiana must first be perceived by its own citizens as a dynamic, innovative hotbed of activity before this image can be projected to the rest of the world. Interestingly, even though agriculture is a significant anchor of the region's economy, many Northeast Indiana residents are three or more generations removed from the farm. Their perception of how food is raised and grown does not align with modern agriculture, which is in a state of change—continuing to evolve with the application of new science and technology. This misalignment has led to false information, the demonization of certain agricultural practices, and the rise of unnecessary alarm among consumers and policymakers.

There is need for an unbiased, credible resource to foster regional food and agricultural awareness that incorporates evidenced-based stories and information from farmers, researchers, and other experts (academics, environmentalists, health care professionals, nutritionists, food retailers, etc.). This effort must be inclusive and consistently provide a diversity of voice and topics – from GMOs to efficient and responsible crop production and animal care and all points in between. Such an initiative will require a multi-media presence as well as programmatic outreach in communities across the region.

To do this, the region needs to implement a brand campaign through marketing, public relations, and signature events. Key policymakers, as well as private sector, philanthropic, and academic partners, will need to be actively engaged in these efforts. Potential efforts could include the following:

- Develop a Food and Agriculture Ambassador program to elevate the voices of champions for the industry cluster. It is recommended that ‘brand champions’ be identified – those who are able to positively advocate on behalf of the industry cluster; draw attention to important issues, events, and resources; and make virtual connections across the region and state.
- Generate excitement through in-person events, when once again able, that celebrate the food and agriculture industry cluster and celebrates success stories.
- Develop a consistent and active media presence in regional publications of company accomplishments, academic efforts, and public/private partnership, thereby generally raising the awareness of the food and agriculture industry cluster within the region.

The Northeast Indiana Regional Partnership, as part of its support for the Food and Agriculture Industry Council, should provide staff support to help coordinate activities among key regional academic and industrial stakeholders.

A Call to Action

Reversing the decline in the food and agriculture industry cluster is critical to maintaining Northeast Indiana's economic vitality and quality of place. Agricultural production anchors not only the region's economy but also its cultural heritage, and the broader food and agriculture industry cluster is a significant driver of Northeast Indiana's economy.

By focusing on supporting the development, retention, and expansion of the food and agriculture industry cluster, the Northeast Indiana Region has the opportunity to catalyze a robust ecosystem that supports the ongoing competitiveness of existing industries and advance entrepreneurship and new business development in emerging areas of opportunity.

However, for Northeast Indiana to be able to catalyze a robust and thriving food and agriculture industry cluster, it must be able to overcome the following four identified challenges:

1. The lack of recent food and agriculture industrial growth, is in part, driven by the lack of agbioscience-related innovation in the region.
2. The lack of entrepreneurial endeavors in the region related to food and agriculture limits emerging opportunities.
3. Access to skilled talent is the greatest concern expressed by the food and agriculture industry in their ability to grow and remain competitive.
4. While there are successful industry cluster/networking initiatives focused on other industry sectors in the region, the food and agriculture sector lacks connectivity.

These challenges, however, are not insurmountable; and, with a renewed and re-oriented focus toward addressing these barriers, the region's food and agriculture industry cluster can thrive. This strategy outlines a blueprint to help ensure the future global competitiveness of the region's food and agriculture industry cluster. Just as there is no single root cause of the region's challenges, there is not a single strategy, initiative, or project that can change the cluster's economic trajectory. Instead, a multi-pronged approach to economic development is needed. The region must attack its challenges from a variety of angles in a strategic, well-coordinated, and efficient manner.

This Food and Agriculture Cluster Strategy has laid out three interrelated strategies to help ensure long-term economic prosperity:

- Retain and expand the current food and agriculture industrial base by tackling commonly identified barriers and issues by **addressing existing industry cluster needs**.
- Encourage new food and agriculture enterprise development by infusing cutting-edge technology into the region's food and agriculture industrial economic drivers by **catalyzing innovation**.
- Catalyze new food and agriculture business attraction by **developing an attraction campaign**.

By implementing the strategies and actions outlined in this cluster roadmap, Northeast Indiana will help ensure that it is positioning its economy for economic growth. Now is the time for Northeast Indiana to double down and leverage its existing strengths to develop a vibrant and high-functioning food and agricultural industry cluster ecosystem.

Appendix A: NAICS Codes Defining the Food and Agriculture Industry Cluster

Table A-1. Food and Agriculture NAICS Codes

Food/Ag Super Sector	Food/Ag Subsector	NAICS Code	NAICS Title
Ag/Bio Research, Testing, & Services	Biological and Agricultural R&D	*541714	Research and Development in Biotechnology (except Nano Tech)
		*541715	Research and Development in the Physical, Engineering, and Life Sciences (except Nano & Bio Tech)
	Testing Laboratories (Ag/Bio/Food)	*541380	Testing Laboratories
	Veterinary Services	541940	Veterinary Services
Agricultural & Biomass Processing	Agricultural Processing	311211	Flour Milling
		311224	Soybean and Other Oilseed Processing
		311225	Fats and Oils Refining and Blending
	Biomass Processing	321113	Sawmills
		325193	Ethyl Alcohol Manufacturing
Food, Nutrition, & Health	Beverage Manufacturing	312111	Soft Drink Manufacturing
		312112	Bottled Water Manufacturing
		312113	Ice Manufacturing
		312120	Breweries
		312130	Wineries
		312140	Distilleries
	Food Processing & Manufacturing	311111	Dog and Cat Food Manufacturing
		311119	Other Animal Food Manufacturing
		311340	Nonchocolate Confectionery Manufacturing
		311352	Confectionery Manufacturing from Purchased Chocolate
		311412	Frozen Specialty Food Manufacturing
		311421	Fruit and Vegetable Canning
		311422	Specialty Canning
		311511	Fluid Milk Manufacturing
		311513	Cheese Manufacturing
		311520	Ice Cream and Frozen Dessert Manufacturing
		311611	Animal (except Poultry) Slaughtering
		311612	Meat Processed from Carcasses
		311615	Poultry Processing
		311811	Retail Bakeries
		311812	Commercial Bakeries
		311821	Cookie and Cracker Manufacturing
		311919	Other Snack Food Manufacturing

Food/Ag Super Sector	Food/Ag Subsector	NAICS Code	NAICS Title
		311920	Coffee and Tea Manufacturing
		311991	Perishable Prepared Food Manufacturing
		311999	All Other Miscellaneous Food Manufacturing
Inputs to Production	Ag Machinery & Equipment	333111	Farm Machinery and Equipment Manufacturing
		423820	Farm and Garden Machinery and Equipment Merchant Wholesalers
	Agricultural Chemicals	325314	Fertilizer (Mixing Only) Manufacturing
		325320	Pesticide and Other Agricultural Chemical Manufacturing
Agricultural Inputs Wholesaling	424910	Farm Supplies Merchant Wholesalers	
Primary Production	Agricultural & Biomass Production	111110	Soybean Farming
		111140	Wheat Farming
		111150	Corn Farming
		111191	Oilseed and Grain Combination Farming
		111199	All Other Grain Farming
		111211	Potato Farming
		111219	Other Vegetable (except Potato) and Melon Farming
		111334	Berry (except Strawberry) Farming
		111336	Fruit and Tree Nut Combination Farming
		111421	Nursery and Tree Production
		111422	Floriculture Production
		111940	Hay Farming
		111998	All Other Miscellaneous Crop Farming
		113310	Logging
		115112	Soil Preparation, Planting, and Cultivating
		115114	Postharvest Crop Activities (except Cotton Ginning)
		115115	Farm Labor Contractors and Crew Leaders
		115116	Farm Management Services
		115310	Support Activities for Forestry
		Livestock Production	112111
	112112		Cattle Feedlots
	112120		Dairy Cattle and Milk Production
	112210		Hog and Pig Farming
	112310		Chicken Egg Production
	112320		Broilers and Other Meat Type Chicken Production
	112340		Poultry Hatcheries
	112390		Other Poultry Production
	112410		Sheep Farming
	112519		Other Aquaculture
	112910		Apiculture

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Food/Ag Super Sector	Food/Ag Subsector	NAICS Code	NAICS Title
		112920	Horses and Other Equine Production
		112990	All Other Animal Production
		115210	Support Activities for Animal Production
Wholesaling, Distribution, & Storage Operations	Agricultural Commodity Wholesaling	424510	Grain and Field Bean Merchant Wholesalers
		424520	Livestock Merchant Wholesalers
		424590	Other Farm Product Raw Material Merchant Wholesalers
	Food Product Wholesaling	424430	Dairy Product (except Dried or Canned) Merchant Wholesalers
		424440	Poultry and Poultry Product Merchant Wholesalers
		424470	Meat and Meat Product Merchant Wholesalers
	Warehousing and Storage	493120	Refrigerated Warehousing and Storage
		493130	Farm Product Warehousing and Storage

***Note: NAICS employment is shared to include only Food/Ag-related employment.**